HB831- Alana Ginsburg- Favorable.pdf

Uploaded by: Alana Ginsburg

Position: FAV

February 23, 2022
Committee: Environment and Transportation
Testimony on: HB831 Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings
Position: Favorable

Dear Delegate Stein, Delegate Barve, and all members of the Environment and Transportation Committee,

My name is Alana Ginsburg and I am a student at the University of Maryland who is currently living in College Park. As a young person, I am disappointed that politicians and corporations make decisions to continue our toxic reliance on fossil fuels that diminish my chance to live in the future.

Our state has combated environmental threats before, and the less immediate impacts of greenhouse gas pollutants should not be an excuse to treat these pollutants differently. Climate change is one of the biggest threats to all of our collective securities, and it has been impossible to ignore the yearly rises in extreme weather recovery expenditures that have increased along with atmospheric greenhouse gas concentrations [1].

Stopping climate change at the source must involve cutting greenhouse gas emissions in all ways that we can, which our state can do by adopting the Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings Bill. All-electric standards for new buildings will result in newer construction being cheaper and will make integrating renewable energy into the electrical grid more practical. 75% of Americans favor these types of changes for new buildings, and narrow-minded fossil fuel corporations and gas utilities should not be able to overrule their opinions [2].

Additionally, the 20% reduction in direct emissions by 2030 over 2025 emissions that the state will be able to achieve by following the recommendations of the bill will delay the rate at which the atmosphere is becoming more unstable. This will help make the impacts of climate change more manageable for all Marylanders.

I want an equal opportunity to finish my degree, get my dream job, start a family and all of the other milestones that come with making it past your twenties. I won't get to do these things if flooding regularly blocks roads that connect us to our homes and work, extreme heat waves frequently create dangerous conditions outdoors, and my community and peers have been demoralized from dealing with climate-change fueled weather events without support.

The Maryland General Assembly has the power to spare us from this worst possible future by passing the Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings Bill.

Thank you for protecting our state.

[1] https://www.ncdc.noaa.gov/billions/
[2] https://www.rff.org/publications/reports/climateinsights2020-policies-and-politics/

Letter in support of HB0831.pdf

Uploaded by: Benjamin Roush

Position: FAV

FSi ENGINEERS

Seattle
506 Second Avenue Suite 700
Seattle, Washington 98104
206.622.3321

Baltimore
4709 Harford Road
Baltimore, Maryland 21214
410.929.6894

Spokane
505 West Riverside Ave. Suite 440
Spokane, Washington 99201
509.215.1500

February 15, 2022

Delegate Dana Stein

Taylor House Office Building, Room 251
6 Bladen St., Annapolis, MD 21401

Subject: **Myths About Building Electrification**

Delegate Stein,

I am a past Chair of the Board for the Maryland Chapter of the US Green Building Council, Chair of the AIA Baltimore Committee on the Environment, and I have long attended the Maryland Green Building Council meetings that are open to the public. I am a Principal at FSi, with 37 employees—we are mechanical and electrical engineers with a strong focus in green and net zero building. As you can see in my signature line below, I am a licensed mechanical engineer, a licensed fire protection engineer, and a certified commissioning professional. I can count myself among only a handful of people in the country with this broad set of certifications to understand, design, and operate building mechanical equipment.

At your request, I am writing a letter to address some misconceptions around building electrification. As you'll see, each of these is a persistent myth because it contains a kernel of truth, but is not the whole picture. Buildings can electrify now, for less money, and within grid constraints. Particularly for new construction, continuing to allow natural gas buildings is a disservice to consumers and a downright waste of taxpayer funding.

Myth: "too expensive":

Heat Pumps at their most basic form are just the same thing as commercial air conditioners, with an extra valve to reverse refrigerant flow (aka the reversing valve). They have a very nominal cost over a traditional furnace and AC unit, and are often cost neutral or cost negative when the total system installation including gas service and piping is included.

The Interagency Commission on School Construction has the data on this, all three net zero schools in Maryland were built at the same cost as other traditional schools, in their bid year. IAC released a report showing the total cost of building the schools averaged 3% more, including the substantial cost of solar panels, and simple math using $2 per watt and the area of the solar arrays shows that means net zero ready schools (everything except solar panels) can be built for less than traditional schools.

For all electric projects without a requirement to be net zero ready, in our own practice we have seen many projects save overall cost by omitting natural gas service, which more than covers the small incremental cost of heat pumps. Compelling alternatives now exist for all former natural gas uses. We have chefs asking for all electric kitchens, laundry staff praising electric washing equipment, and maintenance personnel praising heat pumps for comfort and maintainability. It can be done, at the same cost, right now. Requiring high performance buildings only decreases the size and cost of the HVAC as other systems are improved. See the attached data on net zero school costs.

In existing buildings, several bills in session address the cost of replacing existing gas systems using Empower Maryland funds, and assistance to the most impacted low-income populations. Cost for existing building switchover is not a reasonable argument to anyone who has read those bills.

Myth: "grid can't handle it":

Pepco release a report last year showing the grid would need to grow 1.4% to 1.7% over the next 30 years (to 2050) to handle all new and existing buildings AND all transportation energy: (https://edocket.dcpsc.org/apis/api/filing/download?attachId=140553&guidFileName=1211ecc8-254d-4fc1-9143-10c8442e3fbc.pdf) It offered a handy retrospective that in some points in the grid history, the growth rate has approached 10%. This can be done now, at a low cost to the consumer, if properly directed.

Additionally, we know that the natural gas infrastructure in this country is rapidly aging and failing, releasing methane with its ~30x the global warming potential of CO2 into the air. The Rocky Mountain institute has a report out showing most gas infrastructure we install now will be abandoned after 2035 due to rising costs: https://rmi.org/insight/clean-energy-portfolios-pipelines-and-plants/ Allowing our schools, public buildings, and other tax payer funded projects to install natural gas is a waste of state money over the life of the building. Allowing private buildings to install natural gas now is a disservice to owners and occupants.

Myth: "heat pumps don't work in the cold"

In cold weather climates, there has long been a perception that heat pumps don't work when it's cold, which is no longer true. There are multiple brands of Variable Refrigerant Flow (VRF) systems that work at full capacity down to 5 degrees Fahrenheit, with a few notable brands that work down to -15 degrees F. The lowest recorded temperature at Deep Creek in western MD was -5 degrees in the last 20 years, and the closest available ASHRAE weather data for far western MD, for Morgantown, WV, has a design temperature of 7.4 degrees F, with a 5 year return extreme temperature of -3.6 degrees F. (http://ashrae-meteo.info/v2.0/index.php?lat=39.64&lng=-79.92&place=%27%27&wmo=724176&ashrae_version=2013) These temperatures are well within the engineering range of modern commercial heat pumps. Heat pumps are available in a wide variety of configurations, are just as flexible for use as natural gas equipment, and are at a similar price point when the cost of natural gas service is included in the cost calculation.

Of course, there are also ground source (aka geothermal) systems, which are not outside temperature dependent at all, but we must acknowledge that these systems have a cost premium not present in other heat pump systems, with a long payback. Ground source is not required for any climate in Maryland.

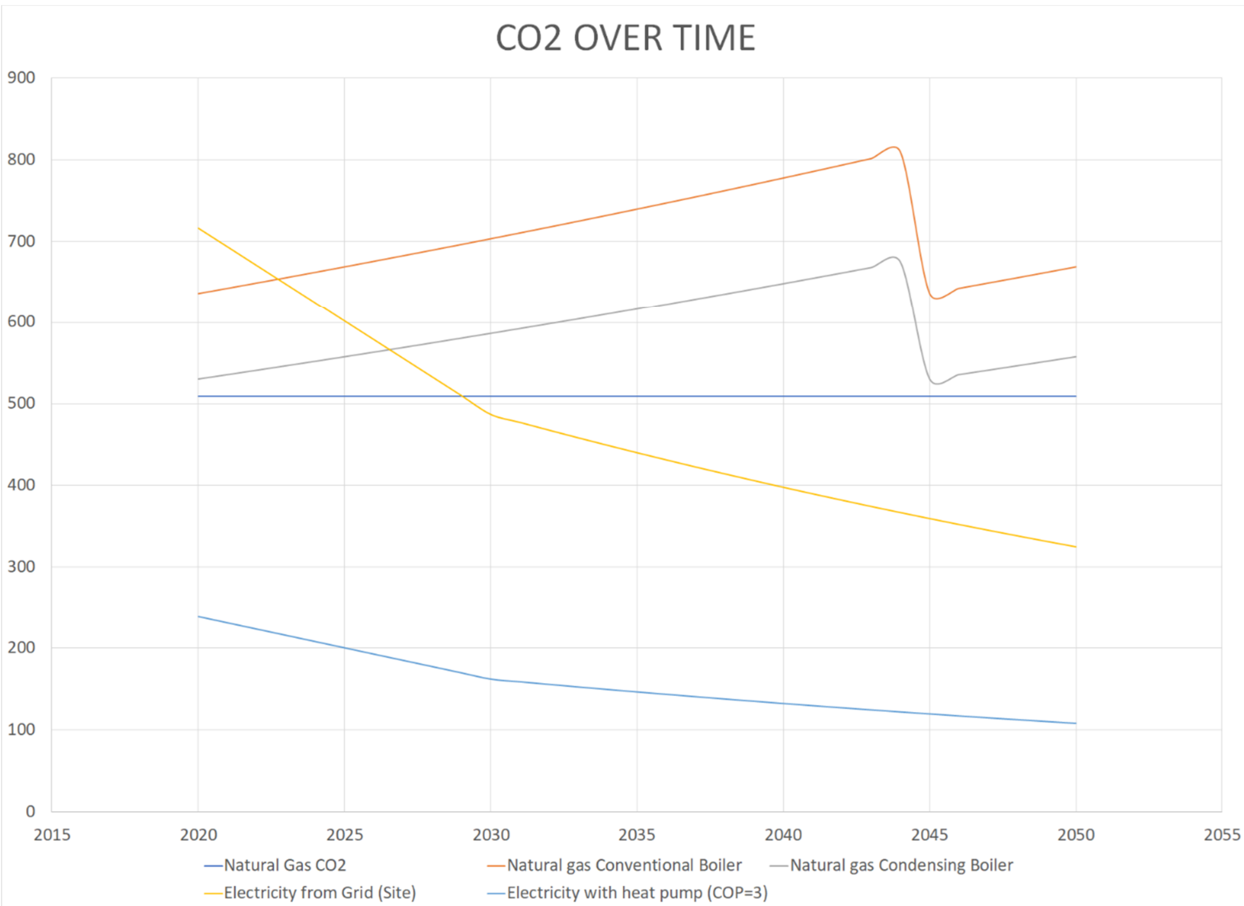
Myth: "grid electric emits more carbon than gas"

This gets thrown out all the time, and it is true that our current grid emissions are nearly the same as natural gas emissions on a per unit energy basis. There is a big caveat--this misses that natural gas equipment is only 80% efficient for a code minimum furnace or boiler. Comparing electric resistance (like a tea kettle) to natural gas, and including efficiency, they're essentially at par for carbon emissions, but as we hit our 2030 60% target and net zero carbon by 2045 in our electric grid (as proposed in the climate bill), the electric resistance carbon emissions continue to improve while the natural gas only decreases in efficiency over time, emitting more and more carbon until the end-of-life equipment replacement.

Heat pumps, with their 3x less energy use already emit ~3x less carbon than natural gas on aa per unit energy basis. The energy code mostly requires the use of heat pumps in modern commercial buildings and can be amended to limit electric resistance except in a few key circumstances, and to entirely prohibit the use of natural gas. This is an easy change for the energy code, and is my recommended pathway to direct building electrification. The technology already exists to use heat pumps for building heating and water heating, and other states like New York and Washington already have an all-electric energy code requiring heat pumps.

(continued) Myth: "grid electric emits more carbon than gas"

Here is a graph I made showing lbs. CO_2/MWH and years, using EPA data specific to our grid, really demonstrating that heat pumps are superior and just get better over time. Note that this uses what's currently in legislation, not the revised 60% by 2030 and 0% by 2045 carbon emission targets, which will only accelerate the improvement:



Myth: "gas equipment will work in a power outage":

There is a persistent idea that gas equipment can work without electric power. There are some very select cases, mostly older equipment, where this is true. Think of direct venting fireplaces and wall heaters, and very old natural draft boilers. These are notable because these appliances direct vent the combustion products into the space, significantly increasing indoor air pollutants and risks for asthma and other issues, and when malfunctioning create tremendous carbon monoxide risk. They have pilot lights that continuously waste energy year-round. Modern gas appliances have glow plug ignitors and safety valves, which will not allow gas flow without proof of ignition. Modern boilers have forced air induction fans and controls, both of which require power to operate. Hot water boilers have electric pumps for system operations. House furnaces have fans and safety valves and controls, all of which require power. Even modern gas stoves have glow plugs and electronic ignition for the oven and cooktop.

Notably, home scale generators are sometimes powered using utility natural gas, and for this one case, they are both safe (when outdoors) and effective. However, the vast majority of homeowners do not have generators, and they can continue to maintain gas service to those generators. I understand there is nothing in the current bills preventing gas usage beyond building HVAC and domestic water heating. If or when gas service becomes too costly, those generators can be replaced with a battery backup in homes that choose to want backup power systems. There is no current requirement forcing any homeowner to buy backup power systems and only a small handful of commercial buildings are required to have backup power systems (hospitals, emergency operations, hazardous occupancies, non-ambulatory care, etc. As a firm, we have designed some of the first emergency operations buildings with battery backup instead of backup generator in the country. Again, the current legislation seems to only address building heating and cooling, and generators are perfectly acceptable.

Myth: "Maryland will be the first to require an all electric energy code":

Seattle beat the pack and was first to require all new building and major retrofit projects to electrify using heat pumps specifically for building heating and service water (domestic) water heating, in the 2018 code cycle. The 2021 Washington State Energy Code, adopted in 2023, will bring the rest of Washington State along. New York City has done the same beginning in 2023, six municipalities in California are already all electric, and Washington DC adopted Appendix Z to the International Energy Conservation Code, allowing a pathway for net zero buildings (which are combustion free) to have preferential code treatment.

All electric energy codes exist already with great examples of thoughtful ways to electrify buildings while allowing targeted exemptions for industrial and process uses. Maryland will be with the leaders in building electrification, but certainly not the first. Note that the 2024 code cycle would be the first available opportunity for an all-electric code adoption in Maryland, which won't apply until 2026, so there are several years for the industry to adjust. The equipment already exists, this is just a matter of political will.

Building Energy Performance Standards (BEPS):

Other jurisdictions, most notably Washington State, Denver, and Washington DC already have a Building Energy Performance Standard in place, addressing the worst performing existing buildings. As written in HB0831, there is a strong push to remove fossil fuels from buildings, but then no energy requirement. This will lead to increased grid demand and a higher cost for all ratepayers in the end. Ultimately, BEPS is good for business and good for ratepayers, only lifting up the worst performing projects with thoughtful energy saving projects.

Other Amendments:

Specific to House Bill 0831, I have provided input to the Climate Partners Group combined amendments. I strongly encourage you to add an energy efficiency component for both new buildings and the Building Energy Performance Standards addressing existing buildings. There are several good ways to do this modeled by other states, and we encourage additional discussion and amendment to adopt energy efficiency standards.

If there is an additional meeting or additional support you need in this discussion about building electrification, I'm happy to help.

FSi Engineers

Ben Roush, PE, FPE, LEED AP BD+C, ASHRAE BEMP and BEAP, Certified Commissioning Professional

Principal

New Schools in Maryland Must Be Net Zero

What is a "net-zero" school? A net-zero school is a school whose input of energy is equal to or less than its output.

Net-Zero schools have many benefits. Net-zero (NZE) and NZE-ready schools are much cheaper to operate and often are less expensive to build. After payroll, the biggest line item for school districts is operating costs of buildings–most of which is due to energy costs. Looking only at costs, net-zero schools are by far the superior option.Their initial construction costs are lower than or the same as traditional construction, and their operational costs are far less.

NZE schools offer features like "daylighting"--using daylight controls that "know" when to lower the brightness of artificial light– and improved ventilation and air quality, which are known to improve student learning and health. Maryland already encourages school districts to set targets to increase renewable energy, decrease greenhouse gas emissions, and to construct net-zero schools, but has only taken tentative steps toward making its schools net-zero.

There's never been a better time to invest in net-zero schools. Pursuant to the Built to Learn Act, Maryland is investing significantly in new school construction. In 2021, the Interagency Commission on School Construction approved $545 million of state funds for the construction of 23 new schools in Maryland. We should seize the opportunity to make these new schools net-zero.

We owe it to our children and grandchildren to transition our schools to net-zero. The United Nations' Intergovernmental Panel on Climate Change warns that we are still on the trajectory of catastrophic global warming of 2.7 celsius by the century's end. Even if we stopped emitting greenhouse gases today, the gases we have already emitted will linger in the atmosphere for decades and continue to cause global warming. If we are to limit global warming to 1.5 celsius -- the goal set in the Paris Climate Accord -- we need a 50% reduction in greenhouse gas emissions by 2030. ***The 2020s are the only decade we have left to make that target.***[1] And, to be clear, meeting the target of 1.5 celsius of warming is only the best *bad* decision we have--it still promises sea level rise, more powerful storms, devastating wildfires, and sharp species decline. If we don't sufficiently reduce emissions this decade, we will set off a domino effect of escalating disasters.

Schools are "beacon" projects. They educate our children and our communities about both the benefits of and the imperatives for changing to clean, renewable energy, reducing our energy use, and improving health for students and teachers.

Gas delivery rates are expected to increase. The Maryland Commission on Climate Change has projected that gas delivery rates are likely to increase by 2 to 5 times the current rate for consumers left on the gas system[2], making it all the more important that all Maryland schools transition from fossil fuels.

Construction Costs of Newly Constructed Net-Zero Schools In Baltimore and Howard County

Included below are construction costs for three schools and the energy use of Wilde Lake Middle School, which is actually net negative (meaning it produces more energy than it uses). Due to Covid, one-year performance data on Holabird Academy and Graceland is not yet available. Using Montgomery County Public Schools as a baseline (which likely on average has better energy performing schools than much of Maryland), Maryland schools have an average energy use intensity of **54 kBTU** per square foot per year. Wilde Lake has an energy use intensity of **13.7 kBTU** per square foot per year and produces twice as much energy as it consumes.

---

[1] https://insideclimatenews.org/news/27082019/12-years-climate-change-explained-ipcc-science-solutions

[2] See MCCC Building Energy Transition Plan.

School construction costs from 2016 - 2021 have averaged between $335-$405 per square foot.

Data from Interagency Commission on School Construction.	Average Building Construction Cost Without Site Preparation (per square foot)	Average Building Construction Cost With Site Preparation (per square foot)
July 2021	$341	$405
July 2018	$302	$360
July 2016	$282	$335.58

Wilde Lake Middle School ($329 per sq ft, with site preparation & solar panels)
Columbia, Maryland

- New Net-Zero LEED Platinum
- Completion date: August 2017
- Total construction cost including site preparation and solar panels: $35,000,000 or $329/square foot
- Energy produced during performance period: 821,618 kWh (approximately 2X use)
- Energy use during performance period: 428,301 kWh
- Net Energy Use: -393,317 kWh (meaning this school's energy use is net-negative)
- Energy Use Intensity (EUI): 13.7 kBTU/sq ft/yr

Graceland Park / O'Donnell Heights Elementary/Middle ($358.16 per sq ft, with site preparation & solar panels)- Baltimore, Maryland

- Design Started: 2015/2016
- Construction Purchase Order: June 4, 2018
- Substantial Completion Phase 1 (Replacement Building): August 26, 2020
- Construction cost, including site and solar panels: $33,752,000.00 or $358.16/square foot

Holabird Academy ($364.30 per sq ft with site preparation & solar panels)
Baltimore, Maryland

- Design Started: 2015/2016
- Substantial Completion Phase 1 (Replacement Building): August 26, 2020
- Construction cost, including site and solar panels: $34,330,500.00 or $364.30/square foot

Montgomery County Public Schools Average Energy Use:
2017 average energy use intensity: 54 kBTU per sq ft per year (for comparison: MCPS conventional schools use 54kBTU/sq ft/year compared to Wild Lake's 13.7 kBTU)

For more information contact MLC Climate Justice Wing at mlcclimatejusticewing@gmail.com.

HB 831 Reducing Greenhouse Gas Emissions - Commerc
Uploaded by: Cait Kerr
Position: FAV

The Nature Conservancy
Protecting nature. Preserving life.

The Nature Conservancy
Maryland/DC Chapter
425 Barlow Pl., Ste 100
Bethesda, MD 20814

tel (301) 897-8570
fax (301) 897-0858
nature.org

Friday, February 25, 2022

TO: Kumar Barve, Chair of the House Environment and Transportation Committee and Committee Members
FROM: Michelle Dietz, The Nature Conservancy, Director of Government Relations; and Cait Kerr, The Nature Conservancy, Conservation & Climate Policy Analyst
POSITION: Support HB 831 Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

The Nature Conservancy (TNC) supports HB 831 offered by Delegates Stein and Barve. In Maryland, TNC's work focuses on delivering science-based, on-the-ground solutions that secure clean water and healthy living environments for our communities, reducing greenhouse gas emissions and increasing resilience in the face of a changing climate. TNC has an institutional goal to help to reduce emissions by avoiding or sequestrating 3 billion metric tons of carbon dioxide per year by 2030. We are dedicated to a future where people and nature thrive together.

HB 831 seeks to address a major carbon emitting sector in Maryland through establishing clear targets and goals to achieve emissions reductions within the buildings sector. This past year, TNC participated in the Mitigation Working Group's Buildings Sub-Group to inform recommendations in the Maryland Commission on Climate Change's (MCCC) Building Energy Transition Plan, which aims to decarbonize residential and commercial buildings across the state. Along with our participation in the Buildings Sub-Group, TNC also provided funding to support the Maryland Building Decarbonization Study, conducted by Energy + Environmental Economics (E3), which provided the foundation for the MCCC's Plan.

According to this Plan, buildings sector emissions accounted for 13 percent of the state's total greenhouse gas emissions in 2017. Maryland's 2030 Greenhouse Gas Reduction Act (GGRA) Plan calls for electrifying fossil fuel end-uses in buildings, such as through energy efficiency advancements and through converting fossil fuel powered heating systems to electric heat pumps. One way in which HB 831 advances GGRA goals is through setting Maryland's sights on implementing holistic retrofits, including weatherization measures and heat pump installations, in 100 percent of low-income households by 2030.

HB 831 puts into action the Building Energy Transition Plan's recommendations in order to set Maryland on a clear path toward significant buildings sector emissions reductions. Under this proposed legislation, standards would be set for covered buildings to achieve 20% reductions by 2030 and meet net-zero requirements by 2040. Establishing the Building Energy Transition Implementation Task Force will make meeting these targets possible; this Task Force will study and make recommendations on how best to retrofit buildings and reduce buildings' emissions. New construction will be required to include electric-ready standards to support renewable energy systems. Renewable energy sources and a clean energy economy are essential parts of reaching state, national, and global low-carbon energy goals and combatting the negative health and environmental impacts caused by fossil fuels.

TNC commends Delegates Stein and Barve for continuing to raise the bar for Maryland's climate commitments and advancing climate solutions that can provide valuable environmental, economic, and public health co-benefits for years to come.

Therefore, we urge a favorable report on HB 831.

HB831 Testimony.pdf
Uploaded by: Caroline Thorne
Position: FAV

February 23, 2022
Committee: Environment and Transportation
Testimony on: HB381 – Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings
Position: Favorable

Chair Barve, Vice Chair Stein, and all members of the Education and Transportation Committee

My name is Caroline Thorne and I'm a sophomore Government and Politics and Sustainability student at the University of Maryland, College Park. I live in College Park, and am from Silver Spring. I am in favor of HB831, and I emphasize the importance of the requirement for gas utilities to develop decarbonization plans, as well as the responsible development of commercial and residential buildings.

Growing up in Silver Spring means I experienced the natural gas explosion at the Flower Branch apartments in 2016. As a 15-year old, hearing about children and adults being injured, and even dying in this explosion and fire shocked me. I didn't think gas explosions like this would happen in Maryland, especially not in Silver Spring. At the time, I couldn't fathom how this had happened. Residents reported smelling natural gas for weeks before the explosion. Despite reporting the issue, the problem wasn't addressed, and people paid with their lives. This event was a focal point in my understanding of how human and environmental welfare are always intertwined. Natural gas is not safe nor environmentally responsible. I support the specific requirement of HB831 requiring gas utilities to develop decarbonization plans. We must stop using natural gas in order to protect human lives and our environment.

I speak from first-hand experience when I say Maryland is growing in all areas - in population, economy, and recognition. Growing up, I've watched Silver Spring bloom into an urban center and hub of activity. I know as we grow, people need places to live and jobs to work. However, it is necessary to develop these areas with strong consideration for our environment. It is essential to our growth that we reduce the number of greenhouse gasses being released into the environment. Buildings are responsible for 33% of greenhouse gas emissions. We are at a pivotal point in the climate crisis which requires us to take action. New buildings must be all-electric with net-zero requirement for large buildings, or an alternative compliance fee. Without actions like these, there is no point in developing a world which will not support human life in a few years.

I strongly support HB831's requirements, including all-electric new building standards, and a net-zero requirement for large buildings. I have watched Silver Spring grow with me, and these requirements are key to our efforts in adapting to and combating climate change. I urge a favorable vote on this bill, and request continued action to fight climate change.

Sincerely,
Caroline Thorne, University of Maryland — College Park, cthorne@terpmail.umd.edu

2-25 NS LH HB0831 Reducing Greenhouse Gas Emission
Uploaded by: Casey Hunter
Position: FAV

LEAGUE OF WOMEN VOTERS® OF MARYLAND

TESTIMONY TO THE ENVIRONMENT AND TRANSPORTATION COMMITTEE

HB0831: Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

POSITION: Support

By: Nancy Soreng - LWVMD President

Date: February 25, 2022

The League of Women Voters of Maryland (LWVMD) supports **House Bill 831**, which updates emissions standards and provides funding for energy efficiency retrofits to commercial and residential buildings.

In 2017, commercial, residential, and industrial buildings in Maryland contributed nearly 20% of the state's overall greenhouse gas emissions. Globally, this number rises to 39%. **House Bill 831** would work to reduce the significant and detrimental environmental impact of this sector.

Aging buildings, and even some newer, conventionally built projects lack energy efficiency, requiring greater energy inputs to achieve desired utility results. The housing sector, in particular, could reduce energy consumption by 25% by implementing energy efficiency and weatherization upgrades. Though energy efficiency upgrades do require sometimes large initial investments, they serve to reduce energy costs in the long run, which is especially crucial for energy-burdened low-income households. **House Bill 831** would ensure that low-income households have access to these upgrades with little to no cost.

The state of Maryland must prioritize the energy efficiency of commercial and residential buildings to protect our environment and shield low-income households from burdensome energy costs. The League of Women Voters of Maryland strongly urges a favorable report by this committee on **House Bill 831**.

121 Cathedral Street, Suite 2B, Annapolis, MD 21401
410-269-0232 * info@lwvmd.org * www.lwvmd.org

HB0831Reducing GHG Emissions AIA MD Support.pdf
Uploaded by: Chris Parts
Position: FAV

AIA Maryland

Delegate Kumar Barve
Chair of the Environment and Transportation Committee
Room 251
House Office Building
Annapolis, Maryland 21401

Re: Letter of Support for HB 0831
Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Dear Chairman Barve and members of the Environment and Transportation Committee:

I am writing to voice AIA Maryland's support of House Bill 0831. AIA Maryland represents nearly 2,000 architects in the state of Maryland and advocates for the profession and the quality of the built environment. We, as architects, recognize the impact of greenhouse gas emissions and climate change as we study building sites, the interaction with the natural and built environment around a project and the people who occupy and live or work near buildings we design.

This bill is important because it takes steps now to make an impact on climate change. Buildings are a source of nearly 40% of energy consumed in the US. It is clear that designing buildings to use less energy and moving buildings away from carbon-based fuel systems can both reduce energy demand and emit less carbon into our atmosphere.

- This bill establishes the key metrics of benchmarking to understand current or designed energy consumption and progress toward reduction goals.
- The building energy performance standards establish clear expectations of efficiency that also drive toward a stronger grid interaction and enable greater capacity for engaging in renewable energy sourcing
- Building electrification goals enable us to use highly efficient equipment and simply move us toward cleaner sourcing and distribution of power.

What this bill means is that our many architect members who already work with teams to design projects this way, will continue working with design teams, to plan efficient and all-electric residences, commercial spaces, and institutional projects. This bill will raise the bar and it means that not some, but <u>all</u> our members will design to comply with the proposed measures. We know we can design these projects because they exist, and many are currently being designed and built to such standards. We will all benefit from knowing more about how buildings are performing so we can better assess peak performers and understand why. On our board alone, we have members who are designing zero energy homes, and school buildings, we have affordable and market rate housing projects being designed to be all electric and we have commercial properties being designed to be all-electric with renewable energy sources on-site.

We believe that you should support this bill for two main reasons. First, the time to act is now. Pushing such regulations further down the road will mean that it will take longer to diminish energy needs and carbon consumption because we failed to act and it increases the likelihood that money will need to be spent to repair catastrophic events, vs money spent proactively to diminish the chance of potential crises. Second, this bill is the result of a consensus approach that is built upon the Maryland Climate Change Commission recommendations that is founded on sound research and a cross-section of representatives that have considered costs and merits of decisions.

Maryland is not acting alone in adopting guidelines like these, New York City, and Seattle have adopted similar guidelines and Washington State is nearing passage of similar legislation. We encourage you to support this legislation that aims to limit the impact the built environment on greenhouse gas emissions in Maryland and drives design to further enhance the health and well-being of our residents. We encourage you to vote with our future in mind and cast your vote in favor of HB 0831 to reduce greenhouse gas emissions in commercial and residential buildings.

Sincerely,

Chris Parts, AIA
Director, Past President, AIA Maryland

cc: Environment and Transportation Committee:

HB0831 Rigby Favorable.pdf
Uploaded by: Christiana Rigby
Position: FAV

Howard County Council

George Howard Building
3430 Court House Drive
Ellicott City, Maryland 21043-4392

Christiana Rigby
Councilmember

District 3

TESTIMONY IN SUPPORT OF HB0831
Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

February 25, 2022

Dear Chair Barve, Vice Chair Stein, and Members of the Environment and Transportation Committee:

Thank you for the opportunity to provide written testimony to the Committee. I am writing to express my support for HB0831, legislation introduced by Delegate Barve and Delegate Stein to enhance building standards, promote electrification, and reduce greenhouse gas emissions in Maryland.

HB0831 would encourage the electrification of buildings in Maryland by requiring that all new buildings meet their water and space heating needs without the use of fossil fuels by 2023. Additionally, this legislation establishes a process to retrofit existing commercial and multifamily buildings away from fossil fuels and toward more sustainable power sources.

These measures are incredibly important in our state's efforts to reduce emissions and combat climate change. According to the Maryland Commission on Climate Change, the use of fossil fuels in buildings currently accounts for roughly 13% of Maryland's greenhouse gas emissions. In their 2021 Annual Report, the Commission encouraged that the General Assembly work to ensure "that new buildings meet all water and space heating demand without the use of fossil fuels." This legislation is a major step toward meeting that goal.

Climate change is one of the greatest threats facing our world. In Maryland, climate change has contributed to rising temperatures, more frequent and severe weather events, and rapid sea level rise. We must meet this crisis head-on by taking forward-looking actions to safeguard the future of our community. Our efforts to reduce emissions and combat climate change must be holistic and span different sectors, including transportation, buildings, the energy grid, waste management, and more.

HB0831 is an important step forward for Maryland as we respond to the climate crisis and chart a sustainable path into the future. Thank you for your consideration of this legislation. I respectfully encourage a favorable report.

Sincerely,

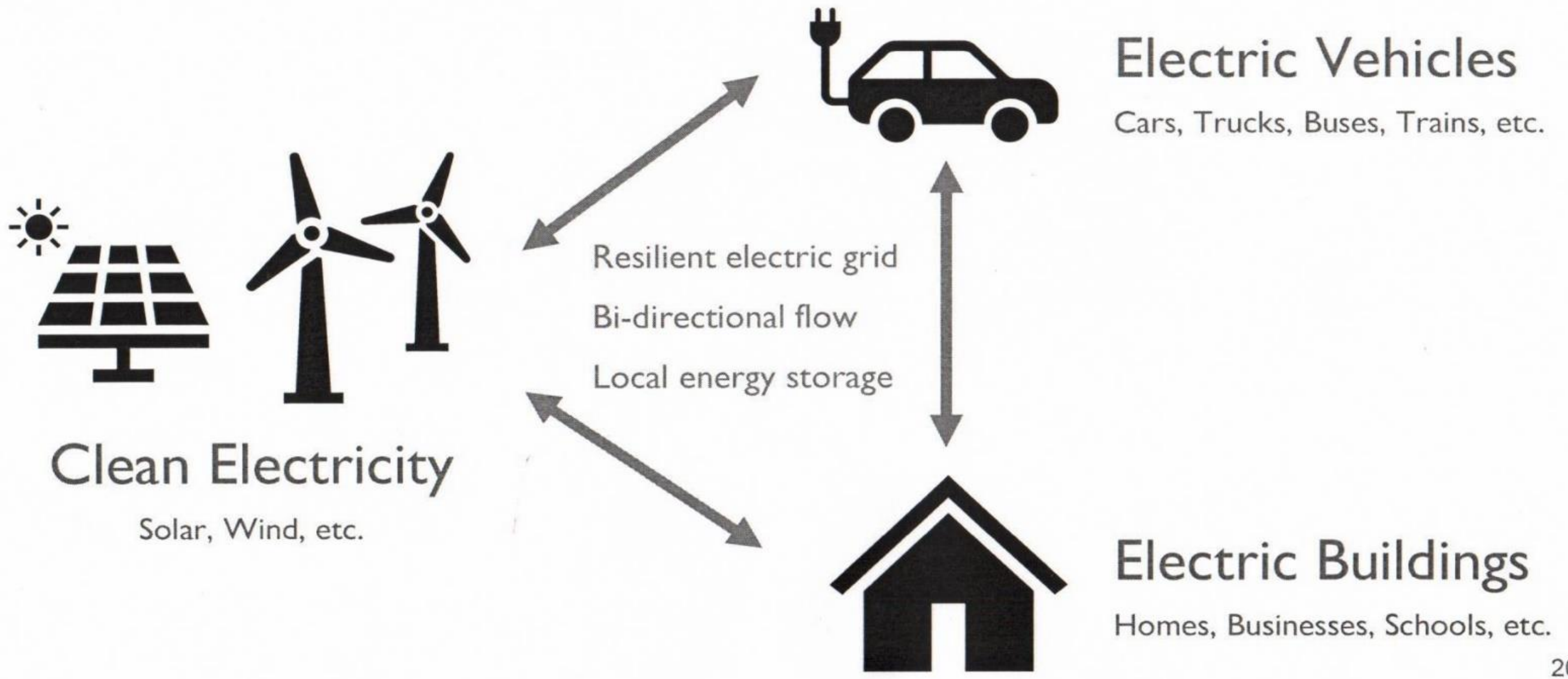
Christiana Rigby

Christiana Rigby
Howard County Councilmember, District 3

HB831_FAV_Stein
Uploaded by: Dana Stein
Position: FAV

HB 831
Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Where We Are Heading



Why Reduce Emissions from Buildings?

- The use of fossil fuels in buildings is a substantial source of CO_2 emissions in Maryland. Most of this energy use is for space and water heating.
- Maryland's **2030 Greenhouse Gas Reduction** Act (GGRA) Plan, approved by the Maryland Commission on Climate Change, set a goal of electrifying fossil fuel end-uses (using natural gas and oil) in buildings.
- The 2030 GGRA plan called on the Maryland Commission on Climate Change (MCCC) to develop a Building Energy Transition Plan to identify measures and goals to decarbonize the buildings sector.

Source: Maryland Commission on Climate Change

MCCC Buildings Subgroup

MCCC established a Buildings Subgroup to develop the transition plan. The group consists of representatives from a variety of sectors: builders, environmentalists, utilities, energy, and state and local agencies.

With the help of the consultant **Energy + Environmental Economics (E3),** the Buildings Subgroup developed the Building Energy Transition Plan: A Roadmap for Decarbonizing the Residential and Commercial Building Sectors in Maryland in November 2021.

This plan was approved by the MCCC Commissioners as part of its Annual Report by a vote of **24-2** (the two “no” votes were State agencies).

The two core concepts of the plan are:

1) Construct **new buildings** to meet space and water heating demand without fossil fuels. An all-electric construction code for space and water heating should be adopted by 2024.

2) Implement a flexible Building Emissions Standard for existing commercial buildings to reduce **direct** building emissions to net zero by 2040.

Building Decarbonization Roadmap for Maryland

Red shading indicates transition time to near-zero emissions

Sector	Measures	Target
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 by 2024
New Commercial	All-Electric Construction Code [P] Heat pumps or other clean energy technologies where practical Ready for solar, EV charging, and building-grid interaction	Zero to low direct emissions by 2024
Existing Homes	Clean Heat Retrofit Program [P] Incentives for holistic efficiency, electrification, comfort, and safety upgrades [E] Gradual transition to an all-electric residential buildings sector	Zero direct emissions by 2045
Existing Commercial	Building Emissions Standard [P] Flexible, technology-neutral program Owners choose the best path for their buildings	Net-zero emissions by 2040
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	Gas Transition Plan [P] Plan for a significant reduction in gas consumption Building Emissions Standard alternative compliance/carbon offset [P]	Low emissions by 2045

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

Key Provisions of HB 831

House Bill 831 is based on the Subgroup's plan and recommendations, as adopted by the MCCC.

- Develop a code that requires new buildings to meet water and space heating demand without using fossil fuels. Department of Labor is to adopt the code by 2024 (by sponsor amendment) and DOL will develop a cost-effectiveness test that builders can use to apply for variances from the electric requirements on new buildings.

- **Existing commercial buildings larger than 25,000 sq. ft.** to reduce on-site emissions to zero by 2040. MDE to develop a flexible building emissions standard to achieve this. Owners of covered buildings can determine on their own how (and with technical support from MEA) to invest in building upgrades to reduce emissions. An alternative compliance pathway allows the owner of a covered building to pay a fee for building emissions that exceed the standard.

Key Provisions (continued)

- ACP funds would be invested in carbon sequestration and other measures that net out remaining building emissions.
- A **Building Energy Transition Taskforce** will recommend a plan to assist commercial and residential building retrofits through tax credits, subsidies, and other state support.
- The bill establishes a goal of retrofitting 100% of low-income households by 2030. Funding to be provided to enable MEA, DHCD, and local governments and organizations to offer little-to-no upfront cost retrofits.

This Is What the Bill Does NOT Do

- Existing homes do **not** have to electrify (or make any changes)
- New buildings will **not** cost more. In fact, almost all building types will cost less to build and operate as electric buildings (per E3 and RMI).
- Existing buildings are **not** required to electrify. The MCCC plan assumes that many buildings can keep gas systems using an alternative compliance program. Also, renewable gas and other low-carbon fuels would qualify.
- A build-out of the grid is **not** necessary to handle increased demand before 2030. E3's study shows that winter power demand will be the same as summer demand in 2030. After that, there will be some investments needed to strengthen the grid (and gas system investments will decline).

Maryland Would Not Be the Only Jurisdiction Requiring Electrification of New Buildings

- **New York City** has enacted an all-electric, new construction law that also includes a ban on fossil fuel used for cooking, not just for space and water heating.
- **California's** new code doesn't require new buildings be all-electric, but its new code will prompt many builders to forego gas in new construction starting in 2023. (nrdc.org)
- **New York State** is currently considering a statewide, all-electric building requirement.
- **Washington State** is considering all-electric new construction for commercial buildings.
- **New Jersey's** Energy Master Plan calls for the full electrification of buildings

This Plan Will Reduce Emissions *and* Costs

E3 found that implementing the plan will:

- Reduce emissions from residential and commercial buildings by 95 percent by 2045 (assuming a high rate of adoption of residential heat pumps)
- Reduce construction and energy costs for all building types except for large commercial buildings
- Ramp up electricity system investments to around $1B annually by 2045
- Ramp down gas system investments, saving around $1B annually by 2045
- Provide the lowest gas rates among all scenarios modeled

Economic Benefits of the Building Energy Transition Plan

According to an RESI (Towson University) analysis, implementing the Building Energy Transition Plan would, between 2021 and 2045, generate an **additional:**

- $16B to $67B in total economic activity;
- **$4.5B to $23B in net economic benefits;**
- 29,000 to 215,000 jobs;
- $4B to $19B in wages;
- $600M to $1.3B in county tax revenue; and
- $800M to $1.9B in state tax revenue

Source: Towson University, Regional Economic Studies Institute, "Economic Benefit Analysis of Building Energy Transition Plan Investments."

THE BALTIMORE SUN
LIGHT FOR ALL

Maryland must reduce its natural gas consumption

Commentary in support of the Climate Solutions Now Act of 2022

By: Baltimore Sun Editorial Board 2/22/22

There's an old saying (and song lyric) repeated around the State House whenever difficult issues arise before the Maryland General Assembly: Everybody wants to get into heaven, but nobody wants to die. In the context of legislative matters, it means that we can all usually agree on good outcomes, but it's how best to get there that proves daunting. In the matter of how to deal with the serious threat posed by climate change, most lawmakers (those who aren't outright global warming deniers) favor a reduced carbon footprint. But, aside from the relatively easy steps like encouraging renewables or providing incentives for homeowners to invest in insulation or other forms of conservation, the devil is inevitably in the details. That was evident last week when landmark climate legislation, the Climate Solutions Now Act of 2022, received its first hearing before the Senate Education, Health and Environmental Affairs Committee.

The sticking point? Not necessarily in setting more ambitious goals like a 60% reduction in greenhouse gas emissions by 2030 (the state is currently on track for a 40% reduction in eight years), but in specific measures to reduce natural gas consumption. And here's one that could prove a significant roadblock: The legislation would mandate that all new buildings in Maryland be powered by electricity. That prospect drew howls from Baltimore Gas and Electric and others with significant investments in natural gas distribution. And, indeed, that industry has long tried to present itself as at least a "transitional" fuel that is not as harmful as burning coal or gasoline. And there's surely no shortage of consumers who like their gas stoves, water heaters and furnaces — or at least they did prior to recent rate hikes that have raised the cost of natural gas 24% from one year ago (and may increase further as Russia threatens Ukraine).

In reality, the primary component of natural gas, methane, is a far more potent greenhouse gas than carbon dioxide. Production leakage is a major problem, but even if that were addressed, methane is still a fossil fuel and so produces carbon dioxide when it's burned. Adding natural gas capacity whether in the U.S. or elsewhere will only make matters worse. There's simply no room for further fossil fuel development if the world is serious about meeting its climate goal of no more than a 2-degrees Celsius rise (or 3.6 degrees Fahrenheit) in average temperatures this century. Switching to all-electric construction is a sensible move, particularly as its followed by greater investment in greener forms of electrical generation including wind and solar.

Nevertheless, opponents of electrification have made claims about natural gas that don't stand up to scrutiny. They have said that natural gas is more reliable (which ignores how most gas furnaces require electricity to run), that it's cheaper (the Maryland Commission on Climate Change actually found the reverse to be true), and that transitioning to electricity will harm low and moderate income households when, again, the long-term fuel costs should actually prove lower. Granted, not everyone can afford new appliances, but that requirement of the legislation is aimed primarily at new construction.

Some companies and individuals may take a financial hit as the state transitions away from natural gas, of course. But setting energy policy based on gas production or pipeline jobs is like setting Chesapeake Bay water quality goals based on the convenience to polluters. And make no mistake, Maryland is particularly vulnerable to climate change because of its coastal location. The U.S. Environmental Protection Agency has warned that rising sea levels, worsening storms, and saltwater intrusion that ruins farmland and infiltrates drinking water supplies could spell disaster for the state, particularly low-lying areas near the Chesapeake Bay and its tributaries. Maryland can't afford to wait for other states or countries to make the transition to clean energy; we must lead by example.

Lawmakers should keep this threat in mind as they consider any changes to the legislation to reduce its impact or delay its implementation. There may be a price to pay for reducing our dependence on methane but there's an even greater price to be paid by doing nothing about climate change. Build more gas pipelines and we are locking in more carbon production for decades hence. And while it's all very well to transition to electric school buses or insist new or renovated schools are energy efficient, lawmakers must insist on doing the more politically difficult things as well beginning with regulating natural gas out of all new buildings.

HB831_OPC_support_final.pdf
Uploaded by: David Lapp
Position: FAV

David S. Lapp
People's Counsel

William F. Fields
Deputy People's Counsel

Joseph G. Cleaver
Deputy People's Counsel

OPC

Office of People's Counsel

State of Maryland

6 St. Paul Street, Suite 2102
Baltimore, Maryland 21202
www.opc.maryland.gov

Brandi Nieland
Director, Consumer
Assistance unit

BILL NO.:	House Bill 831 Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings
COMMITTEE:	Environment and Transportation
HEARING DATE:	February 25, 2022
SPONSORS:	Delegate Stein Delegate Barve
POSITION:	Support

****

The Office of People's Counsel strongly supports House Bill 831. The bill will benefit residential utility customers by lowering the upfront costs of electrifying the State's multi-family housing and reducing the probability that residential customers will face unaffordable energy bills as natural gas rates increase to support utility investments in the natural gas system.

Background

House Bill 831 directs the Department of the Environment to develop building emissions standards for certain commercial and multifamily buildings to achieve a 20% reduction in direct building emissions by January 1, 2030, and net-zero building emissions by January 1, 2040.

HB 831 would create the Building Energy Transition Implementation Task Force under the chair of the Secretary of the Environment with members from various state agencies, including People's Counsel, and representative groups appointed by the Governor. The Task Force will examine policies and programs to reduce emissions from the building sector, develop a plan for retrofitting buildings to reduce emissions, and explore financial incentives through existing state programs and tax credits to decarbonize buildings. The Task Force will make recommendations to the Governor and General Assembly.

Comments

1. HB 831's multi-family housing provisions will protect and benefit residential utility customers as the State acts to meet the challenges of climate change.

Technical analyses show that electrification is the lowest cost means for meeting the State's climate policies for residential customers. This is the finding in the report of the Mitigation Working Group of the Maryland Commission on Climate Change: "Residential customers can save costs by electrifying all building end uses compared to using gas." The MWG's conclusion is supported by analyses performed by our office, and it is widely supported by analyses performed in other States.

Natural gas utility rates are rising and will continue to rise as the State electrifies. Despite the need to electrify, gas utilities are accelerating their infrastructure investments at an unprecedented rate. Setting aside investments for connecting *new* gas customers—investments that by themselves are significant—the State's three largest utilities alone have plans to invest approximately $4.8 billion over the next 20 years to replace *existing* infrastructure. Utilities plan to recover these investments from customers over many decades, through the end of the century. The revenue requirement for these investments is allocated across all customers. As customers leave the gas system to electrify, however, rates will increase for those remaining on the system, causing even more customers to leave the gas system.

Navigating the transition to electrification will be most challenging for less affluent customers, especially those living in multi-family housing who do not control their energy sources. Without intervention by the General Assembly, these households are highly vulnerable to paying high rates as others electrify and save money. They are most likely to remain on fossil fuels longer than more affluent customers who are able and can afford to electrify. Put simply, policies are necessary to ensure that low and moderate-income households are among the first to electrify, not the last.

HB 831 directly addresses the challenges of electrification for residential customers on a budget by requiring standards that will promote early weatherization and electric heat pump installations in multi-family dwellings. It is thus a critical component of State policies for meeting the challenges of climate change.

2. **HB 831's other provisions further the interests of residential utility customers.**

The creation of the Building Energy Transition Implementation Task Force should also yield short- and long-term benefits for residential customers. The Task Force will help the State plan for the energy transition. Better planning will help to avoid uneconomic investments and lower costs for customers.

HB 831's inclusion of financial incentives through EmPOWER program is an important component of the bill. The recommendations contemplated by HB 831 would increase the efficacy of the EmPOWER program and provide stakeholders with clear guidance as to how the EmPOWER program can be utilized to support a transition to electrification of Maryland's building sector.

Extensive retrofits to existing housing will have to take place for Maryland to meet its climate goals. The potential financial burdens from electrification borne by Maryland's low-income and moderate-income ratepayers must be mitigated by public policies supporting the electrification of their households. HB 831 takes a critical step in the right direction.

Recommendation: OPC requests a favorable report from the Environment and Transportation Committee to HB 831.

2022 HB831 Saunders Testimony.pdf
Uploaded by: David Saunders
Position: FAV

SUBMISSION DATE: 2/23/2022

HEARING DATE: 2/25/2022

BILL: HB0831

SPONSOR: Delegates Stein and Barve

TITLE: **Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings**

POSITION: Favorable

COMMITTEE: Environment and Transportation Committee

Point 1. Burning Natural Gas Creates Significant Greenhouse Gases

- Home in Village of Cross Keys burned 1,026 therms of natural gas which produced 5.4 metric tons of greenhouse gas. The greenhouse gas floats in the stratosphere for 100 years.
- Installation of heat pump, powered by 100% renewable, would produce no greenhouse gas.

See Attachment A: Presentation to the American Society for Quality (ASQ) Baltimore (p. 8).

Point 2. Heat Pumps will Save Consumers Money

- Heat pumps, which can both heat and cool your home, do a better job of keeping your home at a constant, comfy temperature than an oil or natural gas furnace, while using only 30% of the energy to do so.
- They can save you money since they use less energy, which makes them cheaper to run over their 10-25 year lifetimes.

See Attachment B: *Electrify Everything in your Home: A Guide to Comfy, Healthy, Carbon-Free Living* by Joel Rosenberg (p. 3).

Point 3. Natural Gas is More Vulnerable to Market Fluctuations

- On average, households that heat with natural gas will likely pay $161 more this winter than last.
- For households with electric heat pumps, energy bills are only expected to rise by only $21 more than last year.
- In every region of the country, the expected increase for natural gas households is greater than that of electric heat pump households.

See Attachment C: *Energy Bill Security for American Households through Electrification* by Sam Calisch, Rachael Grace, Gabe Daly, Ari Matusiak of Rewiring America, Dec 2021 (p. 3)

For these reasons and more, I urge a FAVORABLE REPORT on HB0831 Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Respectfully submitted,
David Saunders CC-P*
410-456-8542 cell, davidsaunders107@gmail.com
*Climate Change Professional (CC-P), Certified by the Association of Climate Change Officers and the State of Maryland

A. ASQ Baltimore.pdf
Uploaded by: David Saunders
Position: FAV

Attachment A: Presentation to the American Society for Quality (ASQ) Baltimore

5T (Five Teams)

What Every Organization Needs to Fight Climate Change

Baltimore, MD
Dec 7, 2021

David M. Saunders, CC-P*
davidsaunders107@gmail.com

*** Climate Change Professional (CC-P)**, Certified by the Association of Climate Change Officers and the State of Maryland

1

1

Agenda

- Team 1. **Strategy Team:** Why climate change is a quality issue.
- Team 2. **Adaptation Team**: How to protect our vulnerable assets.
- Team 3. **Mitigation Team**: How to lower our greenhouse gases emissions.
- Team 4. **Reporting Team**: Managing greenhouse gas data.
- Team 5. **Opportunity Team**: How to profit from the fight against climate change.

Please type your questions in the CHAT

2

2

1. How to conduct an adaptation project

National Oceanic and Atmospheric Administration (NOAA)

Source: https://toolkit.climate.gov/

3

3

Cambridge, Maryland, October 2021

4

4

5

5

6

6

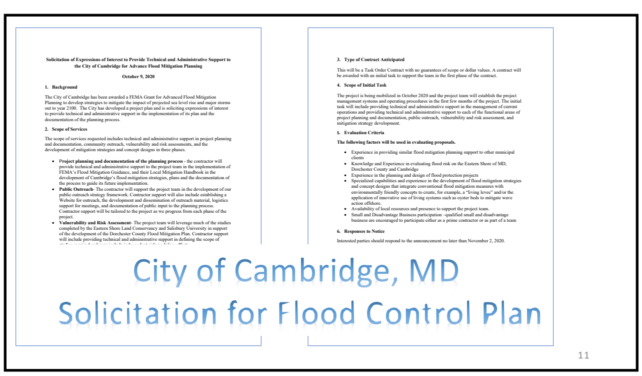
Attachment A: Presentation to the American Society for Quality (ASQ) Baltimore

7

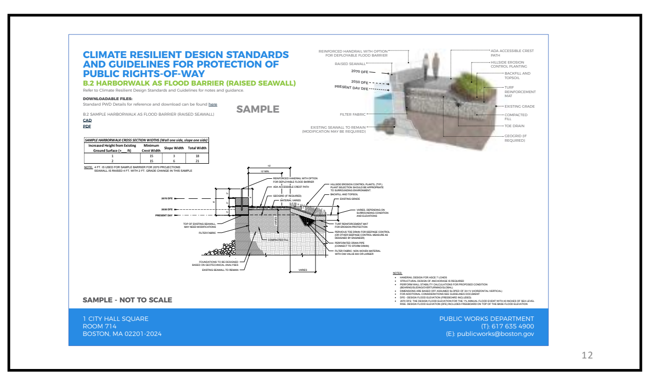
8

9

10

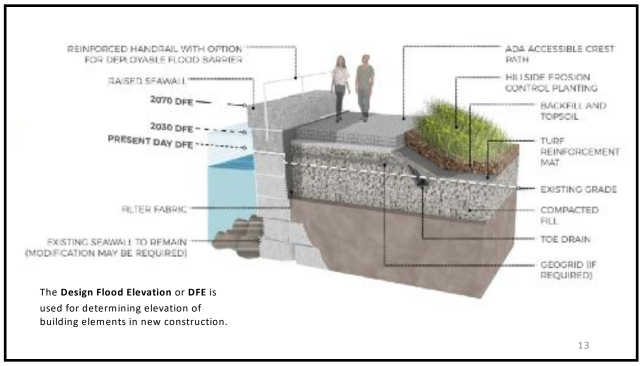


11



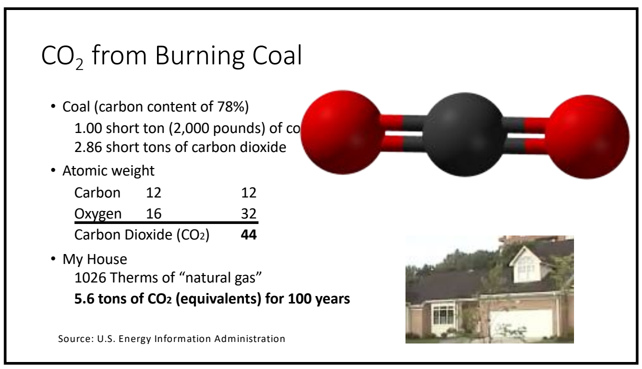
12

Attachment A: Presentation to the American Society for Quality (ASQ) Baltimore



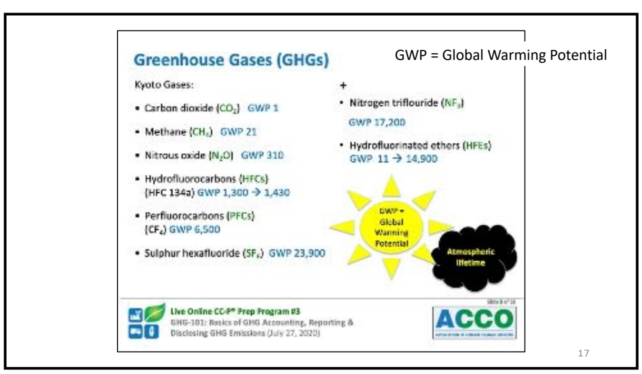
13

14

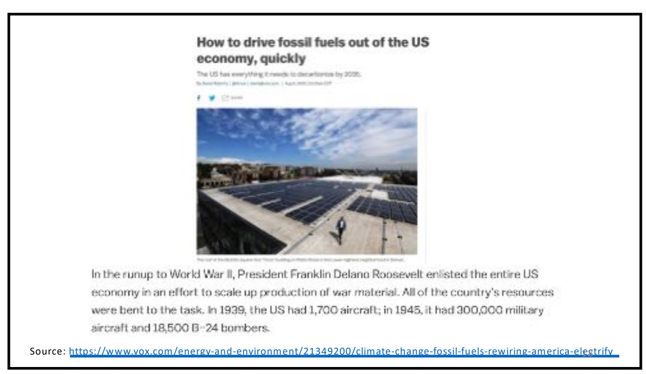


15

16

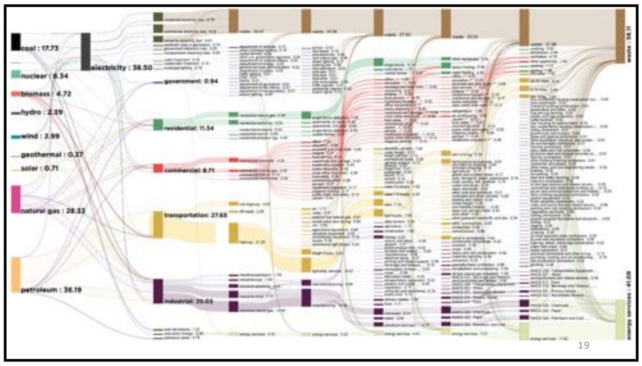


17



18

Attachment A: Presentation to the American Society for Quality (ASQ) Baltimore



19

20

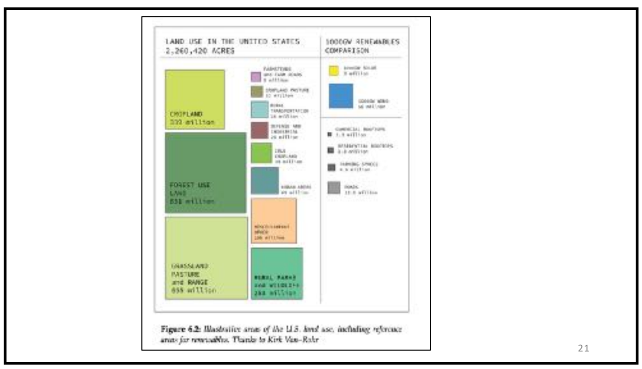


Figure 6.2: Illustrative areas of the U.S. land use, including reference areas for renewables. Thanks to Kirk Van-Rohr

21

B. Electrify Everything... by Rosenberg.pdf
Uploaded by: David Saunders
Position: FAV

Attachment B

ELECTRIFY EVERYTHING

in Your Home

A GUIDE TO COMFY, HEALTHY, CARBON-FREE LIVING

BY JOEL ROSENBERG, REWIRING AMERICA

Attachment B

ELECTRIFY EVERYTHING

in Your Home

A GUIDE TO COMFY, HEALTHY, CARBON-FREE LIVING

By Joel Rosenberg, Rewiring America

REWIRING AMERICA

Attachment B

Version 1.0, released December 2021

Check **rewiringamerica.org/electrify-home-guide**
for a FREE download of this ebook, updates, and other info.

To print at home, choose layout '2 Pages Per Sheet,'
and print on both sides of paper.

REWIRING AMERICA
rewiringamerica.org

Print version: ISBN 979-8-9851808-0-0
Electronic version: ISBN 979-8-9851808-1-7

Written by Joel Rosenberg
Edited by Laura Fraser
Designed by Taylor Roy
Illustrated by Brian Ritter

Printed by Ingram Spark
ingramspark.com

Attachment B

Table of Contents

Why electrify?

At Rewiring America, we're convinced that the future will be awesome — if we electrify everything. Around 40% of the United States carbon emissions come from our homes and the vehicles we drive. Simply switching everything in our lives to be powered by electricity from renewable energy will go a long way toward getting our emissions down and reducing the impact of climate change. Rewiring America estimates that to achieve zero emissions, we need to install 1 billion new machines, or 50 million machines a year for the next 20-25 years.[1] It's a lot, but it's very doable if everyone stops buying fossil-fueled machines. As a bonus, you'll also get better performance and lower utility bills from your new electric appliances.

This is not to say that all of the responsibility for fixing climate change rests on your individual choices and "carbon footprint" — we also need large-scale changes in policy around renewable energy, government subsidies, and industry accountability. But because our homes and cars are such a large part of U.S. emissions, we have to start electrifying them now, and get to 100% adoption of electric replacements as quickly as possible. We need both policy changes and individual action to solve this crisis, and every day we wait just makes it harder.

The actions in this handbook are one-time decisions that update your personal infrastructure for lower energy use and lower carbon emissions. There are also a number of changes in your behavior that would help reduce your emissions, such as eating less meat, buying fewer things of higher quality that will last longer, and flying and driving less. Those are all fine choices as well. But by far the biggest impact you can make is by electrifying everything in your home.

To electrify everything, you'll need to replace any machines that currently burn fossil fuels — your gas-powered car, furnace, water heater, kitchen stove, and dryer. You might also install some new electric machines, like solar panels and a home storage battery. You don't have to do this all at once — you can wait until the next time your car or heater dies and needs to be replaced. This handbook is a tool to help you convert your household to run fully on electricity, backed by renewable energy. And even if you're a renter, there are things you can do, too, to reduce carbon emissions in your home.

The machines you'll learn about in this handbook are *better* than the fossil-fuel versions they're replacing. Here are some examples:

- Heat pumps, which can both heat and cool your home, do a better job of keeping your home at a constant, comfy temperature than an oil or natural gas furnace, while using only 30% of the energy to do so.
- Many people think their Electric Vehicles (EVs) are more fun to drive than their gasoline cars, and much cheaper to charge and maintain. A typical EV costs you 5¢ per mile to drive, while a typical gasoline vehicle costs you 13¢ per mile.[2]
- Induction cooktops deliver better performance than gas stovetops, with higher heat and improved control, which is why many professional chefs and home cooks prefer them. They can boil water in half the time, for example. Plus, you won't hurt your hand if you touch the burner when it's on – they only heat the pan.[3]

Even though these are the machines of the future, they aren't new inventions: heat pumps use the same basic technology as your refrigerator; electric cars were first popular in the late-1800s before gasoline cars dominated the 20th century;[4] and induction cooking was invented in the early-1900s.[5] It's because of more recent improvements in these technologies, including better batteries and computerized control, that these machines got their performance advantages. But there are other benefits as well:

- They're **healthier and safer** since you're not burning fossil fuels inside your kitchen and causing indoor air pollution, you're not storing fossil fuels in your basement or garage, and you can get rid of the explosive methane gas flowing into your home.
- They can **save you money** since they use less energy, which makes them cheaper to run over their

10-25 year lifetimes. Rewiring America estimates that more than 103 million American households would start saving money on their monthly utility bill right away if electric heat pumps for space and water heating cost the same to buy and install as the fossil-fueled machines they're replacing (i.e., those that run on oil, propane, or outdated, inefficient electric resistance heaters). Check out our Bringing Infrastructure Home report — **rewiringamerica.org/policy/bringing-infrastructure-home-report**.

→ If your electricity comes from renewable sources like solar and wind, they will run without producing any carbon emissions, and that helps us **beat climate change**. Even if your electricity comes from fossil fuel power plants run by your local utility, these modern home machines are so much more efficient they'll still have lower total carbon emissions than burning fossil fuel directly at home. Plus, as your grid switches to 100% renewable sources, the emissions will drop to zero — they are "appreciating climate assets" (they get more valuable over time).

ELECTRIFICATION FOR EVERYONE

This guide is geared mostly towards single family homeowners, but Rewiring America is a strong advocate of electrification for everyone. Indeed, our position is that electrification is the most equity-centered of our climate strategies. It applies to all households, and when combined with the right policies, results in economic savings and health benefits that disproportionately benefit low income and historically disinvested communities. Further, many of the electrification projects below can be done by renters.

Right now, some electric machines are more expensive to buy than their fossil fueled versions — though they usually lower your bills once installed. Rewiring America is working on policy initiatives to help eliminate this extra up-front cost through rebates, with an emphasis on helping Low and Middle Income (LMI) households get these machines and the lower bills they provide.

All of the recommendations in this handbook are meant for everyone, even if they're not yet within everyone's budget. As we dial in the correct policy measures, and as industry produces more of the machines that will help us mitigate climate change, their costs will drop even further.

ADDITIONAL RESOURCES

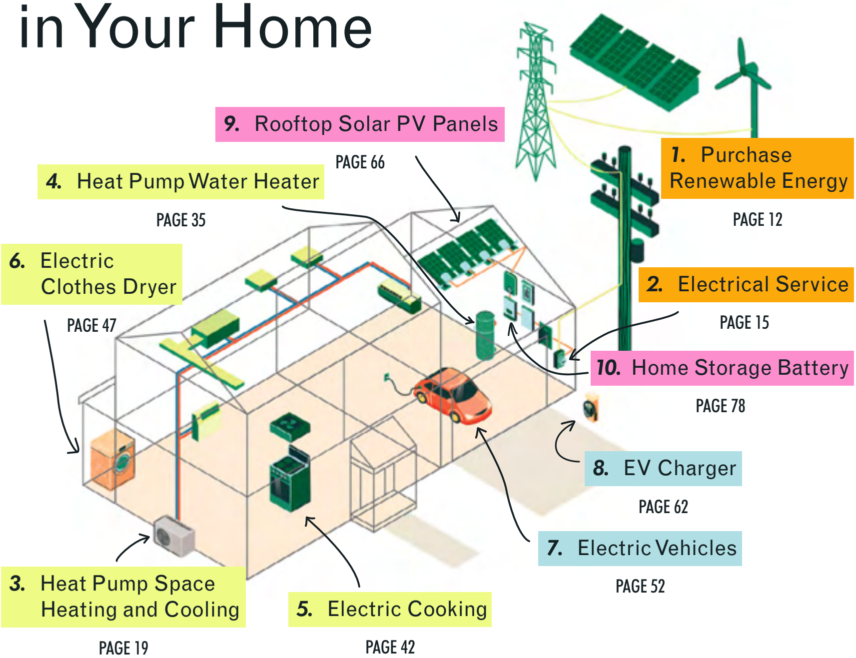
In addition to this *Electrify Everything* guide, two other resources are worth getting:

Attachment B

- Redwood Energy's *Pocket Guide to All-Electric Retrofits of Single-Family Homes* includes a comprehensive guide to many electric appliances on the market, along with case studies and other useful background:
  - Retrofit Guide — **redwood energy.net/research**
  - Webinar — **www.youtube.com/watch?v=uUoyweC0mSE**

- Nate Adams (aka Nate the House Whisperer) "Electrify Everything" course is a series of 12 emails and videos with an emphasis on space heating and cooling, which is the most complex step.
  - Emails — **natethehousewhisperer.com/electrify-everything-course.html**
  - Videos — **youtube.com/playlist?list=PLLTtM5Ga_CUtT-SB20vtU2y2EwtrwC6B6**

Where to Electrify Everything in Your Home



How to use this handbook

Because we're at the start of this electric transition, there aren't companies (yet) that will come and replace all of your fossil fuel machines. For now, you have to do more of the legwork yourself. But you can start small, and you don't have to do everything all at once — you just need to be ready for an electric replacement when the time comes (though it's helpful to retire machines early if your concern is reducing emissions).

Each chapter of this guide goes into detail about one aspect of upgrading your machines. The goal is to help you make a plan, and support you as you go through each process — from understanding what the change is, to hiring the contractors who will do the work, to using your new machines.

GETTING STARTED NOW!

The tables on the next two pages can help you make a plan. The first table lets you prioritize replacing your machines based on their age, their cost and potential savings, or their share of home emissions (cars, space heat, then hot water are the biggest). Harder upgrades might require more design, more permits, or take longer. For items that need an electrical upgrade, consider having an electrician install circuits and outlets in advance, so you're ready the next time you buy a replacement (see *Chapter 2: Electrical Service*). For renters, upgrades you control are marked with an R.

The second table summaries concrete actions you can "Do Now" to start making progress immediately. If you're a renter, consider working with your landlord on upgrades you can't do without them.

Overall, the recommendation is to buy machines with lower energy needs and operating costs. These also have lower emissions, and help you delay (or avoid) needing to upsize your electrical service to 200A, while still providing comfort and performance.

Attachment B

	LIFE IN YEARS	ELECTRICAL UPGRADE	UP FRONT COST BEFORE REBATES	ANNUAL OPERATING SAVINGS	HARDER	% HOME EMISSIONS	IMPROVES AIR QUALITY	RENTER CONTROLS
1. Purchase Renewable electricity			$0					R
2. Electrical Service	20-25 YRS		$750-4,000		✓			
3. Heat Pump Space Heating and Cooling	15-20 YRS	AT INSTALL	$1,000 DIY, TO $20,000+	$$$	✓	25%		R
4. Heat Pump Water Heater	10-15 YRS	MAYBE	$1,500 DIY, $4,000 INSTALLED	$		10%		
5. Electric Cooking	13-15 YRS	YES	$2,000-3,000			5%		R
6. Electric Clothes Dryer	10-13 YRS	MAYBE	$1,000-2,000	$$		3%		R
7. Electric Vehicles	20-25 YRS		$10K (USED) AND UP	$$$		50%		R
8. EV Charger (240V EVSE)	10-15 YRS	YES	$500-2,500					R
9. Rooftop Solar PV Panels	20-30 YRS	AT INSTALL	$15,000-30,000	$$$	✓	HELPS ALL		
10. Home Battery Storage	5-15 YRS[6]		$10,000-20,000	$	✓	HELPS ALL		

KEY:

$ SAVE $50+ PER YEAR
$$ SAVE $200+ PER YEAR
$$$ SAVE $500+ PER YEAR

INDOOR & OUTDOOR
OUTDOOR

Attachment B

DO NOW

1. Purchase Renewable electricity

Log on to your utility account (or call) and switch to a renewable power plan if it's available. If not, look for a Community Solar or Wind project to join. **RENTER**: Same.

2. Electrical Service

Check your electrical panel to figure out how it's sized (see *Chapter 2: Electrical Service* for instructions). **RENTER**: Same.

3. Heat Pump Space Heating and Cooling

Get a "home energy audit" or "home energy assessment" (including a blower door test), and/or schedule at least one heat pump contractor to come to your home and give you an initial quote/ proposal. **RENTER**: Get a window unit or portable heat pump.

4. Heat Pump Water Heater

Find your current water heater and determine how old it is (see *Chapter 4: Heat Pump Water Heater* for instructions). Plan to replace it if it's over 10 years old. **RENTER**: Show your landlord heat pump replacement options & EnergyGuide savings.

5. Electric Cooking

Hold a magnet to your pans, and if the magnet sticks it will work with an induction cooktop. Buy a $50+ portable induction burner now, and plan to have a 240V / 40A outlet installed before you next replace your stove. **RENTER**: Buy a $50+ portable induction burner.

6. Electric Clothes Dryer

Check if you have a gas dryer, or if you already have a 240V appliance outlet behind your dryer. Get a clothes drying rack or clothesline. **RENTER**: Get a clothes drying rack or clothesline, and consider a combo washer & condensing dryer that runs on 120V (if allowed).

7. Electric Vehicles

Consider how far you drive in a day to start thinking about range, and look online for public charging stations nearby to start thinking about where else you can charge. **RENTER**: Same.

8. EV Charger (240V EVSE)

If you have a garage, check if you already have a 240V appliance outlet for a faster "Level 2" charger.
RENTER: Ask your landlord and employer about installing a Level 2 charger.

9. Rooftop Solar PV Panels

Use a website to check your address's potential for sun. Use **energysage.com** to get initial quotes. **RENTER**: Send quotes to your landlord, along with financing options.

10. Home Battery Storage

If you have rooftop solar, check with your installer about whether they also offer a storage option. **RENTER**: Get a standalone backup battery.

Attachment B

How to pay for it

Full electrification of your home can be costly up front, but many of the upgrades pay for themselves over time with lower operating costs. There are also rebates and financing available, which are described more below. But there are also affordable things every household can do to lower their emissions. Consider your budget, and what initial projects make the most sense:

→ $0 up front: Purchase renewable energy from your utility or co-op — it might save you money or cost a little more.

→ $50-100: Buy an induction burner cooktop to start cooking *without* gas.

→ $300: Hire a "home energy auditor" to do a blower door test and suggest ways to reduce your home's energy leaks (might be free through your utility or government).[7]

→ $1,000: Get a mini-split heat pump and install it yourself using YouTube videos.

→ $1,500: Get a heat pump hot water (HPHW) heater and install it yourself using YouTube videos (check with your state that you don't need a licensed installer)

→ $4,000: Get a HPWH installed, or a heat pump space heater/cooler for your 1,000 square foot home.

→ $10,000 to $20,000: Upgrade to a heat pump space heater/cooler for your 3,000 square foot home, or buy a used Electric Vehicle (EV).

→ $20,000+: Start aiming to completely electrify everything in your home.

REBATES

There are many electrification rebates available — from federal tax credits for residential solar PV[8] and EVs,[9] to state and regional rebates for heat pumps and other appliances.[10] These are addressed in chapters that follow. But here are some general places to check for rebates:

- DSIRE (Database of State Incentives for Renewables & Efficiency), where you can find rebates by zip code, as well as policies by state — **www.dsireusa.org**
- Energy Star Rebate Finder by zip code — **energystar.gov/rebate-finder**
- Search online for "[YOUR STATE NAME] + [YOUR UTILITY NAME] + electrification energy efficiency rebate".
- Ask any contractor you talk to if they will help you find and apply for rebates.

FINANCING

Many people borrow money to buy a car — often from the dealer they're buying it from. And the same can be true for an EV you buy, either new or used. But it's also possible to get financing for energy upgrades like better insulation for your home and switching to electric appliances. This is also true if you're a landlord looking to electrify your rental properties.

A loan helps spread your costs over time. And since interest rates are low and energy upgrades will start paying back immediately, financing can make sense to greatly accelerate your electrification timeline. Here's a brief summary of some options:[11]

- **Energy Efficient Mortgages (EEMs):**[12] EEMs, also known as "Green Mortgages," are available when you buy or refinance your home. But this isn't a second mortgage — it gets added to your original mortgage. And if you qualify for a mortgage, you probably also qualify for an EEM. They're available through most lenders, and the three main loan backers are Fannie Mae, the Federal Housing Authority, or the Veterans Administration.[13] A "home energy assessment" (aka "home energy audit") by a qualified energy assessor is required to evalute the costs and benefits of proposed changes. This is worth doing anyway (see *Chapter 3. Heat Pump Space Heating & Cooling* for more details).
- **Renovation Loans:** These loans help pay for upgrades that improve the value of the home, including energy efficiency. They're available when you buy or refinance. Not all banks and lenders offer renovation loans, so you should check around for one that does.[14]
- **Home Equity Line of Credit (HELOC):** Also called a second mortgage, a Home Equity Line of Credit (HELOC) can finance energy-efficient home upgrades. Check with your bank or mortgage holder.

- **Credit Union Loans:** Credit unions are nonprofit banks that are member-owned, and that have Federally insured deposits — just like for-profit banks. Check around to see which credit unions offer Green Energy Loans.[15] Or check with Clean Energy Credit Union, a new, nationally chartered, online-only credit union that's focused on clean energy lending — **cleanenergycu.org/home/about-us/faqs**. Besides retail banking, they give loans for everything from a home energy assessment or electric bike to a full rooftop solar installation.[16]

- **PACE Financing:**[17] PACE (Property Assessed Clean Energy) is not a loan, but rather a property tax lien on your house, where you pay it back as part of your property taxes. This can be a useful option, but you should be aware that having this lien recorded against your house can make it more difficult to sell or refinance it without first paying off the lien.[18] Buying or refinancing using Fannie Mae's EEM HomeStyle Energy Mortgage[19] can be used to pay off a PACE loan and remove the lien.

- **On-bill financing (aka On-bill repayment):**[20] Some utilities offer energy upgrade loans that get repaid through your utility bill, and the bill savings from the upgrades offset the payments, making it appear "free." You can search the utilities with on-bill financing using an interactive map from the Environmental and Energy Study Institute — **eesi.org/obf/map**. If your utility isn't listed there, try searching for "[YOUR STATE NAME] + energy efficiency financing" to see if a state or local government program is available. Also search for your state in the DSIRE database (see "Rebates" section above).

- **Unsecured personal loan:** Based on your FICO credit score, you can get a loan without needing collateral (aka unsecured). These loans might be available through your contractor, the store where you buy an appliance, or the manufacturer directly. Interest rates depend on your credit score and term length, and your contractor might offer a "buydown" to give you a lower interest rate in exchange for a higher overall job price.[21]

- **Solar financing:** See *Chapter 9. Rooftop Solar PV Panels* for info about a solar lease or PPA (Power Purchase Agreement).

- **Multi-family homes, commercial or institutional organizations:** Check with the Department of Energy's Better Buildings program for help identifying financing options — **betterbuildingssolutioncenter.energy.gov/financing-navigator**

Attachment B

1

Purchase Renewable Energy

DIFFICULTY:	EASY from utility or an existing Community Solar or Wind project
UPFRONT COST:	$0 (might save money or cost a little more)
IMPACT:	Medium
CONTRACTORS:	None
DO NOW:	Log on to your utility account (or call) and switch to a renewable power plan if it's available. If not, look for a Community Solar or Wind project to join.
RENTER:	Same.

Nearly everyone in the U.S. can now buy renewable energy for their electricity supply, whether you rent or own a home. This is one of the easiest and most effective things you can do to immediately reduce your climate impact. And the benefit will keep increasing as you electrify your machines and use more electricity, because it will force your energy provider to buy more renewable energy to match your growing demand.

Below are steps you can take to start purchasing renewable power — from simplest to more involved.

SWITCH WITH YOUR EXISTING UTILITY COMPANY

As a first option, check with your utility to see if they have a 100% renewable electricity plan you could switch to. It might be called Solar Choice, or Renewable Choice, or something similar.

Attachment B

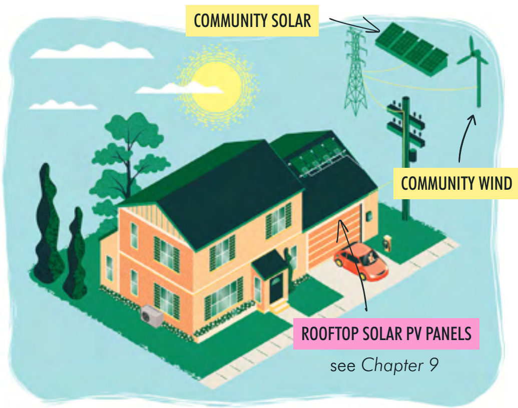
Even if you live in an apartment or mobile home with a single meter for the whole complex, you should ask your homeowners association about switching to a renewable energy plan. This is true of renters as well — ask your landlord about switching!

JOIN A COMMUNITY SOLAR OR COMMUNITY WIND PROJECT

If you can't switch with your utility, you might be able to enroll in a local Community Solar or Community Wind project, where you buy (or subscribe to) solar panels or windmills that feed their power to the grid, and then you get credits to offset your utility bill.

Learn more about Community Solar from Solar United Neighbors — **solarunitedneighbors.org/learn-the-issues/community-solar**. Then look for a project to join from:

- → Energy Sage's marketplace — **communitysolar.energysage.com**
- → NREL's list of "Sharing the Sun" Community Solar projects — **nrel.gov/state-local-tribal/community-solar.html**
- → Search for "[YOUR STATE NAME] + community solar"



see *Chapter 9*

Before signing any Community Solar agreement, read SEIA's "Residential Consumer Guide to Community Solar" — **seia.org/news/interested-community-solar-new-seiaccsa-guide-you**.

We don't know of a Community Wind marketplace, but you can try searching "[YOUR STATE] + community wind" to see if there's a project near you.

OTHER WAYS TO BUY RENEWABLE ENERGY

If renewable energy isn't available from your utility or Community Solar or Wind, you might be able to buy clean energy through other companies, such as:

- → Arcadia Power, which buys clean energy to offset your use — **arcadia.com**
- → Inspire, which charges a flat monthly price for unlimited clean energy use — **inspirecleanenergy.com**

CREATE A COMMUNITY SOLAR OR COMMUNITY WIND PROJECT

It is possible to start a community renewable energy project,[22] though this is a more difficult route than just buying energy from other projects. Your project could revolve around a school, a church, or a block. The Department of Energy has useful resources:

- → "A Guide to Community Solar" — **nrel.gov/docs/fy11osti/49930.pdf**
- → "Community Wind Handbooks" for Small and Large communities — **windexchange.energy.gov/markets/community**
- → Your project might be eligible for technical assistance through the Department of Energy's National Community Solar Partnership — **solarinyourcommunity.org**

DEMAND YOUR RURAL ELECTRIC COOPERATIVE GO RENEWABLE

Rural Electric Cooperatives (REC) are member-owned utilities that have been around since the 1930s. Members might not realize they're also owners who can demand solar or wind. If you or someone you know is part of a REC, check out:

- → "Best Practice Solar Policies for Rural Electric Cooperatives" — **solarunitedneighbors.org/learn-the-issues/rural-electric-cooperatives**
- → The Rural Area Distributed Wind Integration Network Development (RADWIND) site for case studies and other info — **cooperative.com/programs-services/bts/radwind**

BUY OR LEASE ROOFTOP SOLAR

If you own a home, you can install solar panels on your roof (or yard / field). See *Chapter 9: Rooftop Solar PV Panels* for details. If you do install rooftop solar but can't produce enough to cover all your home's electricity usage, local rules often allow you to sign up for a renewable energy plan or Community Solar or Wind subscription to make up the difference.

Attachment B

2

Electrical Service

DIFFICULTY:	HARDER
UPFRONT COST:	$750-$4,000
IMPACT:	Can enable more electrification
CONTRACTORS:	Electrician
DO NOW:	Check your electrical panel to figure out how it's sized (see below).
RENTER:	Same.

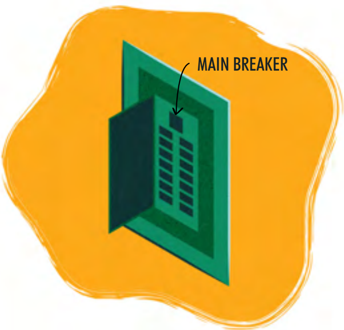
Your home gets its electrical service from the electric grid, and distributes it through your home's electrical panel — sometimes called the breaker box, load center, fuse box, distribution center, or distribution box. You can think of the big wires coming into your home like pipes delivering electricity, with the incoming flow rate of that electricity measured in Amps (See Appendix I for an extremely brief intro to electricity). Older homes might have panels that can handle 60 or 100 Amps (60A or 100A), while newer homes can handle 200A or higher. It might be possible to electrify everything in your home with 100A, but you might also need or want to upsize it to 200A (or more).

One recent report estimates that 35-45 million homes can fully electrify now without a panel upgrade, while another 48 million might need a larger panel.[23] As you make your electrification plans, consider buying machines that use less power (lower Amps & lower Volts) so they'll use less of your electrical service, and will also cost less to operate over time.

DETERMINE YOUR PANEL SIZE

One of the first things you should do on the path to electrify everything in your home is to check the size of your home's electrical service. Finding this out is safe to do yourself, but you can also have an electrician do it for you. Here are three places to check:[24]

Electric meter—Your meter is probably outside your home, and it's how the electric utility measures your usage. It'll look like this picture to the right. See if your meter has an amperage rating printed on its face, or on a label affixed to its body. It might say CL200, which means it can handle a maximum of 200A.



Electrical panel—
Your main electrical panel is inside your home, perhaps in the basement or a closet on the other side of the wall from your outside meter. It looks like this picture to the left. Find a label that indicates the panel's amperage rating. The label may be affixed by the manufacturer, or by an inspector when your panel was first installed or inspected.

Main breaker or fuse—The main breaker may or may not be inside your electrical panel, but it will usually be the largest breaker, and should have its capacity written on it or next to it.

Compare the three ratings to find the lowest one, which is probably your home's electrical service capacity. To electrify everything, you're going to need at least 100A electrical service, which is the minimum the National Building Code now requires.

UPSIZING YOUR PANEL

If you don't have at least 100A, or if you want to move to 200A to future-proof your panel:

1. Call your utility and ask what the maximum Amp service is that you could have in your home without upgrading the wires into your home. Consider going to 200A (or more) if available, which should be enough for electrifying most homes, including adding solar PV and multiple electric vehicles.

2. Budget between $750 and $4,000 to have the upgrade done by an electrician, including parts and labor.[25] It's an 8-10 hour job, but it might take a month or more to schedule with your utility. And it's worth doing this before any of your fossil-fueled appliances fail, so you're ready to replace them with an electric version when that stressful moment arrives. For example, you don't want to run out and buy a new natural gas stove that will last another 15 years because you aren't prepared to handle a new electric induction stove.

"WATT DIET" FOR ELECTRIFYING WITHIN 100A

If you do have 100A available — especially if you have central air conditioning — then upgrading your electrical service is not immediately necessary, and the money can be better spent on other electrification projects. Devices called "Smart Circuit Splitters" allow two higher-powered devices, such as an Electric Vehicle charger and an electric dryer, to share a single 240V circuit. This keeps the total load at a given time below the 100A limit. An example is the NeoCharge Smart Splitter,[26] which costs around $500 and can avoid a panel upgrade.

For more advice about electrifying everything using a 100A panel limit, see Redwood Energy's Watt Diet in their "Pocket Guide to All-Electric Retrofits of Single-Family Homes," and the Watt Diet spreadsheet (scroll down on their research page) — **redwoodenergy.net/research**.

CONSIDER AN ENERGY MANAGEMENT SYSTEM

If you are planning to install rooftop solar PV panels and a home battery, consider buying an "Energy Management System," which is like a computer-controlled, app-connected electrical panel. It is more expensive, but it can be rolled into the cost of the solar/batteries, and might be eligible for tax credits and financing.

One example is the SPAN Smart Electrical Panel.[27] It costs $3,500 (plus installation), and the cost is coming down. One reviewer. calls it "almost essential if you have a backup battery."[28] Other brands include Eaton and Koben.

INSTALL EXTRA WIRING IN ADVANCE

If you're upgrading your panel, or have an electrician come out for any other project, consider having them install dedicated circuits and outlets for other appliances you might want to electrify. Then it won't be an obstacle if you have to replace a broken machine in an emergency, and you can save money by not needing the electrician to come multiple times.

Below are the circuits and outlets that are worth pre-wiring, though you can check to see if you already have some of them (e.g. clothes dryer outlet). If you have space on your electrical panel, you can oversize the circuits (e.g. 50A instead of 40A). These outlets should cost between $250-$750 and take 2-3 hours to install, depending on where the electrical panel and appliances are located.[29] Other machines not in this list (e.g. heat pump, rooftop PV panels) will be wired during their installation.

→ Heat pump water heater: 240V / 15A-30A circuit (or avoid by planning to get a 120V retrofit-ready version)

→ Combo induction stove and electric oven: 240V / 40A-50A circuit and outlet

→ Heat pump dryer or condensing dryer: 240V / 20A-30A circuit and outlet (or avoid by planning to get a 120V combo washer/condensing dryer)

→ EV Level 2 Charger: 240V / 20A-40A (or avoid by planning to use standard 120V Level 1 charging)

ADDITIONAL RESOURCES

→ This Old House videos demonstrating what's involved in upgrading a panel to 200A — **thisoldhouse.com/electrical/21015640/how-to-upgrade-an-electric-meter-and-panel-to-200-amp-service**

→ How to Determine the Size of Your Main Electrical Service — **thespruce.com/electrical-service-size-of-my-home-1152752**

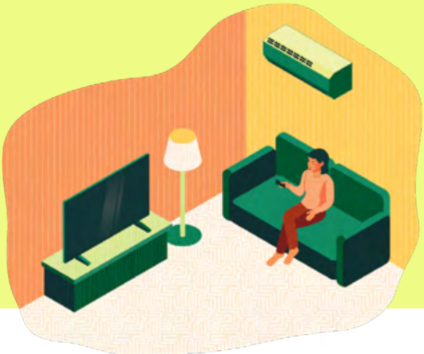
→ Nate Adams, "What Size Electric Panel?" (part of his free Electrify Everything course) — **youtube.com/watch?v=47dl0FGKJWE**

→ "Does Your Electrification Project Require a Service Upgrade?" — **greenbuildingadvisor.com/article/does-your-electrification-project-require-a-service-upgrade**

Attachment B

3

Heat Pump Space Heating & Cooling



DIFFICULTY:	HARDER
UPFRONT COST:	$1,000 (DIY) to $20,000
IMPACT:	High
CONTRACTORS:	HVAC Contractor
DO NOW:	Get a "home energy audit" or "home energy assessment" (including a blower door test), and/or schedule at least one heat pump contractor to come to your home and give you an initial quote/proposal.
RENTER:	Get a window unit or portable heat pump.

RECOMMENDATIONS

ALL CLIMATES: Inverter-driven, HSPF of 10.5 and SEER 20 or higher (COP of 3 or better). The higher your electric rate is, the better your savings from higher efficiency.

COLD CLIMATE: Get a cold climate heat pump that works well down to -5°F or lower. The technology has improved dramatically for cold climates.

WARM CLIMATE & DRY CLIMATE (WESTERN U.S.): Avoid or downsize backup resistance strip heaters if possible.

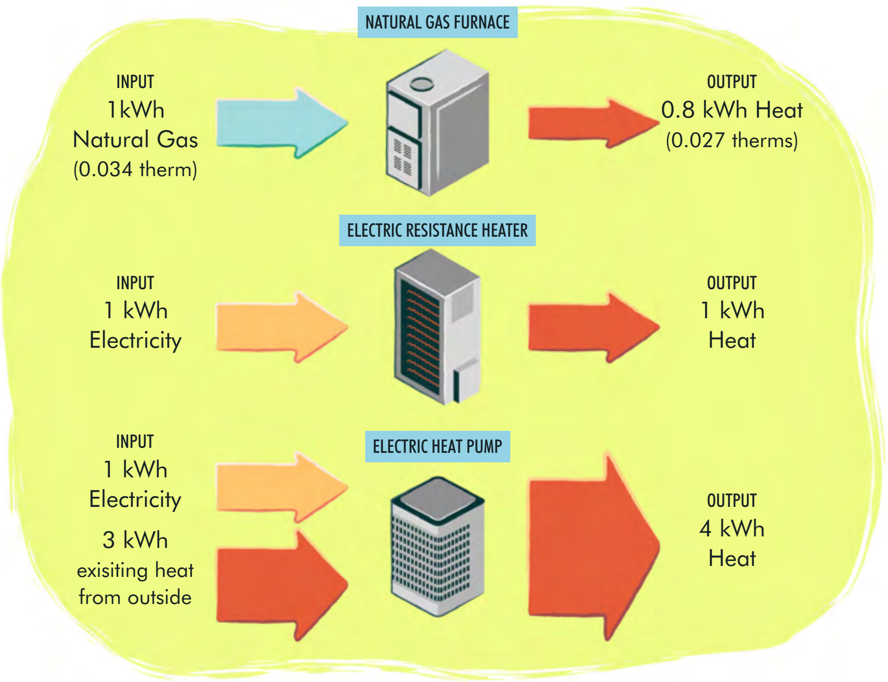
DISTRIBUTION: Choosing ductless can help you abandon ducts you no longer want. Ducts in an attic lose more energy than ducts in a basement or crawlspace.

AVOID: Don't buy a stand-alone Air Conditioner. Most major AC brands make a Heat Pump version that both heats and cool. Demand this of your contractor, spend an extra $100-$400, and you can stop using your inefficient gas furnace. And don't buy a new natural gas furnace!

Attachment B

If you've never heard of a heat pump before, it might be because they go by many names, such as "refrigerator" and "air conditioner." If you feel the back of your refrigerator, it's warm because heat is being pumped out of the fridge, leaving it colder inside. An air conditioner is very similar, pumping heat out of your home. A heat pump is like a reversed air conditioner, where heat is pumped from outside air *into* your home (and leaving it slightly colder outside).

The amazing thing about this is that even freezing cold air contains heat that can be pumped inside, and it's much more efficient to move heat than to create it. So while a natural gas furnace might deliver 80% of the heat produced from burning the gas, and an electric resistance heater can use 100% of the electrical energy to produce heat, a heat pump can pump 300-450% worth of heat into your home for the same electrical energy input! The height of each arrow in the image[30] below visually represents the amount of energy input and output for these devices. The colors are: blue for natural gas, yellow for electricity, red for heat. The heat pump takes existing heat from outside as an input, which is why it's such a huge improvement over a natural gas furnace or an electric resistance heater.



DO NOW: START PREPARING FOR YOUR HEAT PUMP

Upgrading to a heat pump is more complex than the rest of the things in this guide, in large part because it's not just swapping out an appliance like your gas stove for an electric, but instead designing the heat pump to work well with your existing home. For that, you're going to need an HVAC (Heating, Ventilation, Air Conditioning) contractor. Three things you can do now to start planning for a heat pump are:

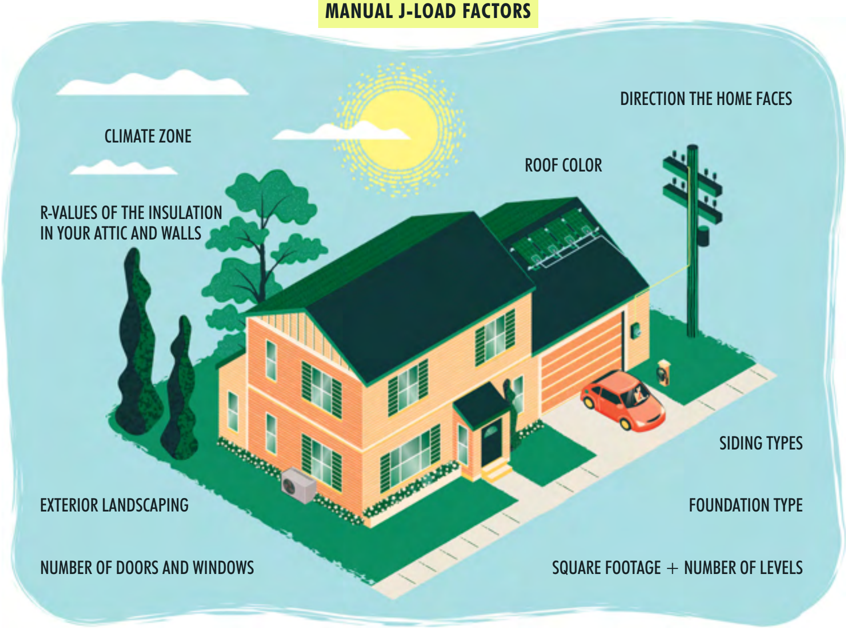
1. **Get a home energy assessment (aka home energy audit):** This can be very helpful if you live in a cold climate, but it's also useful in a warm climate. It involves someone coming to your home to perform some tests to see how well your home is insulated and sealed against air leaks and drafts. The Department of Energy has a video on what to expect from an audit — **energy.gov/energysaver/weatherize/home-energy-audits**. It can cost between $100-$300, but check with your local utility to see if there are programs to make it cheaper, or free. You should also check with your utility, or your state or local energy/weatherization office, for a list of certified energy auditors in your area. Make sure your audit will include a blower door test, where a fan blows air through your front door to measure your home for air leaks.

2. **Pre-contractor prep:** Before you start finding contractors for quotes, make a list of any places in your home that are uncomfortable because they're too hot or cold. Based on your home energy audit results, consider if you want to seal leaks or better insulate your home (see "Weatherizing your home" section below). And be sure to read through the "Understanding Your Heat Pump Options" section below to get a sense of what you're looking for, so you can request quotes on similar units from multiple contractors.

3. **Get quotes for inverter-driven heat pumps:** This might be done by your home energy auditor if they're also an HVAC contractor, or by a separate contractor. By getting initial quotes, you'll get suggestions for what options can work in your home. Check with your state or utility to see if there is a list of contractors who regularly install heat pumps.[31] Working with a state-certified contractor might also help unlock additional state and local rebates. And make sure you ask for quotes on "inverter-driven" heat pumps (see "Variable capacity" section below).

Your contractor has to know how to properly size your heat pump, which requires knowing how much energy your home gains and loses over the course of a day — known as the "load calculation." This calculation has been standardized as "Manual J," and the graphic below shows the standard inputs such as your climate and home position, the quality of the insulation, and the size and number of openings.[32] You might ask any potential contractor what software program they use for their Manual J calculation, since it will give you an idea of how seriously they take this step.[33] See "Finding and working with a contractor" section below.

MANUAL J-LOAD FACTORS



"WEATHERIZING" YOUR HOME

The blower door test from your energy assessment will give you a sense of how much air your home leaks. Ideally, your blower door number will be either similar to or less than the square footage of your home.[34] If it's higher than that, you should consider sealing your home, which is an affordable step you could even do yourself — see the Department of Energy's "A Do-it-yourself Guide to Sealing and Insulating with Energy Star" — **energystar.gov/ia/partners/publications/pubdocs/DIY_Guide_May_2008.pdf**.

Beyond sealing leaks, you can also add insulation to your home, but it might not be necessary. Talk to your HVAC contractor about where to focus — your walls, attic, floors, or windows.

If you are interested in continuing to use your existing ducting, it may only perform well with a smaller unit (maximum size around 3 tons, or 36 kBtu/h). Air sealing and insulation will allow you to install a smaller unit.

FINDING AND WORKING WITH A CONTRACTOR

To help you engage a contractor, below is a collection of recommendations from several different sources:[35]

To find a contractor:

→ Ask for suggestions and referrals from your friends, neighbors, co-workers, and local trade organizations. Aim to get proposals from at least three contractors.

→ For central heat pumps, consider reaching out to a local HVAC distributor for major brands (such as Carrier, Bryant, Mitsubishi, Fujitsu, Trane, and American Standard) and asking which contractors buy a lot of "inverter-driven heat pumps."

→ Before calling for quotes, know the model of your current system and maintenance history, and note any uncomfortable rooms.

QUESTIONS TO ASK A CONTRACTOR WHEN ENGAGING:

- ☐ Make sure they're licensed in your state, and that you verify it with the state license board. Also make sure they have insurance — both general liability and worker's comp. This might be a requirement for a state license.
- ☐ Do you install inverter-driven air source heat pumps? What percentage of your business are they?
- ☐ Do you use a computer program to do load calculations? Which one? (Good contractors will use WrightSoft, EDS, or CoolCalc.)
- ☐ Will you do a home evaluation with a blower door?
- ☐ Have you participated in manufacturer training for the systems you would install?
- ☐ Do you know about available incentives or rebates, and will you provide assistance in applying for them?
- ☐ Where will you mount the outdoor unit(s), and how? (Brackets bolted to an exterior wall may create unwanted noise in a sensitive area like a bedroom; ground-mounted units should always be on a stand to keep them above the normal snow line. Units should

also be shielded from rain and snowmelt dripping off the roof.)

- ☐ If exterior "line sets" (piping) will be visible, where will they be placed?
- ☐ What type of indoor units are you recommending, where will they be located, and why?
- ☐ Do you recommend a wall-mounted thermostat or control? (This is needed for ducted systems. For ductless units serving larger spaces, it can enhance comfort by sensing the temperature in a central location.)
- ☐ Do you always perform a triple evacuation before charging the refrigerant lines?
- ☐ Will I need to hire my own electrician to provide the electrical work? Will I need any electrical service upgrade to accommodate the heat pumps? (This is not unusual in older homes.)
- ☐ Will you use any subcontractors in the process? If so, who are they and what jobs will they do?
- ☐ Will you provide training on how to properly operate and maintain the system?
- ☐ Do you provide a warranty for the systems you install, and how long is it?
- ☐ Can you provide references from previous customers with similar systems?
- ☐ If in a cold climate, do you use the NEEP Sizing and Selecting Guide and Cold Climate Installation Guide[36] to inform your work? Will you choose equipment from the NEEP cold-climate air source heat pump list,[37] and use the information in the listing to help size the system properly?
- ☐ Do you recommend I add Heat Recovery Ventilation (HRV) or Energy Recovery Ventilation (ERV)?

GETTING PROPOSALS FROM A CONTRACTOR, AND SIGNING A CONTRACT:

- ☐ Call the contractor's references to ask about their installation and service performance, and whether the job was done on time and within budget.
- ☐ Get written, itemized estimates. Ask for options for two or three alternatives from each contractor, along with an explanation of the differences and benefits of each alternative.
- ☐ Proposals should include:
  - specific brands, manufacturer's model numbers and all relevant specs;
  - itemized lists of any other parts and accessories that you'll be charged for;
  - planned date of completion (including any subcontractors);

- a schedule of payments for the complete job — in dollars and cents and NOT percentages;
- a down payment (if any) doesn't exceed $1,000 or 10% of the contract, whichever is less.

☐ Sign a written proposal with a contractor before work gets started. It'll protect you by specifying project costs, model numbers, job schedule and warranty information.

WORKING WITH YOUR CONTRACTOR:

☐ Treat your contractors well.

- Have drinks and snacks handy, and tell them which bathroom they can use.
- If there is something you want to incentivize, tell them up front rather than as an end-of-job bonus.
- Only pay for work that's been performed — never in advance.

☐ Make sure all contract changes are in writing and signed by the contractor.

☐ Don't make final payments until you have seen receipts for bills paid by the contractor to any subcontractors and suppliers, or written waivers proving they've paid for materials and labor on the completed job.

☐ Make sure the system is set up well, you're trained in how to properly operate and maintain it, and clear on if and when they'll be back for inspection or service.

UNDERSTANDING YOUR HEAT PUMP OPTIONS

To retrofit an existing home, most people will get an air-source heat pump that extracts heat from the air. There are also ground-source heat pumps with pipes buried near the home to get heat from the ground, and water-source heat pumps if your home happens to be close to water, but these are less common.[38] And if you have radiant floor heating or another type of forced hot water heating, there are hydronic heat pumps that transfer heat from the air to water, which can also be used for heating swimming pools and hot tubs.

Check out Redwood Energy's "Pocket Guide to All-Electric Retrofits of Single-Family Homes" for many different heat pump product options — **redwoodenergy.net/research**.

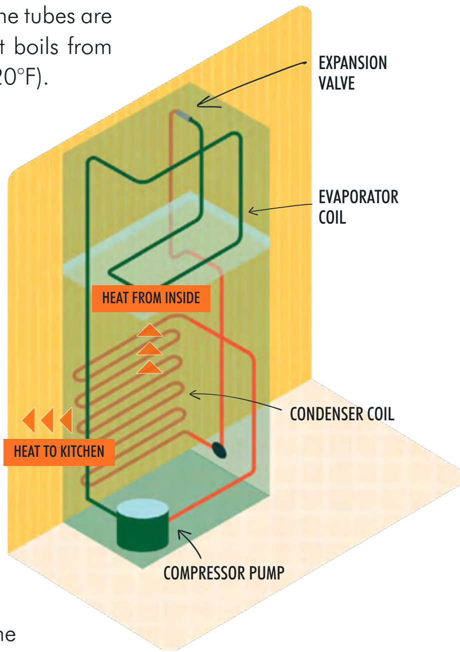
AIR SOURCE HEAT PUMPS

There are a number of different configurations for air source heat pumps, and it can be a little confusing to understand the differences. New York State's "Heat Pump Planner" is a useful reference for understanding your options beyond what's below — **nyserda.ny.gov/All-Programs/Programs/Heat-Pump-Program/Heat-Pump-Planner**.

To start, let's look at how a refrigerator works as a kind of "air conditioner" for the inside of the fridge.

A refrigerator "pumps" heat out

Two coiled tubes are connected together, one running inside the fridge, one outside on the back. The tubes are filled with a fluid called a "refrigerant" that boils from liquid into gas at a low temperature (e.g. -20°F).



Inside the fridge, heat is absorbed by liquid refrigerant in the "Evaporator" coil, and the heat boils the liquid into gas. The refrigerant gas carries more heat than the liquid, the same way steam carries more heat than water.

The "hot" refrigerant gas is then squeezed by a compressor, which heats it even more. The gas then moves to the "Condenser" coil behind the fridge, where it dumps the heat to the kitchen. The refrigerant gas cools down enough to condense back into liquid.

Every refrigerator, air conditioner, and heat pump has these two parts — the Evaporator and Condenser. Where they're located is key to understanding the differences between heat pump configurations.

A. Packaged Heat Pumps—A packaged heat pump is an all-in-one unit, with the Evaporator and Condenser coils in the same "package."

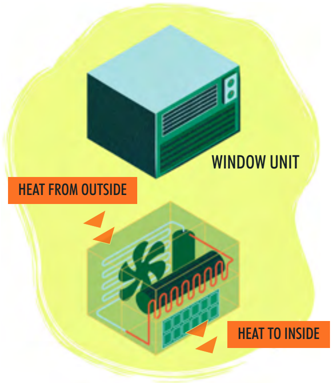
It can look like a window air conditioner. The main difference between an air conditioner and a heat pump is that the heat pump can reverse direction, and either

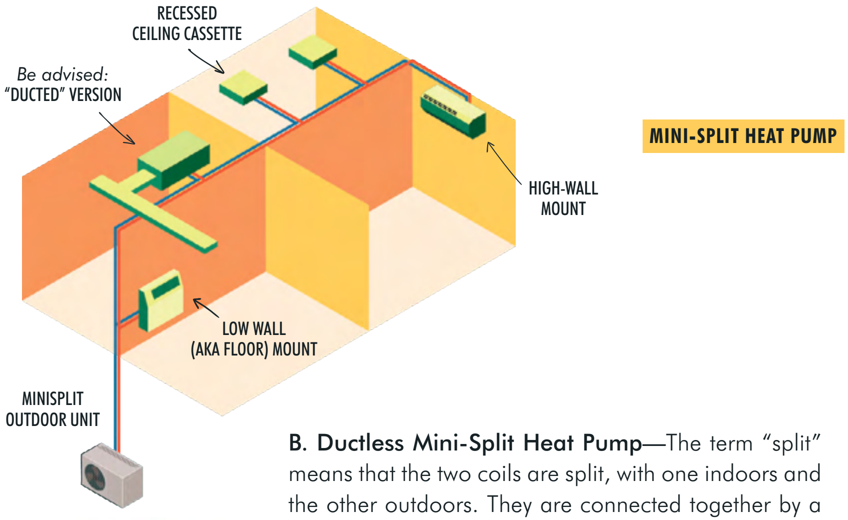
Attachment B

coil can act as the Evaporator or Condenser.

Besides window units, there are also portable stand-alone units (often with hoses that mount in your window), and through-wall mounted units. They cost between $500-$2,000, and can usually be self-installed.

Be advised: There are also larger "packaged" units that could replace your outdoor central air conditioning unit, and even run multi-family homes. This can be confusing, since it's not a window unit. See below on ducted split heat pumps.



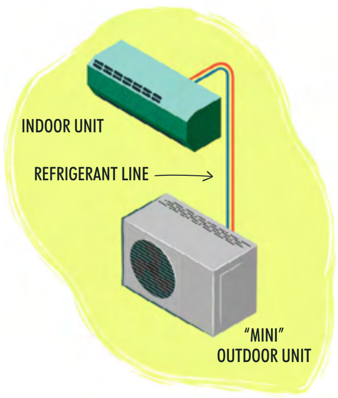


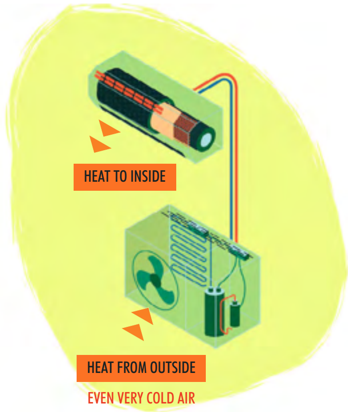
B. Ductless Mini-Split Heat Pump—The term "split" means that the two coils are split, with one indoors and the other outdoors. They are connected together by a refrigerant line that passes through the wall. The term "mini" refers to the outdoor unit, which is the size of a suitcase.

They are called "ductless" because they don't use air ducts to move heated and cooled air around the home.

Consider a mini-split if your home uses:

- baseboard heaters,
- wall or floor heater,
- portable heater,
- window air-conditioner,
- wood stove,
- nothing in a cold space (garage, attic).[39]





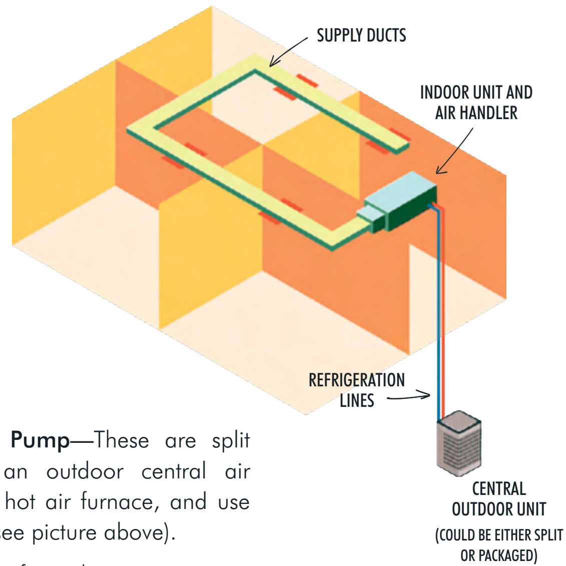
Each room or heating zone needs its own indoor unit, and multi-zone indoor units can share one outdoor unit.

Different brands might have multiple options for indoor units, including high wall mount, low-wall (aka floor) mount, and recessed ceiling cassette (see picture on previous page). Be sure to ask your contractor about which options best fit your situation. You might be able to mix and match.

Be advised: You can also have a "ducted" mini-split that uses air ducts to share a single indoor unit among a few rooms (also in picture on previous page).

Do-It-Yourself (DIY): If you're handy, you might consider installing a "retrofit-ready" mini-split yourself from brands like Pioneer, Gree, and MRCOOL. They work with 120V outlets and come with pre-charged refrigerant lines. Check the manual to see if you need an inspection to get the warranty.[40]

DUCTED CENTRAL HEAT PUMP



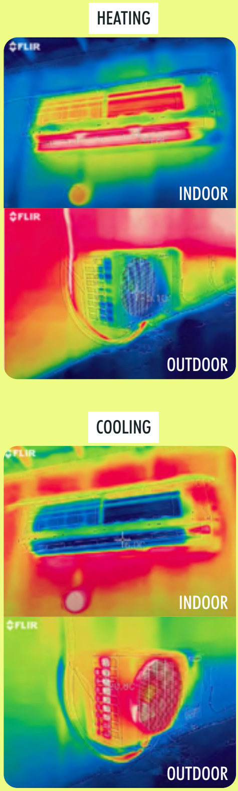
C. Ducted Central Heat Pump—These are split systems that can replace an outdoor central air conditioning unit, or central hot air furnace, and use existing ducts in your home (see picture above).

Consider a central heat pump if your home uses:

- Ducted furnace / air conditioner (forced air)
- Boiler / radiant heating (forced hot water).

It is important for your contractor to check your existing ducts to see if they'll work well with a heat pump. They might be: poorly designed (lots of bends), undersized, oversized, dirty, leak air, run through cold spaces (like an attic), under-insulated, or some combo.

Central heat pumps also need an air handler, and those are typically 240V. Your current furnace has an air handler, and it's 120V. Request a model that has an electric line from the outdoor unit that powers the indoor unit, which also frees up your old furnace air handler circuit for other electrification projects.



REVERSIBLE HEATING & COOLING

To make the reversible operation of a heat pump clearer, to the right are thermal camera images of the indoor and outdoor units of a mini-split system, taken from Technology Connection's fun video, "Heat Pumps: the Future of Home Heating" — **youtube.com/watch?v=7J52mDjZzto**. In the top pair of pictures, it's working as a heater — the indoor unit is warm (red) and the outdoor unit is cool (blue). In the bottom pair of pictures, it's working as an air conditioner, and now the indoor unit is cool (blue) while the heat is pumped outdoors (red).

COLD CLIMATES

There is an outdated misconception that air-source heat pumps only work well in warmer climates. That is no longer the case — recent advances have made them very suitable for cold climates too. NEEP has a list of cold-climate air source heat pumps — **ashp.neep.org**, and a buying guide — **neep.org/air-source-heat-pump-buying-guide**. One manufacturer has a video showing their heat pump working well in winter in the coldest continental U.S. town of Grand Forks, North Dakota — **youtube.com/watch?v=_v8vizQXwss**.

SIZING

The first recommendation your contractor might give is for the size of the unit you'll need, in units of "tons" or BTU/hour.[41] For a mild climate, here are unit size estimates based on floor area:[42]

→ 500 square feet: 1 ton (12,000 BTU/hour)

→ 1,000 square feet: 2 tons (24,000 BTU/hour)

→ 1,500 square feet: 3 tons (36,000 BTU/hour)

These sizes might be much lower than your current furnace, because the furnace has to turn on at 3,000°F and then turn off before it melts. This "cycle" happens three to eight times an hour, even when it's working well. Variable speed (inverter driven) heat pumps put out constant heat at about 120-130°F, so they can be right-sized to stay on and operate quietly. They adjust their fan speed and compressor speed to keep the home temperature stable, which is much more energy efficient, and also makes the space feel more comfortable than with a furnace that keeps turning on and off.

If you have central air conditioning, you can use its capacity as a guide to what you'll need in a heat pump (which is just a reversible air conditioner). So if you need 3 tons of cooling, you need 3 tons of heating too.

Note that the size of the furnace will depend on the Manual J calculations done by your contractor (see the "Do Now" section above). Your contractor should also consider using Manual S (for sizing) and Manual D (for ductwork) calculations when recommending a system.

VARIABLE CAPACITY

You have several options for the amount of control over the heat pump's output. More control can be more energy efficient and thus less expensive to run, but it might be more expensive up front. Here are the main variations:

→ **Single-stage:** This is the simplest and least expensive type of heat pump, and it's either turned on at 100% capacity, or turned off, making it the cheapest but least efficient.

→ **Two-stage:** This heat pump uses a compressor that can run at either 70% or 100% capacity, depending on what your home requires. Better than single-stage.

→ RECOMMENDED — **Inverter-driven (aka "Variable speed" or "Modulating"):** The best heat pumps use an electrical device called an "inverter" to enable variable speed of the compressor, which in turn varies (or "modulates") the capacity between 20% and 100%.[43] This is the most efficient option, and is worth requesting for its operating cost savings and comfort. Ask for quotes on "inverter-driven" heat pumps.

SURGE PROTECTOR FOR INVERTER-DRIVEN COMPRESSOR

Nate Adams notes that power fluctuations can kill an inverter compressor, and recommends using an ICM493 surge protector on outdoor units to protect your investment.[44] Ask your contractors about including one in their proposals.

"HYBRID" RESISTANCE BACKUP

Some heat pumps are called "hybrid" because they come with resistance heating elements that turn on when the temperature drops below a certain threshold. In general, the performance of heat pumps decreases with falling temperature, but some newer heat pumps rated for cold climates eliminate the need for this backup. Even though resistance heating uses a lot more energy than the heat pump itself in cold climates, it can make sense to get this as backup.

FURNACE BACKUP

Some heat pumps can also be installed so that they use an existing fossil-fuel furnace as backup. This might only make sense in severe cold climates with fluctuating electric rates, and the Massachusetts Clean Energy Center, for example, is no longer recommending fossil fueled backups after an extended study of whole home heat pumps.[45]

If you keep a fossil fueled furnace backup, your installer should help you set it up — with either a new thermostat, or a second thermostat — so that the furnace backup only comes on when the heat pump can no longer comfortably heat your home because it's too cold outside to provide enough heat. If the heat pump and furnace are controlled by separate thermostats, they should be set at least several degrees apart so that they don't overlap.

If you want to stick with a furnace backup in other climates, you can add a mini-split heat pump for much of the year, and use the furnace only on a few cold mornings. You can later add additional mini-splits or a central heat pump to replace the furnace entirely.

PERFORMANCE

Heat pump performance is measured with two numbers — SEER (Seasonal Energy Efficiency Rating) for cooling in summer, and HSPF (Heating Seasonal Performance Factor) for heating in winter. These are the measures that appear on each appliance's yellow Energy Guide label required by the U.S. Government.

Attachment B

In the label to the right, the SEER is 22.0 and the HSPF is 10.3, which is an average device, as indicated by the mid-range arrows on the scale below the big bold numbers.

When shopping for a high-performance heat pump:

- **GOOD** heat pumps have SEER above 20, and HSPF above 10.5.
- The current **BEST** heat pumps available in the U.S. are mini-split systems that have SEER of 30, and HSPF of 15.2.
- For reference, an electric resistance heater might have an HSPF of 3.4, which is **MUCH WORSE** than the heat pump.

REFRIGERANTS

It's worth knowing that refrigerants — the stuff moving between the Evaporator and Condenser to transport heat — can themselves be contributors to climate change. Make sure that you don't vent your refrigerants when it's time for maintenance.

LOOKING UP HEAT PUMP UNITS

CEE (Consortium for Energy Efficiency) maintains a Directory of Efficient Equipment — **ceedirectory.org/site/1/Home**. You can search for heat pump units by brand and model number, as well as a number of other criteria including SEER.

If you live in a cold climate, you should also check NEEP's (Northwest Energy Efficiency Partnerships) Cold Climate Air Source Heat Pump List — **ashp.neep.org**.

VENTILATION

Having a well-sealed home is great for keeping heat in (or out), but you still want to be able to let in fresh air, while also filtering out pollen, smoke, and germs. Ask your contractor about two specific types of ventilation — Heat Recovery Ventilation (HRV) and Energy Recovery Ventilation (ERV). The main difference is that an ERV will make your home less humid in summer and more humid in winter, compared with an HRV. See Redwood Energy's "Pocket Guide to All-Electric Retrofits of Single Family Homes" for more info — **redwoodenergy.net/research**.

COST FOR EQUIPMENT AND INSTALLATION

Most heat pumps are purchased through a contractor, who includes the equipment and installation costs together. The cost for an installed air-source 1-ton heat pump with a single zone is around $4,000, and a 2-ton is around $5,000. The cost can be lower for a multi-family home, and can be much higher for larger units, multiple zones, and high quality brands. Additional costs can include:[46]

→ Sealing your home for air leaks.

→ Duct installation or repair ($2,000 - $4,000).

→ A new hybrid furnace ($2,000 - $6,000).

→ A replacement air handler ($2,000 - $3,500).

Again, the best thing to do is to get quotes for recommended systems from a few different contractors, so you can further research and compare what your next steps should be.

INSTALLATION, SETTINGS, & MAINTENANCE

It should take an experienced contractor 2-4 hours to install a 1-ton ductless heat pump. It will take longer to install a central heat pump.

Before the contractor leaves, make sure they explain to you how it's set up, and how to operate and maintain it. You should read about the settings in your owner's manual. Here are some suggestions for getting the most out of your heat pump:[47]

1. Use your heat pump year-round — even on the coldest days if you have a cold-climate heat pump.

2. Set it and forget it — don't try to turn it up and down throughout the day and night (though you can make it cooler at night if that's more comfortable).

3. Minimize thermostat changes. Pick a comfortable temperature, even if it needs to be warmer than your old furnace setting.

4. Give your heat pump its own zone. Close non-heat pump dampers/radiators in spaces heated by the heat pump, and if you have a backup boiler/furnace, move the thermostat out of the heat pump zone.

5. Maximize the heating zone by opening doors between rooms the heat pump can reach (and closing off doors to rooms you don't need to heat).

6. Prioritize your heat pump over another heating system by setting your backup boiler/furnace thermostat at least several degrees below the heat pump's.

7. Avoid "auto" mode for heating and cooling — set it to "Heat" in winter and "Cool" in summer.

8. But do use "auto" mode for fan speed. If that doesn't spread the heated or cooled air far enough, set the speed to the lowest fixed speed that will meet your needs.

9. Optimize air flow direction by pointing the vents towards the open space that is the farthest away from the indoor unit, and away from any obstructions. Warm air should be directed down towards the floor, away from occupants, and cool air directed up, or at occupants.

10. Expect new sounds. Heat pumps are mostly silent, but sometimes make quiet gurgling and clicking noises as they cycle through their settings.

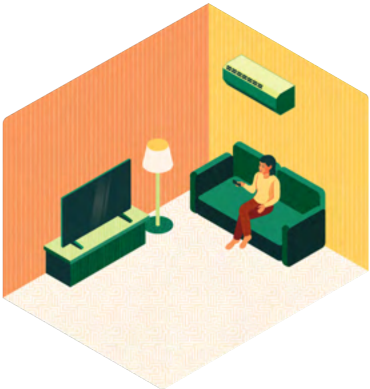
11. Watch for indicator lights, and check the user manual for their meanings.

12. Clean your dust filters by vacuuming or rinsing and drying them every few weeks to months, according to the user manual (and how dirty they get). Also pay attention to the allergen filter if your unit has one.

13. Check on your system once a season. Keep your outdoor unit clear of shrubs, leaves, ice, and snow drifts.

14. If you are in a coastal climate, rinse off your outdoor unit every few months to remove saltwater.

15. Have your heat pump serviced professionally every year or two. Follow the manufacturer's recommendations, and ask your contractor if they include service. Under normal use, modern heat pumps need very little service.



Heat Pump Water Heater

DIFFICULTY: EASY

UPFRONT COST: $1,500 (DIY) to $4,000 installed

IMPACT: High

CONTRACTORS: Plumber (might subcontract electrician if necessary)

DO NOW: Find your current water heater and determine how old it is (see below for instructions). Plan to replace it if it's over 10 years old.

RENTER: Show your landlord heat pump replacement options & EnergyGuide savings.

RECOMMENDATIONS:

COLD CLIMATE: 240V / 15A, with a larger tank and a mixing valve.

WARM CLIMATE: Forthcoming retrofit-ready 120V / 15A version, or 240V / 15A, with a larger tank and mixing valve.

ALL CLIMATES: Plan where the condensed water will go (it dehumidifies).

AVOID: 240V / 30A Heat Pump Water Heater — just get a larger tank.

AVOID: Tankless water heater, even if it's electric. A tank will also provide you with backup water in an emergency or natural disaster.

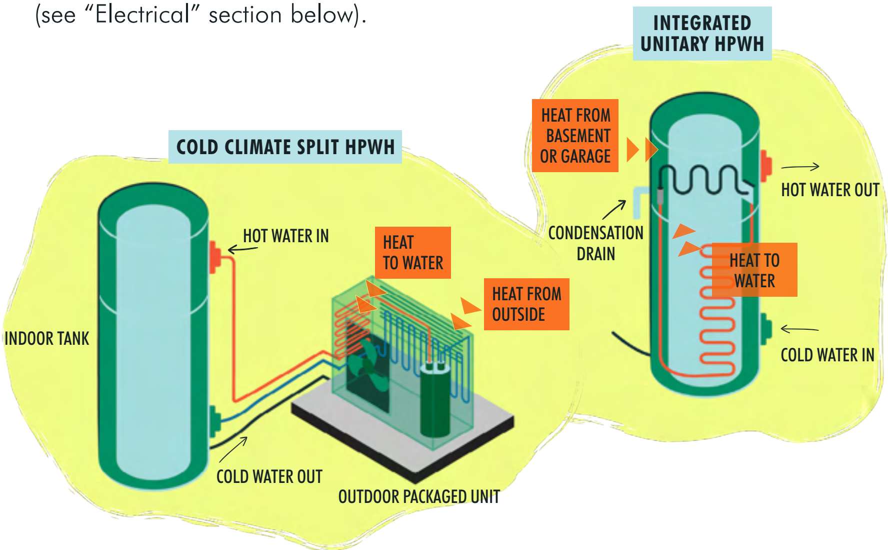
AVOID: Solar Thermal water heating — it's much more expensive, much more complicated, and performs worse than a Heat Pump Water Heater.

Compared to switching your home heating and cooling to a heat pump, getting a Heat Pump Water Heater (HPWH) is MUCH more straightforward. It's more like simply replacing your boiler with another one, with a few additional considerations. And since your water heater is 10% of your home's emissions, it's a great one to target for electrification. Depending on your hot water use, a HPWH might save you hundreds of dollars a year on your utility bill, which would pay for itself in only a few years.

The HPWH works the same as an air source heat pump for space heating, except it doesn't reverse direction to also cool the water. The heat pump is either integrated with the tank, or it's split from the tank for colder climates.

Natural gas water heaters last between 8-12 years. You might be able to see how old your existing one is — and how close to replacement it is — by looking at its attached manufacturer label. If the label isn't there, you can try to decode the serial number using data from this site — **hotwatersolutionsnw.org/news/how-old-is-my-water-heater**.

Before your current water heater fails, you should pick a tank size, pick a location that has enough space heat available, and decide if you want a 240V HPWH, or a forthcoing 120V retrofit-ready version (see "Electrical" section below).



TANK SIZE

Think of HPWHs as water-based batteries that store energy as hot water instead of electricity. Larger tanks are more efficient, store more hot water, and can help reduce costs by avoiding higher time-of-use electricity rates. Therefore, your tank size should be a similar size or larger than your existing tank — 80 gallons is a good target if you can fit it. If you currently have a tankless water heater, you'll need a place to put a tank, such as a basement or garage.

A note on Tankless (aka Demand) water heaters: Tankless water heaters have been billed as more efficient than Tank (aka Storage) natural gas water heaters, since there is no heat loss from hot water waiting in the tank to be used. But HPWHs are much more efficient than either Tank or Tankless water heaters. Since the heat comes from the surrounding air for the HPWH, any heat loss can just be pumped back into the water to maintain it at a given temperature. In fact, bigger tanks kept at higher temperatures are the MOST efficient.

Here's more info from the Department of Energy on sizing a water heater — **energy.gov/energysaver/sizing-new-water-heater**. If you work with a contractor, they should be able to recommend a unit, and you can double-check that it's a good fit.

GETTING MORE HOT WATER[48]

You can use any of these methods individually or combined to get more hot water from your HPWH:

1. Set the tank to a higher temperature like 140°F. Use a mixing valve to mix it with cold water down to 105°F to avoid scalding, and to make the hot water last longer. This is a best practice that your installer should do whether you need more hot water or not.

2. Select a larger volume tank, such as 80 gallons if you have space. Bigger is better — especially if you're considering a 120V "retrofit-ready" model (see "Electrical" section below).

3. Select a higher power HPWH that is 240V / 30A. This will use more power, and need more space on your electrical panel, but does give you more hot water. This is not recommended for most homes. Even in cold climates a 240V / 15A HPWH should be enough.

REDUCING YOUR HOT WATER NEEDS

It's worth pointing out that when upgrading to a HPWH, it also makes sense to reduce your need for hot water, which will allow you to buy a lower-power (240V / 15A, or 120V / 15A) unit. This includes fixing leaks, installing low-flow water faucets & aerators, low-flow shower heads, and getting energy efficient dishwashers and clothes washers (and washing clothes using cold water instead of warm or hot).[49] Renters can do this too.

SPACE CONSIDERATIONS

Since the heat pump is removing heat from the air, the space your HPWH is in needs to be big enough to have enough air to supply the heat. Or if you put it in a smaller space, there needs to be some ventilation to a larger space. A room 10-foot x 9-foot x 8-foot or larger is recommended, ideally one that stays above 45°F all year. Your HPWH also needs enough clearance around it, perhaps 3-feet on the air-inlet side, 5-feet on the air-discharge side, and 6-inches from the back wall.[50] In a warmer climate, the garage can be a good location, and in a colder climate, the basement.

One major advantage of a HPWH vs. a gas boiler is that there is no exhaust from burning fossil fuel that needs to be vented outside. This lets you put the unit anywhere you'd like, and if you're installing a new outlet, you have a lot of flexibility in its placement.

Since the heat pump is acting like an air conditioner for the space it's in, it will also dehumidify the space, which can be another advantage for a damp space like a basement or garage. But you'll need to plan for how to handle drainage for the water that's removed from the air.

Avoid putting a HPWH next to a bedroom if possible, since the noise and vibration, while not too significant, might be disruptive to someone trying to sleep.

COST & REBATES

HPWHs cost between $1,500-$2,500, which is more than many natural gas water heaters, but can be much cheaper to operate than a gas water heater. In addition, rebates between $300-$1,500 — which can be the whole cost of the HPWH — are becoming available. Check with your utility and state for rebates, and ask your contractor for help identifying and getting the rebates.

It might cost $600-800 for a contractor to install the heat pump, and take 6 hours.

If you need to add a 240V outlet, an electrician might charge $200-$500 and take a couple hours.

ELECTRICAL

Many HPWHs require 240V single-phase electricity, and either a 30A or 15A circuit breaker. This requires them to either be installed near an existing 240V appliance-style outlet, or for a new 240V circuit to be installed. If you're having other electrical work done, consider having your electrician install a 240V circuit for a future HPWH at the same time (see *Chapter 2: Electrical Service* for info about other circuits you might want).

"Retrofit-ready" 120V / 15-20A models are becoming available in 2021 from companies like Rheem, GE, and A.O. Smith. The big advantage is that they will have a cord and plug into a regular 120V outlet that's either dedicated to the water heater or shared with other appliances. It will not require an electrician, which can be a big hurdle when your water heater breaks and it's an emergency situation. The tradeoff is that the 120V HPWH is slower to heat water, but a bigger tank will provide more hot water (see "Getting more hot water" section above).

When shopping for a HPWH, get either a 240V / 15A version, or a 120V / 15-20A version, and the biggest tank you can fit. They'll use less energy, and take up less space on your electrical panel.

PERFORMANCE

The "First Hour Rating" of the HPWH is the amount of water it can deliver in an hour of usage, and can be larger than the tank capacity since the tank can be heating the incoming cold water as hot water is used. On the EnergyGuide shown to the left, the tank size is 72 gallons, but the First Hour Rating is 87 gallons. Since most U.S. households use about 65 gallons a day, this should be plenty of hot water, especially if used with a mixing valve (see "Getting more hot water" section above).[51]

The Uniform Energy Factor (UEF) is a measure of the energy efficiency of the HPWH. Look for a UEF of at least 3.1. The EnergyGuide label to the left lists the UEF as 4.

HYBRID HPWH WITH RESISTANCE BACKUP

Many HPWHs are "hybrid," meaning that in addition to the heat pump there is also a resistance heater that will come on if the heat pump can't source enough heat from the room to maintain the setpoint temperature. The resistance heater can be configured to not turn on, and it will still produce plenty of hot water.

For reference, each resistance backup strip uses 15A. So the 240V / 30A hybrid HPWH has two strips, the 240V / 15A HPWH has one strip, and the 120V retrofit-ready HPWH has no resistance backup at all.

COLD CLIMATE HPWH

While most HPWHs integrate the heat pump and tank into a single unit, the SANCO2 is a split unit that uses CO2 as the refrigerant, and works well in very cold climates, down to -30°F.[52] Other cold-climate models are also becoming available.[53] These units are currently more expensive, and may not be necessary if you can locate a HPWH in your basement or garage that stays above 45°F. But it's worth considering if you live in a very cold location.

DIY INSTALLATION

If you have a 240V outlet available, or you go with a 120V version, you could potentially install a HPWH yourself. This "Installation Best Practices" guide might be helpful if you want to go that route, or if you just want to know what your contractor is (or should be) doing — **hotwatersolutionsnw.org/preview/resources/best-practices-installation-guide**.

CONTRACTORS AND INSTALLATION

Most people will have their HPWH installed by a licensed contractor or licensed handyperson. The HPWH needs to be connected to the electrical service panel, and the existing gas line to your gas water heater needs to be capped. It can take from one to several hours to install.

If you go with a contractor/handyperson, you should get recommendations from friends and family, and then interview them, check references, and request written quotes from at least three of them. You should also check their license status with your state license board, and check for complaints with the Better Business Bureau.[54]

Attachment B

Here are some questions to ask HPWH installers during the interview:[55]

- ☐ How many HPWHs have you installed?
- ☐ Which model and size do you recommend and why?
- ☐ Where do you recommend the unit be installed?
- ☐ Where will the condensate drain to?
- ☐ Will you be installing a mixing valve?
- ☐ Will any electrical upgrades be needed at the installation location or the electrical service panel? Will the cost of the electrical work be included in the estimate?
- ☐ Will you help me get all rebates available to me?
- ☐ How do you recommend I operate the HPWH for optimal performance and cost savings?

LIFETIME USE

Heat pump water heaters will last between 10-15 years. They often have a 10-year warranty, and should last longer than gas boilers.

You should clean the heat pump air filter regularly — check the manual for a schedule. You can also consider discharging water from the tank regularly, descaling the tank,[56] and having the unit inspected annually, or as recommended by the manufacturer.[57]

USEFUL RESOURCES

→ Carbonswitch Buyer's Guide — **carbonswitch.co/heat-pump-water-heater-buyers-guide**

→ Silicon Valley Clean Energy's HPWH Buyer's Guide — **svcleanenergy.org/wp-content/uploads/2020/02/Heat-Pump-Water-Heater-Buyers-Guide-Digital-Updated-2020.pdf**

→ To search for a unit, use CEE's (Consortium for Energy Efficiency) Directory of Efficient Equipment, and choose "Heat Pump with tank" for Energy Source — **ahridirectory.org/NewSearch?programId=24&searchTypeId=4**

→ NEEA's (Northwest Energy Efficiency Alliance) list of HPWHs that meet their "advanced" requirements — **neea.org/img/documents/HPWH-qualified-products-list.pdf**

Attachment B

5

Electric Cooking

DIFFICULTY:	EASY
UPFRONT COST:	$2,000-3,000
IMPACT:	Low on emissions, High on indoor air quality
CONTRACTORS:	Electrician
DO NOW:	Hold a magnet to your pans, and if the magnet sticks it will work with an induction cooktop. Buy a $50+ portable induction burner now, and plan to have a 240V / 40A outlet installed before you next replace your stove.
RENTER:	Buy a $50+ portable induction burner.

RECOMMENDATION:

A range (combined induction cooktop and oven) uses less space on your electrical panel than a separate cooktop and oven.

AVOID: Don't expose your family to gas cooking fumes, such as formaldehyde and NOx. Always use your exhaust fan when cooking. Get a $50+ portable induction burner to start using immediately.

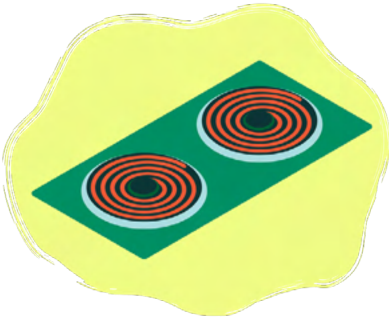
The phrase "cooking with gas" is a marketing slogan first used by the fossil fuel industry in the 1930s, and ever since it has helped people ignore the fact that they're burning toxic, explosive methane (aka natural gas) in their kitchen.[58] It's only recently that the negative health effects of this indoor air pollutant have been getting more attention.[59] But because residential gas customers are so important to the natural gas industry, they are trying to fight electrification.[60]

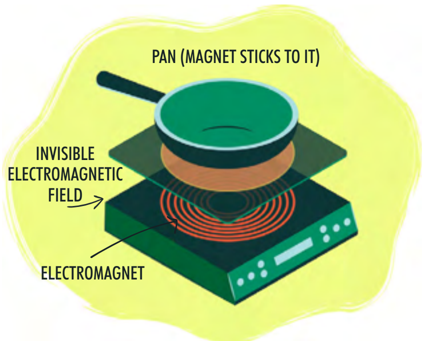
Let's clarify some lingo: kitchens usually have two main parts, a cooktop for heating pots and pans, and an oven. The cooktop and oven can be purchased and installed separately, for example as a cooktop in a kitchen counter, and a wall oven. If they're combined together in one unit we call it a "range" or "stove" (though a cooktop is sometimes called a "stovetop").

A combo range saves Amps on your electrical service, and leaves more room on your electrical panel for other electrification projects. If you're thinking of splitting up your range in a kitchen remodel, be aware that you might also require an electrical service upgrade (see *Chapter 2: Electrical Service* for more info).

INDUCTION COOKTOPS

Electric resistance burners (right) — often in the shape of a coil — have been sold for decades, and it's what you probably think of when you hear "electric stove." They're disliked because they take a long time to get hot, and they're difficult to control. They get hot as electricity passes through a resistance heater, which is how your toaster and hair dryer also get hot. They're not very energy efficient, but at least they're electric.





Modern "induction cooktops" (such as this portable version, left) are a totally different form of electric burner. Energy is transferred directly from electricity to the iron in a cooking pan through a magnetic field. The induction burner itself doesn't get hot, so there's less chance of getting burned. They heat super-fast and can be accurately controlled — think of it more like computerized cooking.[61]

CHECK YOUR PANS

Because induction heats pans using magnetism, your pans need to be attracted to magnets. You can check your existing pans using a simple magnet

— if the magnet sticks, the pan should work. Pure aluminum and copper aren't magnetic, but cast iron is, as are some types of stainless steel.

For any non-magnetic items you don't want to replace (e.g. aluminum stovetop coffee maker), you can buy an "induction converter" (aka "induction interface"). It's basically just an iron plate with a handle, where the plate gets hot and heats your item like an electric resistance stove. It's less energy efficient, but it should work just fine.

SETTING THE INDUCTION HEAT

Most induction stoves use a number that you can adjust (e.g. from 1 to 10 in half steps). It takes a little getting used to, but after that it allows for precise, repeatable heating. Here's an Induction Cooking Temperature Table that might be helpful — **cookeryspace.com/induction-cooking-temperature-guide**. Samsung brand induction cooktops have a "virtual flame" of LED lights as a visual indicator similar to the flame of a gas stove. This is a nice-to-have feature, but it's not necessary to cook well with induction.

BOTH RENTERS AND OWNERS CAN TRY A PORTABLE INDUCTION BURNER

For $50+, you can get a portable induction burner that plugs into a regular 120V outlet to start testing out, which will let you immediately start reducing your gas use. If you like it, consider using it with friends to spread the idea. Many professional chefs are switching to induction, and have no regrets.[62] You can watch some testimonials — **youtube.com/watch?v=7p6buePWKlI**.

Cooking is a relatively small part of home energy use, but it is an emotional obstacle to going all electric that the gas industry is exploiting. A $50 portable induction burner can help break through this obstacle. Reducing your indoor air pollution is a pretty great bonus.

RADIANT COOKTOPS

Most radiant cooktops are similar to old-school coiled electric resistance burners, but covered with a flat surface that's sometimes called a ceramic glass top or smooth top. They are generally cheaper than induction stoves, but their performance is worse. If you already have a radiant stove, you can consider upgrading to an induction stove next time. For now, your cooktop is already electric.

ELECTRIC OVENS

Since the burning flame in a gas oven isn't visible like the flame in a gas cooktop, people have less emotional attachment to their gas oven. In fact, most wall ovens are electric since they don't need exhaust, and many people have experience with electric toaster ovens — electric ovens are basically just bigger versions.

Most electric ovens have a broil heating element at the top for directly cooking solid foods like meat, fish, and fruits and vegetables, like an upside-down barbeque.[63] They also have a baking heating element at the bottom for heating up the air in the oven to evenly surround cookies, cakes, and baked meals with little direct heat that would burn them.

A convection oven is an upgrade that has an extra heating element wrapped around a fan for moving hot air around the oven. This lets you preheat the oven faster, cook things without rotating them, and cook multiple dishes together.

ELECTRICAL

Portable induction burners run on a regular wall outlet with 120V / 15A. But induction cooktops and ovens need appliance outlets that are 240V and 40 to 50A. If you have an electrician come for another electrification job, consider having them run an outlet to your kitchen to make it easier to replace when you're ready to electrify. It should be under $500, and take several hours to install (see *Chapter 2: Electrical Service* for other circuits to consider installing).

POTENTIAL HEALTH CONCERNS

There are two health concerns you might encounter around induction cooktops — the first about pacemakers, the second about cancer. The concerns are because the cooktop uses EMF (Electromagnetic Field) to transfer energy to the pan.

Pacemakers: There is some evidence that EMF from induction cooktops can interfere with some types of pacemakers. If you have a pacemaker, the British Heart Association suggests staying two feet (60 cm) away from the induction cooktop.[64] Switzerland's Federal Office of Public Health recommends you talk to your doctor before using an induction cooktop, don't touch the pan for extended periods while it's on the cooktop, and don't use metal utensils with it.[65]

Cancer: There is no conclusive evidence that EMF has any long-term effect on health, whether the EMF is from your induction cooktop, your cell phone, or your microwave. This article from The Rational Kitchen addresses many questions about this — https://therationalkitchen.com/induction-cooking-safe.

If you're concerned about getting an induction cooktop, you can avoid it completely and get an electric resistance or radiant cooktop instead.

If you do get induction, here are some additional precautionary tips:

→ Read and follow the operating and safety instructions in your cooktop's manual.

→ Use a pan that completely covers the cooking zone on the glass ceramic surface, and always place the pan in the middle of the cooking zone.

→ Don't use damaged pans with buckled or rounded bases, even if they can still be heated easily.

→ If you stand close to the cooktop or touch it with your body during cooking, use the rear burners, or the front burners at lower power.

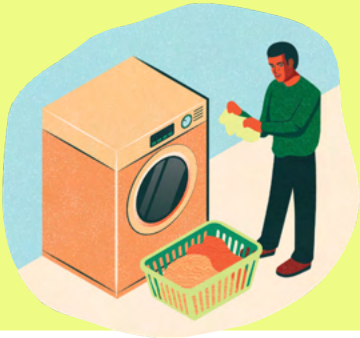
→ Keep 2 to 4 inches (5-10 cm) of space between your body and the burner to greatly reduce your exposure to magnetic fields.

→ Check that your cookware is strongly magnetic to make sure the energy is transmitted efficiently to the pan. You can also get pans that are specially labeled by the manufacturer as induction compatible.

Attachment B

6

Electric Clothes Dryer



DIFFICULTY:	EASY
UPFRONT COST:	$1,000-$2,000
IMPACT:	Low
CONTRACTORS:	Electrician for 240V dryers
DO NOW:	Check if you have a gas dryer, or if you already have a 240V appliance outlet behind your dryer. Get a clothes drying rack or clothesline.
RENTER:	Get a clothes drying rack or clothesline, and consider a combo washer/condensing dryer that runs on 120V (if allowed)

RECOMMENDATIONS

Get a ventless heat pump dryer, condensing dryer, or combo washer/condensing dryer. You'll use less energy, and can seal up the vent hole in your wall.

Hang dry some or all of your clothes.

AVOID: Plan to replace your natural gas dryer, or your inefficient vented electric resistance dryer.

The most energy-efficient way to dry your clothes is to just hang them up, but a dryer is useful for making it go faster. Still, the dryer is one of the most power-hungry appliances in your home, since it takes a lot of energy to evaporate water out of clothes.

If you have a natural gas clothes dryer (which an estimated 12% of homes have), you should plan on electrifying it.

If you already have an electric dryer, it's probably an inefficient resistance heat dryer, and you can consider the options below for when you need to replace it. But if your electrification budget is limited, it's better to spend it on other appliances first.

If you want to free up more space on your electrical panel, look for a ventless dryer that runs on 120V.

Renters, consider getting a combo washer/condensing dryer that runs on 120V. Check your lease (or with your landlord) to make sure they're allowed.

VENTED OR VENTLESS?

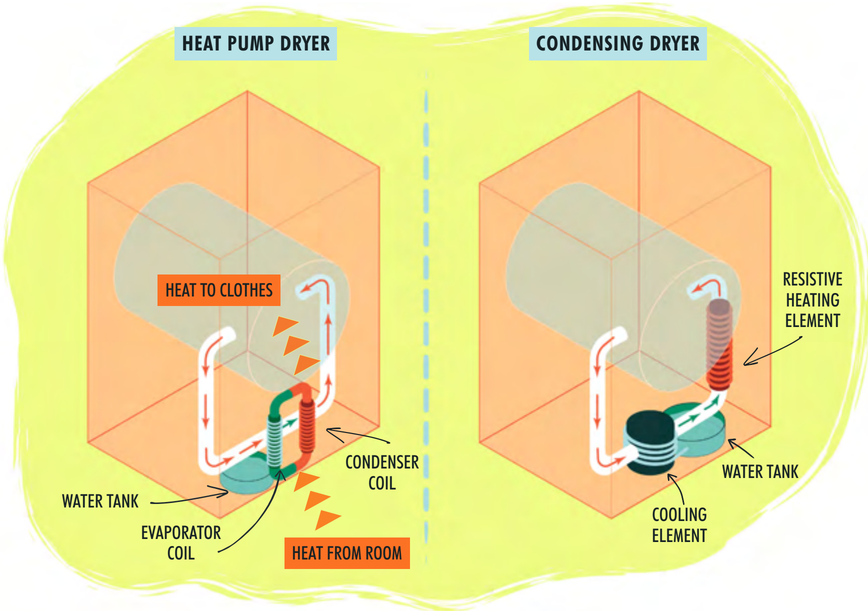
Most dryers in the U.S. are vented, meaning that they take air from the room, heat it up to remove moisture from the clothes, and then exhaust the damp, warm air outside your home using a duct through the wall or window. This is pretty inefficient — not only does it dump warm air, it's also removing climate-controlled air from the room, and leaves a hole in your wall for more air to escape through.

Most dryers in Europe are ventless, and have been for a long time. Ventless dryers take in a much smaller amount of room air, heat it up to remove moisture from the clothes, and then cool the air down to cause the moisture to condense back into liquid water, where it can be collected in a water tank or dumped down a drain. The air is then recirculated until the clothes are dry. No vent (or hole in the wall) is required, and the process is much more energy efficient than with a vented dryer.[66]

Two types of ventless

- → Condensing dryers use a resistive heating element to heat up the room air for moisture removal, and then the hot, damp air passes by cooler air taken from the room, or coils with cold water in them. As the hot air cools down, liquid water condenses out of the air and into either a water tank or down a drain.
- → Heat pump dryers use a heat pump to both heat up the room air on one side, and cool down the air on the other side. The idea is basically the same as a condenser dryer, but the heat pump is even more energy efficient. You can watch a video from This Old House about how they work — **thisoldhouse.com/21097178/exploring-a-heat-pump-clothes-dryer**.

Attachment B



Pros and cons of ventless

Besides the lower energy use of ventless dryers compared to vented, another big advantage is that they can be located just about anywhere, since they don't need to vent to the outside. They're also good for renters and condo owners who can't punch a hole in the wall.

Ventless dryers heat the air to lower temperatures, which means they take longer to dry your clothes — a 50 minute load in a vented dryer might take 90 minutes in a ventless one. But this lower temperature is better for your clothes, since most fabric damage happens during overdrying, and that doesn't happen with condenser and heat pump dryers.

Since ventless dryers don't exhaust outside, there can be a bit more humidity around the dryer. You'll want to make sure the dryer is not in an enclosed space, to avoid mold growth.[67]

Some heat pump dryers are "hybrid," with a resistance heat backup. They use more energy when using the resistance backup.

Electrical

There are both 120V and 240V ventless dryers available. If you already have a 240V electrical socket from a previous dryer, you might want to take a picture of it so you can get a matching plug (see *Chapter 8. EV Charger* for pictures of different 240V socket types).

SIZING

Since dryers need space inside for the warm air to circulate and the clothes to tumble freely, a common recommendation is to size your dryer with about twice the capacity of your washing machine. But if space is an issue, you can get a smaller capacity dryer, and just hang some clothes on a drying rack or clothesline (most clothes last longer if they're hang dried).

The two main dryer outside sizes are compact (around 24" wide) and full-size (around 27" wide). Most condenser dryers are compact, and have a 3.5 to 4 cubic foot drum. There are some full-size heat pump dryers with a 7.4 cubic foot drum that are comparable to regular vented dryers.

Check the height, width, and depth of the space you plan to put the dryer, along with any doorways, hallways, and stairs to get there. Also consider whether you'd want to stack a washer and dryer, or have them side-by-side.

INCENTIVES AND REBATES

Ventless dryers are more expensive, costing between $1,000-$2,000, while standard vented dryers are closer to $400-$700. But depending on how often you use your dryer, you can save up to $75 a year on your utility bill.

Some states and utilities offer rebates ranging from $50 to $300 for an ENERGY STAR or heat pump dryer. Search online, or ask your retailer if they know of other incentives.

USE AND MAINTENANCE

As with any dryer, you should clean the lint trap before every load. Ventless dryers might also have additional filters that need to be cleaned. And if you have a ventless dryer with no drainage, you'll also need to empty the water from the water tank so it doesn't fill up.

When using your dryer, you can save energy by using the sensor settings (e.g. dry, very dry) instead of the standard countdown timers. If your clothes are still dripping wet when you take them out of the washer, run them through an extra spin cycle before moving them to the dryer.[68]

ALL-IN-ONE WASHER AND DRYER

It's worth noting that there are also machines that combine a washing machine and condensing dryer into a single machine. These can be good for renters and space-limited homes, and can run on a single 120V outlet — about the same energy as a hair dryer. It can take 2 to 4 hours for a complete load to be washed and dried, but it's a simpler job than having to also move the clothes in the middle. Dirty clothes in, clean & dry clothes out.

A NEW WASHER TOO?

You might also consider buying a new washing machine with a high spin speed at the same time that you buy a new dryer. This will reduce both the time and energy needed for clothes drying.

Attachment B

7

Electric Vehicles

DIFFICULTY:	EASY
UPFRONT COST:	$10,000 (used) and up
IMPACT:	High
CONTRACTORS:	None if charging on 120V standard outlet
DO NOW:	Consider how far you drive in a day to start thinking about range, and look online for public charging stations nearby to start planning where else you can charge.
RENTER:	Same.

RECOMMENDATION

Try the included 120V / 15A Level 1 charger that comes with your EV. It charges around 4 to 5 miles of range for every hour it's charging, and it's fairly low power. If that's not enough, you can get a Level 2 charger (see *Chapter 8: EV Charger*).

AVOID: If you can afford it, don't drive your gas car until it's breaking down. Getting an EV is one of the highest impact things you can do.

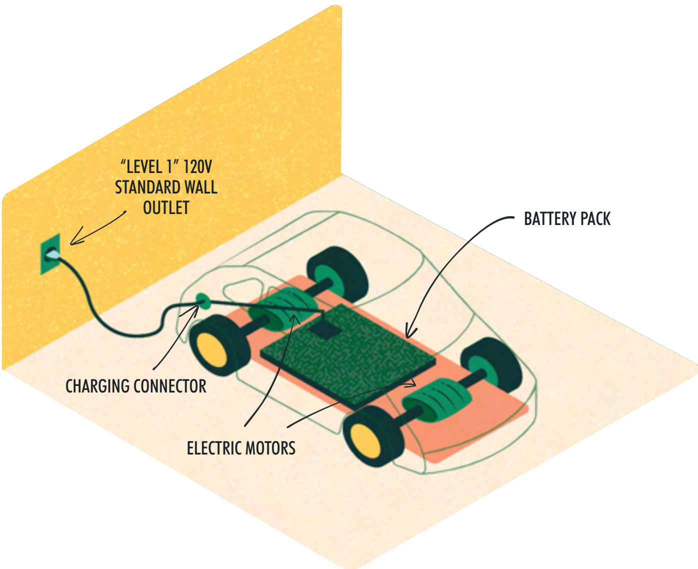
Electric Vehicles (EVs) might be the best-known electrification project from this whole guide. Getting an electric car is much more visible to your neighbors than getting a heat pump. And the change is pretty seamless once you sort out where, when, and for how long you can charge. Once you switch, EVs are better in almost every way than gas cars. Still, there are some things to consider before heading to the dealership for a test drive.

Attachment B

FEWER PARTS, BETTER PERFORMANCE

EVs use batteries and electric motors to move the car, versus the gasoline burning in the complex internal combustion engine of gasoline cars. EVs also don't need a radiator, exhaust system, or catalytic converter, so there are fewer things to break down, and thus maintenance costs are lower. Regenerative braking puts energy from stopping back into the battery, and also preserves the brakes.

Fewer parts also allows for more space in the vehicle. In most EVs, the space under the hood where the engine would be is now storage space (called a "frunk" for "front trunk"), and the interiors are roomier. Since the batteries are often below the floor, it can help improve vehicle handling, and make the vehicle less likely to flip. Electric motors can also deliver 100% of their power instantly, which lets them accelerate quicker than gas vehicles — these are no go-karts.



LESS POLLUTION & LOWER LIFETIME COST

EVs really are better for the environment. On average, EVs in the U.S. produce the carbon dioxide emissions equivalent of a car that drives 88 miles-per-gallon of gasoline. But that depends a lot on how the grid is powered. In places where the grid supplying the electricity is cleaner, EVs get well over 100 miles-per-gallon-equivalent emissions, while dirtier power generation puts it closer to 39 miles-per-gallon-equivalent — still close to very efficient gasoline cars, and which will just keep getting better as the grid adds renewable energy.[69] Studies also show that in addition to much lower emissions due to EVs, they also have considerably lower lifetime costs when compared to gasoline cars.[70]

UNDERSTANDING YOUR EV OPTIONS

There are now a wide variety of EVs to choose from, with more options constantly coming to market. The two main types are:

- **Plug-in Hybrid Electric Vehicles (PHEV):** These have both gasoline engines and batteries and motors, working together in some combination to drive the car. As the name implies, they get plugged in to charge, but can also be filled at the gas station. Some versions have limited electric-only driving ranges, while others mostly run on electric and only use the engine to generate electricity and extend the range.
- **Electric Vehicles (EV):** These run fully on batteries turning electric motors. EVs have no engine, and need to be recharged either at home or at a recharging station.

Car finders

With so many choices, a number of sites have appeared where you can filter cars based on manufacturer, model, type of EV, range, and other criteria. Try searching here:

- PlugStar Shopping Assistant — **plugstar.com/guide**: Helps you drill down using several criteria, including where and how you plan to charge.
- PG&E's EV Savings Calculator — **ev.pge.com**: The page for each individual car gives the relative cost savings versus an equivalent gasoline car over ten years. Note that any incentive pricing listed is California-based.
- Department of Energy's Find and Compare Cars — **fueleconomy.gov/feg/findacar.shtml**: Shows the MPGe (miles-per-gallon equivalent) and total range for both current and older cars, which can be helpful for researching used cars. You can also compare cars side-by-side.
- EVLife — **evlife.co**: Has car pricing with incentives listed, and you can enter your zip code to look for other state and local incentives.
- MyEV — **myev.com/cars-for-sale**: Has used cars for sale, searchable by zip code (other used car sites can also be searched for EVs).

RANGE IS THE MAIN DIFFERENCE

There are now enough EVs on the market to let you choose based on the type of vehicle you need (e.g. sedan, SUV, truck), number of doors, interior space, and other common vehicle purchasing criteria. The main difference between EVs is the "range," which is how far it can drive before needing to be refueled.

Most new EVs have a range over 200 miles, which is comparable to a tank of gasoline. But you can also find EVs for around $10,000 with a range of 60 miles that might be good enough for commuting and getting around town. For now, EV prices are largely determined by the range, so figure out how much you need to drive, and see if your budget matches the car prices for that range.

BATTERY DEGRADATION AND WARRANTIES

Concerns about EV batteries wearing out and requiring expensive replacements have turned out to basically be a non-issue. Most batteries are lasting the life of the car.[71] One estimate is that on average, batteries lose about 2.3% of their capacity each year, which means a 150 mile range car might lose 17 miles over five years.[72] You can get a sense of the degradation for a car you're interested in — **geotab.com/fleet-management-solutions/ev-battery-degradation-tool**.

Federal regulations mandate EV battery warranty at eight years or 100,000 miles. Some manufacturers will replace the battery if it reaches a specified reduced capacity percentage — usually 60%-70% — while under warranty.[73] The warranty for the rest of the vehicle varies by manufacturer.

You should ask the dealer about the most up-to-date warranties for all aspects of the vehicle you're considering, including basic coverage, powertrain, corrosion, battery, and roadside assistance. MyEV has a chart comparing 2019 warranties for particular EVs — **myev.com/research/buyers-sellers-advice/evaluating-electric-vehicle-warranties**.

RANGE DROPS ON COLD AND HOT DAYS

Batteries work best in temperatures that are comfortable for people, around 70°F. At both lower and higher temperatures, the range decreases. You can use GeoTab's Temperature Tool for EV Range to check on how the cars you're considering perform as you slide the temperature up and down — **geotab.com/fleet-management-solutions/ev-temperature-tool**.

Most EVs include a thermal management system for the batteries to keep them around 70°F. Many EVs also use heat pumps to efficiently heat and cool the interior space — check whether the EVs you're interested in have a heat pump available as part of standard equipment, as part of a cold-weather upgrade, or as a feature.[74]

Since space heating is part of what uses a lot of battery power on hot and cold days, some tips for extending the range include:[75]

→ Use heated seats and steering wheel: If your car has them, this can save a lot of battery power instead of using the cabin space heating on a cold day.

→ Pre-condition your vehicle: Before unplugging to go out on a hot or cold day, get the cabin to a comfortable temperature to help preserve the battery while out.

→ Keep your vehicle plugged in on extreme cold or hot days, both at home and when parked. This lets your car's battery thermal management keep working without using the battery.

INCENTIVES & FINANCING

There is a Federal Tax Credit worth up to $7,500 available for people who purchase new EVs. That means that if you owe taxes over $7,500, this can reduce your bill when you file your taxes, but you don't get back extra money if you owe less tax. The amount varies depending on whether it's a full EV or a PHEV, and depending on how many cars the manufacturer has already sold, phasing out for more popular EVs. The Department of Energy maintains a list — **fueleconomy.gov/feg/taxevb.shtml**.

The Federal Tax Credit only goes to the registered owner of the vehicle, so if you lease, the manufacturer gets the credit. If you're leasing, look for a dealer that will roll the credit into a lower monthly payment.[76]

A number of states also offer rebates on EVs (California, New York, Oregon, Massachusetts, Oregon, and New Jersey).[77] The Department of Energy maintains a database that lets you search for such programs in your state — **afdc.energy.gov/laws/search**. Make sure to also check with your utility to see if there are additional incentives, and ask your dealer if they know of other programs like HOV or carpool lane access for EVs, and emissions testing exemptions.[78]

LEASE OR BUY?

A report from 2018 found that around 80% of EVs are leased, which is much higher than the 30% of all vehicles that are leased.[79]

One argument in favor of leasing an EV is that since the technology is changing so quickly, you can get the newest tech when your lease ends. Leasing also lets you get a new car, with a new battery after a few years (but note that battery wear is proving not to be a big deal in the real world — see "Battery degradation and warranties" section above). Another argument in favor of leasing is that it puts more EVs on the market, because when your lease expires, your car becomes a used EV for someone else.

One reason to buy instead of lease is that you'll be eligible for the federal tax credit and other rebates, which can greatly reduce the cost of the car (though some states give rebates for leased and used EVs).[80] Another benefit of buying over leasing is that you won't have a car payment after you pay off the car.

NEW OR USED?

EVs break down slower than gasoline vehicles because they have so many fewer parts. They don't leak oil, their single-speed transmission doesn't fail, and they don't have issues passing inspection. And the price of a used EV might be lower than a comparable gasoline car, though that might be changing as people realize how durable used EVs are.

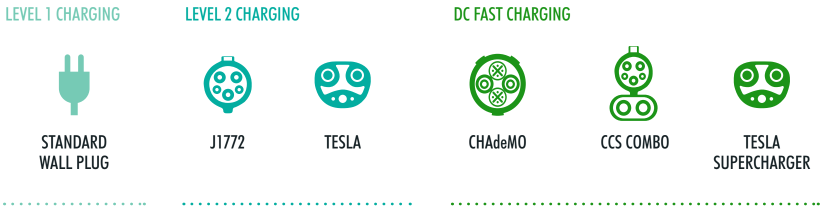
Used EVs are generally priced according to their range. Something to consider with both new and used EVs is that if over time your car's range decreases below what you need, you can sell it to someone else who is looking for that range — whether it's 60-mile, 100-mile, 150-mile, or 200+ mile.

If you're buying a used EV and you're concerned about the battery health, ask the owner or dealer for a copy of a recent scan of the battery. You could also try a service like Recurrent, which can help you understand battery degradation for a specific car you're looking at — **recurrentauto.com/for-shoppers**.

TYPES OF CHARGING

To charge an EV, you have to plug it in. Since the actual battery charging electronics are built into the EV, the different plugs are basically just extension cables for connecting to an outlet. That said, the type of outlet varies by how quickly they can charge. Below are images of the charging connector types found in the U.S., followed by descriptions of the charging levels.[81]

EV CHARGING CONNECTOR TYPES



Home charging

- **Level 1:** Your car will come with a cable that plugs your car into a regular 120V AC standard wall outlet. This is called a "Level 1" charger, and will charge your car 4 to 5 miles every hour. If you're driving 40-ish miles a day (e.g. 15,000 miles per year), you should be fine with Level 1 charging overnight. You can try using this initially to see if it will work for you. Note that the outlet you use should be on a dedicated circuit from your electrical panel, with no other appliances on it. You might also want a hook or shelf for the cord so it doesn't pull on the outlet.[82]
- **Level 2, home:** If you need faster charging or more range, consider installing a faster "Level 2" charger. It uses a 240V AC outlet and can charge 15 to 25 miles every hour — useful if you drive 200-ish miles a day (e.g. 70,000 miles per year). The standard connector is the J1772, and Tesla's proprietary connector has an adapter for this. See *Chapter 8: EV Charger* for more details.

Public charging stations

- **Level 2, public:** Many parking lots outside shopping centers and office buildings now have public Level 2 chargers. The cost for using them ranges from free for some chargers, to about twice the cost of charging at home. See "Finding public charging stations" section below.
- **Level 3, aka "DC Fast Charging":** As the name implies, this is the fastest available charging method. It uses up to 800V DC, and can add 50 to 90 miles in 30 minutes. Tesla's Supercharger stations can charge even faster, up to 170 miles in 30 minutes. Non-Teslas can't yet use Supercharger stations, but Tesla is working on changing that.[83] Most U.S. EVs use the CCS ("Combined Charging System") Combo connector for DC fast charging. The Nissan Leaf and Mitsubishi Outlander use a Japanese standard called CHAdeMO, but that connector is being phased out in the U.S.[84]

Finding public charging stations

Here are some places to search for public charging stations, both to plan your local day-to-day charging, and to plan road trips:

→ PlugShare — **plugshare.com**: Has a map of public charging stations, and includes a trip planner if you register. It maps out the thousands of stations from companies like Electrify America, EVGo, and ChargePoint, which let you charge your car using an app or card.[85]

→ Open Charge Map — **openchargemap.io**: A free & open option for locating chargers.

→ EVmatch — **evmatch.com**: It's like Airbnb for EV chargers, where you join to either rent time on someone else's charger, or rent out your own home or business charger.

CHARGING COSTS

The cost to "fill up" an EV using electricity is a lot cheaper than gasoline.[86] The average person in the U.S. drives around 1,000 miles every month,[87] and the average U.S. car gets 24 miles per gallon,[88] which means each driver burns almost 42 gallons of gasoline every month. If gas is $3.00 per gallon, that's $125 a a month (and even more at $4 or $5 per gallon).

For home charging, the average U.S. cost for a "kWh" (kilowatt-hour) of electric energy is around $0.12 cents (though it varies widely by location — check your utility bill). If a rule of thumb is that electric cars get 3 miles of range for every kWh, it takes around 333 kWh to be able to drive 1,000 miles, which is $40 a month. In this example, that's a savings of around $85 a month, or $1,000 a year by using electricity instead of gasoline.

For public charging, in California it's around $0.30 cents per kWh to charge on Level 2 (~$100 a month for 1,000 miles), and $0.40 cents per kWh for DC fast charging ($133 a month for 1,000 miles).[89] So even if you only used DC fast charging, it would still be about the same cost as driving on $3.00 gasoline.

FUEL USE COMPARISONS

The fuel efficiency of gas vehicles is given in MPG ("miles-per-gallon"), while EVs are rated in MPGe ("miles-per-gallon-equivalent"). An efficient gas car might get 40 MPG, while a Tesla Model 3 can get more like 121 MPGe — a significant improvement![90]

EVs are also rated in "kWh/100 mi" (kilowatt-hours per hundred miles), which is more useful for getting a sense of how much it will cost to charge the car. For example, 121 MPGe is equivalent to 28 kWh/100 mi. If your home electricity costs $0.12 cents for each kWh, then it will cost $3.36 to charge up for driving 100 miles.

GAS-POWERED BACKUP CAR

When getting an EV, you can potentially keep a gasoline car around as a backup. Or get rid of the gasoline car and consider using a bicycle, public transit, ride-share, taxi, or car rental as needed.

HOME POWER BACKUP USING YOUR CAR

Currently, the Nissan Leaf and Mitsubishi Outlander allow you to plug your car into your home to use it like a backup battery. More cars are coming that allow such "bi-directional charging," also known as Vehicle-to-Home (V2H). Audi is working on a system for its e-tron line,[91] Volkswagon is planning to make all of its EVs bi-directional in 2022,[92] and Ford's new electric F-150 Lightning is planned to be bi-directional.[93]

Taking advantage of bi-directional charging requires a Level 2 charger, so see *Chapter 8: EV Charger* for more info. You can also see *Chapter 10: Home Battery Storage* to get an idea of how a backup battery works.

USING THE EV AND PRESERVING THE BATTERY

Note that battery degradation is turning out to not be a big problem, with EVs from 2011-2013 still having 80% capacity, and newer cars demonstrating even slower degradation. But here are some suggestions for how operate your battery extra cautiously:

→ Don't fully charge or fully discharge your battery. Aim to charge to 80% and discharge to 30%, which is better for the battery. You can charge to full capacity when you need to drive farther.

- Try not to quick-charge too often. Since your battery gets hot during quick charging, and hot batteries degrade faster, it's better to quick charge only when necessary. But don't go crazy worrying about it — regular use might cost 1% of capacity per year.[94]
- If leaving your EV for a while (e.g. vacation), keep it plugged in and charging to around 50% if possible.[95]
- Try not to expose your car to extreme temperatures — park in the shade or a garage when possible to keep the battery closer to 70°F.
- Before taking a road trip, practice charging a few times locally first.
- Driving slower will let your battery last longer.
- If you run completely out of power, try shutting the car down and leave it for a short while, maybe half an hour to an hour, and you might have enough power to drive a couple more miles.[96]

ELECTRIC BICYCLES, SCOOTERS, & SKATEBOARDS

Instead of (or in addition to) an EV car or truck, you might also consider getting an electric bicycle. They range from a few hundred to a few thousand dollars, they've gotten much better in recent years, and they might eliminate many of your car trips — including your commute. Start learning more — **rei.com/learn/expert-advice/how-to-choose-an-ebike.html**. You can also consider electric scooters and electric skateboards, which are now pretty advanced.

8

EV Charger (240V EVSE)

DIFFICULTY:	EASY
UPFRONT COST:	$500-$2,500
IMPACT:	Low
CONTRACTORS:	Electrician
DO NOW:	If you have a garage, check if you already have a 240V appliance outlet for a faster "Level 2" charger.
RENTER:	Ask your landlord and employer about installing a Level 2 charger.

RECOMMENDATION

Buy a Level 2 charger with an adjustable current setting between 20A to 40A, and start with it set to 20A.

The Level 1 charger that comes with your EV plugs into a regular 120V outlet and adds around 4 to 5 miles of range every hour, good for 40-ish miles per day (or 15,000 miles per year). If that's not fast enough for your needs, you can install a Level 2 Charger (15-30 miles every hour), also known as an EVSE ("Electric Vehicle Supply Equipment").

Technically an EVSE is not the "charger" that converts AC to DC electricity — the "charger" is built into the car itself. An EVSE is a way to connect your EV to a 240V outlet. One site says "you should not overthink the selection and installation of an EVSE."[97] That said, there are some things worth considering. Here's a checklist from PG&E that might be helpful — **pge.com/pge_global/common/pdfs/solar-and-vehicles/options/clean-vehicles/electric/EV-Charger-Install.pdf**.

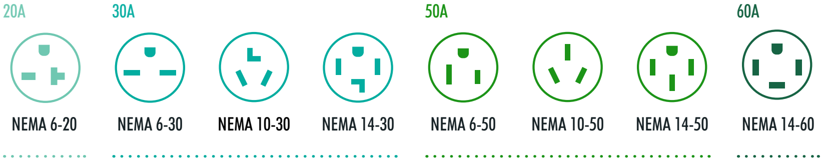
Attachment B

FINDING AN ELECTRICIAN

An EVSE by itself can cost between $200 to $1,000, and installation can range from around $800 to $1,300. An electrician will do the installation, so get quotes from multiple electricians, and try to get one who installs lots of EVSEs. Permits might be required to install an EVSE, so check with your electrician or local government.

If you're having an electrician come to your home, consider adding outlets for other electrification projects at the same time (see *Chapter 2: Electrical Service*).

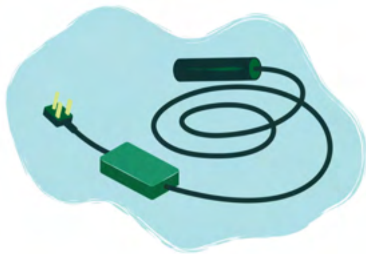
240V SOCKET TYPES



ELECTRICAL REQUIREMENTS

A rule of thumb is that an EVSE that can supply a current of 30A will give about 30 miles of range in an hour of charging, and that 30A charger will require a 40A circuit and two spaces on your electrical panel.[98]

You might already have a 240V appliance outlet in your garage, like the kind that clothes dryers plug into. If that's the case, you can get a portable EVSE that plugs into it (see image right). Just make sure the plug on your charger matches the socket you're planning to use, since there are multiple types of three- and four-prong socket configurations (see image above).[99]



You can also hardwire your EVSE. In that case, it should be around four feet off the ground. Consider how you want it mounted — whether attached to the building (see picture on previous page), or on a stand-alone post (left).[100] If you're installing it on a post and the wiring will run underground, check with DigSafe (or equivalent) before digging.[101] And if the charger is left exposed outside, consider having it covered in a cabinet, or with a small roof.

It's possible that your electrical panel won't have enough space for another 240V connection, in which case you might consider upgrading your electrical panel and electrical service (see *Chapter 2: Electrical Service*). You can also consider getting a "Smart Circuit Splitter" for sharing one outlet between the EVSE and another appliance you want to electrify, like a heat pump dryer (see "'Watt Diet' for electrifying within 100A" section in *Chapter 2: Electrical Service*).

INCENTIVES AND REBATES

There is a Federal Tax Credit for 30% of the cost of purchasing and installing an EV charger — up to $1,000 — if installed by December 31, 2021, when it expires (though it has been extended before).[102]

Individual states and utilities also have rebates for EVSEs. Some EVSE manufacturers maintain a list of rebate programs:

→ Chargepoint — **chargepoint.com/incentives**

→ ClipperCreek — **clippercreek.com/evse-rebates-and-tax-credits-by-state**

→ Search online for your specific utility's programs.

CHARGER SEARCH TOOLS

Here are a couple of sites to help find a charger that works for you:

→ Home Charging Advisor lets you set the estimated installation cost, and includes incentive discounts by zip code — **homecharging.electricforall.org**

→ PlugStar Shopping Assistant suggests chargers based on specific vehicles, but doesn't include incentives — **plugstar.com/chargers**

CHECK WITH YOUR UTILITY ABOUT EV RATES

Switching from paying the gas station to paying your electric utility to fill up your car is going to increase your electric bill (but overall save you money by eliminating your gasoline bill). Check with your utility to see if there is an EV rate plan that will reduce your costs if you charge during specific hours — especially at night, when the grid is being used less.

RENTER'S RIGHTS

Even if you're a renter or live in an apartment, you should consider asking your landlord or Home Owner's Association (HOA) if you can install either a 240V outlet or standalone charger. Some states, including California, Colorado, Florida, and Oregon, prohibit "unreasonably" denying a tenant's request to install an electric car charger.[103] Here are some resources to help you approach your HOA or landlord:

→ Chargepoint resources — **chargepoint.com/drivers/apartments-and-condos**

→ Tesla's form letter — **https://www.tesla.com/sites/default/files/support/home-charging-installation/letter-requesting-approval-charging-installation.docx**

→ Veloz tips — **veloz.org/wp-content/uploads/2017/08/MUD_Guidelines4web.pdf**

→ Department of Energy help — **afdc.energy.gov/fuels/electricity_charging_multi.html**

CHARGING AT WORK

If you drive to work and there's not yet a charging station there, ask your employer about installing one. Chargepoint has suggestions and a guidebook about bringing EV charging to your workplace, which you can share with your employer — **chargepoint.com/blog/six-tips-bringing-ev-charging-your-workplace**. California has also released an Electric Vehicle Charging Station Permitting Guidebook that could be useful — **businessportal.ca.gov/wp-content/uploads/2019/07/GoBIZ-EVCharging-Guidebook.pdf**. Search online to see if your state has a program for helping to finance business charging installations.[104]

EVSE AS ELECTRIFICATION HUB

It's worth noting that new types of EVSE are coming out as the EV market grows. One example is the dcbel r16, which supports bi-directional charging, allowing you to power your home from your car's battery instead of needing a separate home battery (see *Chapter 10: Home Battery Storage*). The r16 also connects to your PV array as the inverter, letting you directly charge your car with your solar panels (see *Chapter 9: Rooftop Solar PV Panels* for more info about inverters).[105] Ford and Sunrun are also teaming up to enable the F-150 Lightning electric pickup truck to power the home through the Ford Charge Station Pro.[106]

9

Rooftop Solar PV Panels

DIFFICULTY:	HARDER
UPFRONT COST:	$15,000-$30,000 before rebates
IMPACT:	High in places with lots of fossil fuel power plants
CONTRACTORS:	Solar Installer
DO NOW:	Use a website to check your address's potential for sun, and use energysage.com to get initial quotes.
RENTER:	Send quotes to your landlord, along with financing options.

Solar "photovoltaic" (PV) panels turn sunlight's photons ("photo") into electric voltage ("voltaic"). People have been putting PV panels on their roof since the 1970s, but improvements in the technology and huge decreases in cost have made it much more accessible. The cost of rooftop solar in 2020 was only 33% of what it was in 2010 — it's no longer a luxury purchase.[107] Putting solar panels on your roof and batteries in your garage (see *Chapter 10: Home Battery Storage*) can make you more resilient against losing power, and it is an increasingly valuable resource to the grid. It's also possible to have your solar array installed on your garage or ground instead of on your roof.

You'll probably want your solar panels installed by certified professionals, which means you're going to need a solar installer (aka contractor). See below for the section "Finding a solar installer." Before you start talking to solar installers, you should do some research into your options. Some useful references to read are:

- → SEIA's (Solar Energy Industries Association) Residential Consumer Guide to Solar Power — **seia.org/sites/default/files/2018-06/SEIA-Consumer-Guide-Solar-Power-v4-2018-June.pdf**
- → A Vermonter's Guide to Residential Solar — **cesa.org/resource-library/resource/a-vermonters-guide-to-residential-solar**
- → Solar United Neighbors Go Solar FAQs — **solarunitedneighbors.org/go-solar/faqs**

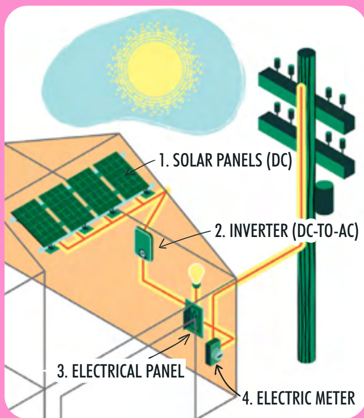
HOW SOLAR WORKS

1—Solar panels on your roof convert sunlight into Direct Current (DC) electricity.

2—An "inverter" converts the DC into Alternating Current (AC).

3—Your home consumes this AC electricity through your electrical panel.

4—Your home is also connected to the electric grid through your electric meter, so that you can sell any excess electricity, and continue getting grid power when the sun isn't shining.[108]



LIFETIME & WARRANTY

Solar panels typically have a production warranty of 20-25 years, which means they will produce the rated power for that long (though they might perform even longer). Panels also have a separate "workmanship" or product warranty that can range from 10 to 25 years, and covers defects. Check whether warranties are from the manufacturer or system installer.[109] System installers often provide installation warranties covering their work that can vary widely in length.

Inverters have a separate warranty, and can range from 5-25 years. This is discussed below under "Picking an inverter."

FIX YOUR ROOF FIRST

Since solar panels can last 25+ years, you should find out if your roof is going to need replacing soon so you won't have to remove the panels during that time. You can't include the roof cost as part of the Federal tax credit, but it will save you potential repair costs later.[110]

In fact, many solar installers won't even work on an older roof. There are some roofers, however, that also install solar, so there is potential cost savings to do them both at the same time. Solar PV panels can also increase the life of a roof. Since the lifespan of solar is a bit unknown but already surpassing expectations, consider getting a longer life roof to avoid uninstall/ reinstall costs.

KNOW (& REDUCE) YOUR LOAD BEFORE BUYING SOLAR

Look at your electric bills from the last 12 months to get a sense of your average monthly energy usage, how much your bill is and how much you pay for each kWh (kilowatt-hour) you use. If you don't have your bills, they might be available through your utility's web site, along with your daily or even hourly use.

Consider replacing any inefficient electric machines with better ones before you buy solar. For instance, it would be better to get a Heat Pump Water Heater that uses 100 kWh per month to replace an electric resistance water heater that uses 450 kWh per month. Over the course of a year, that's 4,200 kWh saved that doesn't have to come from solar. Consider all appliances, including:

→ Any machines you want to electrify that will increase your electricity use, especially car charging equipment.

→ Incandescent light bulbs (replace with LED lightbulbs).

→ Faucets and showerheads (replace with low-flow fixtures to reduce hot water needs).

→ Phantom loads (also called "energy vampires" and "standby power"), such as your TV and cable box, which can be put on a power strip to be fully shut off when not in use.

ROOFTOP POTENTIAL

How much power could your rooftop generate? Here are some sites where you can enter your address to learn about your home's solar potential:[111]

- → Google Project Sunroof — **google.com/get/sunroof**
- → Sun Number — **sunnumber.com**: Gives you a "score" to see how well suited your address is, along with an estimated system size and annual value of the electricity that would be generated.
- → EnergySage's calculator — **energysage.com/solar/calculator**: Gives you some estimates on costs and return on investment, based on your current electricity use (though you should consider if your use will increase if you electrify everything).
- → PVWatts Calculator — **pvwatts.nrel.gov**: This is a more detailed analysis of potential rooftop systems — including being able to draw the area where it could go on your roof. It can be useful for evaluating designs from contractors.[112]

PV PANELS, POWER (& ENERGY) OUTPUT

Buying solar panels is a little like buying a car, in that there are many options in price and performance. The best solar panels can turn over 22% of incoming sunlight into electricity (called the "efficiency"). Energy Sage has a Buyer's Guide that lets you sort solar panels by efficiency, search by brand, and download spec sheets — **energysage.com/solar-panels**. You can also compare updated lists of the best solar panels:

- → Clean Energy Reviews — **cleanenergyreviews.info/blog/best-solar-panels-review**
- → Energy Sage — **news.energysage.com/best-solar-panels-complete-ranking**

To give you a sense of scale, the average residential PV panel is a little over 5 feet long and 3 feet wide, and weighs about 40 pounds.[113] Using a mid-range power output of 290W per panel, it will require 17 panels to output around 5,000W.[114] How many panels you install will depend on your energy usage, the space available on your property, and your budget. Your selected installer will help you decide the best location for your installation.

As of 2021, solar in the U.S. costs around $2.76 per installed watt (including labor). For a 5,000 W array, that's $13,800, which comes down to $10,212 with the 26% federal solar tax credit (see "PV Incentives and rebates" section below).[115]

5,000 W can also be written as 5 kW (5 kilowatts), and the amount of energy a 5 kW PV system transfers to electricity in one hour is 5 kWh (kilowatt-hours).

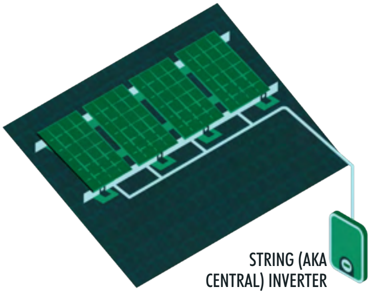
Attachment B

Your utility charges you based on the number of kWh you use. A 5 kW system in sunny Las Vegas, NV could produce almost 8,000 kWh of energy in a year, while it would be closer to 5,000 kWh a year in rainy Seattle, WA. The average U.S. household uses 10,649 kWh a year.

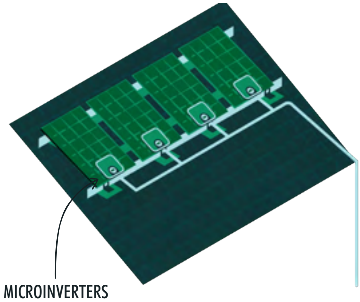
PICKING AN INVERTER

Inverters take the DC output from solar panels and convert it to the AC power your home uses. They are an important part of the system, and three main options are available:

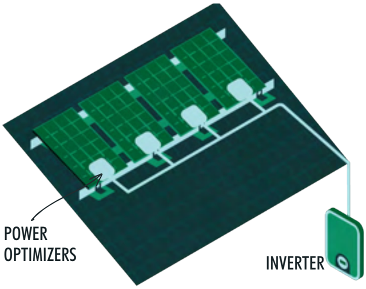
String inverter (aka "central inverter"): A standalone box that's usually installed at ground level and connects to a "string" of solar panels wired together. If one panel gets shaded they all reduce their output, and if one panel fails they all stop producing power. It is the least expensive option, with a 5-12 year standard warranty that can sometimes be extended to 20 years for a fee.

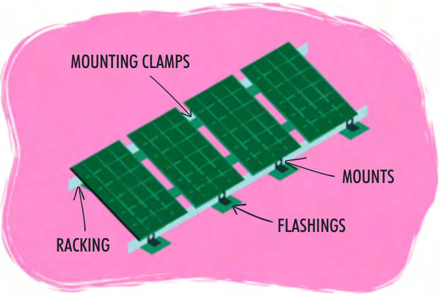


Microinverters: Smaller inverters built into each individual solar PV panel. This means the panels are independent, which can be good for later expansion. But there are more things that can fail, and finding and replacing a broken one on the roof can be challenging. They are more expensive up front, but can be more efficient than a central inverter and have warranties of 25-30 years — similar to the PV panels themselves.



Power optimizers (aka module optimizers): These are similar to microinverters in that there is one on each panel, but they "condition" the DC on its way to a central inverter. Their performance and cost is between microinverters and central inverters, with 25-year warranties.





MOUNTING

The traditional way solar panels are attached to a roof is with racking that is mounted to the roof through water-tight flashings (see image). You should ask your solar installer detailed questions about their mounting plans (see the "Finding a solar installer" section below).

SOLAR NEEDS BATTERIES IN A GRID OUTAGE

For safety reasons, grid-connected PV systems must be rapidly shut down during a grid outage, to make it safe for workers trying to bring the power back up. Inverters sense when grid power is out and stop producing solar power until the grid is back online. Unfortunately, this means your rooftop solar PV CAN'T power your home by itself when the grid is down.

However, if you have a home battery backing up your PV system, you CAN charge the battery with your solar panels (see *Chapter 10: Home Battery Storage*).

PV FINANCING OPTIONS

While the cost of solar PV panels has dropped a lot in recent years, it's still an expensive purchase that can run over $10,000 — comparable to a new car. But since you're locking in free electricity for the 20+ year life of the panels, and also increasing the resale value of your home, think of it more like an investment than as a home appliance. Rooftop solar can even generate cash by selling your excess power back to the grid (see "Net Metering" section below).

CESA (Clean Energy States Alliance) has "A Homeowner's Guide to Solar Financing" that provides details about the three main ways to finance rooftop solar — **cesa.org/wp-content/uploads/Homeowners-Guide-to-Solar-Financing.pdf**. For the first two options where you don't own the panels, you should clarify with the installer the maintenance and service responsibilities (including who is responsible for the inverter); whether the payments increase over time; and what your options are if you sell your home before the agreement is over.

→ **Solar lease:** A solar developer installs and owns the PV on your roof (not you), so you don't have to pay the upfront installation cost. Instead, you pay a monthly payment, which ideally replaces your monthly electric bill (unless you need more power than the panels provide and buy it from the grid).

→ **Power Purchase Agreement (PPA):** Here too a solar developer installs and owns the PV on your roof (not you). Instead of a monthly lease payment, you pay your installer for the electricity you use at a fixed rate, which should be lower than from your utility. Ask the installer to calculate projected rates and savings, and consider whether your utility's rates will increase in the future.

→ **Buy with a Loan:** Here you *do* own the PV on your roof, and the loan for the upfront purchase and installation cost is paid back like any other loan. A "home equity loan" would be one where your home is used as collateral, while an "unsecured loan" might have only the solar equipment itself as the collateral. Consider taking out two loans, as suggested by Clean Energy Credit Union:[116]

- A bridge loan with a 12-18 month term, to cover the time until you get your 26% federal tax credit back (see "PV Incentives and rebates" section below), and
- A second loan with a 12-20 year term, to cover the operational life of the solar panels themselves. Your monthly loan payment plus your remaining utility bill could be less than what you previously paid for electricity.

SELLING YOUR SOLAR HOME

When you're ready to sell your home with solar panels, you should consider getting a realtor with a "Green Designation," and an appraiser who is trained in evaluating the impact of solar. If you don't own the panels, you'll need to consider whether to transfer the lease or PPA to the homebuyer, prepay it, or move it to your new home. Solar United Neighbors has a guide with more details and considerations — **solarunitedneighbors.org/sellingsolarhomes**.

CONSIDER GOING SOLAR IN A GROUP

In addition to Community Solar projects discussed in *Chapter 1: Purchase Renewable Energy*, there are also groups of individuals who band together when looking to get solar panels on their own roofs. Being in a group can help you make informed decisions, and negotiate better prices.

- → Solar United Neighbors has a list of solar co-ops in a number of states, along with "The Ultimate Solar Co-Op Guide" for going this route — **solarunitedneighbors.org/co-ops**.
- → "The Solarize Guidebook" from the Department of Energy has planning templates and case studies for collective group purchases — **nrel.gov/docs/fy12osti/54738.pdf**.

PV INCENTIVES AND REBATES

There is a federal tax credit for buying residential PV. Until the end of 2022, you can deduct 26% of the total cost — including the solar panels, inverter & mounting hardware, batteries, and installation. You can take the credit even if you finance the system, but you can't if it's leased or a PPA. The credit will drop to 22% in 2023. Read more in the "Homeowner's Guide to the Federal Tax Credit for Solar Photovoltaics." — **energy.gov/eere/solar/homeowners-guide-federal-tax-credit-solar-photovoltaics**. You can talk with a tax professional to make sure you're eligible.

Ask your solar installer for help finding and getting rebates. Check these sites for incentives that might be offered from your state or utility:

- → Energy Sage's "Solar panel incentives, rebates & tax breaks" (scroll down to find your state) — **energysage.com/solar/benefits-of-solar/solar-incentives/**
- → SEIA's "Solar State By State" — **seia.org/states-map**
- → Let's Go Solar's "Ultimate Guide to Solar Panels" — **letsgosolar.com/solar-panels**

NET METERING

If your PV system generates more electricity than you can use, many states let you sell that power back to your utility and receive credit on your electric bill. This is called "net metering" (or "feed-in tariff") and it varies widely by state. As of 2020, 34 states plus Washington D.C. and the U.S. territories had some kind of net metering, with most of the rest offering some kind of compensation.[117] Check with your solar installer about the net metering rules for your location, and how it affects the size of your PV system.

SRECS (SOLAR RENEWABLE ENERGY CREDITS)

When your solar cells generate electricity, they also generate a financial instrument called a "Solar Renewable Energy Credit," which can be sold like a stock on the stock market. Utility companies buy SRECs to try to meet state-mandated clean energy standards (called "renewable portfolio standards"), and corporations also buy them to offset their carbon footprint. Some states let you sell the SRECs from your rooftop solar.

If you're buying Solar PV outright, ask your installer who gets the SRECs. If it's you, consider not selling them (aka "retiring" them) to force polluters to purchase and install more solar.[118] If you're getting a lease or power purchase agreement (PPA), make sure you know who controls the SRECs. Typically in lease deals, the solar company will sell the system's SRECs for income as part of their financing model. Read more about SRECs here — **solarunitedneighbors.org/srecs**.

MAINTENANCE

Solar PV panels need very little maintenance but like any investment, should be inspected periodically. Check if your solar installer performs periodic inspections to look for any loose fittings or potential roof leaks, and periodic cleaning.[119] How frequently you need to clean your panels depends on your local conditions and how the panels are mounted — it could range from a few times a year to yearly or longer. Check with your installer for what they recommend. If they suggest doing it yourself, be careful if you have to go on your roof. Here's a maintenance guide — **solarreviews.com/blog/solar-panel-maintenance-everything-you-need-to-know**.

DIY INSTALLATION

You're probably not going to want to install your own solar PV, but if you were curious about going down that path, Solar Wholesale sells complete DIY kits — **solarwholesale.com**. And if you have a large lawn or land you want to use instead of a roof, PowerField makes stand-alone modular racks that get filled with rocks, but can later be emptied and moved — **powerfieldenergy.com**.

FINDING A SOLAR INSTALLER

The process for finding a solar installer is similar to that for finding a contractor to install a heat pump. You should get referrals from friends and family, and then get quotes from at least three potential installers. After picking an installer, it can take two to four months to plan and permit, then the installation itself takes 1-2 days, plus time after the installation for inspections and utility company approval before you can turn your system on.

One easy route for getting some quotes is to use Energy Sage, where you type in your address and contact info, and installers will send back quotes — **energysage.com**.

Here are some questions to ask when interviewing potential installers:[120]

ABOUT THE INSTALLER:

- ☐ How much experience do you have installing residential solar systems? How many systems have you installed?
- ☐ Can you give me references (with phone numbers) for similar systems you've installed recently?
- ☐ What are your licenses or certifications?
- ☐ Will you be using subcontractors? For which parts of the project? What are their qualifications?
- ☐ Who specifically will be working on my roof?
- ☐ Do you have workers' compensation insurance? Can I have a copy?
- ☐ Is the installation company licensed and insured?
- ☐ Does your company follow the SEIA Solar Business Code? Do you agree to abide by SEIA's Complaint Resolution Process?

ECONOMICS, FINANCING, AND OWNERSHIP:

- ☐ What is the total cost of the system? Is that with or without the federal tax credit?
- ☐ How much is the total cost of the solar system if I add battery storage?
- ☐ What's the upfront cost?
- ☐ What will my monthly payment be? For how long?
- ☐ What will my net savings be? What utility rate assumptions are included in your calculations, and what are they based on?
- ☐ Does installing battery storage change how much money I can save with this system? If so, how much?
- ☐ Who gets the tax credit?
- ☐ Will my system be net-metered? How will I be compensated for excess electricity generated by the system?
- ☐ What financing options do you have available?

Attachment B

- ☐ Who gets the SRECs and how do they factor into the (financial) equation? Will you retire the SRECs on my behalf?
- ☐ If I want to sell my home and don't own the SRECs, how can I describe my home to potential buyers?
- ☐ Is residential Property Assessed Clean Energy (PACE) financing available in my state and locality?

SYSTEM DESIGN, PERMITTING, AND APPROVALS:

- ☐ What are my rights under state law?
- ☐ Can my HOA stop me from installing solar?
- ☐ What permits are needed? Who's responsible for securing the permits?
- ☐ Who deals with the utility and arranges for interconnection, inspections, and permission to operate?
- ☐ When will the installation be done, and how long will it take?
- ☐ Who's responsible for repairing my roof if it's damaged during installation? Do you replace any broken roof tiles?
- ☐ Who is the manufacturer of the solar panels and the inverter?
- ☐ What is the system size?
- ☐ How much electricity will the system generate in its first year?
- ☐ How much production decline is expected each year?
- ☐ Do system output calculations consider actual installation details of the system?
- ☐ Do you guarantee a minimum amount (a production guarantee)? Are there any other guarantees?
- ☐ If there is a grid outage, what will happen to my system?
- ☐ If I need battery storage in case of a grid outage, what size system and system attributes do I need?

INSTALLATION:

- ☐ What will the system look like once installed? Will I receive a system design for my review and approval before installation?
- ☐ Will I be required to make any changes to my home (e.g., roofing upgrades)?
- ☐ Do you use the SEIA residential disclosure form? Can you provide a completed copy of the form?
- ☐ What type of flashing will you use on my roof?
- ☐ What type of mounting hardware/footings will you use to attach the panels to my roof?
- ☐ What kind of rail system do you use to connect the footings to the solar panel?

Attachment B

- ☐ What do you use to seal the flashing to the roofing?
- ☐ What kind of conduit do you use? Where will you install the conduit?
- ☐ What type of inverter will you use? If there's a central inverter, where will you install it?
- ☐ Are the solar panels above the roof, or do they go directly on the roof?
- ☐ What disconnects are required, and where will they be located?

MAINTENANCE AND PERFORMANCE:

- ☐ What type of warranties come with the solar system? What do the warranties cover and what are their durations?
- ☐ Are there separate warranties for parts and labor?
- ☐ What type of maintenance or cleaning is required? Are any maintenance services included? If not, who should I contact?
- ☐ Is performance of the system monitored and, if so, by whom? How can I monitor system performance?
- ☐ Who should I contact if I have a question about the system following the installation? Who should I contact if my system stops working?
- ☐ If the company fails, who should I contact regarding panel and inverter warranties and replacement?

FOR LEASES AND PPAS ONLY:

- ☐ What is the length of the lease or PPA?
- ☐ Will my payments increase over time? How much will they increase?
- ☐ What happens if I wish to end the lease or PPA early?
- ☐ Can I purchase the system, either during the agreement or once it ends?
- ☐ What are my options when I sell my home?
- ☐ Am I free to sell my home or do I need the system owner's permission?
- ☐ Do I have to pay off the lease when my home is sold?
- ☐ Can you explain the UCC-1 filing to me? What happens if I want to refinance my mortgage?
- ☐ Are there fees to transfer the PPA or lease agreement to the new homeowner?
- ☐ What are the conditions for a new homeowner to take over the lease or PPA?
- ☐ Who is responsible for repairs and maintenance on the system?

Home Battery Storage

DIFFICULTY:	HARDER
UPFRONT COST:	$10,000-$20,000 before rebates
IMPACT:	Medium on emissions, High on personal resiliency
CONTRACTORS:	Home Battery Installer
DO NOW:	If you have rooftop solar, check with your installer about whether they also offer a storage option.
RENTER:	Get a standalone backup battery.

Getting a home battery to store energy generated by your rooftop solar PV can make a lot of sense. It adds resiliency to your home when the power goes out, which most solar PV systems can't do by themselves (see "Solar and batteries in a grid outage" section below).

Home battery storage also lets you store energy from the sun to use at night, which can avoid higher "Time-Of-Use" rates your utility might charge you for electricity during certain hours. It's a way to help avoid future electricity rate increases. And in the future, your rooftop solar PV and home battery storage might act as a "Virtual Power Plant" to help the utility avoid having to turn on natural gas power plants during times of peak use.

A home battery is not yet going to let you go "off grid" — they are still too small and expensive to provide enough power for most homes for full days. But the technology is being rapidly developed and scaled, making them an increasingly viable and affordable option.[121] They can be worth the current cost, especially if you need reliable power, or you've already fully electrified your home. Here are some useful references for learning more about home batteries:

→ Solar United Neighbors' "Battery Storage Guide" — **solarunitedneighbors.org/storage**

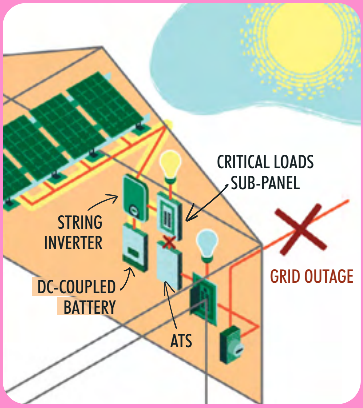
→ Residential Solar PV Plus Battery Storage talk — **youtube.com/watch?v=iKVUP01_ld0**

BATTERIES FOR THOSE WITHOUT NET ENERGY METERING

Net Energy Metering means that your utility pays you for excess electricity generated by your solar panels (see "Net Metering" section in *Chapter 9. Rooftop Solar PV Panels*). Having home storage batteries can be a great addition to solar if your utility either doesn't have net energy metering, or pays you less for your excess electricity than what you pay them for it from the grid. In either case, you're better off storing the excess electricity in a home storage battery for later use.

SOLAR AND BATTERIES DURING A GRID OUTAGE

Batteries can be charged by your rooftop solar PV during a grid outage (see image). Since rooftop solar panels have to be disconnected by the inverter when the grid is down for safety reasons, an Automatic Transfer Switch (ATS) can isolate your PV & battery system. This will let you safely use your battery, and recharge it with your solar.



You should discuss this arrangement with your solar installer. It may require wiring just some select essential circuits to your battery through a critical loads sub-panel, since even a 20kWh battery won't be able to power your entire home (see "Home battery sizing" section below).

HOME BATTERY FINANCING AND LEASING

There are fewer options for financing a home battery than there are for solar PV, though you might be able to include them both together through a Home Equity Line of Credit (HELOC), a home improvement loan, or a solar loan. PACE (Property Assessed Clean Energy) loans might also be used. See the "How to pay for it" section near the beginning of this guide for more about financing options.

Some utilities and independent companies offer leases of home batteries, but it is not yet common. Note that you will not get a tax credit if you lease your home battery (see next section).

HOME BATTERY INCENTIVES AND REBATES

Home battery storage can be included as part of the Federal solar tax credit (see "PV incentives and rebates" in *Chapter 9: Rooftop Solar PV Panels*). It should be eligible even if it's installed separately, at a later time than the solar PV system.[122] To qualify, the battery has to be charged by your solar panels 100% of the time.[123]

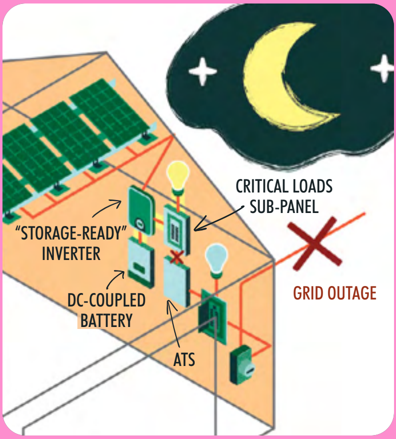
Additional rebate programs exist for specific states, such as California' Self-Generation Incentive Program (SGIP) and Maryland's solar battery tax credit.[124] Ask your battery installer if there are other incentives available for storage.

AC VS. DC COUPLING

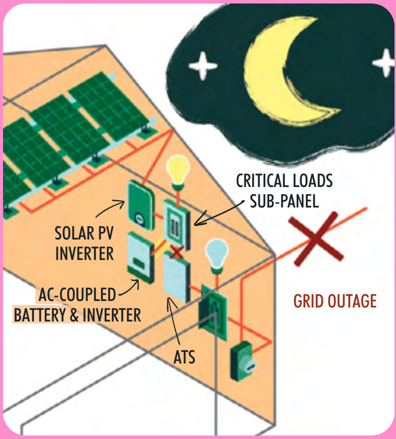
Batteries operate using direct current (DC), while the grid provides our homes with alternating current (AC). Just like with solar PV panels, which also use DC, an inverter is needed to convert the DC to AC for your home. There are two main ways to connect the battery to your home, and you can learn more here — **news.energysage.com/ac-vs-dc-solar-battery-coupling-what-you-need-to-know**.

Attachment B

DC-COUPLED BATTERY



AC-COUPLED BATTERY



DC coupled: If you have a "storage ready" solar PV inverter, a battery can be connected to it directly. This arrangement is useful for ensuring the battery is only charged by the solar panels, which is important for the federal tax credit (see "Home battery incentives and rebates" section above). It's also possible to replace your existing solar PV inverter to work with your battery, which could make sense if your inverter is more than five years old (since they last around 10 years). And some DC coupled battery systems aren't directly connected to your electric panel, which can leave more panel space for other home electrification projects without needing to upsize. But DC coupled batteries are more expensive and complicated than AC coupled.

AC coupled: Here the battery has its own inverter, separate from the solar PV inverter. The inverter might even be integrated with the battery, like Tesla's Powerwall 2. Having different inverters for your solar PV and home battery storage might be slightly less efficient than having them combined, but an advantage is that they can also be charged by the grid (though this will remove the federal tax credit).[125]

BATTERY CHEMISTRY

The most widely available home batteries use lithium-ion chemistry, similar to the batteries in laptops and cell phones. The cost has come down a lot recently due to their mass production for use in EVs. On average, home storage lithium ion batteries can be fully discharged and then recharged (or "cycled") 7,500 to 10,000 times, and have 10 year warranties.[126] There are some differences in the types of lithium ion batteries, which you can discuss further with your installer:[127]

- → **Lithium Nickel Manganese Cobalt Oxide (NMC):** Most common and least expensive lithium ion, found in cars and power tools. NMC is used in Tesla's Powerwall and LG Chem's Resu home storage batteries.
- → **Lithium Iron Phosphate (LFP):** These are cheaper than NMC because they don't use nickel or cobalt, but they store less energy. LFP is used in batteries from many manufacturers including Sonnen, SimpliPhi, and Enphase.
- → **Lithium Nickel Cobalt Aluminum Oxide (NCA):** Newer to the market, they store more energy than NMC. NCA is not widely used yet, but is available in the TrinaBESS system from Trina Solar.

Besides lithium ion batteries, there are also "sealed lead acid" batteries — similar to car batteries — that are used as home storage batteries. They are cheaper than lithium ion, but should only be discharged to 50% of their capacity, and they can't be cycled as much — more like 2,000 cycles, with 2-5 year warranties.

It's also worth mentioning that flow batteries are a newer design with long lifetimes and good electrical performance, and are currently being commercialized for grid-scale batteries. They are not yet ready for the home market or EVs, but they could be in a few years.[128]

BATTERY RECYCLING AND MATERIAL CONCERNS

Lead acid batteries are easily recycled, thanks to their long-time use in cars. It is both the value of the lead, and concern about its toxicity, that leads to very high recycling rates.

Lithium-ion batteries are more complex and not as easily recycled, though they have much longer lifetimes than lead acid batteries. Several startups are trying to make lithium battery recycling cost-effective, especially as the number of batteries manufactured skyrockets.[129]

There are some concerns about both the quantities and sources of raw materials for batteries, including lithium, cobalt, and nickel.[130] A lot of research is going into new battery chemistries right now that don't need cobalt and other supply-constrained materials[131] (see "Battery chemistry" above). As recycling grows, the need for newly mined materials will decrease.

Don't be discouraged from buying an EV or home storage battery today over concerns about materials in the batteries — the climate benefits outweigh the materials concerns.

HOME BATTERY SIZING

Because home batteries are still expensive, most people size them to only power critical appliances for around 24 hours while the grid is out.[132] The list usually includes: charging cell phones and other personal devices, running computers and the internet (modems & routers), food refrigeration, some lights and ceiling fans, some limited air conditioning (e.g. window units), and any other critical loads like well pumps and medical equipment. Your electrician might rewire key appliances into a separate critical loads sub-panel, powered by your battery (see pictures above in section "AC vs. DC coupling"). Smart Energy Management Systems can also replace your electrical panel, and manage critical loads (see *Chapter 2: Electrical Service*).

One way to think about sizing the battery is to multiply the kW of solar PV you have by 2 to 4 hours to get a kWh number, which represents the energy stored in the battery. So for a 5 kW array, you might get a 10 kWh battery. Your installer will provide more detail on sizing and justification for it.

WHERE TO INSTALL THE BATTERY

Both lead acid and lithium ion batteries need to be installed in non-living spaces, since there is the potential for them to offgas. If they need to be installed outside, it will probably have to be shaded and water-proofed. If inside, it will probably be in the garage or other non-living space. Your installer will size the battery in part based on where it will be located.

USE AND MAINTENANCE

Your installer will initially program your battery system and show you how to use it, including any custom settings and operating modes. Make sure you learn how to set the charge and discharge times to coincide with any time-of-use rates from your utility.

Maintenance includes visually checking your battery several times a year to make sure there are no alerts or warnings. The battery might also need a system check-up by the contractor at some point during its lifetime. Overall, they are very low maintenance.

USING YOUR EV FOR BACKUP

Instead of buying separate home battery storage, it could soon be possible to use your EV's battery to power your house, though the technology is still in development. See "Home power backup using your car" in *Chapter 7: Electric Vehicles* for more info.

THERMAL STORAGE

In addition to a home battery for storing electricity, you can also think of a tank of hot water as a "thermal battery" that can "store" heat for later use. Two examples are Heat Pump Water Heaters (see *Chapter 4: Heat Pump Water Heater*) and hydronic air-to-water heat pumps for radiant floor and hot water space heating (see *Chapter 3: Heat Pump Space Heating*). Your heat pump heating your space overnight in winter, or cooling it overnight in summer, can also store energy in your home.

Thermal storage won't give you electrical resiliency in a grid outage like a home battery, but it will give you some thermal resiliency, and can also help you manage varying "time-of-use" electricity rates.

FINDING A BATTERY INSTALLER

Check with your solar PV installer to see if they also offer battery storage.

INITIAL BACKGROUND QUESTIONS:

- ☐ Number of home storage batteries they've installed and how many in your area.
- ☐ Experience with the specific technology/equipment you are interested in.
- ☐ Availability of your preferred equipment (if you have a preference).
- ☐ Installer workmanship warranties
- ☐ NABCEP certification, a common certification for solar installers that includes battery knowledge
- ☐ Whether they take care of all permitting and inspection requirements.

QUESTIONS TO DISCUSS WITH YOUR INSTALLER[133]:

- ☐ What is the total installed cost of the battery storage system versus the expected output over its lifetime?
- ☐ Do you have an appropriate space to install the battery?
- ☐ Can the battery store and supply enough energy for your needs?
- ☐ Is the supplier a reputable company that can deliver on any potential warranty claims?
- ☐ Do you have any safety concerns?
- ☐ What do you want to use the battery for (e.g. backup for grid outages, saving money)?
- ☐ How much energy do you use between battery charges (both now and in the future)?
- ☐ How much power do you need to run your appliances?

Attachment B

- ☐ How much excess energy do you generate from your solar panels each day?

COMPARING SYSTEMS:

- ☐ How do I know what the system is doing (i.e. what is the user interface?)?
- ☐ How is it intended to be used (e.g. some systems are only intended for providing backup power while others can only charge from your solar panels and not from the electricity grid)?
- ☐ How much energy can it store?
- ☐ How fast can it store and supply energy?
- ☐ What are the maintenance and safety considerations of the system and technology?
- ☐ How big is it and where does it need to be installed?
- ☐ What is the battery storage system's operating temperature range? (Some systems cannot charge in cold weather or may not operate on very hot days.)
- ☐ Can the battery storage system be recycled?
- ☐ How long will the battery storage system last, and what is the product warranty period?
- ☐ Would it be simple to add more batteries to the system later if your needs change?
- ☐ Is it an 'all-in-one' device or are there multiple components that must also be installed, including any programming to ensure compatibility?
- ☐ Does the battery storage system only work with a specific inverter or is it compatible with multiple brands?
- ☐ What is the efficiency of the system (how much of the stored energy can be used)?
- ☐ Are there any additional state or local rebates or incentives available?

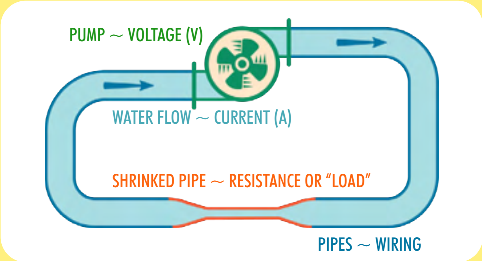
PROPOSALS SHOULD INCLUDE:

- ☐ Full cost of the storage system, installation, and additional equipment
- ☐ Payment milestones
- ☐ Equipment details
- ☐ Battery size (kW and kWh)
- ☐ Battery model and manufacturer
- ☐ Inverter model and manufacturer (if separate from battery)
- ☐ Battery management system (if used)
- ☐ List of all warranties (battery, inverter, installer workmanship)
- ☐ Details of additional work needed (electrical work, inverter swap, etc.)
- ☐ Pricing guarantee for all equipment
- ☐ Installer information (office location, point of contact, contact information)

An extremely brief intro to electricity

Electrification can be confusing because electricity can be confusing. We can't see it, we can't touch it, and most of us never learned much about it. We know the words — Volts, Amps, Watts, kilowatt-hours — but it all ends up just being lumped together as "electricity." So here is an extremely brief overview that might help you get an initial grasp on what's happening in the wires.

Main ideas in electricity: Here's a water flow analogy for thinking about it that might be helpful:



WATER ANALOGY	ELECTRICITY	FUNCTION
Pump	Battery/power plant	Provides the "oompf" (electric "Voltage")
Water flow (shown by arrows)	Current ("electric fluid" flow)	Stuff that carries energy through circuit
Shrinked pipe	Resistance or "Load"	Reduces flow & uses the energy
Pipes	Wiring	Provides low-resistance path for flow

Voltage: Provides the "oomph" in a circuit, measured in Volts (V). If we use a fluid analogy for electricity, you can think of voltage as the "pumping action" created by a pump that makes the "electric fluid" flow. For scale, USB outlets provide 5V, while regular U.S. wall outlets provide 120V, and many appliance outlets provide 240V. Higher voltage loads more energy onto the flowing "electric fluid."

Current: Sticking with the fluid analogy, current is a measure of the flow rate of this "electric fluid" through a circuit — how much charge is flowing past a given point every second, measured in Amps (A). A USB outlet can provide a little less than 1A, while 120V wall outlets often provide up to 15A or 20A, and 240V appliance outlets up to 60A.

→ **Alternating current (AC):** Wall outlets provide AC, where the "electric fluid" moves back and forth 60 times every second ("alternating" direction). Think of the pump quickly reversing direction many times a second.

→ **Direct current (DC):** Batteries and USB provide DC, where the "electric fluid" is always pumped in the same direction, around and around the circuit.

Energy: As the "electric fluid" flows, it transfers energy from the source (e.g. battery or power plant) to the load (e.g. electric machine). Both AC and DC transfer energy. Measured in kilowatt-hours (kWh). Energy is what you pay for, and what appears on your electric utility bill.

→ **Power:** It might seem confusing that energy and power are different, but power is a measure of energy in motion, or the energy flow rate, measured in Watts (W). It measures how much energy is being transferred past a given point every second. A cell phone can charge using around 5 W of power, while a hair dryer can use around 1,800 W, and a clothes dryer around 5,000 W. Think of it this way — if you run a 5,000 W (5 kW) clothes dryer for 1 hour, you'll use 5 kWh of energy, whereas if you run it for 30 minutes, you'll use half as much energy, or 2.5 kWh. The power need in both cases is the same 5 kW, but it uses more energy (kWh) the longer it runs.

Efficiency: This is a measure of how much of the energy input to do something is used to accomplish that goal. When burning fuel in a gasoline engine, only 30% of the energy in the fuel goes to moving the car. For electricity you get from the grid, if it's generated burning coal or natural gas in a power plant that's only 30-40% efficient, then what you pay for in kWh ignores the 60-70% of the fossil fuel's energy released up the power plant's smokestack. Good solar cells are around 20% efficient, but the "wasted" energy from the sun was free anyway, and doesn't produce any carbon emissions.

→ **Greater than 100% efficient:** When burning fossil fuel for heating, at most 100% of the energy in the fuel can go into the air or hot water being heated. But using a heat pump for space heating or water heating can be 300% efficient or more, since the electric energy input is only moving existing heat from lower to higher temperature instead of creating it. In the 300% example, the heat pump is pumping two units of heat energy from the yard outside, adding one unit of electric energy from the grid, and delivering all 3 units of heat into the house or water heater. It's almost magical that we can get out more heating's worth of energy out than the energy we put in.

Electrification is the Efficiency We Need

To give you a sense of how much more efficient electric machines can be, we can compare average monthly fossil fuel use BEFORE electrification, with the equivalent electricity use AFTER, along with potential cost savings. To do so, we have to convert the energy stored in fossil fuels to electrical energy units (kWh), and assume average fuel costs:

1 KILOWATT-HOUR (KWH)

Costs an average of $0.15

A battery that stores 1 kWh of energy can power a **1 KW BLENDER** for 1 hour.

1 THERM (= 29KWH)

Costs an average of $1.20

About 100 cubic feet of natural gas, which would fill **100 BALLOONS.**

1 GALLON OF GAS (= 33KWH)

Costs an average of $3.50

Imagine filling your car using **1 GALLON MILK JUGS** of gasoline, instead of the pump.

If you replace your 23 miles-per-gallon car, 87% efficient natural gas furnace, and 74% efficient natural gas water heater with electric replacements, you might get these results:

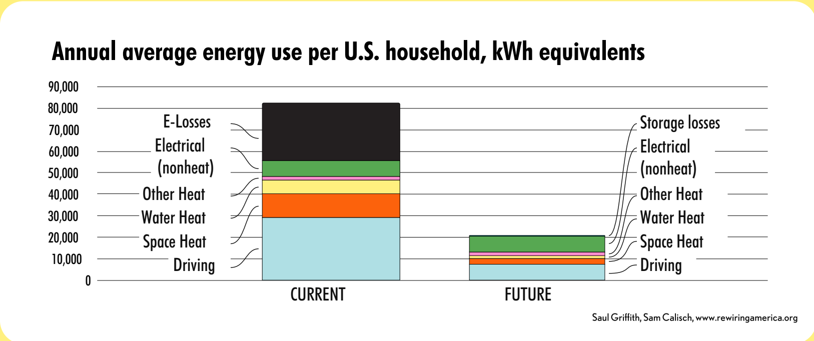
	BEFORE Average monthly fossil fuel use, (electrical equivalent) & monthly cost	AFTER Average monthly electrical use, (fossil fuel equivalent) & monthly cost	MONTHLY CASH SAVINGS
DRIVING	55 gallons *(1810 kWh)* $192	405 kWh *(12 gallons)* $60	$132
SPACE HEATING	53 therms *(1535 kWh)* $80	355 kWh *(12 therms)* $53	$27
WATER HEATING	20 therms *(578 kWh)* $30	114 kWh *(4 therms)* $17	$13

Attachment B

That's $172 in monthly savings, or around $2,000 a year. In addition to the potentially large cost savings, the energy savings will help reduce carbon emissions immediately, and will continue to do so as the grid is made more renewable. And if you add solar panels (or community solar) and a home storage battery, you can save even more money.

Below is a chart from Rewiring America's Household Savings Report — **rewiringamerica.org/policy/household-report**. By putting the above numbers in graphical form on an annual basis instead of monthly (and showing everything in kWh equivalents). It can add up to **HUGE** savings! Part of what's interesting about this is that the "e-losses" from generating electricity, shown in black, are basically eliminated as we stop burning fossil fuels in power plants that waste 50-70% of the energy up the smokestacks, and switch to clean, renewable electricity sources (including rooftop solar).

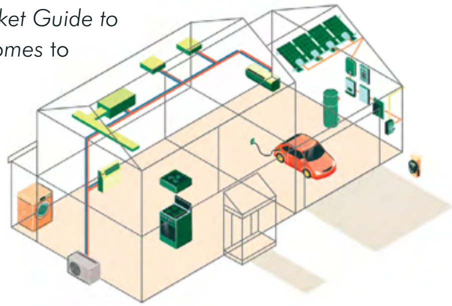
Let's electrify everything!



Homeowner and Landlord Checklist

→ If you're a homeowner or a landlord, this list will help you *Electrify Everything in Your Home* as you go through Rewiring America's guide: **rewiringamerica.org/electrify-home-guide**

→ Also download *Redwood Energy's Pocket Guide to All-Electric Retrofits of Single-Family Homes* to see product options for many of these items: **redwoodenergy.net/research**



Which of these modern electric options do you want working for you?

1. Purchase Renewable electricity	HAVE	WANT
Your utility's renewable plan	☐	☐
If shared meter ask homeowner's association to switch	☐	☐
Community Solar subscription	☐	☐
Community Wind subscription	☐	☐
Rooftop Solar PV Panels (see *9. Rooftop Solar PV Panels*)	☐	☐
Reduce your electricity needs	☐	☐
LED light bulbs	☐	☐
Power strips to shut off standby loads	☐	☐

2. Electrical Service	HAVE	WANT
100 Amp capacity	☐	☐
200 Amp capacity	☐	☐
Energy Management System	☐	☐
Smart Circuit Splitter for sharing circuits	☐	☐
New outlets and circuits to consider installing	☐	☐
Heat Pump Water Heater, 240V / 15-30A	☐	☐
EV Level 2 Charger, 240V / 20-40A	☐	☐
Heat pump dryer or condensing dryer, 240V / 20-30A	☐	☐
Combo Induction stove & oven, 240V/ 40-50A	☐	☐

Attachment B

3. Space Heating and Cooling

	HAVE	WANT
Home Energy Assessment / Audit	☐	☐
Efficiency upgrades		
Air leaks sealed	☐	☐
Wall Insulation	☐	☐
Attic insulation	☐	☐
Floor insulation	☐	☐
Better windows	☐	☐
Packaged heat pumps:		
Window unit heat pump	☐	☐
Portable heat pump	☐	☐
Mini-split heat pump:		
Inverter-driven	☐	☐
SEER above 20	☐	☐
HSPF above 10.5	☐	☐
Indoor unit style:		
High wall mount	☐	☐
Floor mount	☐	☐
Recessed ceiling cassette	☐	☐
Ducted mini-split	☐	☐
Ducted central heat pump:		
Inverter-driven	☐	☐
SEER above 20	☐	☐
HSPF above 10.5	☐	☐
Air handler	☐	☐
ICM493 surge protector	☐	☐
Hybrid resistance backup	☐	☐
Furnace backup	☐	☐
Other types of heat pump:		
Ground-source heat pump	☐	☐
Hydronic air-to-water heat pump	☐	☐
Ventilation	☐	☐
Heat Recovery Ventilation (HRV)	☐	☐
Energy Recovery Ventilation (ERV)	☐	☐
Other heating options:		
Plug-in space heater	☐	☐
Electric blanket	☐	☐
Electric fireplace	☐	☐
Electric sauna heater	☐	☐
Electric outdoor patio heater	☐	☐

4. Hot Water

	HAVE	WANT
Heat Pump Water Heater (HPWH)	☐	☐

	HAVE	WANT
UEF above 3.1	☐	☐
240V / 15A	☐	☐
120V retrofit-ready	☐	☐
Larger tank (80 gallon)	☐	☐
Mixing valve	☐	☐
Reduce your hot water needs:		
Leaks and drips fixed	☐	☐
Low-flow shower heads	☐	☐
Low-flow faucets & aerators	☐	☐
Energy-efficient dishwasher	☐	☐
Energy-efficient clothes washer	☐	☐
Other hot water options:		
Swimming pool heat pump	☐	☐
Hot tub heat pump	☐	☐

5. Electric Cooking

	HAVE	WANT
$50+ portable induction burner	☐	☐
New 240V / 40-50A circuit (see 2. *Electrical Service*)	☐	☐
Induction stove (combo cooktop & oven)	☐	☐
Separate induction cooktop	☐	☐
Separate electric oven	☐	☐
Cooktop exhaust hood	☐	☐
Other electric cooking options:		
Electric crockpot	☐	☐
Electric multi-cooker	☐	☐
Electric wok	☐	☐
Countertop toaster oven	☐	☐
Electric camp stove	☐	☐
Electric barbeque	☐	☐

6. Clothes washing

	HAVE	WANT
Clothes drying rack or clothesline	☐	☐
Combined washer / condensing dryer, 120V ventless	☐	☐
Condensing dryer, 120V ventless	☐	☐
Heat pump dryer, 240V ventless	☐	☐
New 240V / 20-30A outlet (see 2. *Electrical Service*)	☐	☐
Hybrid heat pump & resistance dryer	☐	☐
New washer with high speed spin	☐	☐

7. Electric Vehicles

	HAVE	WANT
Driving plan	☐	☐

Attachment B

	HAVE	WANT
Plug-in Hybrid Electric Vehicle (PHEV)	☐	☐
All Electric Vehicle (EV)	☐	☐
120V Level 1 Charger (included with EV)	☐	☐
Other electric transportation:		
Electric bicycle	☐	☐
Electric scooter	☐	☐
Electric skateboard	☐	☐

8. EV Charger

	HAVE	WANT
Try included 120V Level 1 charger first	☐	☐
Additional outlet (see *2. Electrical Service*)	☐	☐
240V Level 2 EVSE, with changeable 20-40A settings	☐	☐
Portable version	☐	☐
Installed hardwired version	☐	☐
Housing for installed hardwired version	☐	☐
Ask employer about installing Level 2 charger	☐	☐

9. Rooftop Solar PV Panels

	HAVE	WANT
Check your roof's sun potential	☐	☐
Quotes from **energysage.org**	☐	☐
Inverter:		
String inverter	☐	☐
Microinverters	☐	☐
Power optimizers	☐	☐
Do-it-yourself version	☐	☐
Solar panels	☐	☐
Mounting system	☐	☐

10. Home Battery Storage

	HAVE	WANT
AC coupled	☐	☐
DC coupled	☐	☐
Standalone backup battery	☐	☐

Other Activities

	HAVE	WANT
Electric leaf blower	☐	☐
Electric chain saw	☐	☐
Electric hedge trimmer	☐	☐
Electric lawn mower	☐	☐
Electric snowblower	☐	☐
Electric snowmobile	☐	☐

Renter Checklist

→ If you're a renter, this list will help you *Electrify Everything in Your Home* as you go through Rewiring America's guide: **rewiringamerica.org/electrify-home-guide**

→ Also download *Redwood Energy's Pocket Guide to All-Electric Retrofits of Single-Family Homes* to see product options for many of these items: **redwoodenergy.net/research**

Which of these modern electric options do you want working for you?

1. Purchase Renewable electricity	HAVE	WANT
Your utility's renewable plan	☐	☐
If shared meter ask landlord to switch	☐	☐
Community Solar subscription	☐	☐
Community Wind subscription	☐	☐
Reduce your electricity needs	☐	☐
LED light bulbs	☐	☐
Power strips to shut off standby loads	☐	☐

3. Space Heating and Cooling	HAVE	WANT
Packaged heat pumps	☐	☐
Window unit heat pump	☐	☐
Portable heat pump	☐	☐
Other heating options:		
Plug-in space heater	☐	☐
Electric blanket	☐	☐
Electric fireplace	☐	☐
Electric outdoor patio heater	☐	☐

4. Hot Water	HAVE	WANT
Reduce your hot water needs	☐	☐
Leaks and drips fixed	☐	☐
Low-flow shower heads	☐	☐
Low-flow faucets & aerators	☐	☐

Attachment B

5. Electric cooking	HAVE	WANT
$50+ portable induction burner	☐	☐
Other electric cooking options:		
Electric crockpot	☐	☐
Electric multi-cooker	☐	☐
Electric wok	☐	☐
Countertop toaster oven	☐	☐
Electric camp stove	☐	☐
Electric barbeque	☐	☐

6. Clothes washing	HAVE	WANT
Clothes drying rack or clothesline	☐	☐
Combined washer / condensing dryer, 120V ventless	☐	☐

7. Electric Vehicles	HAVE	WANT
Driving plan	☐	☐
Plug-in Hybrid Electric Vehicle (PHEV)	☐	☐
All Electric Vehicle (EV)	☐	☐
120V Level 1 Charger (included with EV)	☐	☐
Other electric transportation:		
Electric bicycle	☐	☐
Electric scooter	☐	☐
Electric skateboard	☐	☐

8. EV Charger	HAVE	WANT
Try included 120V Level 1 charger first	☐	☐
Ask landlord about installing Level 2 charger	☐	☐
Ask employer about installing Level 2 charger	☐	☐

10. Home Battery Storage	HAVE	WANT
Standalone backup battery	☐	☐

Other activities	HAVE	WANT
Electric leaf blower	☐	☐
Electric chain saw	☐	☐
Electric hedge trimmer	☐	☐
Electric lawn mower	☐	☐
Electric snowblower	☐	☐
Electric snowmobile	☐	☐

Attachment B

Endnotes

1 https://www.rewiringamerica.org/policy/one-billion-machines

2 These numbers assume a U.S. grid average of 13.8¢/kWh in a 350Wh/mile vehicle, and U.S. gas average of $3.20/gallon in an average 25mpg vehicle.

3 https://www.reviewed.com/ovens/features/induction-101-better-cooking-through-science

4 https://slate.com/technology/2021/08/tom-standage-brief-history-of-motion-electric-cars.html

5 https://en.wikipedia.org/wiki/Induction_cooking#History

6 https://www.sunrun.com/go-solar-center/solar-articles/what-is-the-life-expectancy-of-a-solar-battery

7 https://www.energy.gov/energysaver/home-energy-audits/professional-home-energy-audits

8 https://www.energy.gov/sites/prod/files/2020/01/f70/Guide%20to%20Federal%20Tax%20Credit%20for%20Residential%20Solar%20PV.pdf

9 https://fueleconomy.gov/feg/taxevb.shtml

10 For example, the Association of Bay Area Governments https://www.bayrenresidential.org/get-rebates

11 This San Diego realtor has more detail, including some California-specific options: https://www.mylenemerlo.com/blog/finance-energy-efficient-upgrades/

12 https://www.mortgageloan.com/environment

13 https://www.energystar.gov/newhomes/mortgage_lending_programs/energy_efficient_mortgages

14 https://www.mylenemerlo.com/blog/renovation-loans/

15 https://www.nerdwallet.com/blog/finance/green-credit-union-green-energy-loan/

16 https://www.cleanenergycu.org/home/fiFiles/static/documents/Clean_Energy_CU_Eligible_Products.pdf

17 https://en.wikipedia.org/wiki/PACE_financing

18 https://www.mylenemerlo.com/blog/energy-efficient-home-upgrades-pace-financing/

19 https://www.knowyouroptions.com/buy-overview/affordable-mortgage-options/homestyle-energy-mortgage

20 https://earth911.com/home-garden/finance-energy-efficiency-upgrades/

21 https://www.investopedia.com/terms/b/buydown.asp

22 "Growing Your Own" from Solar United Neighbors, https://www.youtube.com/watch?v=CzuTKSbMX3Q

23 https://www.pecanstreet.org/panel-size-paper-update/

24 https://homeguides.sfgate.com/check-amp-size-houses-electrical-service-72409.html

25 https://www.angi.com/articles/ask-angie-what-does-it-cost-upgrade-200-amps.htm

26 https://www.getneocharge.com/products

27 https://www.span.io/smart-panel-product

28 https://www.wired.com/review/span-smart-electrical-panel/

29 https://clean-coalition.org/ecmr-guidelines/ and https://www.switchison.org/assets/pdfs/Electrical%20Panel%20Upgrades.pdf

30 https://newbuildings.org/webinar/its-getting-betr-the-building-electrification-technology-roadmap-is-here/

31 For example, New York State's Clean Heat Contractors list: https://www.nyserda.ny.gov/Contractors/Find-a-Contractor/NYS-Clean-Heat-Contractors And Massachusetts's Installers Directory: https://goclean.masscec.com/installers-directory/

32 You can also learn about load calculation from an episode of This Old House, from 6:40-14:10: https://www.thisoldhouse.com/jamestown-net-zero-house/21053794/hvac-of-the-future-the-jamestown-net-zero-house

33 This is just one question in Nate's useful "Electrify Everything/HVAC 2.0 Contractor Interview Form.": https://docs.google.com/forms/d/e/1FAIpQLSdqkjs2joY2XVtu89gRu8PtQ7BU9l21c1IU6pguiPOlmTNiPA/viewform

Attachment B

34 http://www.natethehousewhisperer.com/home-comfort-101.html

35 NEEP: https://neep.org/sites/default/files/resources/ASHP_buyingguide_5.pdf, Department of Energy: https://www.energystar.gov/campaign/heating_cooling/10_tips_hiring, SoCal Gas: https://www.socalgas.com/save-money-and-energy/energy-saving-tips-tools/hiring-a-contractor, Finding a Contractor, https://www.youtube.com/watch?v=nQuwkcZPdLY, and https://docs.google.com/forms/d/e/1FAIpQLSdqkjs2joY2XVtu89gRu8PtQ7BU9l21c1IU6pguiPOlmTNiPA/viewform

36 https://neep.org/guide-sizing-selecting-ashps-cold-climates and https://neep.org/installing-air-source-heat-pumps-cold-climates

37 https://ashp.neep.org/

38 Watch two entertaining videos to learn more about heat pumps: "Heat Pumps: The Future of Home Heating" and "The Future of Heat Pumps is Underground (and other places, too!): https://www.youtube.com/watch?v=7J52mDjZzto and https://www.youtube.com/watch?v=7zrx-b2sLUs

39 From https://www.switchison.org/how-it-works

40 For example, The Heat Pump Store in Portland, Oregon provides this service: https://www.theheatpumpstore.com/diy-with-assistance/

41 "One ton" of cooling capacity, historically, referred to the amount of heat energy absorbed in the melting of one ton of ice over 24 hours, which is 288,000 British Thermal Units (BTU), or 12,000 BTU/hour. From https://inspectapedia.com/heat/Tons-Cooling-Capacity.php

42 https://www.heatpumpshq.com/heat-pump-sizing.html

43 https://en.wikipedia.org/wiki/Inverter_compressor

44 https://www.youtube.com/watch?v=b7cghS1G_Wc

45 https://www.masscec.com/blog/2021/09/13/masscec-pilot-showcases-success-whole-home-heat-pumps

46 https://homeguide.com/costs/heat-pump-cost

47 https://www.efficiencymaine.com/heat-pump-user-tips/ and https://neep.org/sites/default/files/GettingTheMostFromYourHeatPumpConsumerGuideFINAL.pdf

48 https://www.youtube.com/watch?v=uUoyweC0mSE

49 https://www.energy.gov/energysaver/water-heating/reduce-hot-water-use-energy-savings

50 https://www.contractormag.com/management/article/20874577/hp-water-heaters-where-the-rubber-meets-the-road

51 https://www.energy.gov/articles/new-infographic-and-projects-keep-your-energy-bills-out-hot-water

52 https://www.eco2waterheater.com/product-info

53 https://www.heat2o.com/

54 https://www.bbb.org/search

55 From BayREN's FAQ: https://www.bayren.org/residentialhpwh

56 https://homewatertech.com/ultimate-water-heater-descaling-guide-tank-tankless/

57 https://www1.eere.energy.gov/buildings/publications/pdfs/building_america/measure_guide_hpwh.pdf

58 https://www.motherjones.com/environment/2021/02/how-the-fossil-fuel-industry-convinced-americans-to-love-gas-stoves/

59 https://www.vox.com/energy-and-environment/2020/5/7/21247602/gas-stove-cooking-indoor-air-pollution-health-risks

60 https://earther.gizmodo.com/leaked-slides-show-the-gas-industry-is-freaking-out-1846822881

61 "Experiments in Induction Cooking," https://www.youtube.com/watch?v=T3AI1eQ50iE

62 "Why London's Top Chefs Are All Cooking on £99 Induction Hobs," https://www.vice.com/en/article/78mvqa/why-londons-top-chefs-are-all-cooking-on-99-induction-hobs

63 https://recipes.howstuffworks.com/tools-and-techniques/question228.htm

Attachment B

64 https://www.bhf.org.uk/informationsupport/heart-matters-magazine/medical/ask-the-experts/induction-hobs-and-pacemakers

65 https://www.bag.admin.ch/dam/bag/en/dokumente/str/nis/faktenblaetter-emf/faktenblatt-induktionskochherd.pdf.download.pdf/faktenblatt%20induktionskochherd%20e.pdf

66 https://www.reviewed.com/laundry/features/everything-you-need-to-know-about-ventless-dryers

67 https://ohmyheartsiegirl.com/ventless-dryer/

68 https://earth911.com/home-garden/buyers-guide-clothes-dryers/

69 https://blog.ucsusa.org/dave-reichmuth/are-electric-vehicles-really-better-for-the-climate-yes-heres-why

70 https://www.nytimes.com/interactive/2021/01/15/climate/electric-car-cost.html

71 https://www.caranddriver.com/research/a31875141/electric-car-battery-life/

72 https://www.geotab.com/blog/ev-battery-health/

73 https://www.myev.com/research/ev-101/10-questions-to-ask-yourself-before-buying-an-electric-vehicle

74 https://enrg.io/electric-cars-heat-pumps/

75 https://www.geotab.com/blog/ev-range/

76 https://americantaxservice.org/tax-credits-for-electric-vehicle-car/

77 https://energycenter.org/sites/default/files/docs/nav/transportation/cvrp/presentations/2021-07_Williams-CSE_Collab-for-ZEV-Success_handout.pdf

78 https://www.truecar.com/blog/electric-vehicle-tax-credits-and-rebates-explained/

79 https://insideevs.com/news/335662/nearly-80-of-electric-cars-minus-tesla-are-leased-not-bought-in-us/

80 Oregon gives rebates for leased, and even used EVs: https://goelectric.oregon.gov/incentives-rebates

81 https://www.ucsusa.org/resources/electric-vehicle-charging-types-time-cost-and-savings

82 https://www.hsph.harvard.edu/electric-cars/ev-types-plugs-home-charging/

83 https://insideevs.com/news/524006/tesla-supercharger-sharing-analyzed/

84 https://insideevs.com/news/433929/nissan-switches-to-ccs-in-us-europe/

85 https://www.electrifyamerica.com/ and https://www.evgo.com/ and https://www.chargepoint.com/

86 https://www.kbb.com/car-news/how-much-does-it-cost-to-charge-an-ev/

87 https://www.caranddriver.com/research/a32880477/average-mileage-per-year/

88 https://afdc.energy.gov/data/10310

89 https://driveclean.ca.gov/electric-car-charging

90 https://www.fueleconomy.gov/feg/PowerSearch.do?action=noform&year1=2020&year2=2020&make=Tesla&baseModel=Model%203&srchtyp=ymm

91 https://electrek.co/2020/07/24/audi-bi-directional-charging-electric-cars-store-solar-energy/

92 https://electrek.co/2021/04/06/vw-electric-vehicles-bi-directional-charging-next-year/

93 https://techcrunch.com/2021/05/19/ford-f-150-lightning-electric-pickup-truck-can-power-your-home-in-an-outage/

94 https://www.plugincars.com/eight-tips-extend-battery-life-your-electric-car-107938.html and https://www.myev.com/research/interesting-finds/is-dc-fast-charging-bad-for-your-electric-car

95 https://clippercreek.com/extend-life-ev-battery/

96 https://insideevs.com/news/404632/winter-range-test-best-evs-cold-weather/

97 https://www.plugincars.com/quick-guide-buying-your-first-home-ev-charger-126875.html

98 https://www.plugincars.com/quick-guide-buying-your-first-home-ev-charger-126875.html

99 https://www.splitvolt.com/ev-socket-interface-types/

100 https://www.hsph.harvard.edu/electric-cars/aesthetic-outdoor-home-charging-stations/

Attachment B

101 https://www.hsph.harvard.edu/electric-cars/ev-types-plugs-home-charging/

102 https://clippercreek.com/tax-credits/

103 https://insideevs.com/features/368272/apartment-dweller-owning-charging-electric-car/

104 For example, in California: https://driveclean.ca.gov/node/919745

105 https://mashable.com/article/dcbel-electric-vehicle-fast-charger-battery/

106 https://cleantechnica.com/2021/05/30/ford-sunrun-team-up-to-make-v2h-technology-a-reality-is-v2g-next/

107 https://www.nrel.gov/news/program/2021/documenting-a-decade-of-cost-declines-for-pv-systems.html

108 From https://www.solarunitedneighbors.org/go-solar/download-our-go-solar-guide/

109 See "Warranty: What to Look For": https://www.letsgosolar.com/solar-panels/home-and-residential/

110 https://southern-energy.com/solar-federal-tax-credit-what-is-and-isnt-eligible/

111 Additional options: https://www.energy.gov/eere/solar/solar-rooftop-potential

112 This site has recommendations for how to use PVWatts to get even more detailed results: https://www.solarreviews.com/blog/how-to-use-pvwatts-to-figure-out-the-ideal-size-for-your-solar-system

113 https://news.energysage.com/average-solar-panel-size-weight/

114 https://news.energysage.com/5kw-solar-systems-compare-prices-installers/

115 https://news.energysage.com/5kw-solar-systems-compare-prices-installers/

116 https://www.youtube.com/watch?v=oRMX6GTb1YI and https://www.cleanenergycu.org/

117 https://www.solarpowerworldonline.com/2020/03/which-states-offer-net-metering/

118 https://news.energysage.com/should-i-pre-sell-my-srecs/ and https://www.motherjones.com/environment/2016/01/green-energy-rec-rooftop-solar-panels/

119 https://www.mylenemerlo.com/blog/residential-solar-power-basics/

120 https://www.mylenemerlo.com/blog/choosing-a-solar-power-contractor/ and https://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/Vt%20Guide%20to%20Residential%20Solar%202016.pdf and SEIA

121 https://www.greentechmedia.com/articles/read/the-myth-of-whole-home-battery-backup

122 https://www.greentechmedia.com/articles/read/irs-says-that-batteries-can-take-the-federal-tax-credit and https://www.nrel.gov/docs/fy18osti/70384.pdf

123 https://www.irs.gov/pub/irs-wd/201809003.pdf

124 https://www.energysage.com/solar/solar-energy-storage/energy-storage-tax-credits-incentives/

125 https://sunwatts.com/ac-coupled-vs-dc-coupled-batteries/

126 https://www.solarunitedneighbors.org/wp-content/uploads/2018/11/Solar-United-Neighbors-Battery-Guide.pdf

127 https://news.energysage.com/comparing-lithium-ion-battery-chemistries/ and https://batteryuniversity.com/index.php/learn/article/types_of_lithium_ion

128 https://www.solarreviews.com/blog/what-are-flow-batteries

129 https://www.wired.com/story/the-race-to-crack-battery-recycling-before-its-too-late/ and https://spectrum.ieee.org/energy/batteries-storage/lithiumion-battery-recycling-finally-takes-off-in-north-america-and-europe

130 https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary

131 https://cleantechnica.com/2021/01/07/cobalt-banished-from-new-lithium-ion-electric-vehicle-batteries/

132 https://news.energysage.com/tesla-powerwall-how-much-home-can-you-run-on-it-for-how-long/

133 https://assets.cleanenergycouncil.org.au/documents/consumers/battery-storage-guide-for-consumers.pdf

Attachment B

Acknowledgments

Electrify Everything in Your Home is based on the work of many, many people who documented their knowledge online through web pages, booklets, recorded webinars, and other useful sources. It was created by:

- Author: Joel Rosenberg
- Editor: Laura Fraser — **laurafraser.com**
- Designer: Taylor Roy — **taylorjaneroy.com**
- Illustrator: Brian Ritter — **brianritterdesign.dribbble.com**

This guide was generously reviewed by:

- Sean Armstrong, Michael Winkle, Emily Higbee, and Dylan Anderson from Redwood Energy — **redwoodenergy.net**
- Tom Kabat from Carbon Free Silicon Valley — **carbonfreemountainview.org/cfsv**
- Panama Bartholomy and Amy Rider from the Building Decarbonization Coalition — **buildingdecarb.org**
- Brian Stewart from Electrify Now — **electrifynow.net**
- Rachael Harvey from Stow Energy — **stow.energy**
- Corey Ramsden from Solar United Neighbors — **solarunitedneighbors.org**
- Jonathan Scott from Scott Brothers Global — **scottbrothersglobal.com**

Inspiration and support comes from Saul Griffith, Ari Matusiak, Sam Calisch, and Ellen Qualls at Rewiring America. Thanks also to Pushan Panda from Otherlab.

About the Author

Joel Rosenberg is an educator and entrepreneur focused on helping solve the climate crisis for his elementary-age daughter, his amazing partner, and the future of everyone on the planet. He has worked on science and engineering education — especially how to teach about energy systems — at the Museum of Science, Boston; the Karlsruhe Institute of Technology in Germany; the Lawrence Hall of Science at U.C. Berkeley; Maker Media; and Otherlab. He is also the co-founder of 3D Fab Light, an industrial laser cutter company. Joel has a mechanical engineering degree from MIT, and a master's from Columbia's Graduate School of Journalism.

About Rewiring America

Rewiring America is a growing nonprofit, working to launch a movement that electrifies everything, starting with our 121 million households. Through accurate, accessible, and actionable data and storytelling tools that power smart, inclusive advocacy and market-transforming partnerships, Rewiring America aims to achieve national emissions goals, improve our health, lower monthly bills, and create millions of clean energy jobs. Join us at **rewiringamerica.org** and **@rewiringamerica**.

Attachment B

Feedback Welcome

This guide is our best effort to help you make a plan to electrify everything. If you have any feedback on its contents, including corrections, suggestions, improvements, and your own electrification stories of what you've done and challenges you've encountered, please don't hesitate to reach out at **electrifyhomeguide@rewiringamerica.org**. We plan to update this guide as technology changes and electrification becomes easier.

Electrifying everything in your home — whether you're a renter, owner, or landlord — can be a big undertaking. But it's worthwhile for your home's comfort and health, your energy resiliency, and the future of the planet's climate. Thanks for taking on the challenge.

C. Energy Bill Security...pdf
Uploaded by: David Saunders
Position: FAV

Energy bill security for American households through electrification

Sam Calisch, Rachael Grace, Gabe Daly, Ari Matusiak
Rewiring America

December 2021

1 Summary

- There is a national conversation today about energy prices, whether for heating our homes or filling our gas tanks. Prices are going up, in some places resulting in over 50% increases in energy costs. The burden of these bill increases and uncertainty disproportionately impacts low- and moderate-income families. Because driving to work and keeping our homes warm are not discretionary expenses, bill increases represent real hardship for millions of American families.
- Much of the current conversation cites data from the U.S. Energy Information Administration's (EIA) *Winter Fuels Outlook*[1], which compares expected utility bill increases by heating fuel (i.e., propane, fuel oil, natural gas, electricity). These data are being misinterpreted in two key ways. First, the costs for electric heating have lumped together antiquated electric resistance systems with modern electric heat pump systems, obscuring the large savings made possible by these new technologies. Second, for homes heating with electricity, the data include all household electrical loads (e.g., lighting, televisions, etc.), whereas for homes heating with fossil fuels these are not included (despite the fact that these homes will also incur these costs).
- These two effects combine to meaningfully under-represent the advantages of efficient, electric heat pump technology. Indeed, households using natural gas for heat should expect to pay $161 more than last year over the heating season, and more than $500 greater for those using propane and fuel oil. Meanwhile, households with electric heat pumps can only expect to pay $21 more – just 13% of the cost increase gas heated homes will face.
- Heating costs are only part of the story of household bills; when we include driving, the other major component of household energy spending, the case for electrification grows even stronger. Compared to last year, average monthly driving costs are expected to be $118 higher for households driving gasoline vehicles, while only $4 higher for those with electric vehicles.
- Energy bill insecurity is driven by the inherent volatility of fossil fuel prices. Over the past two decades, home heating fuel prices fluctuated by ±50% and gasoline by ±60% from their means. Modern electric heat pumps would have supplied 38% lower bill volatility than fossil fuels for home heating. EVs would have cut driving bill volatility by 88%.[2]
- Even data from the past few days suggesting natural gas price increases may be less steep than anticipated[3] illustrates the highly volatile nature of fossil fuels. This volatility translates to increased uncertainty for American households.
- Policymakers should immediately address the current bill hardships American households are facing because of spiking fossil fuel prices. They also have an opportunity to get at the root cause of this repeating pattern by passing the electrification measures in the Build Back Better Act. Transitioning American households to efficient electric machines in their basements, garages and driveways will give American families the energy bill security they need and deserve.

[1] *Winter Fuels Outlook*, U.S. Energy Information Administration, October 2021.
[2] Here and subsequently we define volatility as the average absolute change in bills over the relevant time period.
[3] *Natural Gas Spot and Futures Prices (NYMEX)*, U.S. Energy Information Administration, December 8, 2021

2 Introduction

American households are likely going to pay a lot more for energy this winter. A number of factors, including the pandemic, extreme weather, and supply chain disruptions have combined[4] to push prices sky high for fossil fuels used for home heating and at the pump.[5]. This, combined with a colder than average forecast, will mean that homes using fossil fuels for heating will likely pay 30-55% more on their energy bills compared to last season.

These energy bill increases will create potential hardship for millions of American households, particularly the 15 million households below the federal poverty line, who already spend on average 17% of their income on energy bills[6], and have little financial capacity to deal with sudden price spikes. Because what we spend to drive our cars, heat our homes and water, cook our food and dry our clothes represent "inelastic demand" — what we must spend to keep our jobs and ensure our families are safe — energy bill security is paramount for all American households, and particularly for low- and moderate-income families.

In contrast to fossil fuel prices, electricity prices are only projected to rise modestly[7], especially in places that generate significant portions of their electricity from non-gas sources, like solar and wind. These forms of renewable energy are now the cheapest sources of new generation to install and operate[8][9]. They are also not subject to global supply disruptions, political instability and associated price shocks. For these two reasons, more renewable generation combined with efficient, electric homes will result in greater energy bill security, which all American families deserve.

We have the policy and technology solutions available today to provide relief both in the near and long term. Immediately, policymakers should help households through direct bill assistance programs like the Low-Income Home Energy Assistance Program (LIHEAP) and percentage-of-income payment programs (PIPPs). Beyond these crisis management measures, the long-term answer to combating future bill increases is residential electrification with clean, efficient machines. The good news is that, thanks to incredible advances in heat pump technology, electric vehicles and battery storage, all–electric homes are now a viable option for reducing energy bills in every climate in the U.S.

[4]See *What is behind soaring energy prices and what happens next?*. International Energy Agency, Carlos Fernández Alvarez and Gergely Molnar, October 2021.

[5]For example, by the end of 2021, residential natural gas prices are projected to increase 15-20%, hitting levels not seen since 2008. EIA Data browser.

[6]Low-Income Energy Affordability Data (LEAD) Tool, U.S. Department of Energy.

[7]The U.S. average residential retail electricity price is only projected to increase 3% by the end of 2021. EIA Data browser

[8]*Majority of New Renewables Undercut Cheapest Fossil Fuel on Cost*, International Renewable Energy Agenecy.

[9]*Wind, Solar Are Cheapest Power Source In Most Places*, BloombergNEF.

Region	Natural Gas	Propane	Fuel Oil	Elect. Resist.	Elect. HP
New England	$76.49 (9%)	$600.76 (48%)	- (-)	$190.69 (13%)	$76.28 (13%)
Mid Atlantic	$128.24 (21%)	$600.76 (48%)	- (-)	$94.46 (8%)	$31.49 (8%)
E.N. Central	$257.27 (53%)	$677.12 (69%)	- (-)	$75.27 (7%)	$30.11 (7%)
W.N. Central	$208.99 (38%)	$677.12 (69%)	- (-)	$22.96 (2%)	$9.18 (2%)
South Atlantic	$100.10 (20%)	$455.40 (43%)	- (-)	$104.26 (10%)	$29.79 (10%)
E.S. Central	$233.51 (43%)	$455.40 (43%)	- (-)	$70.94 (6%)	$20.27 (6%)
W.S. Central	$62.59 (17%)	$455.40 (43%)	- (-)	$5.95 (1%)	$1.70 (1%)
Mountain	$124.35 (28%)	- (-)	- (-)	$9.44 (1%)	$3.15 (1%)
Pacific	$90.58 (18%)	- (-)	- (-)	$50.35 (5%)	$16.78 (5%)
U.S. Average	$161.09 (31%)	$582.16 (55%)	$524.00 (43%)	$64.11 (6%)	$21.37 (6%)

Table 1: Projected heating bill increases from winter heating season 2020-2021 to 2021-2022, by region and by fuel type (natural gas, propane, fuel oil, electric resistance, or electric heat pump).

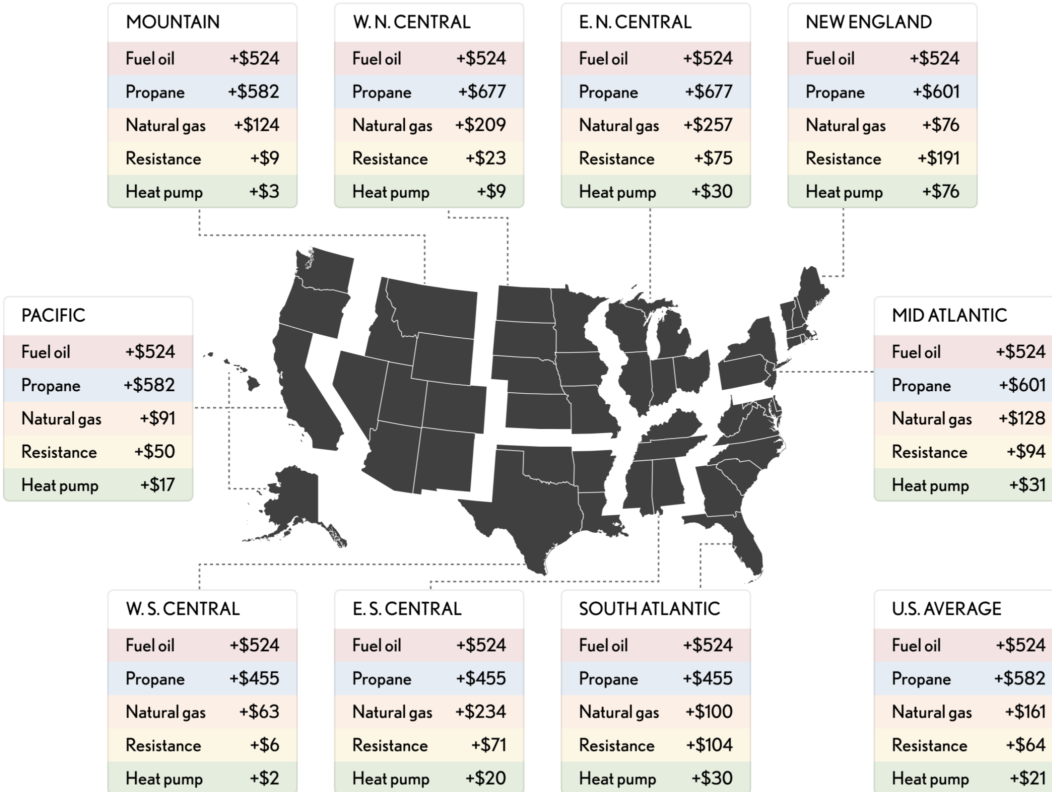


Figure 1: Regional breakdown of expected winter season heating bill increases from 2020 to 2021.

3 Projected household bills

In this section, we quantify the expected bill increases for the two largest categories of household energy expenditures: heating and driving.

3.1 Heating

When it comes to our energy use inside our homes, the major driver of bill increases is home space and water heating. In Table 1 and Figure 1, we tabulate the projected increases in seasonal[10] heating bills by region and fuel type. Here we use consumption and price data from the EIA's Winter Fuels Outlook. As noted previously, that study calculates total bills by fuel, which includes different end uses depending on fuel. For instance, a household's electricity bill contains a large number of non-heat end uses, which will be included in bills regardless of the main heating fuel. For this reason, we disaggregate expenditures by end-use to allow comparison between fuels. To do this, we use regional estimates of heat pump performance[11] and estimate regional share of electricity heating encompassed by heat pumps[12].

On average, households that heat with natural gas will likely pay $161 more this winter than last, while households using delivered fuels (propane and fuel oil) are likely to spend even more ($582 and $524, respectively). For households with electric heat pumps, energy bills are only expected to rise by only $21 more than last year. In every region of the country, the expected bill increase for natural gas households is greater than that of electric heat pump households. In some regions, like those in the Midwest, the natural gas bill increases are 8-20 times larger than that of electric heat pumps.

To see what this looks like on the ground, consider two neighboring households in rural Michigan.

[10] We follow the EIA's definition of the heating season as October through March, inclusive.
[11] *Bringing Infrastructure Home: A 50-State Report on U.S. Home Electrification*, Rewiring America, 2021.
[12] *American Housing Survey (AHS)*, U.S. Census Bureau, 2021.

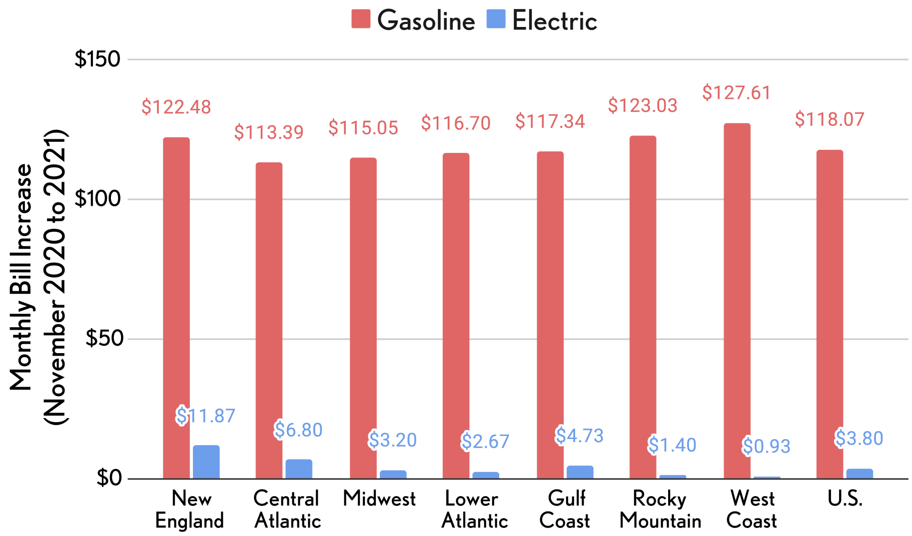


Figure 2: Household driving bill increases by region, from November 2020 to November 2021, comparing gasoline powered vehicles with electric vehicles.

In this setting, natural gas hookups are generally not available, and so delivered fuels (predominantly propane) are popular for home heating. Earlier this year, when their propane furnace needed replacement, the first household took advantage of an incentive for electric heat pumps offered by their utility. Now that winter has come, the first house expects to pay about $481 for heating over the course of the season, an increase of about $30 over last year due to slightly higher electricity prices and colder weather. The second household, however, who still burns propane, faces a bill of $1,660, an increase of $677 over last year. Even in nearby Detroit, where natural gas hookups are available, bill increases are expected to be dramatic. A household there should expect a bill of $745, an increase of $257 over last year.

Previous analysis by the authors[13] found that roughly 104 million out of the 121 million American households would save on energy bills by installing an electric heat pump for space or water heating. When this winter's energy bill projections are taken into account, that number grows to 115 million, or about 95% of all American households.

3.2 Driving

Besides home heating, the other place high fuel prices hit households is the price at the pump. This winter is projected to bring continued high gasoline prices, with the average expected household driving costs already exceeding $310 per month as of November 2021, an increase of $118 since the same time last year. In contrast, the average household electricity cost to power battery electric vehicles remains around $93 per month.

In Figure 2 and Table 2, we show increases to monthly household driving bills from November 2020 to November 2021, comparing gasoline- and electric-powered vehicles. We see on average, household driving bills with gasoline increased from $193 to $311, while for electric vehicle households, they only increased from $89 to $93. Returning to our Michigan households from before, we see a 64% increase in driving bills with gasoline, while only a 4% increase with electric.

[13] *Bringing Infrastructure Home: A 50-State Report on U.S. Home Electrification*, Rewiring America, 2021.

Region	Gasoline 11/20	Gasoline 11/21	Increase	Electric 11/20	Electric 11/21	Increase
New England	$191.38	$313.85	$122.48	$140.07	$151.93	$11.87
Central Atlantic	$206.88	$320.28	$113.39	$106.80	$113.60	$6.80
Midwest	$179.54	$294.59	$115.05	$84.73	$87.93	$3.20
Lower Atlantic	$179.63	$296.33	$116.70	$78.80	$81.47	$2.67
Gulf Coast	$162.84	$280.18	$117.34	$78.47	$83.20	$4.73
Rocky Mountain	$201.28	$324.31	$123.03	$76.67	$78.07	$1.40
West Coast	$253.85	$381.47	$127.61	$111.07	$112.00	$0.93
U.S.	$193.39	$311.47	$118.07	$89.00	$92.80	$3.80

Table 2: Projected monthly household driving bill increases from November 2020 to November 2021, by region and by fuel type (gasoline vs. electric).

4 Bill Volatility

This winter's bill projections may be stark, but they are not unprecedented. In this section we look at historical trends to examine bill volatility.

4.1 Heating

Figure 3 shows historical estimated winter season heating bills by fuel for the average American household at left. Indeed, variations in fuel prices and average temperatures give rise to significant variance in energy bills, especially for fossil fuels. As above, we distinguish between older electric resistance technology and newer, more efficient electric heat pump technology. To estimate historical heat pump operating costs, we use historical values of the average coefficient of performance[14].

In the right-hand graph below, we extract the twenty year average price volatility of these bills, defined as the expected year-over-year absolute change in bill. The greatest offenders are heating oil and propane, with a volatility of $200-300. Electric heat pumps are the hands down winner, with a volatility of $35, roughly 38% less than that of natural gas.

[14] The coefficient of performance is the ratio heat energy discharged into space or water versus the electric energy used to run the pump. We use an average value of 3.0 to represent today's heat pumps, and linearly interpolate back twenty years to a value just above 1.0.

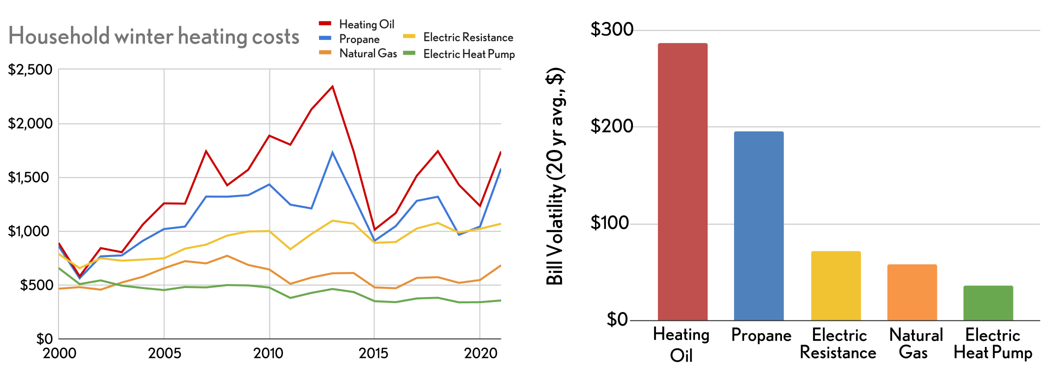


Figure 3: Average U.S. household heating cost variation by fuel type between 2000 and 2020. Electric heat pumps create stable winter heating bills compared to fossil alternatives.

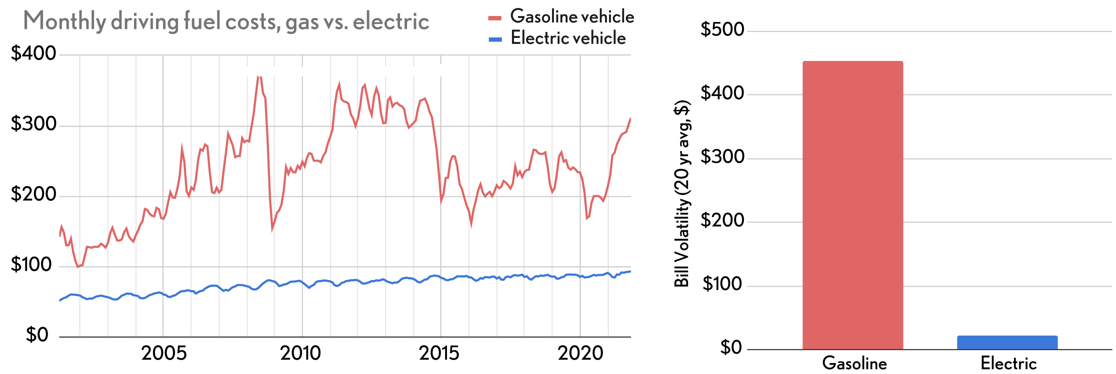


Figure 4: a) Historical comparison of fuel costs of gasoline powered vehicles and electric vehicles (had they been available on the mass market). b) Year–over–year driving bill volatility. Not only is the cost of driving an electric vehicle significantly lower than a gasoline powered vehicle, but it is also significantly less volatile.

4.2 Driving

In Figure 4, we compare the driving fuel costs for a household with gasoline vehicles versus one with electric vehicles. Clearly, fully electric vehicles were not available on the mass market during this historical period of analysis, but the comparison shows the trends we can expect now that they are.

We can see that a household driving gasoline vehicles should expect to pay around $250 per month, but that figure can easily vary by plus or minus $100. In contrast, a household with electric vehicles can expect to pay less than $100 per month, with a variability of only about $10. In annual bill volatility, the household bill volatility for gasoline vehicles is $454, while for electric vehicles it is $21.

5 What Policymakers Should Do

Policymakers must take immediate and decisive action to protect American households from rising energy bills, both this winter and for the years to come. Critically, there are steps at every level of government – local, state, and federal – that would help all households, particularly low- and moderate-income (LMI) ones, purchase and install efficient, electric machines.

5.1 Immediate Actions

Immediately, two policy solutions stand out as viable options for direct and targeted assistance: the federal Low-Income Heating Assistance Program (LIHEAP)[15] and the state-administered Percentage-of-Income Payment Programs (PIPPs). In addition, for existing efficiency and weatherization programs, efficient electric appliances should be the sole option for appliance installation, so that homes can benefit from the stability, comfort, and cost savings from heat pumps as soon as possible.

With respect to LIHEAP, multiple organizations have called on Congress to authorize an additional $5 billion in funding through the Build Back Better Act.[16]. As the National Association for Energy Assistance Directors' Association letter states, LIHEAP's funds will need to account for the increased prices this winter, amounting to a $2.5 billion decrease in its purchasing power.

PIPPs are currently utilized by a number of states to limit how much LMI households pay each year for their energy bills. The avoided costs for households are substantial, particularly because these programs can also include outstanding bill forgiveness. For instance, Virginia's PIPP, enacted into law

[15] Low Income Home Energy Assistance Program (LIHEAP), U.S. Department of Health and Human Services.
[16] *NEADA Calls for an Additional $5 Billion for LIHEAP for High Fuel Costs, Cooling Concerns*, National Energy Assistance Directors Association, October, 2021.

this year, can help Virginians with over $300 on their electrical bills per year, on average, and provides options to eliminate owed bills.[17] Before higher winter energy prices hit home energy bills, states should prioritize shoring up PIPPs so that funds are available when bills come due. And, in cases where programs can be established within this short time frame, such efforts should be prioritized. In all cases, streamlining these programs so eligible homeowners are automatically identified and, where appropriate, enrolled, would help ensure these necessary funds reach the homes that will need it the most. In support, Congress can pass emergency funding that flows to appropriate State agencies so that programs can provide these essential funds in the early part of 2022, just as winter utility moratoriums are coming to an end.

5.2 Sustainable Solutions

These immediate measures are important, but they do not solve the structural problem of energy bill volatility associated with fossil-fuel powered machines. Only electrification of our households will do that. The Build Back Better Act contains provisions that will serve as the down payment for this transition, and policymakers should understand its passage not only as a generational investment in addressing climate change, but also as a means of providing energy bill security to American households in every zip code in the country.

Specifically, the High-Efficiency Electric Home Rebates Act (formerly known as the Zero-Emission Homes Act) and the Home Energy Performance-Based, Whole-House Rebates and Training Grants (formerly known as the HOPE for HOMES Act) provide rebates for households to replace their space heating and cooling, water heating, cooking, and clothes drying appliances with efficient, electric versions. The High-Efficiency Electric Home Rebates are designed to be point-of-sale and will offer up to $14,000 for a LMI household to electrify their home. Critically, the High-Efficiency Electric Home Rebates also provide support for electrical work required to install such an appliance. These programs are also transferable to a third party, such as a contractor business, an installer, a retailer or a utility, making the process as seamless as possible for the consumer.

Between the Build Back Better Act and the Infrastructure Investment and Jobs Act (also known as the Bipartisan Infrastructure Deal), there are also new authorizations for subsidized low-cost loans and increased funding for weatherization and health and safety upgrades, crucial for many LMI homes to reduce energy bills but also to electrify. Upon enactment, States will have access to billions of dollars in new funding to support low-cost financing for heat pumps and induction stoves through newly established state green banks[18]. States will be able to weatherize more homes through additional funding to the Weatherization Assistance Program. And all building envelope efficiency programs can be done in conjunction with electrifying home appliances. These actions can be done in the near term so that next winter, or next summer, when heating and cooling needs are at their highest, Americans can avoid heat or cold stress, stay healthy, and save money while doing it.

In addition, states can direct appliance improvement funds under building envelope, efficiency, and weatherization programs to only fund efficient electric appliances and not gas, oil, or propane appliances. Practically, this would mean a state efficiency or weatherization program may install a heat pump water heater in a home in combination with insulation, air sealing, ventilation, and other health and safety improvements. Together, these efforts will meaningfully reduce energy use, costs, and indoor air pollutants for Americans in every region.

Indeed, these approaches are already taking hold. In Maine, for example, households are eligible for up to $1,200 in rebates for efficient heat pumps, as part of the state's effort to install an additional 100,000 heat pumps by 2025. To date, the program, run by the Efficiency Maine Trust, has already installed over 55,000 heat pumps and 33,000 heat pump water heaters. Combined with the other high efficiency and electric appliances the program has installed, the Efficiency Maine Trust expects up to $2 billion in cost savings for households [19].

[17] *2021 Special Session I: HB 2330 Percentage of Income Payment Program and Fund; DHCD & DSS to adopt rules, etc., for adoption,* Virginia Legislative Information System.

[18] See *Rewiring Communities: A Plan to Accelerate Climate Action and Environmental Justice By Investing in Household Electrification at the Local Level*, Adam Zurofsky, Jeffrey Schub, John Rhodes, Tony Curnes, and Sam Calisch, Rewiring America and Coalition for Green Capital, May 2021.

[19] *Efficiency Maine: FY2020 Annual Report*, Efficiency Maine Trust, November 2020

6 Conclusion

Projected high energy prices this winter, driven by fossil fuels and manifesting themselves in higher home heating bills and prices at the pump could create unnecessary hardship for millions of American families. Analyzing the data and the trend lines over the last twenty years shows clearly that the path to energy bill security for American households depends on electrification. Leveraging today's efficient, electric heat pump and electric vehicle technology is a triple win. It will deliver real savings to almost every American household, safeguard against future bill volatility and shock and materially contribute to addressing the climate crisis.

In order to make this transition in a timely way that all American households can benefit from, we must invest now in a series of rebates, tax credits, low-cost financing and other incentives to bring down the front-end cost of these efficient, electric machines. This will enable American households to take advantage of their operating cost savings – providing predictability – and spur the industrial scale necessary to achieve upfront cost parity with the incumbent, fossil fuel machines they will replace.

As we make these investments, it is important to note that the grid can accommodate the transition. Grid reliability is often raised as a counterargument to widespread electrification, especially with the 2021 Texas Blackouts fresh in the minds of homeowners. This is despite the fact such blackouts are infrequent[20], and, in the case of the Texas blackouts, natural gas infrastructure failures preceded and were the major cause of the electricity system shutdowns[21].

In reality, electrification has the potential to actually increase household energy reliability. Installing solar plus battery systems with "islanding" capability is increasingly becoming the norm[22]. During normal operation, such systems are tied to the grid, benefiting from net metering and grid services. During a power outage, these systems automatically disconnect from the grid, allowing the photovoltaics to continue generating power to be stored in the batteries and used locally, without any risk of pushing power back to the grid. Further, electric vehicle models like the forthcoming Ford F150 Lightning now ship with the hardware required for it to be used as a backup system, capable of powering a household for days[23]. Without also electrifying appliances inside the home, i.e., ensuring that the machines have plugs and not pipes, homes will simply not be able to take advantage of the powerful backup systems that will increasingly be in their garages and driveways.

Beyond the scope of a single household, electrification also stands to increase grid reliability. The added load of heat pumps and electric vehicles will certainly require increasing capacity of the transmission and distribution networks, but this is well within the scale of historical precedent. Fully electrifying all America's households will likely require about two to three times as much electricity to be delivered to the residential sector[24], and will take roughly twenty years to complete[25]. Critically, we have increased our capacity on that scale before: In the twenty years between 1950 and 1970, we increased the total amount of delivered electricity by nearly five times[26].

Further, concentrating investment in electric infrastructure will drive down the costs of these systems. Today, we maintain multiple redundant distribution networks for the fuels used in our households: power lines for electricity, pipes for natural gas, delivery trucks for propane and fuel oil. When we concentrate investment in the electrical distribution network, we can make these investments go further to boost reliability, particularly through undergrounding of wires[27]. When electrification is

[20] *Average frequency and duration of electric distribution outages vary by states*, U.S. Energy Information Administration, Annual Electric Power Industry Report (EIA-861).

[21] See *Winter storms wreak havoc on ERCOT grid,* Patrick Milligan, ICF, 2021. and *The Timeline and Events of the February 2021 Texas Electric Grid Blackouts*, University of Texas at Austin, July 2021.

[22] See *Storage is Increasingly Paired with All Forms of Solar*, Solar Industry Research Data, Solar Energy Industries Association. and *Behind-the-Meter Solar+Storage: Market data and trends*, Galen Barbose, Salma Elmallah, and Will Gorman, Lawrence Berkeley National Lab, July 2021.

[23] *Ford F150 Lightning will be a home backup power broker*, Green Car Reports, 2021.

[24] *The Rewiring America Handbook: A Guide to Winning the Climate Fight,* Saul Griffith, Sam Calisch and Laura Fraser, Rewiring America, July 2020.

[25] This length of time is set by assuming fossil machines are replaced with electric versions at the end of their useful life, rather than being retired early. With 10-20 year lifetimes common among these machines, and a few years required to ramp up production of electric machines, roughly twenty years are required to fully convert.

[26] *Table 7.2a Electricity Net Generation: Total*, Electric Power Monthly, U.S. Energy Information Administration.

[27] *Cost and reliability comparisons of underground and overhead power lines*, Utilities Policy, Steve Fenrick and Lullit Getachew, Volume 20, Issue 1, March 2012, Pages 31-37

paired with distributed generation and storage, demands on the distribution network can be greatly reduced and reliability increased [28][29]. Heat pumps and electric vehicles both offer massive opportunities for demand response[30], providing valuable grid services that increase reliability. And, in contrast to fossil fuels, a renewable energy-powered grid, bolstered by storage and paired with demand-side machines capable of demand response, can be insulated from the price volatility that adds stress and burden to American households.

Moments of price spikes and uncertainty require immediate action to prevent harm. But they can also point to the best and right path forward to ensure we solve the underlying issues and not consign ourselves to repeating the same experience. With respect to our winter heating bills and the price we pay at the pump, the answer to delivering energy bill security to American households is clear. It is time to invest in the electrification of our households, leveraging the opportunity of the Build Back Better Act to do just that.

A Acknowledgements

The authors would like to thank many additional contributors, including Leah Stokes, Saul Griffith, Sarah Grimm, Sean McClure, Josh Ziman, Igor Kofman, and Christopher Mayorga.

B Methodology

In this brief, we have followed the methodology of the EIA's October 2021 *Winter Fuels Outlook*, as much as possible. To calculate consumption over the past twenty years, we use the EIA's estimates for the last eight seasons, fitting a linear regression based on the number of heating degree days. Then, using historical heating degree days from the EIA's Monthly Energy Review (Table 1.9: Heating Degree Days by Census Division).

Energy prices also come from the EIA: Weekly Heating Oil and Propane Prices: Residential heating oil, Weekly Heating Oil and Propane Prices: Residential propane, Natural Gas Prices, Form EIA-861M (formerly EIA-826) detailed data, Weekly Retail Gasoline and Diesel Prices. U.S. EIA.

Regional heat pump coefficients of performance were calculated using manufacturer–supplied performance curves (including those cataloged in the NEEP Cold Climate Air Source Heat Pump Specification and Product List). These performance curves were used in conjunction with local hourly dry bulb temperature data from NASA's MERRA2 dataset, and with NREL's hourly demand profiles for all TMY3 locations. Together these datasets are used in a model which calculates average coefficient of performance over the heating season (first used in Rewiring America's report, Bringing Infrastructure Home: A 50-State Report on U.S. Home Electrification), including contributions from hours in the year when backup electric resistance heating supplements heat pump capacity. To separate heating loads from total fuel consumption, the regional proportion attributable to space heating and water heating was extracted from NREL's hourly demand profiles for all TMY3 locations.

For the comparisons between gasoline and electric vehicles, the average vehicle miles traveled per household and gasoline fuel efficiency were estimated based on data from the Department of Transportation's Travel Monitoring Data and National Household Travel Survey. Electric vehicle efficiency was assumed to be the average of electric models listed on fueleconomy.gov.

[28] *Resilient Distribution Systems Powered by Solar Energy*, U.S. Department of Energy, Solar Energy Technologies Office.

[29] *Overview of energy storage systems in distribution networks: Placement, sizing, operation, and power quality*, Das et. al., Renewable and Sustainable Energy Reviews, Volume 91, August 2018, Pages 1205-1230

[30] *Beneficial Electrification: A Key to Better Grid Management*, Ken Colburn, Regulatory Assistance Project, 2017.

HB 831 - Reducing Greenhouse Gas Emissions -- Comm

Uploaded by: deborah miller

Position: FAV

JCRC
JEWISH COMMUNITY RELATIONS COUNCIL

Government Relations • Israel Advocacy
Inter-Group Relations • Social Justice
Maryland • Virginia • Washington, DC • Since 1938

Testimony in SUPPORT of *House Bill 831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings*
Environment and Transportation Committee
February 25, 2022

The Jewish Community Relations Council of Greater Washington (JCRC) serves as the public affairs and community relations arm of the Jewish community. We represent over 100 Jewish organizations and synagogues throughout Maryland, Virginia, and the District of Columbia. The JCRC is strongly committed to cultivating a society based on freedom, justice, and pluralism. We work tirelessly throughout the entire Greater Washington area to advocate for our agencies that serve the most vulnerable residents, support our Jewish day schools and community centers, and to campaign for important policy interests on behalf of the entire Jewish community.

The JCRC has a long history of favoring policies which promote climate justice, protect the environment, and reverse climate change. Our agency is committed to addressing the detrimental effects of climate change, which is accelerating due to human behaviors, many of which are within our power to change.

House Bill 831 requires the Department of the Environment to establish building emissions standards for commercial and residential buildings and to set up the Building Energy Transition Implementation Task Force to develop a plan for funding the retrofit of certain buildings. The goal of the State is for these holistic retrofits, including weatherization measures and heat pump installation, to be done with minimal or no upfront costs for all low-income households by January 2030. The Bill also requires adoption of standards on or before January 2023 requiring that new residential or commercial construction meet all water and space heating demand without the use of fossil fuels and that electric-ready standards are ready for the installation of solar energy systems.

The JCRC is committed to addressing the deleterious impact of climate change on our community and to reducing greenhouse gas emissions. However, given that the JCRC represents more than 50 houses of worship in the state, we would like to ask for clarification in HB 831 regarding the establishment of building emissions standards, specifically about the definition of “commercial building.” While we support HB 831, we also ask for clarification from the committee.

HB831_MDPIRG_ENVMD_FAV (1).pdf
Uploaded by: Emily Scarr
Position: FAV

<u>HB831</u>
Reducing Greenhouse Gas Emissions - Commercial and Residential Building
Environment and Transportation Committee
February 25th, 2022
Emily Scarr, Maryland PIRG Director
FAVORABLE

Maryland PIRG is a state based, small donor funded public interest advocacy organization with grassroots members across the state. For fifty years we've stood up to powerful interests whenever they threaten our health and safety, our financial security, or our right to fully participate in our democratic society.

Environment Maryland is a citizen-based environmental advocacy organization. We work to protect clean air, clean water, and open space

Maryland could see a critical reduction of greenhouse gas emissions and gas usage if it electrifies all of its buildings during the next 30 years. In 2021 Maryland PIRG Foundation and Environment Maryland Research and Policy Center released **Electric Buildings: Repowering Homes and Businesses for Our Health and Environment**, which found that completely repowering Maryland's homes and businesses with electricity by 2050 is expected to result in emissions reductions equal to taking more than 1 million cars off the road.

HB831 makes important provisions to move commercial and residential buildings towards electrification by setting goals for emissions reductions and requiring new commercial and residential buildings be energy efficient and ready for solar, electric vehicle charging, and building-grid interaction.

Maryland PIRG and Environment Maryland support this bill and any provisions that move us to more aggressively transition to cleaner, safer electric homes and buildings. In particular, we support the amendments being recommended by the Climate Partners Table.

Throughout the state, Maryland children and families are suffering from the damaging effects of living with unhealthy air quality. In October, Maryland PIRG Foundation and Environment Maryland Research and Policy Center released "Trouble in the Air," which outlined elevated air pollution days throughout the state. The Baltimore area experienced 43 elevated air pollution days in 2020, and many metropolitan areas throughout Maryland faced similar levels of air pollution. Elevated air pollution increases the risk of premature death, asthma attacks, cancer and other adverse health impacts.

In the American Lung Association's 2021 State of the Air Report, six Maryland counties received an "F" for air quality. [See chart on final page]

According to our 2021 **Electric Buildings** report, in 2017 20% of Maryland's carbon emissions came from homes and businesses.

Pollution from fossil fuel powered buildings impacts the climate and the health of Maryland children and families: it's dirty, it's dangerous, and it's puting our health at risk.

A 2019 study that looked at five major urban areas on the East Coast, including Baltimore, and found these urban areas emit more than twice the amount of methane previously estimated by the EPA, with most of these emissions coming from leaks of gas systems in homes and businesses, as opposed to natural sources or landfills.

A 2021 study from the Harvard T.H. Chan School of Public Health found that taken together, commercial and residential buildings are now responsible for approximately 18,300 early deaths and $205 billion in health impacts, accounting for roughly one third of early deaths attributed to air pollution from stationary sources. This statistic is conservative, as it only includes health impacts from one outdoor pollutant and does not account for emissions generated by fuel extraction or the significant health impacts from indoor air pollution generated by burning fuels.

According to the Rocky Mountain Institute, air pollution from burning fuels in buildings led to an estimated 627 early deaths in Maryland and seven billion in health impact costs in 2017.

Fossil fuels also pose a risk to our communities, as seemingly every year we hear of another explosion. The August 2020 explosion that leveled homes, killing 2 people in Northwest Baltimore, the August explosion in Columbia, Maryland that leveled a shopping center, the 2016 explosion in the Flower Branch explosion in Silver Spring Maryland that killed 7 people and left dozens hospitalized, and many other explosions big and small.

While new gas stove hookups are not covered by this bill, they pose a serious public health concern and it's time to incentivise a transition to induction and electric cooking**. A 2022 study from Stanford University found that stoves used without ventilation can surpass the Environmental Protection Agency's guidelines for one-hour exposure to nitrogen dioxide in outdoor settings within a few minutes of stove usage, particularly in smaller kitchens.** The study found no relationship between either the age or purchase price of the stove with methane or NOx emissions. In addition, the report found that gas stoves across the United States emit methane equivalent to the annual emissions from 500,000 cars.

HB831 will:

- Will require new commercial and residential buildings with a gross floor area greater than 25,000 sq. ft. to be built to a modified all-electric standard (water and space heating only).
- Will require reporting by existing and new building owners starting in 2025 and specifies reductions in direct emissions (those produced in heating and cooling the building) starting at a 20% reduction by 2030 and net zero by 2040.
- Will require new buildings to be solar ready and have electric vehicle charging infrastructure.
- Creates a Building Energy Transition Implementation Task Force to study and recommend complementary policies, programs and incentives to reduce greenhouse gasses and develop a plan for retrofitting existing buildings.

We respectfully request a favorable report.

Maryland PIRG is a state based, small donor funded public interest advocacy organization with grassroots members across the state. For fifty years we've stood up to powerful interests whenever they threaten our health and safety, our financial security, or our right to fully participate in our democratic society.

Environment Maryland is a citizen-based environmental advocacy organization. We work to protect clean air, clean water, and open space.

IPL testimony on HB 831.pdf
Uploaded by: Jonathan Lacock-Nisly
Position: FAV

DC.MD.NoVA INTERFAITH Power & Light
ipldmv.org
Our religious response to climate change.

Interfaith Power & Light (DC.MD.NoVA)
900 Massachusetts Ave NW
Washington, DC 20001
202-525-9397 • jonathan@ipldmv.org

Jonathan Lacock-Nisly, Director of Faithful Advocacy
February 23, 2022

Testimony on HB 831 –
HB 831: Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings
Environment and Transportation Committee

Position: Favorable

Interfaith Power & Light (DC.MD.NoVA) supports HB 831.

Maryland faith communities have long been taking action to green our houses of worship as a way to care for our climate and our neighbors, and we call on our elected officials to help in our efforts to start ***turning away from burning***–moving from burning gas and other fossil fuels in our buildings to clean and affordable electric heat pumps. With fully 40% of our state's climate pollution coming from our buildings, we know that there is a direct line between the gas, oil, and propane burned to heat our buildings and our water, and the extreme weather, flooding, and sea-level rise that is becoming all-too-common in Maryland.

In the past year, many congregations have been learning more about the danger that burning gas poses to our health and our climate. The **Sikh Spiritual Center in Rockville** is one of many congregations across our region that have participated in a gas leak tagging event. Using a handheld methane leak detector, they **were able to find a number of leaks in the gas network right outside their house of worship.**

At left, children from Tifereth Israel Congregation monitor gas leaks near Silver Spring. At right, members of the Sikh Spiritual Center in Rockville prepare to head out for their own leak tagging expedition.

Sadly, this is not surprising. Comprehensive leak monitoring in Washington, DC, both by the District government and volunteers, as well as leak monitoring other places across the country, has shown that **the gas networks beneath our streets, bringing gas to our furnaces and water heaters, leak constantly.** Our leaky gas networks are a climate catastrophe, releasing methane gas with 80 times the warming power of CO_2 directly into the atmosphere.

A recent report from Stanford University shows that **those leaks don't stop when gas pipes enter our homes.** Our gas appliances are constantly releasing low-level methane leaks, with about 80% of leaks coming when appliances are turned off. That's on top of the dangerous indoor air pollution gas appliances produce when they're turned on, harming our lungs and endangering our most vulnerable neighbors.

Across Maryland, faith communities are starting the work of turning away from burning, choosing healthy and clean electric appliances over gas, oil, and propane. **We call on you to pass HB 831 and its essential climate-friendly buildings provisions.**

In January, over 100 people of faith from across Maryland gathered on zoom to learn about the harm caused by burning gas and show support for clean building legislation in Maryland.

Members of the Jewish Climate Action Network DMV celebrate Tu BiShvat, the new year of the trees, with a call to turn away from burning gas.

hb831, all electric, code, 2022.pdf
Uploaded by: Lee Hudson
Position: FAV

Delaware-Maryland Synod
Evangelical Lutheran Church in America
God's work. Our hands.

Testimony Prepared for the

Environment and Transportation Committee

on

House Bill 831

February 25, 2022

Position: **Favorable**

Mr. Chairman and members of the Committee, thank you for this opportunity to testify for advancing a net-zero energy regime in Maryland's building inventory. I am Lee Hudson, assistant to the bishop for public policy in the Delaware-Maryland Synod, Evangelical Lutheran Church in America. We are a faith community with three synods in every part of our State.

Energy sourcing is critical in housing and commercial building construction because it determines future energy demand. Energy demand management is critical to reducing greenhouse gas emissions. We must begin building to a net-zero future now.

Maryland's robust construction market should not be built to standards that are carbon dependent. Transitioning to an inventory that uses less energy and produces less carbon emissions is necessary for accelerating GGRs. Building additional carbon-intense structures only increases the time, expense, and effort it will require to transition later. Moving the inventory to something nearer all-electric, and expanding renewable energy demand, is the right way to build ourselves out of the warming/climate-crisis trap we've built ourselves into.

We hold that lowering carbon emissions is a social, economic, and moral necessity for the obvious reasons; fire, draught, flooding, sea rise, human displacement, storm catastrophe, infrastructure vulnerability. We support **House Bill 831** because it is an actual plan for carbon emissions reductions using State building code.

We are especially appreciative that it establishes a goal for retrofit, weatherization, and electric heating in *100% of the low-income housing stock*. This corner of the housing market typically is one of the last to receive treatments that qualify for the designation "appropriate."

Our concern for the environmental health and safety of our Maryland neighbors, and a livable and sustainable future for all earth's creatures, compels our support of **House Bill 831**, and we urge your favorable report.

Lee Hudson

5699 Meridale Rd. Baltimore, MD 21228 410-230-2860 800-869-5492 fax 410-230-2871

Testimony (HB 831).pdf
Uploaded by: Mark Conway
Position: FAV

Councilman Mark Conway
Councilman *Fourth District*

100 N. Holliday Street, Suite 550 • Baltimore, Maryland 21202
(410) 396-4830 • mark.conway@baltimorecity.gov

TO: Chair Kumar P. Barve; members of the Maryland House Environment and Transportation Committee

BILL: HB831 (Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings)

POSITION: Favorable

Chair Barve and honorable members of the committee,

Climate change presents an existential risk to our planet and to communities across Maryland. In cities like Baltimore, which I am proud to represent, rising temperatures can cause worse health outcomes (especially in "heat islands" where trees are scarce but concrete is abundant). Severe storms in Baltimore have caused flooding scenes in neighborhoods like Wilson Park and Beechfield, and rising tides threaten the waterfront Baltimore is so proud of. We know the effects of climate change are and will continue to be felt more acutely by our most vulnerable residents: the elderly, low-income individuals and families, and people of color.

I urge a favorable report on and expeditious consideration of HB831 so we can move Maryland toward a more sustainable, environmentally-friendly, and healthy future.

Existing building codes and construction rules were created for a different time, a time when our understanding of the effects of greenhouse gases on our environment was significantly less developed. This bill helps catch Maryland up and establishes clear rules for sustainable, all-electric construction of commercial and residential buildings. Additionally, through the creation of Building Emissions Standards and Building Energy Transition Implementation Task Force, this bill contains important accountability mechanisms to transition existing buildings to be all-electric.

The bill also includes provisions for the inclusion of solar power and electric vehicle charging infrastructure at new buildings, important considerations when inefficient modes of transportation make up a sizable slice of the emissions that contribute to warming.

From city halls to statehouses to neighborhoods, there are so many ideas out there for becoming smarter and more environmentally conscious in how we live our lives. Climate change will affect all of us, and we all need to do our part.

For all those reasons, I urge a **favorable report**.

Sincerely,

Mark S. Conway, Jr.

cc:
Vice Chair Dana Stein
Del. Marlon Amprey
Del. Carl Anderton Jr.
Del. Regina Boyce
Del. Barrie Ciliberti
Del. Jerry Clark
Del. Linda Foley
Del. David Fraser-Hidalgo
Del. Jim Gilchrist
Del. Anne Healey
Del. Marvin Holmes Jr.
Del. Jay Jacobs
Del. Jay Jalisi
Del. Mary Lehman
Del. Brooke Lierman
Del. Sara Love
Del. Charles Otto
Del. Neil Parrott
Del. Roxane Prettyman
Del. Sheila Ruth
Del. Vaughn Stewart
Del. Jen Terrasa
Del. Melissa Wells
Del. William Wivell

HB831 Testimony - Meghana Kotraiah (1).pdf
Uploaded by: Meghana Kotraiah
Position: FAV

February 23, 2022
Committee: Environment and Transportation
Testimony on: HB381 – Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings
Position: Favorable

Good afternoon Delegate Barve, Vice Chair Stein, and members of the Environment and Transportation Committee,

My name is Meghana Kotraiah and I am a sophomore dual degree student at the University of Maryland. I am the Speaker of the Legislature for the Student Government Association, and am heavily involved in student leadership for the College of Agriculture and Natural Resources. I am a born and raised Marylander, growing up in Montgomery County; living in Germantown and Gaithersburg, and now living in College Park.

Having spent all my life here, I know how deeply Marylanders care for the environment and the communities around them. My parents are the perfect example of this. A few years ago, my family was able to sign a lease on solar panels for the roof of our single-family residential home, and my mom bought a new car - electric. We installed an EV charger and environmentally friendly water and space heating. We did this because of the care and regard my parents have for the environment, but we were able to do it because of the privilege we had to do so.

HB831 would manifest Marylanders' concern and regard for the environment and our communities into law, as it contains essential aspects of environmental protection, including building emission standards and new construction regulations. This bill includes building emission standards for commercial and multifamily buildings, which are responsible for roughly 30% of total U.S. greenhouse gas emissions. Because of efficiency standards and building codes, energy intensity and use has decreased since peaking in 2005. However, due to rapid population growth and commercial development, the current standards for environmental protection are not enough. We need stronger goals for our new buildings, to ensure that they are not contributing to these greenhouse gas emissions.

My parents chose to take individual action for our environment, and we all have that choice. As students in SGA, we make that choice by being here today giving testimony, the rallies we plan, and action we take. My student government has been excellent in pursuing climate action, and I would like to see the MGA make that same choice. With HB831, not only can we all choose to prioritize the environment and the communities that we call home, but we can push other entities towards making the same crucial choices. I strongly support HB831, and its requirements for all-electric new building standards, net-zero requirement for large buildings, alternative compliance fees, and decarbonization plans. I urge a favorable vote on this bill, hoping that you all make your own individual choices towards environmental protection. This is our responsibility.

Sincerely,

Meghana Kotraiah | University of Maryland - College Park | *meghana.kot55@gmail.com*

HB831 Jeffries Favorable .pdf
Uploaded by: Nina Jeffries
Position: FAV

Testimony in Support of HB831- Reducing Greenhouse Gas Emissions:

Good afternoon Delegate Barve and members of the Environment and Transportation Committee,

My name is Nina Jeffries, I'm from Takoma Park and currently a resident of College Park. I am a UMD student representing the MaryPIRG Student Climate Action Coalition. Requiring the gas utilities to develop a decarbonization plan is a key component of the bill that must be retained.

The science tells us we must move away from natural gas- both to protect our climate and our public health. When I was in high school, there was an explosion from a natural gas leak in the Flower Branch Apartments, no more than 5 minutes from where I lived. 7 people died and 65 were sent to the hospital. That weekend, I volunteered with tens of other people to help sort through donated clothes for those who had lost everything. Having not replaced out-of-date and dangerous components that allowed the gas to leak, Washington Gas settled in 2019 with affected residents. [1] I think we forget, natural gas is dangerous. According to an Harvard study, Maryland ranks in the top ten states for most premature deaths from all fuels burned in buildings.[2]

As our Student Government Association wrote in our comment on our County's draft CAP, "Natural gas is not "clean" and we cannot afford to perpetuate these deceptive narratives spread by the fossil fuel industry." [3] On campus, the entire university of Maryland is run by its on-campus natural gas plant, making us the largest single emitter of greenhouse gasses in state government. It's embarrassing and dangerous, the superheated steam plumes burn students and struck natural gas lines cause disruptive evacuations. Due to the extensive infrastructure, the cost of moving campus away from natural gas ASAP was deemed too high, we will have to wait another 15-30 years. We cannot put more buildings on natural gas, because it becomes near impossible to move away. We need an all-electric new building code and we need the gas utilities to lead the way with decarbonization plans.

Natural gas is detrimental to the climate system. At the Senate hearing last Tuesday, throughout the 8 hours I was there, I heard a lot of pushback from the gas utilities on the Climate Solutions Now Act. Different excuses that amounted to "we don't have the will". Maryland must write into policy that these gas utilities decarbonize. Otherwise, they will continue to hijack the public process with false truths about their intentions, and continue to jeopardize my life, your life, and the lives of those that will come after us.

We urge a favorable report on this bill and remind you all that climate action cannot stop here.

Thank you.

---

[1] https://www.marylandmatters.org/2019/12/19/settlement-reached-in-2016-silver-spring-apartment-explosion/
[2] https://www.hsph.harvard.edu/c-change/news/gas-biomass/
[3] https://docs.google.com/document/d/1YIkhE98IIFH4E-4b7GwvoyvDSaUZszM3wgYQ229dLYQ/edit

GHHI Written Testimony - HB831PDF.pdf

Uploaded by: Ruth Ann Norton

Position: FAV

Green & Healthy Homes Initiative®

2714 Hudson Street
Baltimore, MD 21224-4716
P: 410-534-6447
F: 410-534-6475
www.ghhi.org

February 23, 2022

Sen. Kumar P. Barve, Chair
House Environment & Transportation Committee
House Office Building, Room 251
6 Bladen St., Annapolis, MD 21401

Re: **SUPPORT** – HB831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Dear Chairman Barve and Members of the Committee:

On behalf of the Green & Healthy Homes Initiative (GHHI), I offer this testimony in support of HB831. GHHI is a member of Energy Efficient Maryland, the Maryland Public Health Association Advisory Committee, and the New York State Climate Action Council Housing and Energy Efficiency Advisory Panel. In addition, I represent GHHI as a member of the EPA Children's Health Protection Advisory Committee and the Maryland Lead Poisoning Prevention Commission. GHHI is dedicated to addressing the social determinants of health and the advancement of racial and health equity through the creation of healthy, safe and energy efficient homes. GHHI has been at the frontline of holistic healthy housing for over three decades.

Over its 30-year history, GHHI has developed the holistic energy efficiency, health and housing service delivery model adopted by the U.S. Department of Housing and Urban Development and implemented in our nationally recognized, Maryland-based direct services program. GHHI helped to elevate Maryland as a national leader in healthy housing and the reduction of childhood lead poisoning by 99% statewide through more than 45 pieces of state and local healthy housing legislation. Through our own research and evidence-based practices, GHHI has found that a healthy and energy efficient home yields a multitude of energy and non-energy benefits for residents, particularly low-income residents who can benefit the most from such energy efficiency improvements in terms of economic mobility, housing stability and wealth attainment over the long-term. We are deeply committed to advancing racial and health equity, economic mobility and climate resiliency through efficiency standards for low-income housing, and thus write in support of HB831. This legislation is a crucial lynchpin in the effort to advance energy equity and address home health and energy efficiency gaps for Maryland's low-income families and households while mitigating the impacts of climate change statewide.

Why is HB831 Needed?
Direct fuel use in residential, commercial, and industrial (RCI) buildings accounted for 18% of Maryland's gross greenhouse gas emissions in 2017 and is projected to become the second largest source of emissions, behind transportation, within 10 years as emissions from electricity generation continue to decline.[1] HB831 will address the need to reduce emissions from existing buildings, and by prioritizing retrofits for low-income households, it will advance racial equity, environmental justice, and meet Maryland's climate goals. Based on our decades of work serving families and improving housing conditions in Maryland, GHHI recognizes the important role of housing in achieving the state's climate goals and improving health, economic and social outcomes for our most vulnerable families.

The need for energy solutions for Maryland's low-to-moderate income housing stock is clear. Throughout our state, low-income residents face disproportionately higher utility bills. As a proportion of total income, low-income residents in the state of Maryland pay 550% more as a portion of income for energy than non-low-income residents in the state. Some low-income Marylanders devote such an extremely high share of their income to energy services that up to 42 cents out of every dollar is spent on energy bills (APRISE: Applied Public Policy Research Institute for Study and Evaluation, 2018). Every dollar that low-income residents allocate to costly utility bills is a dollar that cannot be used on other household essentials ranging from affording medical bills and school supplies to food (APRISE: Applied Public Policy Research Institute for Study and Evaluation, 2018).

Approximately 55% of Maryland's low-income households include Asian, Hispanic or Black residents. These residents have less access to affordable, energy efficient and healthy homes (Lucy Laflamme, N.D.). These disparities persist across the state, characterized by energy inefficient homes and health hazards like lead-based paint, faulty roofs, poor indoor air quality and mold.

Specifically, GHHI is in support of the following proposed actions, in direct alignment with our mission and vision to create healthy, safe, energy efficient and decarbonized homes for Maryland families:

- Requirement for the Department of the Environment to establish building emissions standards for certain buildings
- Establishment of the Building Energy Transition Implementation Task Force to study certain matters and develop a plan for funding the retrofit of certain buildings.
- Requirement for the Maryland Department of Labor to update the Maryland Building Performance Standards

[1] Maryland Commission on Climate Change; Buildings Subgroup Report to the Mitigation Work Group; September 21, 2020

- Setting of Building Performance Standards, including:
    - Setting a state goal that holistic retrofits, including weatherization measures and heat pump installations, be implemented in 100% of low-income households with minimal or no upfront costs for the resident by January 1, 2030.
    - Developing building emissions standards that achieve specific reductions in greenhouse gas emissions, including:
        - 20% reduction in net greenhouse gas emission before 2030
        - Net-zero before 2040

Benefits of providing low-income households with energy efficiency upgrades and building decarbonization

The investment in low-income homes is not just a smart investment, but an urgent one. The market is moving towards electrification and renewable energy, and bills like this will rightly accelerate this process. As this necessary transition occurs, households depending on the gas infrastructure will see increases in the fixed costs of their utility expenses as they fund the maintenance of the remaining gas infrastructure. Without assistance to meet the initial costs of decarbonization and energy efficiency upgrades, low-income households will be left behind to pay for the stranded assets of the infrastructure. The Maryland Commission on Climate Change Building Report summarizes the state model of future residential gas prices as follows, "Gas rates remain flat through the 2020s but then climbs [approximately four to five times of current levels] to the $40-50/MMBtu range by 2045. This Plan recommends transitioning 100 percent of low-income households to heat pumps by 2030 to reduce energy burden for the most vulnerable Marylanders." Leading with meeting the needs of Maryland's most vulnerable residents will provide compounding benefits to health, economics, and energy. We strongly urge the house to follow this guidance and prioritize holistic retrofits for low-income households by 2030.

Completing holistic retrofits also has tangible implications for racial equity. In the US, Black households have the greatest likelihood of residing in older homes with compromised energy systems, aging or ineffective appliances and other assorted structural deficiencies, all of which contribute to making the home energy inefficient (Hernández, Aratani, Jiang, 2014; Hernández, Jiang, Carrión, Phillips, and Aratani, 2016). Residential segregation, racist housing policies and intentional disinvestment in communities of color, including in Maryland, result in conditions that contribute to poor health and high energy burdens, including inadequately sustained and inefficient ventilation (HVAC), cooling and heating systems, drafts or air leaks, and poor insulation (Drehobl and Ross, 2016; Hernández and Phillips, 2015; Reames, 2016; United States Census Bureau, 2015). These structural conditions, coupled with a household's inability to obtain energy – independent systems within higher quality homes, all contribute to increased costs for fundamental home utilities such as cooling and heating systems and lighting, through inefficient household energy usage (Lewis, Hernández & Geronimus, 2019).

In addition, data demonstrates that Black households are disproportionally subjected to trade-offs, for instance choosing between paying energy expenses or food and medicine, with 28% of Black households reporting having waived food and medicine monthly in order to pay for energy, (James Berry, Independent Statistics & Analysis: U. S. Energy Information Administration, 2018). Investigations have revealed how challenges central to energy insecurity, including difficulties paying energy bills or experiencing reduced thermal comfort, were connected to raised stress levels, known to be damaging to long term health when chronically sustained (Geronimus, 2000; Hernández, 2016).

Decarbonization slows the pace of climate change which affects the health, safety, and economy of the entire population. As a coastal state, Maryland is on the front lines of many of the dangers of climate change, and within the state these impacts are projected to affect the most vulnerable populations disproportionately (Maryland 2030 GGRA Plan 2021). Over the next 30 years, the increased flood risk from climate change is modelled to disproportionately affect low- income Black communities in Maryland and across the country (Wing et al. 2022). Furthermore, extreme heat and weather events are projected to have the most severe health impacts (e.g., increased hospitalizations from asthma and heart attacks) in the low-income and minority population centers of the state such as Baltimore City (Maryland Climate and Health Profile Report 2016).

Buildings are significant emitters of greenhouse gases that contribute to global climate change as well as particulates that have significant effects on local health. In 2017, buildings accounted for 18% of direct greenhouse gas emissions in Maryland (The 2030 GGRA Plan 2021). Numerous studies have demonstrated a link between particulate ($PM_{2.5}$) levels and premature loss of life. Decarbonization is an essential step to reducing this burden because both nationally and within Maryland, gas emissions have passed coal as the energy source with the largest impact on human health from pollutant emissions (Buonocore et al. 2021). Because buildings emit pollution where people live and work, humans are acutely affected. In a major 2012 paper, researchers looked at 35 years of data collected across six US cities and found a statistically significant 14% increase in all-cause mortality for a 10-μg/m3 annual increase in local $PM_{2.5}$ measures, confirming the findings of previous studies (Lepeule et al. 2012; Dockery et al. 1993; Laden et al. 2006). Thankfully, researchers find that community health improves quickly with reductions in $PM_{2.5}$. On the other hand, energy infrastructure is often a long-term investment for both buildings and for municipalities. Beginning the process of decarbonization immediately is the best way to reduce total harm caused to residents' health.

Finally, recent studies have highlighted the health impacts of indoor air pollution from gas appliances. A team of researchers at Stanford University found that stoves emit significantly more methane emissions than previously understood because most of their emissions occur when in their steady state off position (Lebel et al 2022). Families who do not use their range hoods or who have poor ventilation can surpass the 1-h national standard of acute NO_2 (100 ppb) within a few minutes of stove usage, particularly in smaller kitchens. Because many people live in small, older housing, and most appliances remain in use for long periods of time, both the contributions to greenhouse gas emissions and unhealthy levels of indoor air pollution point to a need to prioritize gas-free appliances in most buildings. Preparing buildings for a gas-free operation promotes improvements in indoor and outdoor air quality, as well as allowing a transition off the gas infrastructure which will reduce costs both for energy and gas system maintenance.

How Does Maryland Compare with Other States and Federal Actions?

HB831 presents an opportunity to place Maryland in a position of national leadership in advancing racial, health and energy equity and supporting economic mobility by meeting the critical housing and energy needs of Maryland's most vulnerable families and seniors. State and local governments around the country are moving toward setting clear, statewide standards for building energy efficiency and electrification, and putting in place innovative funding mechanisms to support these standards. In January, 2022 the federal government launched a Coalition of State and Local Governments to Strengthen Building Performance Standards, with the understanding that:

> "When building performance standards are designed in partnership with frontline communities and key stakeholders, innovative and equitable solutions can address multiple needs in a community. Energy efficiency improvements and electrification in multifamily buildings improve indoor air quality, eliminate drafts, and protect residents from extreme heat– delivering health benefits and lower health care costs. For businesses, high-performing buildings are not only good for the world, they are good for the bottom line – attracting higher occupancy rates and generating more revenue."

Maryland can realize these benefits for families, older adults, workers and our environment by passing the targeted commitments in the Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings Act. We request a Favorable report on HB831.

Respectfully Submitted,

Ruth Ann Norton
President and CEO

HB831 Testimony- Steven Berit.pdf
Uploaded by: Steven Berit
Position: FAV

February 23, 2022
Committee: Environment and Transportation
Testimony on: HB831 – Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings
Position: Favorable

Chair Barve, Vice Chair Stein, and all members of the Education and Transportation Committee

My name is Steven Berit, and I am a sophomore pursuing a double degree in Computer Science and Government and Politics at the University of Maryland, College Park. Throughout my time at UMD, I have witnessed first-hand the damages greenhouse gas emissions have on our local and global environment and the importance of reducing these emissions.

Currently, UMD relies on a natural gas power plant to provide energy for the university. This supposedly "clean" form of energy is a misleading title when considering the fact that the methane released from drilling is 86 times stronger than carbon dioxide at trapping heat over a 20-year time period and is responsible for roughly 25% of the man-made causes for our current climate change crisis. The current infrastructure at UMD has also led to many potential dangers for students such as in 2021 when a gas leak occurred causing many buildings on campus to be forced to be evacuated. Along with the random stacks of dangerous plumes of steam pouring out of the ground and walls that stain our otherwise beautiful campus, it can oftentimes feel unsafe walking around campus. This is why it was so devastating to hear that our university has already begun working on replacing our current power plant with another natural gas power plant to last another 30 years.

This new power plant project was ironically named the Next Gen project which was a huge slap in the face for students who felt that the next generation had no voice in the project's direction. As someone who was passionate about getting student input listened to in the development of Next Gen, I was selected as the only undergraduate student to sit on a NextGen Advisory Committee. That's right I, myself was somehow tasked with representing over 30,000 student voices in a project that greatly affected every student that attended this university. However, even more to my dismay the committee met only 2 times in over a year, and my input wasn't even considered. Instead, I felt I was used as a scapegoat by my university to say they checked the box of involving students in the process. It's clear to me that the university is not going to listen to students on finding alternate solutions to natural gas which is why it is essential that legislation such as HB831which takes the first step to introducing sustainable ideas such as an all electric building code must pass to ensure that our Next Generation is truly protected.

As a student, an advocate, and someone who cares for the future of my planet, I urge a favorable report on this legislation. Thank you.

Steven Berit | sberit@umd.edu

Committee: Environment and Transportation
Testimony on: HB831 Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings Organization: (self)
Submitting: Thomas Potyraj
Position: Favorable
Hearing Date: February 25, 2022

Chairman Barve and Members of the Committee:

Thank you for allowing my testimony in support of HB831.

The Maryland Commission on Climate Change (MCCC), in its 2021 report, recommends that the building sector reduce greenhouse gas emissions. Buildings make up 40% of Maryland's greenhouse gas emissions. 13% of this 40% is from direct emissions, primarily from gas to fuel heat and water systems.

The all-electric building code specified in this bill would require new residential and commercial construction to have water and space heating provided without the use of fossil fuels. It would also require new buildings to be ready for the installation of solar energy systems and electric vehicle charging equipment.

We have spent enough time incorporating fossil fuel infrastructure into Maryland buildings. Now is the time to curtail investments in a fossil-fuel based infrastructure. To do this, we need guidance such as that provided in this bill.

Thank you for your consideration of HB0831 Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings. I support this bill and urge a FAVORABLE vote.

Thomas Potyraj
116 Glenrae Drive
Baltimore MD 21228

HB 831 - Reducing Greenhouse Gas Emissions - Lette

Uploaded by: Brian Frazee

Position: FWA

Maryland
Hospital Association

February 25, 2022

To: The Honorable Kumar P. Barve, Chair, House Environment & Transportation Committee

Re: Letter of Support with Amendments- House Bill 831- Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Dear Chair Barve:

On behalf of the Maryland Hospital Association's (MHA) 60 member hospitals and health systems, we appreciate the opportunity to comment in support of House Bill 831 with amendments. Maryland hospitals support and lead efforts to combat climate change to secure a healthy planet for our future, but **we are concerned the bill may have overlooked the unique needs of hospitals to ensure continuous delivery of life-sustaining care to patients. We urge the Committee to convene a health care task force to understand the impact of new building standards on hospitals before imposing requirements.**

HB 831 aims to reduce greenhouse gas (GHG) emissions through a number of mechanisms. Among other things, the bill would require the Department of the Environment to establish building emission standards, create the Building Energy Transition Implementation Task Force to study certain matters, and require the Maryland Department of Labor to update building standards.

MHA supports the intent to reduce GHG emissions and combat climate change. However, the proposals may inadvertently hinder patient care. Hospitals also would face financial challenges in meeting the requirements. In Maryland, the state regulates hospitals' revenues by setting fixed global budgets. Plus, many hospitals already have secured permits and design plans for new buildings, which may conflict with some requirements in the bill.

There are two areas of concern:

Requirements for new buildings

The bill would require the Maryland Department of Labor to adopt by January 1, 2023, (1) a requirement that new residential and commercial buildings meet all water and space heating demands without the use of fossil fuel and (2) electric-ready standards to ensure that new buildings are ready for the installation of solar energy systems, the installation of electric vehicle charging equipment, and building-grid interaction.

Hospitals today are required to have robust resiliency planning, which conflicts with these provisions. For instance, **federal regulations that govern hospitals' ability to contract with Medicare and Medicaid ("Conditions of Participation") require hospitals to maintain an**

adequate fuel supply to sustain essential services in the event of a power interruption, such as a natural disaster. Under existing technology, diesel fuel, natural gas, and other forms of fossil fuel are more dependable for this purpose. We fear the proposed requirement that new buildings must meet heating demands without fossil fuel would contravene federal mandates and jeopardize hospitals' emergency response. A recent New York City legislation that imposed similar restrictions on natural gas and fossil fuel, for instance, recognized the unique obligations of hospitals and created an exception for the sector. **Hospitals should be exempt from this requirement until a reliable fossil fuel alternative is readily available.**

Requirements for existing buildings

For commercial buildings that have a floor area of 25,000 square feet or more, the bill would require the Maryland Department of Environment to develop building emission standards. Under the bill, the owner of covered buildings must measure and report direct emissions annually beginning 2025, achieve a 20% reduction in direct building emissions by January 1, 2030, and attain net-zero by January 1, 2040.

Again, we are concerned the specific proposals may negatively affect patient care. **Unlike other commercial buildings, hospitals must have continuous and reliable energy to ensure they can deliver and maintain lifesaving care 24/7/365.** Ventilators and life support systems cannot afford any interruptions and hospitals must have reliable methods to sterilize surgical instruments. These unique demands require hospitals to utilize all available energy sources or risk jeopardizing patient safety. While hospitals are using best efforts to reduce emission and identify clean energy sources, **we are concerned the existing supply of clean energy alternatives is not sufficient to meet hospitals' needs by the dates set out in the bill.**

During 2021 interim, the Maryland Commission on Climate Change worked to develop the *Building Energy Transition Plan.* That comprehensive effort did not include hospitals nor the unique considerations. **For these reasons, we ask the Committee to create a health care task force to study the unique needs of hospitals and other health care providers.** The task force should include sustainability experts knowledgeable with health care facility needs and representatives from the hospitals. The task force can develop recommendations that balance care delivery, patient safety, and climate change considerations. The task force should work expeditiously to propose emission and building standards, but until a workable solution is developed, hospitals should be exempt from the proposed requirements described above to avoid patient harm.

We appreciate the Committee's consideration and look forward to working with stakeholders to move this issue forward.

For more information, please contact:
Brian Frazee, Vice President, Government Affairs
Bfrazee@mhaonline.org

HB831_IndivisibleHoCoMD_FWA_BrianWessner.pdf
Uploaded by: Brian Wessner
Position: FWA

HB831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Testimony before

Environment and Transportation Committee

February 25, 2022

Position: Favorable With Amendments

Mr. Chair, Mr. Vice Chair and members of the committee, my name is Brian Wessner, and I represent the 750+ members of Indivisible Howard County. We are providing written testimony today in ***support of HB831***, to establish building emissions standards for commercial and multifamily residential buildings. Indivisible Howard County is an active member of the Maryland Legislative Coalition (with 30,000+ members). We appreciate the leadership of Delegate Stein in moving this bill.

Solving the climate issues facing Maryland is not a one-size-fits-all effort. With 13% of Maryland's greenhouse gases (GHC) coming directly from the building section, success requires setting aggressive goals for GHG reduction in order to meet or exceed Maryland's goals. With amendments outlined in this testimony, including the priority amendments being put forth by Maryland Climate Partners and the Climate Justice Wing (see attached), HB831 targets these elements of a lasting solution through:

- Setting **building emissions targets** to achieve a 20% reduction in direct building emissions from 2025 levels by January 1, 2030, achieving net-zero direct emissions by January 1, 2040. Proposed amendments, supporting attached amendments put forth by the Maryland Climate Partners and the Climate Justice Wing, include:
  - Add an interim target of at least 40% by 2035 to align with targets defined in SB528. Interim goals provide helpful guidance to MDE.
- Developing **building emissions standards** that provide maximum flexibility to encourage building owners to comply, providing owners with financial incentives recommended by the Building Energy Transition Implementation Task Force, and include an alternative allowing an owner to pay a fee greater than the social cost of GHG set by EPA. Proposed amendments, supporting attached amendments put forth by the Maryland Climate Partners and the Climate Justice Wing, include:
  - For HB831 to be equivalent to SB528, emissions should include both direct and indirect building emissions to account for emissions created by the building's use of fossil fuels. Indirect emissions are included in a building's GHG inventory to create a real-world picture of GHG emissions.

- ❖ Creating a **Building Energy Transition Implementation Task Force** to develop complementary policies, programs and incentives to reduce GHC. Incentives include tax credits and subsidies, financial incentives through EmPOWER and other state programs, and low-interest financing to spread up the up-front costs of electrification retrofit upgrades. The task force will develop a plan for funding retrofits to comply with building emissions standards, and delivering the finalized plan to the General Assembly by December 1, 2023. Proposed amendment, supporting attached amendments put forth by the Maryland Climate Partners and the Climate Justice Wing, include:

  - ➢ SB528 creates the Climate Catalytic Capital Fund as an funding strategy to support many of the changes in this bill. This concept should be included in HB831.

- ❖ Requiring adoption of an **all-electric code for water and space heating** as an above-code modification of the International Energy Conservation Code (IECC). By January 1, 2023 buildings constructed to an above-code certification program will meet energy conservation requirements; new residential and commercial buildings must meet water and space heating demands without fossil fuels and are electric ready for solar, EV charging equipment and building grid interaction. Variances can be issued by local jurisdictions. Proposed amendments, supporting attached amendments put forth by the Maryland Climate Partners and the Climate Justice Wing, include:

  - ➢ Change "all Commercial and Residential" to "all buildings" to ensure that all electric includes all buildings, not just covered buildings. The new construction code should apply to ALL new buildings – Commercial, residential, and government buildings – including our schools as models for the rest of society. If we don't apply the all-electric standard to all buildings, we will be forced to retrofit those same new buildings at a later date (not a very economic approach).

  - ➢ If a building is funded at least 25% by State funds, require a 20% reduction in modeled energy use consumption over the 2018 IECC code for permit applications received between January 1, 2023 and December 31, 2024, a 40% reduction for applications received between January 1, 2025 and December 31, 2026, and a 60% reduction for applications received between January 1, 2027 and December 31, 2028. These targets will lead all other covered buildings by 2 years.

- ❖ Adopting the **2018 International Green Construction Code** by January 1, 2023 and adopt each subsequent version of the code within 18 months after it is issued.

These actions, when taken together, contribute to the framework necessary for achieving Maryland's GHG reduction goals.

Thank you for your consideration of this important legislation.

We respectfully urge a favorable report with amendments.

Brian Wessner
Columbia, MD 21044

Priority Amendments

Amendments for HB831 - Coordinated by the Maryland Climate Partners

1. **Strengthen provisions related to Building Energy Performance Standard**

HB831 directs MDE to create a Building Energy Performance Standard (BEPS) which will require reduced emissions from commercial and residential buildings over 25,000 sq ft. This is a critical policy Maryland must enact to reduce pollution from existing buildings and move towards net zero. Colorado, Washington State, Washington DC already have similar programs, and Montgomery County is currently implementing a BEPS program. There are some critical amendments that should be added to ensure the policy achieves its intended goal.

- **Clarify that the policy should establish targets to "energy use intensity" which includes reductions on both electricity usage AND onsite fossil fuel use for heating & cooking.**
    - As written, the bill appears to target just onsite emissions, which means the burning of fossil fuels for heating and cooking, also known as "scope 1". It should also include reductions in electricity usage.
    - Improved building energy efficiency will reduce overall electricity demand (helping grid transition) and can result in smaller sized heating and cooling systems.
    - Energy efficiency (e.g., site electricity use) includes: maintaining and retro-commissioning building energy systems; implementing HVAC scheduling and other smart control systems; and making building shell and other energy efficiency improvements.
    - This aligns with the recommendations of the MD Commission on Climate Change's Building Energy Transition Plan (see p. 23).

- **Add the interim target of at least 40% by 2035.** We want to ensure that annual reductions are spread out (SB 528 on page 47 , lines 5-14) *This will also align the numerical goals of HB831 with SB528. Interim goals provide helpful guidance to MDE.*

2 The new fossil-free construction code to new buildings should apply to all new buildings, and end of life system retrofits.

HB831 takes an important step of requiring that Maryland Dept of Labor, which establishes MD building codes, specify that new commercial and residential buildings must be built to use electricity (not fossil fuels) for heating. Additionally, require that the majority of space heating and service water heating use heat pumps. The current language limits the new code to "commercial and residential".

The new construction code should apply to ALL new buildings - Commercial, residential, and government buildings. (page 8, starting line 8)

- Our public buildings, including our schools, should be models for the rest of society, and should be stronger, or at a minimum comparable, to other building standards.
- It is our understanding that HB806 addresses construction standards for new public buildings, potentially based on levels for state funding. We support stronger goals for state buildings, but the new construction codes laid out in HB 806 should apply to all buildings, regardless of level of state funding.
- If we don't apply the all-electric standard to all buildings, every time we build a building that is not all-electric, it is one more building we will have to retrofit. Retrofitting is far more expensive than building the all-electric in the first place.

- With a state surplus and plans to spend significant money on schools through the Built to Learn funding, this is the ideal time to pay-it-forward. Building schools with fossil fuel infrastructure will require far more funds in the future to operate and eventually retrofit.

3. Add "Energy Efficiency" to new construction Commercial code requirements

An increasingly popular approach to this is for a city or state to adopt a "stretch code" which adds provisions on top of the standard code to achieve additional energy efficiency improvements. Washington State, City of Seattle, California, New York City, as well as Montgomery County and Baltimore City, are just a few of the jurisdictions taking this approach. The Maryland General Assembly notes that "energy efficiency is among the least expensive ways to meet the growing electricity demands of the State" and the American Council for an Energy Efficiency Economy reports that "Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050"

We recommend the following targets for all New Construction Commercial buildings, public and private. State Funded Buildings will lead the way by 2 years. Note that this is a percent target for modeled energy use reductions. These targets have been developed from the AIA 2030 challenge and the originally stated International Code Council energy reduction targets. The International Code Council publishes the International Energy Conservation Code, which is already behind targets, two code cycles after targets were set.

- ***For public buildings, funded at least 25% by State funds***
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2023 and Dec 31 2024
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026

- o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028

- ***For all other new covered buildings***
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
  - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2029 and Dec 31 2030

Additionally, there should be energy efficiency performance targets for new "major renovations".

- ▪ Targets
  - A 40% reduction in the building's average annual energy use; or
  - A 20% reduction in modeled energy use consumption over the current Energy Code

Additions to Ensure that HB831 is Equivalent to SB528

- On page 9, line 12 and page 7, line 27, SB528 creates a MCEC Climate Catalytic Capital Fund (C3). Add that language in a new section in HB831. *A Climate Catalytic Capital Fund is an innovative funding strategy envisioned in SB528 which will be important to support many of the changes in this bill. We recommend these concepts by incorporating into this bill or other appropriate legislation.*

CASA_FAV_HB831.pdf
Uploaded by: Cathryn Paul
Position: FWA

Testimony in SUPPORT WITH AMENDMENTS of HB831
Reducing Greenhouse Gas Emissions in Commercial and Residential Buildings
Environment and Transportation Committee

February 25, 2022

Dear Chairman Barve, Vice-Chair Stein, and Members of the Environment and Transportation Committee:

CASA offers favorable with amendment testimony for House Bill 831, Reducing Greenhouse Gas Emissions in Commercial and Residential Buildings. CASA is the largest membership-based immigrant services and advocacy organization in the mid-Atlantic region, with a membership of over 120,000 Black and Latino immigrants and working families. Thank you for this opportunity to testify today in support of SB662.

HB831 is a good step forward in reducing greenhouse gas emissions, and CASA supports the overall intent of the bill. CASA believes that this legislation must be strengthened with the following amendments:

Amendment #1
Pg, 3 under "Regulations adopted under this section shall:" add "Allow owners of covered buildings to submit an Alternative Compliance Action Plan to the Department if the building owner cannot meet the interim or final emissions standards by the required date or cannot meet the interim or final emissions standards due to economic infeasibility or other circumstances beyond the owner's control. The Plan shall include: (a) documentation of economic infeasibility or other circumstances beyond the owner's control such that the interim or final emissions standards cannot be met; (b) if applicable, new proposed interim or final emissions standard; (c) a list of actions the owner will take to achieve the proposed interim or final emissions standard; (d) the timeline for achieving the proposed interim or final emissions standard; and (e) other requirements determined by the Department.

The criteria for evaluating an Alternative Compliance Action Plan submitted by owners of affordable housing shall include, at a minimum, whether: (a) there is a plan to refinance or recapitalize their property; or (b) there are cash flow constraints, including, but not limited to, restrictions on the usage of net cash flow, or prohibition from utilizing a portion of existing cash reserves for implementing improvements to the building that would reduce emissions."

Amendment #2
Pg. 3, add to the Building Energy Transition Implementation Task Force: "One representative who is a tenant of an apartment building or is an advocate for the rights of tenants of apartment buildings."

Amendment #3
Pg. 5, under "The Task Force Shall" add "Study the costs of complying with building emissions standards for different building types including, but not limited to, affordable housing."

Amendment #4
Pg. 5, under the "Task Force Shall" add "Study and make recommendations regarding the development of complementary programs and policies that protect renters from increased rents and energy burdens and risk of displacement."

Amendment #5
Pg. 5, line 20, under the "Task Force Shall" add at the end of the sentence "that shall prioritize recommendations for funding the retrofit of affordable housing."

As an organization dedicated to tenants' rights, CASA stands with members to support HB 831 with the above amendments to benefit renters and move towards climate justice. We stand with our members in asking for safer apartments. Members of Flower branch apartments where a fire killed seven know all too well the dangers of leaking gas. In Bedford/Victoria Station and other apartment complexes around Langley Park and Riverdale Park, Maryland, members often complain about the smell of gas in their old apartments.

We stand with our members in asking for more affordable utilities. Apartment complexes like Montgomery White Oak and Villas of Langley and others have stopped paying the utilities only to charge the individual tenants the cost because of the increasing rates. We stand with our members in not passing on the costs of the retrofitted buildings with cleaner and safer appliances. We stand with our members in asking that in the case of market-rate, multi-unit apartment complexes where thousands of CASA members in Maryland live; that those buildings that cannot afford to pay for the retrofits that are preserved so that CASA members are not displaced or gentrified such is happening in complexes like Laurel24 and Westgate in Laurel. We stand with our members to make sure that we achieve climate justice, including the important retrofitting of the appliances from gas to electric.

We ask that you move a favorable report with amendments on HB 831.

Trent Leon-Lierman, CASA

HB0831_Commercial_Residential_Climate_Partners_FWA
Uploaded by: Cecilia Plante
Position: FWA

marylandclimatepartners

Testimony for HB0831
Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Bill Sponsor: Delegate Stein
Committee: Environment and Transportation
Position: FAVORABLE WITH AMENDMENTS

The undersigned organizations express their strong support for **HB0831 Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings** and thank the sponsor, Delegate Stein, for introducing such an important and transformative piece of legislation. We support this bill and offer several amendments that strengthen the legislation (listed below).

This bill takes aim at the greenhouse gas emissions from residences and businesses across Maryland. This is an important piece of legislation because eliminating emissions from buildings is critical to our success in reducing overall greenhouse gas emissions. Buildings contribute 40% of the greenhouse gasses that are produced in Maryland (18% from onsite fossil fuel combustion and the remainder from the power they use from the grid, which contains fossil fuels) because they rely heavily on fossil fuel infrastructure. Over the next couple of decades, we have to reduce that 40% number to zero. This is not an easy problem to solve. It will take a great deal of effort and resolve and will involve making real change in the way we build our buildings and in the way we live our lives.

We support the all-electric building code specified in the bill. Starting in 2023, it would require new residential and commercial construction to have water and space heating provided without the use of fossil fuels. Additionally, it would require new buildings to be solar ready and have electric vehicle charging infrastructure. We understand that in order to solve the problem of building carbonization, you have to contain the problem first, and requiring new buildings to be all-electric is the perfect way to do this.

We also agree with the need to develop Building Emissions Standards to understand and measure the emissions that each residence or business is producing. Not only do we need standards developed, but there should be requirements for building owners to report the emissions, as well as requirements to decrease the emissions in a decisive manner. Building Emissions Standards should be designed to achieve reductions in direct emissions (those produced in heating and cooling the building) starting at a 20% reduction by 2030 and net zero by 2040. Additionally, reporting by building owners would start in 2025.

One of the most critical aspects of the bill is the creation of a Building Energy Transition Implementation Task Force. This Task Force will be charged with recommending complementary policies, programs, and incentives to support this transition, including the creation of tax credits and direct subsidies; new financial incentives that will help low- and moderate- income residents through the EmPOWER program; and on-bill, low-interest financing to spread out the upfront costs. Additionally, the Task Force will recommend a plan to fund the retrofit of existing buildings.

Because we have spent decades building fossil fuel infrastructure into every building that we have developed, it will take a great deal of effort to undo all of that. In this great undertaking, we need leadership and guidance, and we believe that this bill provides a very positive roadmap.

As stated previously, we have attached amendments that we believe will strengthen the bill and we look forward to working with the sponsor and leaders throughout the legislature on these proposed amendments.

Thank you for your consideration of HB0831 Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings. We support this bill and we urge a **FAVORABLE** vote from the Committee with the inclusion of these amendments.

Endorsing Organizations

350 Baltimore
350 Montgomery County
Adat Shalom Climate Action
Assateague Coastal Trust
Audubon Naturalist Society
Casa de Maryland
Cedar Lane Unitarian Universalist Church
CHEER
Chesapeake Bay Foundation
Chesapeake Climate Action Network Action Fund
Chesapeake Physicians for Social Responsibility
Chispa MD
Clean Air Prince Georges
Clean Air Prince Georges
Clean Water Action
Climate Law & Policy Project
Climate Parents of Prince Georges
Climate Reality Montgomery County
Climate Solutions
Climate Stewards of Greater Annapolis
Climate XChange - Maryland
Coalition For Smarter Growth
Columbia Association Climate Change
Concerned Citizens Against
Industrial CAFOs
Do The Most Good Montgomery County
Echotopia
Elders Climate Action
Environmental Justice Ministry
Frack Free Frostburg
Glen Echo Heights Mobilization
Greenbelt Climate Action Network
HoCo Climate Action
Howard County Indivisible
Howard County Sierra Club
Interfaith Power and Light, DC, MD, NoVa
Labor Network for Sustainability
Laurel Resist
Maryland Environmental Health Network
Maryland League of Conservation Voters
Maryland Legislative Coalition
Maryland NAACP State Conference,
Environmental Justice Committee
Maryland Poor People's Campaign
MCPS Clean Energy Campaign
MD Campaign for Environmental Human Rights
Mid-Atlantic Ministry of Maryland
MoCo DCC
Montgomery Countryside Alliance
Montgomery County Faith Alliance
Mountain Maryland Movement
National Parks Conservation Association
Nuclear Information & Resource Service
Potomac Conservancy Sustainability Advisory Committee
Sierra Club, Maryland Chapter
Strong Future Maryland
Sunrise Baltimore
Takoma Park Mobilization Environment Committee
Talbot Rising
The Climate Mobilization Montgomery County
The Nature Conservancy
Unitarian Universalist Legislative Ministry
Wicomico NAACP
WISE

Amendments for HB831 - Coordinated by the Maryland Climate Partners

1. **Strengthen provisions related to Building Energy Performance Standard**

HB831 directs MDE to create a Building Energy Performance Standard (BEPS) which will require reduced emissions from commercial and residential buildings over 25,000 sq ft. This is a critical policy Maryland must enact to reduce pollution from existing buildings and move towards net zero. Colorado, Washington State, Washington DC already have similar programs, and Montgomery County is currently prepared to vote to implement a BEPS program. There are some critical amendments that should be added to ensure the policy achieves its intended goal.

- **Clarify that the policy should establish targets to "energy use intensity" which includes reductions on both electricity usage AND onsite fossil fuel use for heating, water & cooking.**
  - As written, the bill appears to target just onsite emissions, which means the burning of fossil fuels for heating and cooking, also known as "scope 1". It should also include reductions in electricity usage.
  - Improved building energy efficiency will reduce overall electricity demand (helping grid transition) and can result in smaller sized heating and cooling systems.
  - Energy efficiency (e.g., site electricity use) includes: maintaining and retro-commissioning building energy systems; implementing HVAC scheduling and other smart control systems; and making building shell and other energy efficiency improvements.
  - This aligns with the recommendations of the MD Commission on Climate Change's Building Energy Transition Plan (see p. 23).

- **Add an interim target of at least 40% by 2035.** We want to ensure that annual reductions are spread out (SB 528 on page 47, lines 5-14) This will also align the numerical goals of HB831 with SB528. Interim goals provide helpful guidance to MDE.

2. **The new fossil-free construction code to new buildings should apply to all new buildings, and end of life system retrofits.**

HB831 takes an important step of requiring that Maryland Dept of Labor, which establishes MD building codes, specify that new commercial and residential buildings must be built to use electricity (not fossil fuels) for heating. Additionally, require that the majority of space heating and service water heating use heat pumps. The current language limits the new code to "commercial and residential".

The new construction code should apply to ALL new buildings - Commercial, residential, and government buildings. (page 8, starting line 8)

- Our public buildings, including our schools, should be models for the rest of society, and should be stronger, or at a minimum comparable, to other building standards.

- It is our understanding that HB806 addresses construction standards for new public buildings, potentially based on levels for state funding. We support stronger goals for state buildings, but the new construction codes laid out in HB 806 should apply to all buildings, regardless of level of state funding.
- If we don't apply the all-electric standard to all buildings, every time we build a building that is not all-electric, it is one more building we will have to retrofit. Retrofitting is far more expensive than building the all-electric in the first place.

- With a state surplus and plans to spend significant money on schools through the Built to Learn funding, this is the ideal time to pay-it-forward. Building schools with fossil fuel infrastructure will require far more funds in the future to operate and eventually retrofit.

3. Add "Energy Efficiency" to new construction Commercial code requirements

An increasingly popular approach to this is for a city or state to adopt a "stretch code" which adds provisions on top of the standard code to achieve additional energy efficiency improvements. Washington State, City of Seattle, California, New York City, as well as Montgomery County and Baltimore City, are just a few of the jurisdictions taking this approach. The Maryland General Assembly notes that "energy efficiency is among the least expensive ways to meet the growing electricity demands of the State" and the American Council for an Energy Efficiency Economy reports that "Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050"

We recommend the following targets for all New Construction Commercial buildings, public and private. State Funded Buildings will lead the way by 2 years. Note that this is a percent target for modeled energy use reductions. These targets have been developed from the AIA 2030 challenge and the originally stated International Code Council energy reduction targets. The International Code Council publishes the International Energy Conservation Code, which is already behind targets, two code cycles after targets were set.

- ***For public buildings, funded at least 25% by State funds***
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2023 and Dec 31 2024
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
  - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
- ***For all other new covered buildings***
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026

o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2029 and Dec 31 2030

Additionally, there should be energy efficiency performance targets for new "major renovations".

- Targets
    - A 40% reduction in the building's average annual energy use; or
    - A 20% reduction in modeled energy use consumption over the current Energy Code

Additions to the Buildings Energy Transition Implementation Task Force

- HB0832 sets a goal of holistic retrofits for low-income households by 2030 with little or no cost. Additionally, it creates a Buildings Energy Transition Implementation Task Force to develop a plan for the retrofits and create the appropriate programs, policies and incentives to effect the transition to meet that goal.
    - We recommend that the Task Force include representation by EJ communities, as well as relevant non-profits. We also recommend that the Task Force coordinate with the Environmental Justice and Sustainability Commission, and Clean Energy Hub.

Additions to Ensure that HB831 is Equivalent to SB528

- On page 9, line 12 and page 7, line 27, SB528 creates a MCEC Climate Catalytic Capital Fund (C3). Add that language in a new section in HB831. *A Climate Catalytic Capital Fund is an innovative funding strategy envisioned in SB528 which will be important to support many of the changes in this bill. We recommend these concepts by incorporating into this bill or other appropriate legislation.*

Building Emissions Fact Sheet_ Climate Solutions N

Uploaded by: Diana Younts

Position: FWA

maryland climate partners

Building Emission Standards:
A Critical Tool for Reducing Greenhouse Gas Pollution from Large Buildings

Building Emission Standards will help Maryland Meet Climate Goals: Buildings are 40% of Maryland's greenhouse gas emissions and consume 90% of the electricity. Climate Solutions now follows the recommendation of **the Maryland Commission on Climate Change** to reduce emissions from existing buildings 100% by setting Building Emission Standards. Building Emission Standards are a critical tool that provides a flexible pathway for building owners to eliminate greenhouse gas (GHG) pollution from existing buildings by setting **greenhouse gas reduction targets.**

Climate Solutions Now Requires:

- Building that are 25,000 square feet or greater must reduce their GHG emissions 50% by 2030 and 100% by 2040; state buildings must reduce emissions 100% by 2035;
- Benchmarking of buildings energy usage data to refine compliance pathways;
- Alternative compliance payments for owners who fail to comply with standards.

Complementary Components That Make it Work:

- **The Climate Transition & Clean Energy Hub** – a clearinghouse for information, technical advice and financial incentives for the public and professionals (If you want to see how a similar program in D.C. works, watch here: Retrofit Accelerator;
- **The Climate Catalytic Capital Fund (C3) –** provides Green Bank financing and creates green bonds program to leverage private investment. For every $1 of public investment, the C3 Fund generates $4 to $10 of private capital.
- **The Building Energy Transition Implementation Task Force**- to develop recommendations for further complementary programs and incentives aimed at reducing greenhouse gas emissions from the building sector; and
- **The Expansion of the utilities' EMPOWER** program that will expand and increase rebates and other energy efficiency measures for consumers.
- **Maryland Commission on Environmental Justice & Sustainable Communities** to address priorities of environmental justice and vulnerable communities
- **Just Transition & Retraining Work Group**
- **Climate Justice Corps** to create career training opportunities for our youth and disadvantaged youth

Suburban Propane - House Bill 831.pdf
Uploaded by: Doug Dagan
Position: FWA

240 Route 10 West
P.O. Box 206
Whippany, NJ 07981-0206

www.suburbanpropane.com

M. Douglas Dagan
Vice President
Strategic Initiatives - Renewable Energy

ddagan@suburbanpropane.com
(p) 973.503.9967
(c) 201.452.3748

February 23, 2022

VIA ELECTRONIC SUBMISSION
Delegate Kumar Barve
Chair, House Environment and Transportation Committee
Maryland General Assembly
Room 251
House Office Building
Annapolis, Maryland 21401

RE: House Bill 831

Dear Chairman Barve:

Suburban Propane Partners, L.P. ("Suburban Propane") writes in regards to House Bill 831, requiring the state Department of Labor to adopt building standards mandating new residential and commercial buildings meet all water and space heating demand without the use of fossil fuels and are electric-ready. Suburban Propane has been serving customers for 94 years and is the nation's third-largest propane retailer with operations in 42 states. In Maryland, Suburban Propane distributes propane to more than 55,000 customers, and we employ 158 people at 18 locations.

Suburban Propane supports the legislation's goal of achieving net-zero greenhouse gas emissions. However, requiring electricity over all other available energy sources does not achieve these goals. In fact, requiring electricity over traditional propane, renewable propane, and renewable dimethyl ether ("rDME") will lead to an increase in greenhouse gas emissions in the State because electricity is not the energy source with the lowest carbon intensity. Therefore, we ask the Committee to amend the bill to promote a technology-neutral approach encouraging the adoption of the lowest carbon intensity energy source to achieve the State's goal of reducing greenhouse gas emissions.

As currently drafted, House Bill 831 prioritizes electricity under the inaccurate assumption that electricity is the energy source with the lowest carbon intensity. Mandating that all new residential and commercial buildings use only electricity ignores readily available lower-carbon and carbon-negative energy sources that can accelerate Maryland's path towards net-zero emissions. Using data from the U.S. Energy

Information Administration and the procedure employed by the California Air Resources Board ("CARB") to calculate emissions from electricity generation, the carbon intensity ("CI") score of Maryland's electric grid is 112.9.[1] Meanwhile, CARB has calculated the CI score of traditional propane to be 83.19, and renewable propane has a range of CI scores from 43.5 and 20.5, making both fuels substantially less carbon intensive than grid electricity.[2] The carbon intensity of rDME has not yet been established, but our analysis indicates that the CI score could be negative. Requiring only electric energy will not achieve the State's goal of reaching net-zero emissions because it requires the use of an energy source that has a higher carbon intensity then other readily available energy sources.

We encourage the Committee to focus on driving down greenhouse gas emissions by taking a technology-neutral approach that requires low carbon and carbon negative energy sources. The General Assembly should develop and enact legislation to establish a clean fuel standard for building emissions, similar to low carbon fuel programs for transportation in California, Oregon, and Washington. The regulatory framework and technical details of establishing a CI score are well tested and have led to a 10.9 percent reduction in transportation sector emissions from 2006 in California alone.[3]

We urge the Committee to amend House Bill 831 by adopting a technology-neutral approach that requires that new residential and commercial buildings to use low-carbon, carbon-neutral, or carbon-negative energy sources. We would appreciate the opportunity to discuss with you how such energy sources can play a role in lowering Maryland's carbon footprint. Thank you for your consideration.

Sincerely,

/s/ M. Douglas Dagan

M. Douglas Dagan
Vice President, Strategic Initiatives –
Renewable Energy
Suburban Propane Partners, L.P.

[1] See https://propane.com/research-development/emissions/decarbonization-of-md-hd-vehicles-with-propane/ (accessed February 21, 2022)
[2] See https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities (accessed February 21, 2022)
[3] See https://ww2.arb.ca.gov/applications/greenhouse-gas-emission-inventory-0 (accessed February 21, 2022)

Johns Hopkins Testimony - HB831 - Reducing Greenho

Uploaded by: Jeanne Hitchcock

Position: FWA

JOHNS HOPKINS
UNIVERSITY & MEDICINE
Government and Community Affairs

HB831
Support with Amendments

TO: The Honorable Kumar Barve, Chair
House Environment and Transportation Committee

FROM: Jeanne Hitchcock, Interim Vice President
Government and Community Affairs, Johns Hopkins University and Medicine

Annie Coble
Assistant Director, State Affairs, Johns Hopkins University and Medicine

DATE: February 25, 2022

Johns Hopkins is very supportive of the State's efforts to reduce greenhouse gas emissions as a method for fighting climate change and would be supportive of HB831, provided the amendments described in this testimony were incorporated into the legislation.

Johns Hopkins owns and operates many buildings (over 20 million square feet in total) throughout the State that would be required to comply with the building emissions standards established in this bill. While Johns Hopkins supports the bill's intent and a majority of its strategies, we believe there are opportunities to meet the outlined objectives of the legislation while providing responsible compliance pathways for different categories of building owners and operators to achieve the desired results, and be easier for industries to implement.

Requested Amendment: Replace Emissions Requirement with Building Energy Performance Standards (BEPS)
Johns Hopkins recognizes that interim targets are important to holding building owners accountable and achieving long-term net zero emissions goals. However, other states and localities with similar climate change legislation, have addressed climate mitigation in the building sector by setting escalating performance efficiency requirements by building types rather than requiring an across-the-board greenhouse gas emissions reduction as written in the current bill. BEPS would establish performance thresholds, such as Energy Use Intensity (EUI) or related standards, for respective building types through which building owners would be required to increase their efficiency incrementally towards an overall net zero target. Using a BEPS policy, energy and/or emissions efficiency requirements for a traditional office building would not be the same as the required performance expectations for labs, residence halls, health care facilities, etc., as these buildings vary significantly in terms of their equipment, operations, and utility use. Additionally, these policies are effective in requiring building owners to improve their overall efficiency and reduce greenhouse gas emissions, while allowing for greater flexibility in the types of strategies employed, including electrification as highlighted in the current bill, but also other methods such as energy efficiency. We believe this approach will support the intent of the bill while giving greater

flexibility to building owners and operators, so they can plan accordingly and have more options in meeting the set 2030, 2035, and 2040 targets.

Additionally, owners such as Johns Hopkins, have a number of older research facilities that due to their age and use, will be challenged to meet established BEPS standards within a short-time frame. It is likely that an alternate compliance path for these buildings will be required, one that allows an institution to demonstrate meaningful steps to improve efficiency and steps to net zero, while acknowledging the limits on making a 40-year-old, energy-intensive lab building significantly reduce its emissions in a short period of time.

Requested Amendment: Compliance Pathways for District Energy System Operators
Johns Hopkins has invested significantly in developing district energy systems that ensure critical reliability and redundancy for healthcare facilities, laboratories, offices and classrooms through the delivery of heating and power. While there is a variance for buildings whose electrification costs would exceed the social cost of carbon, the bill does not offer any additional variance pathways for building owners to fully study and propose solutions for the decarbonization of large district energy systems. District energy systems require a longer time horizon to decarbonize, new buildings cannot easily be constructed separately from an existing district energy loop, and it is more effective to allow for planning at the campus level than taking a building-by-building approach. An amendment that allows district energy system operators to submit a campus-level plan to achieve net zero targets is requested.

Requested Amendment: Inclusion of Indirect Emissions
Moreover, for institutions with central plants and district energy systems, it is unclear how individual buildings will be required to report their greenhouse gas emissions. Currently, using common approaches in EnergyStar Portfolio Manager, campuses can report a large number of buildings as a single entity encapsulating a central plant as direct emissions or as a set of individual buildings whereby emissions from a central plant are considered indirect and would not be counted under the current legislation. Additionally, by excluding greenhouse gas emissions from electricity, the bill does not incentivize institutions to address onsite or offsite renewable energy solutions. It would be helpful if the reporting requirements called for in the bill included all Scope 1 and 2 greenhouse gas emissions sources and the subsequent targets took all scopes into account including incentives for sourcing renewable electricity, improving energy efficiency and decarbonizing heating.

Requested Amendment: Establish Baseline Year for Existing Buildings
While the current bill requires owners to report greenhouse gas emissions for all covered buildings by 2025, it does not specify a baseline year for reporting of emissions reductions. For owners of existing buildings that have been tracking emissions and investing in energy efficiency improvements over the course of many years, there should be a set year by which baseline reporting would be allowed.

Requested Amendment: Reliability and Redundancy Power Backup Standards
Many of the facilities that Johns Hopkins operates, including hospitals, animal care facilities, and research laboratories must be protected from power supply interruptions in order to

operate 24/7 and protect patient care, research, and animal welfare. These facilities often require backup generation capacity in the case of power outages, which are currently reliant on fossil fuels. Although Johns Hopkins is committed to limiting the use of fossil fuels on our campuses in the coming years, this will require a phased in approach that could not be met through the immediate electrification of new facilities and would not be in compliance with federal standards for reliability and redundancy of power systems. As written, the bill does not provide for this important contingent need.

Requested Amendment: Initial Exemption for Hospitals per the Maryland Hospital Association
Johns Hopkins is also supportive of the amendment we expect will be suggested by the Maryland Hospital Association to exempt hospitals from the definition of covered buildings in this bill for a period of one year during which time a workgroup will be established and to establish a workgroup that will make recommendations on the most appropriate path to compliance by hospitals to the State's goals to reduce greenhouse gases emissions.

In summary, Johns Hopkins is appreciative of the sponsor and legislators who have introduced this bill as a means to address the urgency of climate change both locally and globally. Our institution is deeply committed to the important goal of reducing greenhouse gas emissions and fighting climate change and requests considerations of the issues raised herein to ensure this legislation works for building owners of all types, especially those with complex healthcare and research facilities and those connected through district energy systems. We respectfully request that there would be more time to work with the State to develop standards that meet all the needs of building owners under this bill and look forward to collaborating towards impactful legislative outcomes.

VE Testimony HB 831.pdf
Uploaded by: John Fiastro
Position: FWA

House Bill 831

Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Environment and Transportation Committee

February 25, 2022

Position: FAVORABLE, with amendments

Proposed Amendment

1. Exemption for new building water and space heating demand that allows for district energy hook-up

Vicinity Energy is supportive of HB 831 as it further aligns the state with our own greenhouse gas (GHG) reduction goals. However, we believe the requirement that new buildings meet all water and space heating demand without the use of fossil fuels, could have the unintended consequence of prohibiting new buildings from connecting to our district energy network. This unintended consequence would be detrimental to Vicinity's growth in Baltimore as we support a large and growing medical research and life science sector for which steam is essential for both reliability and sterilization.

As explained herein, Vicinity's district energy system is critical to helping the state achieve its GHG reduction goals. While our customer base consists of the vital institutions with mission-critical energy requirements, the environmental benefits extend to all corners of Baltimore, including the environmental justice neighborhoods that are disproportionately affected by fossil fuel pollution. Renewables and electrification play a key role in decarbonization; however, by not providing an exemption for new buildings connecting to the district energy system, this legislation would potentially take an important decarbonization tool out of the state's toolbox.

Vicinity Energy Company Profile

With 19 district energy systems in 12 major cities, Vicinity Energy is the largest provider of district energy solutions in North America. Vicinity produces and distributes steam, hot water, and chilled water directly through its vast underground network, eliminating the need for boiler and chiller plants in individual buildings, improving overall efficiency, lowering carbon footprints, and increasing reliability. In 2020, Vicinity launched a Clean

Energy Future roadmap and is committed to reaching net zero carbon emissions across all operations by 2050.

Vicinity Energy in Baltimore

In downtown Baltimore, Vicinity Energy serves over 80 million square feet of commercial space, including Hospitals (UMMC and Mercy), the University of Maryland Baltimore campus, City, State and Federal office buildings, the Housing Authority, Ravens Stadium and Oriole Park at Camden Yards, the Baltimore Convention Center, and numerous hotels, office, retail, and residential buildings. Baltimore's most vital infrastructure benefits from our 99.99% reliability and enhanced resiliency to natural disasters. And our steam, which is more carbon-efficient than onsite fossil fuel burning boilers, will continue to attract more medical research and life science sector jobs for which high pressure steam is essential.

Through a network of over 28 miles of underground pipes, Vicinity distributes reliable steam, hot water, and chilled water to over 245 customers in the central district and Harbor East while lowering the city's GHG emissions by nearly 30,000 tons annually compared to conventional means of heating and cooling buildings. This is the equivalent of removing almost 11,000 cars from the roads every year. District energy is an innovative and resilient energy solution that involves the production of thermal energy at a central plant, eliminating the need to install or manage onsite boilers and chillers. District energy also offers our customers a green energy alternative. Over 50% of the steam distributed throughout the Baltimore system is already derived from renewable energy, and Vicinity is on track to achieve net zero carbon emissions by 2050. Including district energy in a solution for new construction will have the added benefit of easily reducing GHG emissions for all buildings connected to our district energy system as Vicinity's climate goals are met.

Vicinity also supplies many buildings in the downtown Baltimore business corridor with reliable central chilled water services – offering a cost-effective alternative to replacing, operating, and maintaining in-house cooling equipment. As one of the largest ice thermal storage systems in the U.S., Vicinity's innovate system uses ice to augment electrical chilling capacity during the day. By reducing electricity during peak demand, Vicinity takes pressure of the electrical grid when power usage is at its highest.

In addition to reducing Baltimore's carbon footprint, with district energy, individual buildings do not require onsite boilers or chillers – freeing up space for building amenities and eliminating the risk of onsite combustion. Our interconnected central energy facilities have built in redundancy, back-up generation and multiple water and fuel sources.

Conclusion

In closing, Vicinity thanks the committee for holding this hearing and demonstrating leadership to reduce statewide GHG emissions. We share your commitment to adopting sensible solutions to address climate change and achieve net zero carbon emissions. With the inclusion of an exception for new buildings that connect to a district energy system, Vicinity supports HB 831.

Sincerely,

Mathew Ware

Vice President, Operations

HB0831 - Reducing Greenhouse Gas Emissions - Comme
Uploaded by: Joseph Jakuta
Position: FWA

Committee: Environment and Transportation
Testimony on: HB 831 - "Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings"
Organization: Climate Parents of Prince George's
Person Submitting: Joseph Jakuta, Lead Volunteer
Position: Favorable, with Amendments
Hearing Date: February 25, 2022

CLIMATE PARENTS

Dear Mr. Chairman and Committee Members:

Thank you for considering our testimony in support of HB 831 - "Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings." Climate Parents is a campaign to reduce climate change causing pollution in our schools and our group is active in Prince George's County. In particular, we are currently working directly with Prince George's County Public Schools (PGCPS) technical staff and other advocates to develop a Climate Action Plan for PGCPS

The 2018 Intergovernmental Panel on Climate Change (IPCC) Special Report found that limiting global warming to 1.5°C above pre-industrial levels by 2100 would require human-caused emissions of carbon dioxide (CO_2) to fall by about 45 percent from 2010 levels by 2030 and reach 'net zero' by 2050 as a planet. Science gives us the end date for burning fossil fuels and as blessed as we are in Mayland we must lead, we must get there sooner.

We are generally supportive of the efforts to implement Building Emissions Standards. This type of program is being shown to be effective in the District of Columbia and a program has been adopted in Montgomery County. However, we are greatly concerned over an exemption of governmental buildings, and specifically schools, from being required to meet building performance standards. There are 1428 schools in the state of Maryland and nearly every one of these is both powered using fossil fuels and less than efficient. This costs the taxpayers money in terms of operating costs, produces harmful oxides of nitrogen emissions that impact student's learning environment and health, and most germain to this legislation, emits greenhouse gasses.

Of course you are hearing about how schools cannot be retrofitted, but the evidence when it is tried shows the opposite. Recently PGCPS completed deep retrofits of Glenarden Woods Elementary School and Greenbelt Middle School. The heating and cooling systems in these buildings were replaced with geothermal heat pumps, solar panels were installed on these buildings, and they were made more efficient and healthy. Why was this path taken – because it made the most economic sense.

Besides the specific amendment of including governmental buildings, including schools, as "covered buildings", we support the Climate Partners' Priority Amendments for HB 831 that are attached.

We must get to net zero. We are at an inflection point when it comes to our children's future. We know that time is coming to an end on our test and we need to stop passing the problems of burning fossil fuels on to future generations. We implore you to enact this legislation, with amendments to include governmental buildings, that will require holistic changes in the way we consume energy in Maryland and to make our schools resilient for years to come, for our children's sake.

We encourage a **FAVORABLE** report, with **AMENDMENT**, for this important legislation.

<u>Attachment - Climate Partners' Priority Amendments</u>

1. **Strengthen provisions related to Building Emissions Standard**

HB 831 directs MDE to create a Building Emissions Standard which will require reduced emissions from commercial and residential buildings over 25,000 sq ft. This is a critical policy Maryland must enact to reduce pollution from existing buildings and move towards net zero. Colorado, Washington State, Washington DC already have similar programs, and Montgomery County is currently implementing a Building Energy Performance Standard (BEPS) program. There are some critical amendments that should be added to ensure the policy achieves its intended goal.

- **Clarify that the policy should establish targets to "energy use intensity" which includes reductions on both electricity usage AND onsite fossil fuel use for heating & cooking.**
  - As written, the bill appears to target just onsite emissions, which means the burning of fossil fuels for heating and cooking, also known as "scope 1". It should also include reductions in electricity usage.
  - Improved building energy efficiency will reduce overall electricity demand (helping grid transition) and can result in smaller sized heating and cooling systems.
  - Energy efficiency (e.g., site electricity use) includes: maintaining and retro-commissioning building energy systems; implementing HVAC scheduling and other smart control systems; and making building shell and other energy efficiency improvements.
  - This aligns with the recommendations of the MD Commission on Climate Change's Building Energy Transition Plan (see p. 223).

- **Add an interim target of at least 40% by 2035.** We want to ensure that annual reductions are spread out (SB 528 on page 47, lines 5-14) This will also align the numerical goals of HB 831 with SB 528. Interim goals provide helpful guidance to MDE.

2. **The new fossil-free construction code to new buildings should apply to all new buildings, and end of life system retrofits.**

HB831 takes an important step of requiring that Maryland Dept of Labor, which establishes MD building codes, specify that new commercial and residential buildings must be built to use electricity (not fossil fuels) for heating. Additionally, require that the majority of space heating and service water heating use heat pumps. The current language limits the new code to "commercial and residential".

The new construction code should apply to ALL new buildings - Commercial, residential, and government buildings. (page 8, starting line 8)

- Our public buildings, including our schools, should be models for the rest of society, and should be stronger, or at a minimum comparable, to other building standards.
- It is our understanding that HB 806 addresses construction standards for new public buildings, potentially based on levels for state funding. We support stronger goals for state buildings, but the new construction codes laid out in HB 806 should apply to all buildings, regardless of level of state funding.
- If we don't apply the all-electric standard to all buildings, every time we build a building that is not all-electric, it is one more building we will have to retrofit. Retrofitting is far more expensive than building the all-electric in the first place.
- With a state surplus and plans to spend significant money on schools through the Built to Learn funding, this is the ideal time to pay-it-forward. Building schools with fossil fuel infrastructure will require far more funds in the future to operate and eventually retrofit.

3. **Add "Energy Efficiency" to new construction Commercial code requirements**

An increasingly popular approach to this is for a city or state to adopt a "stretch code" which adds provisions on top of the standard code to achieve additional energy efficiency improvements. Washington State, City of Seattle, California, New York City, as well as Montgomery County and Baltimore City, are just a few of the jurisdictions taking this approach. The Maryland General Assembly notes that "energy efficiency is among the least expensive ways to meet the growing electricity demands of the State" and the American Council for an Energy Efficiency Economy reports that "Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050"

We recommend the following targets for all New Construction Commercial buildings, public and private. State Funded Buildings will lead the way by 2 years. Note that this is a percent target for modeled energy use reductions. These targets have been developed from the AIA 2030 challenge and the originally stated International Code Council energy reduction targets. The International Code Council publishes the International Energy Conservation Code, which is already behind targets, two code cycles after targets were set.

- ***For public buildings, funded at least 25% by State funds***
    - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2023 and Dec 31 2024
    - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
    - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
- ***For all other new covered buildings***
    - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
    - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
    - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2029 and Dec 31 2030

Additionally, there should be energy efficiency performance targets for new "major renovations".

- Targets
    - A 40% reduction in the building's average annual energy use; or
    - A 20% reduction in modeled energy use consumption over the current Energy Code

Additions to Ensure that HB831 is Equivalent to SB528

On page 9, line 12 and page 7, line 27, SB528 creates a MCEC Climate Catalytic Capital Fund (C3). Add that language in a new section in HB 831. *A Climate Catalytic Capital Fund is an innovative funding strategy envisioned in SB 528 which will be important to support many of the changes in this bill. We recommend these concepts by incorporating into this bill or other appropriate legislation.*

HB 831 - Sierra Club - SWA 2.25.2022.pdf
Uploaded by: Josh Tulkin
Position: FWA

P.O. Box 278
Riverdale, MD 20738

Committee: **Environment and Transportation**

Testimony on: **HB 831 Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings**

Position: **Favorable with amendments**

Hearing Date: **February 25, 2022**

The Maryland Chapter of the Sierra Club urges a favorable report for HB 831, which charts a path for dramatically reducing greenhouse gas pollution from privately owned commercial and residential buildings in Maryland, while protecting low and income renters. We recommend certain amendments included at the end of the testimony.

HB 831 calls for newly constructed and substantially renovated commercial and residential buildings to operate without direct use of fossil fuels starting in 2024. They must also be electric ready for solar and EV chargers. It also charts a path for existing large commercial and residential buildings to reduce their direct emissions of greenhouse gases 20% by 2030 and 100% by 2040 by implementing Building Emissions Performance Standards (BEPS). Protections for low-income renters set a goal for no-cost holistic retrofits including heat pumps and weatherization by 2030.

Reducing greenhouse gas pollution is critical to limiting the damage from the climate crisis. The Maryland Commission on Climate Change has recommended a 50% reduction in greenhouse gas pollution by 2030 and net zero pollution by 2045. Residential, commercial and industrial consumption of fracked gas in Maryland generates 13% of all greenhouse gas emissions (2017 Maryland GHG Inventory). Including the emissions generated from producing the electricity used in Maryland buildings, approximately 40% of greenhouse gases come from buildings.

The Maryland Commission on Climate Change recommends that we reduce greenhouse gas pollution by electrifying our buildings. Among their 2021 recommendations were: adopting an all-electric building code; encouraging fuel switching to electric water and space heating; beneficial electrification (replacement of fossil fuel heating with heat pump or other electrical heating); targeting 50% of heating ventilation, air conditioning and hot water heater sales to be heat pumps by 2025 and 95% by 2030; creating building emissions performance standards; developing utility transition plans; and goals for electrification of low and moderate income households. Many of these goals are partially implemented through HB 831.

Protections for low and moderate income households are critical as we transition off fossil fuels. As families and businesses who can afford to shift to low carbon forms of home and water heating, low and moderate income customers will be left with the bill. According to the E3

Building Decarbonization Study for the Maryland Climate Commission (page 31), residential fracked gas rates could quadruple by 2040. To assure that low income households achieve the benefits of electrification, HB 831 sets a goal to provide holistic retrofits, weatherization measures and heat pump installations with no up-front cost by 2030. We support these provisions and other amendments included at the end of this testimony to assure that there are sufficient resources to successfully achieve these goals. In addition, we recommend provisions to protect low-income renters from rent increases that result from investments in greenhouse gas reductions and energy efficiency improvements.

<u>Provisions to Reduce Greenhouse Gas Emissions in Existing Large Commercial and Residential Buildings</u>

The Sierra Club Maryland supports the Building Emissions Performance Standards (BEPS), for existing buildings, under proposed 2-1601. These call for a 20% reduction in direct emissions of greenhouse gases by 2030 and net zero direct emissions by 2040 for commercial and residential buildings of over 25,000 gross square feet. The bill calls for these buildings to start reporting their direct emissions from burning fossil fuels in 2025.

The exact process for meeting the targets set out in HB 831 will depend in part on the work of the Maryland Department of the Environment and the Building Energy Transition Task Force. In other jurisdictions (Washington, DC, Montgomery County, MD (prospectively), St. Louis, New York and Boston) the process starts out with a baseline, where emissions are measured for each type of building. Because the baseline is needed to measure the improvements in greenhouse gas or energy emissions, we propose that the baseline years be 2023 and/or 2024 (instead of having reporting begin in 2025 in H831), in order to give buildings enough time to achieve a 20% improvement by 2030. An emissions standard is then set for each type of building either in energy units or greenhouse gases. Hospitals, for example, have much higher baseline emissions per square foot than multi-family housing.

In the case of Washington, DC and Montgomery County, a pathway is then laid out, typically in 4 or 5 year compliance periods, for buildings to reach the target emissions for each type of buildings, starting with each individual building's initial emissions rate. Other programs, including New York's, set out a greenhouse gas emission targets per square foot by building type, showing improvements for each compliance period. Consistent with these plans, we propose adding an interim reduction of 40% in direct emissions in 2035.

We support the provisions of HB831 that offer alternative compliance approaches by paying a penalty equal to the social cost of carbon emitted. The current bill also calls for all large commercial and residential buildings, including those paying alternative compliance payments, to make improvements needed to be ready for solar energy and electric vehicles.

The Sierra Club supports the proposed work of the Building Energy Transition Task Force to recommend approaches to finance the improvements needed for building owners to achieve the bills target reductions in direct production of greenhouse gases. We agree that on-bill financing should be explored. On-bill financing, which may require additional legislation, would encourage owners of rental properties to improve the efficiency of the fossil fuel burning appliances in their buildings. Because owners of commercial and multifamily rental properties normally do not pay the utility bills on the property; therefore they are reluctant to invest in more efficient electric heat and water heating equipment. By financing the improvements through on-bill financing (as well as other incentives), the electrification investments are likely to happen more quickly. Another approach would re-allocate EmPOWER funds to convert low-income households to heat pumps. In 2020 the vast bulk of residential EmPOWER funds went to lighting and behavioral efforts and close to one-third of the budgeted residential funds were unspent. These could supply $46 million to $150 million annually.

HB 831 will be effective at reducing greenhouse gas emissions from directly burning fossil fuels in large residential and commercial buildings, but these direct emissions represent only about one-third of the emissions in buildings. 13% of total greenhouse gas emissions in Maryland come from direct combustion of fossil fuels, but another 27% of emissions come from the use of electricity in buildings. To reduce these emissions strong efficiency targets are also needed including improve electricity consumption as proposed in SB 528. A proposed amendment, included at the end of the testimony calls for standards for Energy Use Intensity (EUI) in large residential and commercial buildings.

<u>Provisions to Reduce Greenhouse Gas Emissions in New and Substantially Renovated Housing and Commercial Buildings:</u>

The Sierra Club of Maryland supports the provisions of this bill to eliminate the combustion of fossil fuels in newly constructed housing and commercial buildings effective 2024. It also requires that new buildings be net zero ready, with electric service and wiring for solar, electric vehicle chargers and grid integration. While a variance of these standards may be granted if an all-electric building is more expensive, including the social cost of carbon for fossil fuel to be consumed, our research suggests that this is rarely the case. We also propose energy efficiency targets, adopted by 10 other states for all electric buildings built under the provisions of this bill. Specific language is included in the amendments at the end of this testimony.

<u>Impact on the Electric Generation and Distribution Grid:</u>

Opponents of HB 831 and similar bills claim that more study is required before implementing electrification. These opponents argue that the electric grid cannot handle electrification. A Pepco study of its entire service territory by consultant Brattle Group last year came to a different conclusion. It showed the grid would need to grow 1.4% to 1.7% over the next 30 years (to 2050) to handle electrifying all new and existing buildings AND all transportation energy. (The study was sponsored by Pepco and was performed for a District of Columbia regulatory proceeding but based its load projections on the entire Pepco service territory.) If this were compressed to full electrification by 2040, the grid would need to grow 2.1% per year. In the early years limited or no growth would be needed as the installation of heat pumps shifts the peak electric load from Summer to Winter. Until Winter becomes the peak, additional capacity from electrification will not be required. The Brattle report offered a handy retrospective that at some points in the grid history, the growth rate has approached 10%. This can be done now, at a low cost to the consumer, if properly directed.

Proposed Amendments:

Baseline Reporting: Section 2-1602B establishes a 2025 baseline for the emissions reductions under HB831. The baseline may be used to measure the greenhouse gas reductions included in the bill. We recommend that the baseline be for 2023 or 2023 and 2024 in order to provide building owners and managers sufficient time to achieve the targeted 2030 goal of 20% reduction in direct emissions. The language in 1602-2(B)(1)(I) on page 2, line 24 should be removed and the following should be included:

(I) 2023 and 2024 LEVELS; OR

and in 1602-2 on page 3 line 4, the date "2025" shall be changed to "2023".

Interim BEPS Targets: We recommend a 2035 interim target of: a 40% reduction in direct building emissions on or before January 1, 2035. This should be inserted after 2-1602 (B) (1).

Most of the building emissions plans that have published targets operate in 5 year periods with progressively tighter targets each 5 years. With this addition, the bill would target a 20% reduction in 2030; a 40% reduction in 2035 and net zero in 2040.

Definition of Building: HB 831 BEPS defines a Covered Building as a commercial or multifamily residential building in the state of over 25,000 gross square feet excluding the parking garage area. The bill excludes historic property under state, federal or local law. Other House bills cover schools and government buildings. We recommend modifying the definition of building to cover "all buildings of 25,000 gross square feet excluding parking garage area and also excluding any buildings owned by or with 25% or greater financing by a local, county, or state government." It should continue to exclude historic property. The prior definition would have excluded industrial buildings and buildings owned by non-profits which the Sierra Club believes should be covered by this legislation.

Energy Efficiency for Newly Constructed Commercial and Residential Buildings:

To minimize greenhouse gas emissions from electricity consumption, it is critical that newly constructed covered buildings be energy efficient. After 2-1602(B)(2) on page 2, line 29.

For covered buildings

- A 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2027

- A 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received after December 31, 2027.

Energy Efficiency Standards for Renovated Buildings:

"Major Renovation" means a renovation project: For which the total projected cost exceeds 50% of the assessed value of the existing building; or Involving a change of use, if the change involves the application of different requirements of the standards.

G. Except as provided in subsection (_) of this section, if a covered building is undergoing a major renovation, the building shall be renovated to achieve:

A 40% reduction in the building's average annual energy use; or

A 20% reduction in modeled energy use consumption over the current Energy Code.

Electricity Use for Existing Commercial and Multi-Family Buildings Over 25,000 Gross Square Feet:

To achieve our climate goals, it is critical that buildings increase energy efficiency (measured as kWh/square foot) in the use of electricity, which accounts for about two-thirds of the greenhouse gases generated by buildings. To take account of this, after the Building Energy Performance Standards, Section 2-1602(B)(2), the following language should be inserted:

The Building Energy Transition Task Force shall develop standards for improvement in Energy Use Intensity of 20% in 2030; 30% in 2035; and 40% in 2040.

Provisions for Low Income Multi-Family: The Building Energy Transition Task Force needs to identify sources of funding to supply heat pumps to low-income households. Low-income households and renters have the least resources available to electrify their homes. One contributing option would be to re-allocate EmPOWER residential funds from lighting and behavioral efficiency efforts to focus on subsidizing heat pumps for low-income residents. In addition, unused EmPOWER funds could be used for this purpose. This would require legislation to allow fuel switching from gas heat and hot water to electric heat pumps.

We also recommend that Section 2-1603B add a tenant representative to the Building Energy Transition Task Force.

Christopher T. Stix
Clean Energy Team
Stixchris@gmail.com

Josh Tulkin
Chapter Director
Josh.Tulkin@MDSierra.org

HB 831_CBF SUPPORT WITH AMENDMENTS.pdf
Uploaded by: Joshua Kurtz
Position: FWA

CHESAPEAKE BAY FOUNDATION

Environmental Protection and Restoration
Environmental Education

House Bill 831

Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Date:	February 25, 2022	Position:	Support with Amendments
To:	Environment and Transportation	From:	Josh Kurtz, MD Executive Director

Chesapeake Bay Foundation (CBF) **SUPPORTS House Bill 831 WITH AMENDMENTS.** This bill reduces direct greenhouse gas emissions from commercial and residential buildings by requiring the adoption of an all-electric code for water and space heaters for new construction, requiring the development of building emission standards for covered buildings resulting in net zero emissions from buildings by 2040, and creating a building energy transition implementation task force to plan for reaching the legislated goals.

Climate change has immediate and drastic impacts on the Chesapeake Bay, many of which are already being witnessed. Warmer climates translate into warmer waters, which decrease dissolved oxygen, exacerbating the Bay's fish-killing "dead zones" and contributing to algal blooms. Rising water temperatures stress fish and reducing the populations from the Bay's iconic striped bass to brook trout. Other temperature-sensitive species such as eel grass, a critical habitat plant, are at risk. Atmospheric deposition of nitrogen is the highest nitrogen input load in the Chesapeake Bay. Nitrogen pollution feeds algal blooms that block sunlight to underwater grasses and suck up life supporting oxygen when they die and decompose. The principal source of oxidized nitrogen, also called NOx, is produced by machines or processes that are powered by gas, coal or oil, like the heating of a building.[1]

Requiring all newly constructed buildings to heating and water demands without fossil fuels will not only reduces fossil fuel use but also reduces costs to Maryland residents.
Direct use of fossil fuels, primarily for space and water heating, account for 13% of statewide emissions since 2017[2]. By requiring all newly constructed buildings to use electric heat pumps we will drastically reduce those greenhouse gas emissions. The costs associated with new construction of electrified homes is cheaper than homes constructed with gas or other fossil fuel heating systems[3]. The annual costs of maintaining electric heat pumps is also cheaper or comparable depending on the system – which will save Maryland home owners and renters money each year.

CBF urges the Committee's FAVORABLE report on HB 831 WITH AMENDMENTS. Please see the Maryland Climate Partners memo for proposed amendments. For more information, please contact Robin Jessica Clark, Maryland Staff Attorney, at rclark@cbf.org and 443.995.8753

[1] Chesapeake Bay Program, *Air Pollution: What airborne pollutants are affecting Bay health?*, last visited 2.22.2021.
[2] Maryland Commission on Climate Change. Building Energy Transition Plan, November 2021.
[3] *Ibid.*

Maryland Office ▪ Philip Merrill Environmental Center ▪ 6 Herndon Avenue ▪ Annapolis ▪ Maryland ▪ 21403
Phone (410) 268-8816 ▪ Fax (410) 280-3513

HB831_ Maryland LCV - Support with Amendments.pdf
Uploaded by: Kim Coble
Position: FWA

MARYLAND
LEAGUE OF
CONSERVATION
VOTERS

February 23, 2022

SUPPORT with AMENDMENTS: HB831
Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Mr. Chairman and Members of the Committee:

Maryland LCV supports HB 831, and we thank Vice Chairman Stein for his leadership on the issues presented here. We are grateful for the suite of legislation before the House to make substantive reductions to our state greenhouse gas emissions.

The proposed legislation would require new commercial and residential buildings with a gross floor area greater than 25,000 sq. ft. to be built to a modified all-electric standard (water and space heating only). It would also specify reductions in direct emissions (those produced in heating and cooling the building) for existing buildings starting at a 20% reduction by 2030 and net zero by 2040 to be monitored under new Building Emissions Standards. Additionally, a Building Energy Transition Implementation Task Force will be established to help building owners manage the upfront costs of the transition to all-electric and to develop a plan to retrofit existing buildings.

We also agree with the amendments being submitted by Climate Partners, and would like to bring special attention to the following amendments to improve the bill and align components we supported in the Climate Solutions Now Act (SB 528) in the Senate:

Climate Catalytic Capital Fund

- SB 528, The Climate Solutions Now Act, creates a MCEC Climate Catalytic Capital Fund (C3). We recommend adding the C3 to HB 831 and we urge an increase in the amount of funds allocated to this initiative in order to ensure that it is sufficient to make a substantive contribution to the programs funded by the statewide green banks. Additionally, in this article, we ask that other statewide green banks that support funding projects that serve low and moderate income communities be eligible for receiving these funds. Most importantly, we strongly urge that this program follow the provisions of Justice 40 and require 40% of the Climate Catalytic Capital Fund investments be directed to overburdened communities as identified above (and in HB 1033).

Low Income Household Retrofits

- On page 2, line 16-19, the legislation codifies the recommendation of the Maryland Climate Commission that we achieve 100% of holistic retrofits for low-income households by 2030 with little or no cost. We recommend a task force to provide input on this goal, with underserved communities represented (underserved as defined in HB 1330), as well as relevant non-profits to study the issue and make recommendations. The task force should make recommendations to MDE and MGA; require MDE to implement a plan to achieve the goal.

And finally, we recommend adding “energy efficiency” to new construction code requirements. The Maryland General Assembly notes that “energy efficiency is among the least expensive ways to meet the growing electricity demands of the State” and the American Council for an Energy Efficiency Economy reports that “Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050.”

We respectfully offer and strongly advocate for the inclusion of these clarifying and strengthening amendments and Maryland LCV strongly urges a favorable report on this important bill.

HB831-Commercial Res Bldgs-E&T-TPMEC-favwithamend.
Uploaded by: Laurie McGilvray
Position: FWA

Environment Committee

Committee: Environment and Transportation
Testimony on: HB831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings
Organization: Takoma Park Mobilization Environment Committee
Submitting: Laurie McGilvray, Co-Chair
Position: Favorable
Hearing Date: February 25, 2022

Dear Chair and Committee Members:

We are pleased to submit testimony favorable with amendments for HB831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings. The Takoma Park Mobilization Environment Committee is a grassroots organization focused on State and County level climate action. We strongly urge you to vote favorably on HB831 and to include the suggested amendments described below.

HB831 would require all new commercial and residential buildings to be constructed to a modified all-electric standard for water and space heating. It also would require the development of Building Emissions Standards for greenhouse gas emissions from large commercial and residential buildings (> 25,000 sq. ft.) with a plan to achieve net zero emissions by 2040. The bill includes a Building Energy Transition Implementation Task Force to help plan for building transition to all-electric and retrofitting existing buildings, including financing and incentives to cover costs.

Buildings Must be Part of the Climate Solution

Buildings emit 40% of Maryland's greenhouse gases (13% of which are direct emissions from the combustion of gas, oil, and propane) and account for 90% of Maryland's electricity use. First, we must stop digging the climate pollution and ratepayer cost hole deeper and stop constructing new buildings heated with fossil fuels. In fact, it now costs the same or less to construct all-electric buildings. The cost of operating electric buildings will only get better in the future, because the cost of gas is projected to rise 2-5 times in the coming years as fixed utility costs are spread among fewer and fewer ratepayers. In fact, the three gas utilities (BGE, Washington Gas and Columbia Gas) project the cost of STRIDE-related surcharges for gas infrastructure replacement to rise from approximately $150 million annually to $450 million annually in 2044. These are exorbitant surcharges gas customers – like homeowners and businesses – will be expected to pay. These costs will rise just as Maryland should be getting off gas entirely to meet its climate goals, and this does not even include the climate and human health impacts of methane leaks from gas infrastructure.

Second, we must put existing large commercial and residential buildings on an "energy diet" by reducing emissions and improving energy efficiency. The best kilowatt hour is one that doesn't get used. Building Emissions Standards must require monitoring and reporting so buildings owners know how much energy they are using. As energy use is reduced, building owners save money on utility bills and buildings are healthier for occupants and residents.

Third, energy efficiency is a gift to the electric grid. Energy efficiency retrofits in existing buildings and construction of energy efficient new buildings will help lower electricity demand and allow for a smoother transition to electrification of both buildings and the transportation system. In fact, in an August 27, 2021 letter from Pepco to the DC Public Service Commission they noted that, "Moreover, EE [energy efficiency] and load flexibility can significantly reduce future increases in peak demand and can be scaled up as electrification initiatives gain traction. Indeed, with an achievable portfolio of EE and load flexibility measures, the annual peak demand growth rate can be reduced from a projected 1.4% down to 0.9% between 2021 and 2050. Finally, heating electrification is expected to shift the Pepco DC system peak to the winter season, which is currently lower than its summer peak demand. As a result, heating load will have "room to grow" before it begins to contribute to new capacity needs."

HB831 Can be Strengthened

While HB831 can achieve much of the elements described above for new and existing buildings, we recommend amendments to ensure the bill addresses all of the elements for a robust climate solution.

1. **Energy Efficiency** – the bill appears to only include direct emissions from burning fossil fuels onsite (e.g., space and water heating, clothes drying, cooking). We recommend adding a requirement to reduce site electricity use through improved energy efficiency in existing buildings. The necessary first step must be a requirement to monitor and report energy use in buildings ("benchmarking"). According to the Environmental Protection Agency, building benchmarking alone can achieve a 2.4% decrease in energy use (i.e., you need to get on a scale for the energy diet to work.) This recommendation is also consistent with those of the MD Commission on Climate Change's Building Energy Transition Plan (see p. 23).

2. **New Construction** – the bill should be strengthened to add energy efficiency requirements for new buildings by adopting the "stretch code" similar to Montgomery County and Baltimore City. Additionally, major retrofits and new buildings should have energy efficiency targets including: 1) 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code (IeCC) for permit applications received between Jan 1 2025 and Dec 31 2027, and 2) 60% reduction in modeled energy use consumption over the 2018 IeCC for permit applications received on or after Dec 31, 2027.

3. **Climate Catalytic Capital Fund (C3 Fund):** We recommend adding the establishment of a Fund similar to SB528. Such a fund would add money to the Maryland Clean Energy Center's Green Bank to achieve the objectives of the bill Green Banks leverage public monies with private capital and for every $1 of public investment they generate $4 - $10 of private capital. With existing sources of funding and financing plus a C3 Fund and any other incentives developed by the Building Energy Transition Implementation Task Force, building owners will get help with the upfront costs of energy retrofits.

4. **Affordable Housing/Low Income Households:** The bill should address the particular needs of Affordable Housing by: providing flexibility and allowing an alternative compliance pathway to accommodate refinancing and recapitalization

timelines; ensuring the Building Energy Transition Implementation Task Force includes a tenant representative; directing the Task Force to identify policies and programs that provide tenant protections and funding support for affordable housing retrofits; and creating a role for the Task Force in advising the Department on the development of regulations to ensure that input from community members is considered.

HB831, with the proposed amendments, will help the City of Takoma Park and Montgomery County reach their climate goals. In 2017, Montgomery County adopted climate emergency goals to reduce greenhouse gas emissions by 80% by 2027 and 100% by 2035. Similarly, the City of Takoma Park passed a climate emergency resolution in 2020 with strategies to achieve net zero emissions city-wide by 2035 and to be fossil fuel-free by 2045. Reducing climate pollution from buildings must be part of the climate solution, for our City, County and State, and for the benefit of Maryland energy consumers.

We strongly urge a **FAVORABLE WITH AMENDMENTS** vote on HB831.

HB0831 - Testimony - Reducing GHG Emissions - Buil

Uploaded by: Lee McNair
Position: FWA

February 23, 2022

Testimony: HB0831 - Reducing GHG Emissions - Commercial and Residential Buildings

Organization: Cedar Lane Environmental Justice Ministry (CLEJM)

Submitter: Lee McNair, Co-Leader

Position: FAVORABLE

CLEJM supports this bill and encourages a FAVORABLE outcome in committee.

This bill requires the Department of the Environment to establish building emissions standards for many of our commercial and residential buildings which will help us reach our state GHG emissions reduction goals since buildings are a source of 40% of our emission pollutants.

But CLEJM also urges the committee, in it's deliberations, to consider the need for building efficiency also as this too will be extremely effective in reducing GHG emissions, especially among our low-income and historically disadvantaged communities. It cannot be stated too strongly that we must include these communities and we must make it financially feasible for these communities to meet the required standards. This is not only a just, moral, and ethical

stand to take. It is a very practical action from an economical viewpoint since reducing GHG emissions in these communities will:

- **help the state meet it's climate goals**
- **reduce state supported health costs as the inhabitants will no longer be breathing damaging pollutants**
- **reduce state supported energy and utility costs.**

CLEJM urges a FAVORABLE outcome in committee for HB0831.

We thank you for this opportunity to share our thoughts with you.

HB831 - WISE Testimony.pdf

Uploaded by: Monica O'Connor
Position: FWA

Committee: **Environment & Transportation**
Testimony on: **HB831 - Reducing Greenhouse Gas Emissions–Commercial and Residential Buildings**
Organization: **WISE**
Submitting: **Monica O'Connor, Legislative Liaison**
Position: **Favorable with Amendments**
Hearing Date: **February 25, 2022**

Dear Mr. Chairman and Committee Members,

Thank you for allowing our testimony today. WISE is an all-volunteer women-led group of advocates formed in Anne Arundel County, and has over 600 members. WISE urges you to vote favorably on HB831.

The Maryland Commission on Climate Change (MCCC), in its 2021 report, recommends that the building sector reduce their greenhouse gas emissions 100%. Buildings are 40% of Maryland's greenhouse gas emissions, of which 13% are direct emissions, primarily from gas to fuel our space and water heating systems. Buildings also consume 90% of the electricity generated. As currently written, this bill addresses some of those emissions from new and existing buildings and follows a more modest path forward than recommended by the MCCC:

- For **existing** commercial and multifamily buildings larger than 25,000 square feet, HB831 sets **Building Emission Standards** that require that they reduce their direct emissions (i.e., the emissions from gas boilers) 100% by 2040, with an interim target of 20% reduction by 2030. It also requires buildings to begin reporting their energy use in 2025 (i.e., benchmarking); and

- For **new** commercial and residential buildings (not just large buildings), HB831 requires that they be constructed to an all electric code for water and space heating and to implement the International Green Construction Code.

The MCCC's Modeled Costs: The MCCC Plan[1] found that:

- For single-family homes, the cost to install a heat pump for heating and cooling is close to the cost of replacing an air conditioner and a gas furnace.

---

[1]*Exelon's Representative on the MCCC voted in support of the MCCC plan. Exelon is the parent company of BG&E, Pepco, and Delmarva Power.*

Energy costs for heat pumps are comparable to gas furnaces and lower than electric resistance, oil, or propane;

- For multifamily buildings, the cost of installing heat pumps *can be significantly less than the cost of replacing existing air conditioning and gas systems. Annual energy costs of heat pumps are comparable to gas heating;*

- For commercial buildings, the cost-effectiveness of replacing heating and cooling systems with heat pumps depends on building type and use, but can be less than replacing existing air conditioning and gas systems;

- *Electricity system costs and rate impacts can be reduced through a variety of demand management measures.*

The MCCC also projected that as more of the building sector electrifies, natural gas rates will increase 4-5 times current rates by 2045, making it all the more important for Marylanders to transition off of gas soon. If we do not enact an all-electric building code standard now, those that do install fossil fuel energy systems (i.e., gas boilers), the uneconomic cost of that investment must be absorbed. Delaying the start will lead to new gas infrastructure investments that will become uneconomic before they are fully paid for and will lead to those who have such systems paying for those "stranded assets" in their utility bills.

Building Emissions Standards: Complementary Components that Make it Work:

- **The Building Energy Transition Implementation Task Force**- to develop recommendations for further complementary programs and incentives aimed at reducing greenhouse gas emissions from the building sector;

- **The Climate Transition & Clean Energy Hub** – a clearinghouse for information, technical advice and financial incentives for the public and professionals (If you want to see how a similar program in D.C. works, watch here: Retrofit Accelerator; ((Hub details are in companion bill, HB708, being considered by the Economic Matters Committee);

- **The Expansion of the utilities' EMPOWER program** that will expand and increase rebates for electrification and energy efficiency measures for consumers, with an emphasis on low-income households, and to disallow funds being expended on assistance for fossil fuel equipment and appliances (in HB708);
.
- **Maryland Commission on Environmental Justice & Sustainable Communities** to address priorities of environmental justice and vulnerable communities (in HB708);

- **Just Transition & Retraining Work Group** (in HB708);

- **Climate Justice Corps** to create career training opportunities for our youth and disadvantaged youth in a new green economy, including opportunities with retrofitting low income households and installing renewable energy systems (in HB708);

The MCCC's Modeled Costs for Building Emissions and All-Electric Construction:
The MCCC also modeled 4 cost scenarios in recommending an implementation plan and recommended what we call the Mitigation Working Group ("MWG) Plan. That MWG Plan is more ambitious than the one set forward in HB831 (even when including HB831's companion bill, HB806 addressing government buildings being considered in the Appropriations Committee). **The plan passed the MCCC by a 24-2 vote. The representative for Exelon voted for the MCCC plan. Exelon is the parent company of BG&E, Pepco, and Delmarva Power**.

The MCCC plan found that:

- For single-family homes, the cost to install a heat pump for heating and cooling is close to the cost of replacing an air conditioner and a gas furnace. Energy costs for heat pumps are comparable to gas furnaces and lower than electric resistance, oil, or propane;

- For multifamily buildings, the cost of installing heat pumps *can be significantly less than the cost of replacing existing air conditioning and gas systems. Annual energy costs of heat pumps are comparable to gas heating;*

- For commercial buildings, the cost-effectiveness of replacing heating and cooling systems with heat pumps depends on building type and use, but can be less than replacing existing air conditioning and gas systems;

- *Electricity system costs and rate impacts can be reduced through a variety of demand management measures.*

The MCCC also projected that as more of the building sector electrifies, natural gas rates will increase 4-5 times current rates by 2045, making it all the more important for Marylanders to transition off of gas soon. If we do not enact an all-electric building code standard now, those that do install fossil fuel energy systems (i.e., gas boilers), the uneconomic cost of that investment must be absorbed. Delaying the start will lead to new gas infrastructure investments that will become uneconomic before they are fully paid for and will lead to those who have such systems paying for those "stranded assets" in their utility bills.

Necessary Amendments:

Energy Efficiency

It is equally critical to increase the energy efficiency of our buildings. One key reason buildings constitute 40% of Maryland's greenhouse gas emissions is because of their outsize draw on the grid, which is not yet clean. Also, as we transition to a fossil free economy, we need to reduce the buildings sector's draw on the grid in order to maintain the integrity of the grid. We therefore ask that HB831 require an energy use reduction pathway.

Interim Targets: There should be an additional interim target to encourage and ensure that buildings are steadily reducing their emissions and energy use.

Benchmarking: The beginning date for benchmarking buildings should begin in 2023. Not only is it an easy requirement to implement, but the data from benchmarking is foundational to the success of building emissions standards.

All-Electric New Construction: Should be a requirement for all buildings, to conform with SB528, Climate Solutions Now.

Climate Catalytic Capital Fund (C3 Fund): SB528 gives additional funding to the MCEC (Maryland's Green Bank) to create a special fund to achieve the objectives of the Senate and House Climate bills, including creating a green bonds program. Green Banks leverage public monies with private funds. For every $1 of public investment, the C3 fund would generate $4 to $10 of private capital.

Holistic Goal of 100% Retrofits of Low Income Households by 2030, Including Weatherization and Heat Pumps: The Building Energy Transition Implementation Task Force should have an explicit requirement that it develop and recommend an implementation plan to carry out the goal.

Affordable Housing/Low Income Households: It is also important to address the particular needs of Affordable Housing by:

- Providing flexibility to affordable housing owners by allowing for alternative compliance pathways to accommodate their refinancing and recapitalization timelines;
- Ensure that the Building Energy Transition Implementation Task force includes a tenant representative and directs the Task Force to prioritize identifying policies and programs that provide tenant protections and funding for Affordable Housing; and
- Create a role for the Task Force in advising the Department on the development of regulations to ensure that input from community members is considered.

Authority to Enact Local Standards: The bill should be clarified that it does not affect the authority of a county, municipality, or other local government to enact building emissions or energy standards that are at least as stringent as the standards established in the bill.

For these reasons, we urge you to adopt our proposed amendments and vote favorably for SB528.

Committee: House Environment & Transportation
Legislation: HB 0831 Reducing Greenhouse Gas Emissions-Commercial and Residential Buildings
Organization: Environmental Justice Ministry Cedar Lane Unitarian Universalist Church
Position: FAVORABLE WITH AMENDMENTS
Hearing: February 25, 2022

Cedar Lane's Environmental Justice Ministry supports HB0831 that requires the Department of the Environment to establish building emissions standards for certain commercial and residential buildings; establishing the Building Energy Transition Implementation Task Force to study certain matters and develop a plan for funding the retrofit of certain buildings; and requiring the Maryland Department of Labor to update the Maryland Building Performance Standards. Reduction of greenhouse gases is a practical implementation of our faith's holding the inherent worth and dignity of every person to have a clean and healthful environment.

We have attached strengthening amendments to the bill.

The proposed legislation would require all new commercial and residential buildings to be built to a modified all-electric standard (water and space heating only). It would also require Building Emissions Standards to be developed to monitor emissions from commercial and residential buildings greater than 25,000 sq. ft., with a plan to achieve net zero emissions by 2040. Additionally, a Building Energy Transition Implementation Task Force will be established to help building owners manage the upfront costs of the transition to all-electric and to develop a plan to retrofit existing buildings.

We support the all-electric building code specified in the bill. Starting in 2023, it would require new residential and commercial construction to have water and space heating provided without the use of fossil fuels. Additionally, it would require new buildings to be solar ready and have electric vehicle charging infrastructure.

We also agree with the need to develop Building Emissions Standards to understand and measure the emissions that each residence or business is producing. Not only do we need standards developed, but there should be requirements for building owners to report the emissions, as well as requirements to decrease the emissions in a decisive manner. Building Emissions Standards should be designed to achieve reductions in direct emissions (those produced in heating and cooling the building) starting at a 20% reduction by 2030 and net zero by 2040. Additionally, reporting by building owners under the Standards would start in 2025.

We also support the creation of a Building Energy Transition Implementation Task Force. This Task Force will be charged with recommending complementary policies, programs, and incentives to support this transition, including the creation of tax credits and direct subsidies; new financial incentives that will help low- and moderate- income residents through the EmPOWER program; and on-bill, low-interest financing to spread out the upfront

costs. Additionally, the Task Force will recommend a plan to fund the retrofit of existing buildings.
For all of these reasons, we support this bill and we urge a favorable vote from the Committee with the inclusion of the following amendments to conform with SB 0528:
Necessary Amendments:

Energy Efficiency

It is equally critical to increase the energy efficiency of our buildings. One key reason buildings constitute 40% of Maryland's greenhouse gas emissions is because of their outsize draw on the grid, which is not yet clean. Also, as we transition to a fossil free economy, we need to reduce the buildings sector's draw on the grid in order to maintain the integrity of the grid. We therefore ask that HB831 require an energy use reduction pathway.

Interim Targets: There should be an additional interim target to encourage and ensure that buildings are steadily reducing their emissions and energy use.

Benchmarking: The beginning date for benchmarking buildings should begin in 2023. Not only is it an easy requirement to implement, but the data from benchmarking is foundational to the success of building emissions standards.

All-Electric New Construction: Should be a requirement for all buildings, to conform with SB528, Climate Solutions Now.

Climate Catalytic Capital Fund (C3 Fund): SB528 gives additional funding to the MCEC (Maryland's Green Bank) to create a special fund to achieve the objectives of the Senate and House Climate bills, including creating a green bonds program. Green Banks leverage public monies with private funds. For every $1 of public investment, the C3 fund would generate $4 to $10 of private capital.

Holistic Goal of 100% Retrofits of Low Income Households by 2030, Including Weatherization and Heat Pumps: The Building Energy Transition Implementation Task Force should have an explicit requirement that it develop and recommend an implementation plan to carry out the goal.

Affordable Housing/Low Income Households: It is also important to address the particular needs of Affordable Housing by:

- Providing flexibility to affordable housing owners by allowing for alternative compliance pathways to accommodate their refinancing and recapitalization timelines;
- Ensure that the Building Energy Transition Implementation Task force includes a tenant representative and directs the Task Force to prioritize identifying policies and programs that provide tenant protections and funding for Affordable Housing; and
- Create a role for the Task Force in advising the Department on the development of regulations to ensure that input from community members is considered.

Authority to Enact Local Standards: The bill should be clarified that it does not affect the authority of a county, municipality, or other local government to enact building emissions or energy standards that are at least as stringent as the standards established in the bill.
For these reasons, we urge you to adopt our proposed amendments and vote favorably for HB 0831.

Thank you.

Nanci Wilkinson
Environmental Justice Ministry
Cedar Lane Unitarian Universalist Church

HB0831-FAV with Amendments-DTMG-2-25-22.pdf

Uploaded by: Olivia Bartlett

Position: FWA

Olivia Bartlett, DoTheMostGood Maryland Team

Committee: Environment and Transportation

Testimony on: HB0831 - Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Position: Favorable with Amendments

Hearing Date: February 23, 2022

Bill Contact: Delegates Dana Stein and Kumar Barve

DoTheMostGood (DTMG) is a progressive grass-roots organization with more than 3000 members across all districts in Montgomery County as well as a number of nearby jurisdictions. DTMG supports legislation and activities that keep residents healthy and safe in a clean environment and which promote equity across all our diverse communities. DTMG strongly supports HB0831, with addition of the strengthening amendments noted below, because reducing greenhouse gas emissions from buildings is necessary to limit the damaging effects of climate change due to global warming.

Greenhouse gas emissions from our use of fossil fuels are driving global warming. Buildings contribute 40% of the greenhouse gasses that are produced in Maryland (because they rely heavily on fossil fuel infrastructure. Over the next couple of decades, we must reduce that 40% number to zero if we have any hope of limiting the most disastrous effects of climate change due to global warming. Addressing this difficult problem will take a great deal of effort and resolve and will involve making real change in the way we build our buildings and in the way we live our lives.

HB0831 directly addresses reducing greenhouse gas emissions from residences and businesses across Maryland, which is critical to meeting Maryland's overall greenhouse gas emission reduction goals. HB0831 will do this by requiring, starting in 2023, new residential and commercial construction to have water and space heating provided without the use of fossil fuels, to be solar ready, and to have electric vehicle charging infrastructure. The all-electric building code specified in HB0831 will move Maryland in the right direction on climate change.

HB831 also directs the Maryland Department of the Environment (MDE) to create a Building Emissions Standards (BEPS) which will require reduced emissions from commercial and residential buildings over 25,000 sq ft. This is a critical policy Maryland must enact to reduce pollution from existing buildings and move towards net zero. Colorado, Washington State, and Washington DC already have similar programs, and Montgomery County is currently prepared to vote to implement a BEPS program. Not only do we need standards developed, but there should be requirements for building owners to report the emissions, as well as requirements to decrease the emissions in a decisive manner. Building Emissions Standards should be designed to achieve reductions in direct emissions (those produced in heating and cooling the building) starting at a 20% reduction by 2030 and net zero by 2040. Additionally, reporting by building owners would start in 2025.

One of the most critical aspects of HB0831 is the creation of a Building Energy Transition Implementation Task Force. This Task Force will be charged with recommending complementary policies, programs, and incentives to support this transition, including the creation of tax credits and direct subsidies; new financial incentives that will help low- and moderate- income residents through the EmPOWER program; and on-bill, low-interest financing to spread out the upfront costs. Additionally, the Task Force will recommend a plan to fund the retrofit of existing buildings.

Because it's taken decades to build the fossil fuel infrastructure that we have now, it will take a great deal of effort to undo it. HB0831 provides a very important roadmap in this critical effort. Therefore, DTMG supports HB0831 and urges a FAVORABLE vote from the Committee with the inclusion of the amendments below coordinated by the Maryland Climate Partners that will strengthen the bill.

Respectfully submitted,

Olivia Bartlett
Co-lead, DoTheMostGood Maryland Team
oliviabartlett@verizon.net
240-751-5599

Amendments for HB831 - Coordinated by the Maryland Climate Partners

1. Strengthen provisions related to Building Energy Performance Standard and ensure the policy achieves its intended goal

- Clarify that the policy should establish targets to "energy use intensity" which includes reductions on both electricity usage AND onsite fossil fuel use for heating, water & cooking.
    - As written, the bill appears to target just onsite emissions, which means the burning of fossil fuels for heating and cooking, also known as "scope 1". It should also include reductions in electricity usage.
    - Improved building energy efficiency will reduce overall electricity demand (helping grid transition) and can result in smaller sized heating and cooling systems.
    - Energy efficiency (e.g., site electricity use) includes: maintaining and retro-commissioning building energy systems; implementing HVAC scheduling and other smart control systems; and making building shell and other energy efficiency improvements.
    - This aligns with the recommendations of the MD Commission on Climate Change's Building Energy Transition Plan (see p. 23).

- Add an interim target of at least 40% by 2035. We want to ensure that annual reductions are spread out (SB 528 on page 47, lines 5-14) This will also align the numerical goals of HB831 with SB528. Interim goals provide helpful guidance to MDE.

2. The new fossil-free construction code to new buildings should apply to all new buildings, and end of life system retrofits.

HB831 takes an important step of requiring that Maryland Dept of Labor, which establishes MD building codes, specify that new commercial and residential buildings must be built to use electricity (not fossil fuels) for heating. Additionally, require that the majority of space heating and service water heating use heat pumps. The current language limits the new code to “commercial and residential”.

The new construction code should apply to ALL new buildings - Commercial, residential, and government buildings. (page 8, starting line 8)

- Our public buildings, including our schools, should be models for the rest of society, and should be stronger, or at a minimum comparable, to other building standards.
- It is our understanding that HB806 addresses construction standards for new public buildings, potentially based on levels for state funding. We support stronger goals for state buildings, but the new construction codes laid out in HB 806 should apply to all buildings, regardless of level of state funding.
- If we don't apply the all-electric standard to all buildings, every time we build a building that is not all-electric, it is one more building we will have to retrofit. Retrofitting is far more expensive than building the all-electric in the first place.
- With a state surplus and plans to spend significant money on schools through the Built to Learn funding, this is the ideal time to pay-it-forward. Building schools with fossil fuel infrastructure will require far more funds in the future to operate and eventually retrofit.

3. Add “Energy Efficiency” to new construction Commercial code requirements

An increasingly popular approach to this is for a city or state to adopt a “stretch code” which adds provisions on top of the standard code to achieve additional energy efficiency improvements. Washington State, City of Seattle, California, New York City, as well as Montgomery County and Baltimore City, are just a few of the jurisdictions taking this approach. The Maryland General Assembly notes that “energy efficiency is among the least expensive ways to meet the growing electricity demands of the State” and the American Council for an Energy Efficiency Economy reports that “Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050”

We recommend the following targets for all New Construction Commercial buildings, public and private. State Funded Buildings will lead the way by 2 years. Note that this is a percent target for modeled energy use reductions. These targets have been developed from the AIA 2030 challenge and the originally stated International Code Council energy reduction targets. The International Code Council publishes the International Energy Conservation Code, which is already behind targets, two code cycles after targets were set.

- For public buildings, funded at least 25% by State funds
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2023 and Dec 31 2024
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
  - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028

- For all other new covered buildings
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
  - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2029 and Dec 31 2030

Additionally, there should be energy efficiency performance targets for new “major renovations”.

Targets

- A 40% reduction in the building’s average annual energy use; or
- A 20% reduction in modeled energy use consumption over the current Energy Code

4. Additions to the Buildings Energy Transition Implementation Task Force

HB0831 sets a goal of holistic retrofits with little or no cost for low-income households by 2030. Additionally, it creates a Buildings Energy Transition Implementation Task Force to develop a plan for the retrofits and create the appropriate programs, policies and incentives to effect the transition to meet that goal.

We recommend that the Task Force include representation by EJ communities, as well as relevant non-profits. We also recommend that the Task Force coordinate with the Environmental Justice and Sustainability Commission, and Clean Energy Hub.

5. Additions to Ensure that HB831 is Equivalent to SB528

On page 9, line 12 and page 7, line 27, SB528 creates a MCEC Climate Catalytic Capital Fund (C3). Add that language in a new section in HB831. A Climate Catalytic Capital Fund is an innovative funding strategy envisioned in SB528 which will be important to support many of the changes in this bill. We recommend this concept be incorporated into H0831 or other appropriate legislation.

HB831_HoCoClimateAction.org_FWA.pdf
Uploaded by: Ruth White
Position: FWA

HoCoClimateAction.org
Howard County, Maryland

Testimony on HB831
Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Hearing Date: February 25, 2022
Bill Sponsor: Delegate Dana Stein
Committee: House Environment and Transportation
Submitting: Ruth White for Howard County Climate Action
Position: Favorable with amendments.

HoCo Climate Action -- a 350.org local chapter and a grassroots organization representing more than 1,450 subscribers, and a local group of the international climate organization 350.org **–** supports HB831 - Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings.

We are in a time of climate crisis with Maryland's coastline barely above sea level and experiencing continual local flooding. Even if the world meets the IPCC Paris Agreement, the University of Maryland's Center for Environmental Services estimates MD sea level rise of .8 to 1.6 ft. by 2050 and 1.2 to 3 ft. by 2100 and some estimates are higher. The largest GHG emissions nationwide and in Maryland are from buildings and transportation. Many bills address mass transit and electric cars. We also need to target greenhouse gas emissions from buildings.

Our HoCoClimateAction group is particularly excited about supporting the buildings provisions in HB831. We closely followed the work of the Maryland Commission on Climate Change's Building Transition Report (here and here) and are pleased that their findings and recommendations are reflected in this bill.

Since buildings emit 40% of Maryland's greenhouse gasses (13% of which are direct emissions) and account for 90% of Maryland's electricity use, improving building energy performance and transitioning buildings off of fossil fuels is crucial to reaching Maryland's climate commitments. We applaud provisions to electrify new buildings to meet future climate goals.

Please note that the fossil gas industry and pipeline installers are circulating a fairy tale that they can fill pipelines with methane gas that is non (or less) polluting since it is made from organic sources like food waste, poop, wood in the form of costly biogas and more. Even youngsters know this is a fairy tale. The science is that biogas and similar substances the industry calls "renewable gases" are composed of methane (CH_4), the same compound in'"natural" gas. Gas is delivered to buildings via pipelines. All pipelines leak. And methane is methane, whether from fossil gas or the other gases (which are also expensive to produce and a small % of total gas used)

We joined the movement to ban fracking in Maryland and are committed to limiting, not expanding, gas use in Maryland. To move to a clean energy future, it is crucial to stop allowing gas-fired building stock that will require costly retrofits.

HB0831

- requires that all new buildings meet water- and space-heating needs without the use of fossil fuels by 2023,
- establishes a process to gradually retrofit existing commercial and large multifamily buildings, and
- establishes a Building Energy Transition Implementation Task Force to plan for and assist the retrofit/ electrification of existing buildings.

HoCo Climate Action has additional suggestions for building electrification provisions. As drafted, the legislation allows for gas stoves/cooktops. These are responsible for excessive indoor air pollution and illness, especially if the space is not well-ventilated. See RMI article here. According to this Washinton Post article, two-thirds of Americans already use electric stoves. If gas stoves/cooktops are still allowed, we recommended that the bill mandate that codes for new buildings require venting to the outdoors. In addition, if builders install gas stoves/cooktops in new buildings, they should be required to also install electrical outlets designed for electric and induction stoves, to provide choice when appliances are replaced.

We share the concern of the National Housing Trust and others that electrification of new buildings and changes to existing building codes do not unduly burden low income residents and make housing less or unaffordable for vulnerable populations. HB831 sets the goal of completing retrofits for low-income households by 2030, and we agree this is an important goal. We would like to see stronger provisions to ensure that this can occur as soon as possible, and that low-income residents are not left to bear the higher costs anticipated for those left in the gas system.

For all of these reasons, we support this bill and urge a favorable vote from the Committee, with the inclusion of the suggestions above and the following amendments from the Maryland Climate Partners.

HoCo Climate Action
HoCoClimateAction@gmail.com
Submitted by Ruth White, Steering and Advocacy Committee, Columbia MD
www.HoCoClimateAction.org

Amendments for HB831 - Coordinated by the Maryland Climate Partners

1. **Strengthen provisions related to Building Energy Performance Standard**

HB831 directs MDE to create a Building Energy Performance Standard (BEPS) which will require reduced emissions from commercial and residential buildings over 25,000 sq ft. This is a critical policy Maryland must enact to reduce pollution from existing buildings and move towards net zero. Colorado, Washington State, Washington DC already have similar programs, and Montgomery County is currently prepared to vote to implement a BEPS program. There are some critical amendments that should be added to ensure the policy achieves its intended goal.

- **Clarify that the policy should establish targets to "energy use intensity" which includes reductions on both electricity usage AND onsite fossil fuel use for heating, water & cooking.**
    - As written, the bill appears to target just onsite emissions, which means the burning of fossil fuels for heating and cooking, also known as "scope 1". It should also include reductions in electricity usage.
    - Improved building energy efficiency will reduce overall electricity demand (helping grid transition) and can result in smaller sized heating and cooling systems.
    - Energy efficiency (e.g., site electricity use) includes: maintaining and retro-commissioning building energy systems; implementing HVAC scheduling and other smart control systems; and making building shell and other energy efficiency improvements.
    - This aligns with the recommendations of the MD Commission on Climate Change's Building Energy Transition Plan (see p. 23).

- **Add an interim target of at least 40% by 2035.** We want to ensure that annual reductions are spread out (SB 528 on page 47, lines 5-14) This will also align the numerical goals of HB831 with SB528. Interim goals provide helpful guidance to MDE.

2. **The new fossil-free construction code to new buildings should apply to all new buildings, and end of life system retrofits.**

HB831 takes an important step of requiring that Maryland Dept of Labor, which establishes MD building codes, specify that new commercial and residential buildings must be built to use electricity (not fossil fuels) for heating. Additionally, require that the majority of space heating and service water heating use heat pumps. The current language limits the new code to "commercial and residential".

The new construction code should apply to ALL new buildings - Commercial, residential, and government buildings. (page 8, starting line 8)

- Our public buildings, including our schools, should be models for the rest of society, and should be stronger, or at a minimum comparable, to other building standards.
- It is our understanding that HB806 addresses construction standards for new public buildings, potentially based on levels for state funding. We support stronger goals for state buildings, but the new construction codes laid out in HB 806 should apply to all buildings, regardless of level of state funding.
- If we don't apply the all-electric standard to all buildings, every time we build a building that is not all-electric, it is one more building we will have to retrofit. Retrofitting is far more expensive than building the all-electric in the first place.

- With a state surplus and plans to spend significant money on schools through the Built to Learn funding, this is the ideal time to pay-it-forward. Building schools with fossil fuel infrastructure will require far more funds in the future to operate and eventually retrofit.

3. **Add “Energy Efficiency” to new construction Commercial code requirements**

An increasingly popular approach to this is for a city or state to adopt a “stretch code” which adds provisions on top of the standard code to achieve additional energy efficiency improvements. Washington State, City of Seattle, California, New York City, as well as Montgomery County and Baltimore City, are just a few of the jurisdictions taking this approach. The Maryland General Assembly notes that “energy efficiency is among the least expensive ways to meet the growing electricity demands of the State” and the American Council for an Energy Efficiency Economy reports that “Energy Efficiency Can Cut Energy Use and Greenhouse Gas Emissions in Half by 2050”

We recommend the following targets for all New Construction Commercial buildings, public and private. State Funded Buildings will lead the way by 2 years. Note that this is a percent target for modeled energy use reductions. These targets have been developed from the AIA 2030 challenge and the originally stated International Code Council energy reduction targets. The International Code Council publishes the International Energy Conservation Code, which is already behind targets, two code cycles after targets were set.

- ***For public buildings, funded at least 25% by State funds***
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2023 and Dec 31 2024
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
  - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
- ***For all other new covered buildings***
  - o 20% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2025 and Dec 31 2026
  - o 40% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2027 and Dec 31 2028
  - o 60% reduction in modeled energy use consumption over the 2018 International Energy Conservation Code for permit applications received between Jan 1 2029 and Dec 31 2030

Additionally, there should be energy efficiency performance targets for new “major renovations”.

- Targets
  - A 40% reduction in the building’s average annual energy use; or
  - A 20% reduction in modeled energy use consumption over the current Energy Code

Additions to the Buildings Energy Transition Implementation Task Force

- HB0832 sets a goal of holistic retrofits for low-income households by 2030 with little or no cost. Additionally, it creates a Buildings Energy Transition Implementation Task Force to develop a plan for the retrofits and create the appropriate programs, policies and incentives to effect the transition to meet that goal.

  - We recommend that the Task Force include representation by EJ communities, as well as relevant non-profits. We also recommend that the Task Force coordinate with the Environmental Justice and Sustainability Commission, and Clean Energy Hub.

Additions to Ensure that HB831 is Equivalent to SB528

- On page 9, line 12 and page 7, line 27, SB528 creates a MCEC Climate Catalytic Capital Fund (C3). Add that language in a new section in HB831. *A Climate Catalytic Capital Fund is an innovative funding strategy envisioned in SB528 which will be important to support many of the changes in this bill. We recommend these concepts by incorporating into this bill or other appropriate legislation.*

Maryland Written testimony HB831.pdf
Uploaded by: Stephen Dodge
Position: FWA

Chairman Kumar Barve
House Environment and Transportation Committee
251 Taylor House Office Building
6 Bladen Street
Annapolis, MD 21401

February 23, 2022

RE: House Bill 831

Dear Chairman Barve and Members of the Committee,

I am pleased to have the opportunity to offer this written testimony in support of HB 831, An Act Concerning Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings. We do believe the bill is missing some important elements regarding the potential use of biodiesel and renewable diesel as an immediate carbon-reducing pathway and have included suggested amendments at the end of this written testimony. I also plan to testify orally at the February 25th hearing.

I am Director of State Regulatory Affairs for Clean Fuels Alliance America. Clean Fuels represents the farmers, the producers, the distributors and the end users for our all of the products our members and the U.S. industry are producing, which include biodiesel, renewable diesel, sustainable aviation fuel, Bioheat ® fuel for thermal space heating as well as maritime and railroad fuels.

Cleans Fuels supports the carbon reduction goals established in current state law as well as the more aggressive goals proposed in pending legislation in both the House and Senate. However, we are disappointed that no biodiesel pathways are established for either the thermal heat sector, the medium and heavy-duty transportation sector nor the electricity generation sector in any of these bills. We understand the focus of HB 831 is on the thermal heat sector.

Made from an increasingly diverse mix of resources such as recycled cooking oil, soybean oil and animal fats, biodiesel and renewable diesel are better, cleaner fuels that are available now for use in existing diesel engines and heating furnaces and boilers without modification. Nationwide, some 3 billion gallons was consumed last year, and we project use will exceed six billion gallons by 2030, eliminating over 35 million metric tons of CO_2 equivalent greenhouse gas emissions annually. With advancements in feedstock, use will reach 15 billion gallons by 2050.

The IPCC's 6th assessment released last summer provided us with a stark warning: "It is unequivocal that human influence has warmed the atmosphere, ocean and land. From a physical science perspective, limiting human-induced global warming to a specific level requires limiting cumulative CO_2 emissions, reaching at least net zero CO_2 emissions, along with strong reductions in other greenhouse gas emissions."

Simply put, reducing carbon emissions now, is more valuable than reducing the same amount of emissions later. It's the same principle we learned in high school: a dollar invested now is worth more than a dollar invested 20 years from now. This is because earlier reductions limit the long-term climate impact caused by the accumulation of greenhouse gases. This significant and often overlooked principal is frequently absent from policy discussions, which, for example treat a reduction of CO_2 in 2021 with the same weight as a reduction in 2050. This is simply not accurate and skews the market to seek options which may not be deployed for years or decades, if ever at all.

The increased use of biodiesel in home heating oil applications not only has significant GHG benefits as noted by researchers across the nation, but replacing petroleum-based diesel with biodiesel also results in a dramatic reduction in co-pollutants, sometimes called criteria pollution or tailpipe emissions. These dramatic reductions can lead to significant health benefits in the form of reduced asthma attacks, avoided work loss days, and reduced cancer risks.

Often, the modeling framework to assess the health benefits from a reduction in criteria pollution employs a top-down method, estimating a reduction in a specific criteria pollutant like PM, and assuming there is a normal distribution of these benefits among citizens. While this is appropriate to generally characterize the benefits of a policy designed to reduce these harmful emissions, it often fails to help decisionmakers and citizens truly understand how the reduction in these emissions will affect their local community and in what way.

To better characterize the health benefits biodiesel can have on local communities who switch from diesel, Clean Fuels commissioned a study by Trinity Consultants, a globally renowned air quality modeling firm who specializes in air dispersion modeling. Their work, which is published online, characterizes the benefits of these fuels much more granularly, allowing decisionmakers to understand where the benefits of reduced particulate matter, improved health outcomes, would occur and to whom. The results demonstrate that the use of B100 as a heating oil replacement reduces carcinogenic, diesel particulate matter emissions by 86%. Furthermore, since the use of diesel is most heavily concentrated in environmental justice communities these health benefits are likely to accrue where they are needed the most, in historically disadvantaged communities.

And other states like New York, Connecticut, Rhode Island and Massachusetts have established biodiesel pathways in reducing carbon emissions. Massachusetts has an aggressive incentive program, part of their APS (Alternative Portfolio Standard), that has resulted in the displacement of 46 million gallons of petroleum-based heating oil. The program, now under review, has the potential to double that figure if the program, as recommended, moves from

B10 to B20. In addition, Massachusetts' Governor Baker has issued an executive order requiring state agencies to increase their use of biodiesel in state buildings for heating purposes over the next ten years.

New York state, Connecticut and Rhode Island last year all adopted Bioheat mandates. Those three states alone make up about 40 percent of the heating oil market in the Northeast and the mandates, when fully implemented, will result in 480 million gallons of biodiesel being consumed annually in the Northeast. While we are not suggesting Maryland adopt a Bioheat ® mandate, these initiatives demonstrate that other states have recognized biodiesel as a viable and immediate carbon reduction pathway in the thermal heat sector.

In conclusion, renewable fuels such as biodiesel and renewable diesel provide greenhouse gas reductions immediately, benefit American (including Maryland) farmers and are cost-effective. Other states have acknowledged the important role that biodiesel can play in reducing greenhouse gas emissions immediately and so should Maryland.

Below are suggested amendments to HB 831. The amendments simply direct the state to study biodiesel and renewable diesel as a pathway to immediate greenhouse gas reductions.

Thank you for the opportunity to testify. We look forward to working with you, the Committee members and your staff on this vitally important bill.

Sincerely,

Stephen C. Dodge

Stephen C. Dodge
Director of State Regulatory Affairs
Clean Fuels Alliance America
sdodge@cleanfuels.org

Suggested amendments (in red):

Section 2 – 1602

(A) It is the goal of the State that holistic retrofits, including weatherization measures, biodiesel blends and heat pump installations, be implemented in 100% of low-income households with minimal or no upfront costs for the resident by January 1, 2030.

Section 2 -1603

(B)(11)

(XI) One representative of the liquid home heating fuels industry who specializes in heating system design and technology.

(F)(2)

(IV) The use of biodiesel and renewable diesel as a carbon reduction pathway in the thermal heat sector, including a review of biodiesel initiatives in other states and existing studies of biodiesel life-cycle analysis compared to heat pumps for residential heating applications.

HB831_FWA_Nedwick
Uploaded by: Todd Nedwick
Position: FWA

National Housing Trust
Testimony to the House Environment and Transportation Committee
HB 831- Reducing Greenhouse Gas Emissions- Commercial and Residential Buildings
Position: FAVORABLE WITH AMENDMENTS
February 25, 2022

Submitted by:
Todd Nedwick
Senior Director of Sustainability Policy
National Housing Trust

National Housing Trust (NHT) is a non-profit that creates and preserves affordable homes to provide opportunity, advance racial equity, reduce economic disparities, and strengthen community resilience through practice and policy. As an affordable housing developer, NHT has preserved 450 affordable housing units in Maryland, including most recently Hamilton Manor in Hyattsville. As a policy advocate for sustainable affordable housing, NHT has been deeply engaged in the Building Energy Performance Standard (BEPS) policymaking process in Washington, D.C., including as a representative of affordable housing owners on the D.C. Building Energy Performance Standards Task Force.

This testimony is focused on the Building Emissions Standard in HB 831. NHT supports the Building Emissions Standard with amendments that would provide flexibility to ensure that affordable housing can comply with the performance standards.

The following organizations support the recommendations proposed in this testimony:

- **AIA Maryland**
- **American Council for an Energy-Efficient Economy**
- **Green and Healthy Homes Initiative**
- **Interfaith Power & Light (DC.MD.NoVA)**
- **Maryland Affordable Housing Coalition**
- **MLC Climate Justice Wing**
- **Natural Resources Defense Council**
- **Sierra Club**
- **Takoma Park Mobilization Environment Committee**

A building performance standard (BPS) is an important policy tool for accelerating decarbonization and delivering health and economic benefits to residents. Like any policy, BPS should be designed in a way that centers community priorities, provides direct benefits to under-resourced communities, and does not exacerbate existing inequities.[1]

[1] Building Performance Standards: A Framework for Equitable Policies to Address Existing Buildings, Prepared for the American Cities Challenge, July 2021.

BPS policies should not exempt affordable housing. Electrifying and improving the energy and water efficiency of multifamily buildings can preserve affordable housing by lowering operating costs, reducing residents' energy bills, and creating healthier housing. However, affordable housing owners face several obstacles to improving the energy efficiency of their properties. Obstacles primarily relate to limited access to the funding and staff capacity required to undertake building upgrades. Therefore, it is essential that easily accessible funding and technical assistance be available to help affordable housing owners comply with the law. Complementary policies and programs and compliance flexibility are necessary to ensure that the costs of BPS are not passed through to tenants or force owners of under-resourced buildings to sell their buildings if they cannot comply with the law.

The Amendments presented below:

- provide flexibility to affordable housing owners by allowing for alternative compliance pathways,
- ensure that the Building Energy Transition Implementation Task Force includes a tenant representative and directs the Task Force to prioritize identifying policies and programs that provide tenant protections and funding for affordable housing, and
- create a role for the Task Force in advising the Department on the development of BPS regulations to ensure that input from community members is considered.

Proposed Amendments to HB 831

Amendment #1:

- Pg, 3 under "Regulations adopted under this section shall:" add "Allow owners of covered buildings to submit an Alternative Compliance Action Plan to the Department if the building owner cannot meet the interim or final emissions standards by the required date or cannot meet the interim or final emissions standards due to economic infeasibility or other circumstances beyond the owner's control. The Plan shall include: (a) documentation of economic infeasibility or other circumstances beyond the owner's control such that the interim or final emissions standards cannot be met; (b) if applicable, new proposed interim or final emissions standard; (c) a list of actions the owner will take to achieve the proposed interim or final emissions standard; (d) the timeline for achieving the proposed interim or final emissions standard; and (e) other requirements determined by the Department.

  The criteria for evaluating an Alternative Compliance Action Plan submitted by owners of affordable housing shall include, at a minimum, whether: (a) there is a plan to refinance or recapitalize their property; or (b) there are cash flow constraints, including, but not limited to, restrictions on the usage of net cash flow, or prohibition from utilizing a portion of existing cash reserves for implementing improvements to the building that would reduce emissions."

Purpose of Amendment:

- Provides flexibility for building owners who face significant challenges to meeting compliance by proposing revised emissions standards and/or an adjusted timeline for meeting the emissions standard.
- Assures accountability by:
    - Requiring owners to document the reasons they cannot meet the emissions standard and/or timelines
    - Specifying the requirements that owners must meet when applying for an alternative compliance pathway and authorizing the administering agency to approve or deny the owner's proposed Plan.
- Specifies financial barriers unique to affordable housing that the Department must consider when evaluating a proposed alternative compliance action plan.

Why It's Important:

- A covered building may have specific circumstances such as financial distress, changing ownership, changing occupancy type, vacancy, demolition, or other events that may require adjustments to compliance requirements and timeline.
- Affordable housing faces unique financial challenges, such as an inability to take on new debt between recapitalizations, limited cash flow due to restricted rents, and restrictions on using reserves for building improvements in regulated housing.
- Alternative compliance may be used as a tool to chart custom compliance paths for buildings to match with their capital investment cycle and provide additional flexibility as needed while still requiring building owners to take action to reduce emissions.
- Building performance policies in Boston, Denver, DC, and St. Louis provide a process for building owners to request adjustments to the compliance timeline and/or performance target.

Amendment #2:

- Pg. 3, add to the Building Energy Transition Implementation Task Force: "One representative who is a tenant of an apartment building or is an advocate for the rights of tenants of apartment buildings."

Purpose of Amendment:

- Adds a tenant or tenant advocate to the Task Force

Why It's Important:

- Including a tenant representative can provide perspective on real-world constraints on achieving the policy's goal and can help target funding, supportive programs, and resources to those who need it most.

Amendment #3:

- Pg. 5, under "The Task Force Shall" add "Study the costs of complying with building emissions standards for different building types including, but not limited to, affordable housing."

Purpose of Amendment:

- Requires the Task Force to conduct a cost analysis for different building types and sizes.

Why It's Important:

- The Task Force members and other stakeholders will need cost information to weigh complementary policy and program design considerations and shape supportive programs.

Amendment #4:

- Pg. 5, under the "Task Force Shall" add "Study and make recommendations regarding the development of complementary programs and policies that protect renters from increased rents and energy burdens and risk of displacement."

Purpose of Amendment:

- Helps ensure that programs and policies will be in place to protect tenants from unintended consequences that perpetuate existing inequities.

Why It's Important:

- If upgrade costs or penalties/fines are passed through to renters, this could result in eviction and long-term displacement, especially in unregulated affordable housing where there is no restriction on how much the landlord can charge for rent.
- The potential cost of compliance could also lead building owners to sell their properties to new owners who may raze or upgrade the building, making it no longer affordable.

Amendment #5:

- Pg. 5, line 20, under the "Task Force Shall" add at the end of the sentence "that shall prioritize recommendations for funding the retrofit of affordable housing."

Purpose of Amendment:

- The bill requires the Task Force to develop a plan for funding retrofits of covered buildings. The amendment prioritizes developing funding recommendations for affordable housing.

Why It's Important:

- Funding and technical assistance for affordable housing are critical parts of an equitable building performance standard law.
- Affordable housing owners will struggle to meet performance standards without such assistance.
- Compliance costs could force building owners to sell or redevelop their buildings, resulting in the loss of affordable housing and displacement of renters.

Amendment #6:

- Pg. 5, under the "Task Force Shall" add: "Advise the Department on the creation of an implementation plan for the Emissions Standards Program; and Recommend amendments to proposed regulations issued by the Department."

Purpose of Amendment:

- Adds to the Task Force's responsibilities advising the Department on creating the rules to implement the policy.

Why It's Important:

- Ensures that key stakeholder perspectives are consulted as the regulations and implementation plan for the building emissions standard are developed.
- Helps the Department to understand the real-world constraints and impacts of the policy.

Amendment #7:

- Incorporate a definition of "Affordable Housing" by adding the following: "Affordable Multifamily Housing means buildings that are primarily residential, contain five or more dwelling units, and: (1) In which use restrictions or other covenants require that at least 50% of all of the building's dwelling units are occupied by households that have household incomes of less than or equal to 80% of the area median income; or (2) The building owner can demonstrate that at least 50% of the dwelling units rent at levels that are affordable to households with incomes less than or equal to 80% of the area median income."

Purpose of Amendment:

- Defines affordable housing for the purpose of qualifying for flexibility.

Why It's Important:

- Uses a definition that aligns with affordable housing programs make it easier for building owners that use those programs to prove affordability.
- Incorporates naturally occurring affordable housing and provides building owners two ways to qualify as affordable: based on tenant income or rent level -- referencing rent level makes it easier for owners of unsubsidized affordable housing to demonstrate affordability.
- Defines as affordable any building for which most of its units are affordable.

Thank you for considering these recommendations to improve HB 831. If you have any questions about this testimony, please contact Todd Nedwick, Senior Director of Sustainability Policy, at tnedwick@nhtinc.org or 202-333-8931 ext. 128.

LS22, HB831, CCAN Venable testimony.pdf
Uploaded by: Victoria Venable
Position: FWA

HB0831 - Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Date: February 25, 2022
Committee: House Environment & Transportation Committee
Position: Favorable with amendments
Victoria Venable, Maryland Director - Chesapeake Climate Action Network Action Fund

On behalf of the Chesapeake Climate Action Network Action Fund, I urge a favorable report from the committee on **HB0831 - Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings.** While CCAN Action Fund strongly supports this bill, we concur with several amendments introduced with the Climate Partners testimony to strengthen it.

The CCAN Action Fund is the advocacy arm of Chesapeake Climate Action Network, a grassroots organization dedicated exclusively to fighting for bold and just solutions to climate change in the Chesapeake region of Maryland, Virginia, and Washington, DC. We have worked hard with members of this body to increase clean energy deployment, pass greenhouse gas reduction goals, and combat climate change at the state level. We must pass legislation this year to address the way our building sector contributes to climate change and put our built infrastructure on a greener pathway.

The latest report from the Intergovernmental Panel on Climate Change, issued in August of 2021, has declared a "code red for humanity" due to rapidly worsening climate change. The report declared that nations have delayed curbing their fossil-fuel emissions for so long that they can no longer stop global warming from intensifying over the next 30 years. However, there is still a short window to prevent the most harrowing future. In order to adequately respond to the climate crisis, we must take meaningful steps to cut emissions across the economy. Buildings contribute 40% of the greenhouse gasses that are produced in Maryland (18% from onsite fossil fuel combustion and the remainder from the power they use from the grid, which contains fossil fuels) because they rely heavily on fossil fuel infrastructure. Therefore, in order to reach our climate commitments, we must reduce emissions in our building sector.

In November of 2021, the Maryland Commission on Climate Change released its annual report and Building Energy Transition Plan, recommending the adoption of Building Emission Standards and an "all-electric new construction code." HB831 introduces versions of both of these recommendations. While we believe that new construction should adhere to a true all-electric standard, we appreciate the introduction of an electric standard for water and space heating. Based on current trends, Maryland is on track to have 12% more residential gas customers in 10 years than today. Much of this infrastructure will be obsolete in a matter of decades as we transition to clean energy. In order to reduce emissions from our building sector, we must not invest in new fossil fuel infrastructure. Electrifying our new buildings will help us shift this trend while ensuring that ratepayers are not paying the costs of ill-thought-out energy investments of investor-owned utilities.

Building electrification is particularly important for residential buildings due to the cost and health benefits associated with shifting from gas to electric energy systems. According to Rewiring America, 99% of households in Maryland—2.2 million homes—could save money on energy bills if they converted an existing appliance to a high-efficiency electric appliance. Rewiring America also found that the average household in Maryland will save **$393 on their energy bills** by switching to modern, electric appliances.

The Maryland Department of the Environment worked with Energy + Environmental Economics (E3) to model the costs of construction of all-electric new buildings. E3's Maryland Buildings Decarbonization Study found that:

- For single-family homes, all-electric homes **cost less to construct** than new mixed-fuel homes.
- For multifamily buildings, all-electric **costs about the same to construct** as mixed-fuel buildings.
- At current utility rates, **annual energy costs are comparable** between homes with electric heat pumps and homes with gas furnaces. Gas rates are expected to increase this winter.
- **Annual energy costs are lower** for homes with electric heat pumps than homes heated by electric resistance, oil, or propane.
- As Maryland moves toward a net-zero-emissions goal, all-electric new buildings of any type—residential and commercial—will have the **lowest total annual costs** (including equipment, maintenance, and energy costs).

These cost savings are more relevant than ever, as fuel prices across the country continue to rise. The U.S. Energy Information Administration predicts that utility bills will continue to increase through this winter, largely due to the volatility of fossil fuel prices. Households with electric heat pumps will feel this impact significantly less than homes using natural gas, propane, or fuel oil. In fact, households using fracked gas for heat should expect to pay on average $161 more this winter compared to last year, and households using delivered fuels (propane and fuel oil) will see even greater increases ($582 and $524, respectively), while households with electric heat pumps can expect to pay only $21 more. Electrifying our homes can help provide Maryland families with more energy cost stability while helping reduce emissions.

Another critical aspect of the bill is the creation of a Building Energy Transition Implementation Task Force. This Task Force will be charged with recommending complementary policies, programs, and incentives to support this transition, including the creation of tax credits and direct subsidies; new financial incentives that will help low- and moderate-income residents through the EmPOWER program; and low-interest financing to spread out the upfront costs of electrification. Additionally, the Task Force will recommend a plan to fund the retrofit of existing buildings.

Climate change is a complex and intersecting issue, which will require comprehensive and iterative solutions. With 3,000 miles of tidal shoreline, Maryland is one of the most climate-vulnerable states in America – just from sea-level rise. HB831 takes the first step to ensure our buildings are part of the solution and to protect Maryland ratepayers from the financial, environmental, and health costs of continued fossil fuel use.

Thank you for your consideration of HB831. For all the reasons stated above, we urge a favorable vote from the committee.

CONTACT: Victoria Venable, Maryland Director
Victoria@chesapeakeclimate.org (301) 960-8824

2022 GBCC HB 831 UNF.pdf
Uploaded by: Ashlie Bagwell
Position: UNF

THE GREATER BETHESDA
CHAMBER of COMMERCE

Testimony on behalf of the Greater Bethesda Chamber of Commerce

In Opposition to
House Bill 831---Reducing Greenhouse Gas Emissions—Commercial and Residential Buildings

February 25, 2022
House Environment and Transportation Committee

The Greater Bethesda Chamber of Commerce (GBCC) was founded in 1926. Since then, the organization has grown to more than 550 businesses located throughout the Greater Bethesda area and beyond. On behalf of these members, we appreciate the opportunity to provide written comments on House Bill 831—Reducing Greenhouse Gas Emissions—Commercial and Residential Buildings.

The Greater Bethesda Chamber of Commerce supports reasonable policies that reduce greenhouse gas emissions and enhance sustainability. We worry, however, that what is required in House Bill 831 is *un*reasonable based on the timelines for meeting the bill's goals coupled with the costs associated with doing so. While we are certainly not energy policy experts, we are concerned about the impact of this bill on things like access to affordable housing, our ability to compete with neighboring jurisdictions and our state's energy infrastructure.

House Bill 831 may also compromise Maryland's economic competitive. This legislation goes well beyond:

- United Nations recommendations that countries reach net-zero by 2050;
- Biden Administration recommendations that states reduce greenhouse gas emissions by 50% by 2030;
- The Maryland Commission on Climate Change's recommendations that Maryland reduce greenhouse gas emissions by 50% by 2030; and
- Every city and county that has considered similar decarbonization policies.

With this proposal exceeding the targets of jurisdictions at every level of government, it is reasonable to question the impacts of this legislation on Maryland's economy.

For these reasons, we would respectfully request an unfavorable vote on House Bill 831. Thank you for the opportunity to provide written comments.

Testimony for HB 831.pdf

Uploaded by: Austin Tulin

Position: UNF

28420 Point Lookout Rd Leonardtown MD, 20650
(P): 301.758.3258 Austin Tulin(P): 301.758.1435
www.somdhearth.com
somdhearth@gmail.com
CSIA certification#: 9561
NFI certification #: 162640

As a Maryland resident and business owner, I am writing to express my apprehension regarding forced electrification in new construction.

I am the owner of SOMD Hearth in Leonardtown, Maryland. Including myself I have seven employees. And while I strongly support climate action, forced electrification in new construction jeopardizes my business, my employees, and the consumers' ability to choose affordable, reliable heating options.

Today's electric heating technology alternatives, such as heat pumps, underperform on cold days and are not as reliable in a power outage. Bottom line, electrification policies will cost consumers more to heat their home and would take away reliable and affordable home heating options that they currently have access to.

Since opening in 2016 I have been able to keep my employees year-round, full time even during what is considered our off season. We survived our operations being shut down during the pandemic as well as many turns of the economy throughout the years but restricting what is available to offer not only drastically limits the choices of consumer's it will drastically limit the amount of work, I am able to offer to my employees.

I ask that you please consider the impact it will have on small businesses, jobs, and consumer choice.

Please OPPOSE HB 831. Thank you.

Sincerely,

Austin Tulin

API HB831 comments.pdf
Uploaded by: Bernie Marczyk
Position: UNF

American Petroleum Institute
Northeast Region

Michael S. Giaimo
Northeast Region Director
giaimom@api.org
603.777.0467 (cell)

February 25, 2022

House Environment and Transportation Committee
Room 251
House Office Building
Annapolis, Maryland, 21401

IN RE: Comments to HB 831, An Act Concerning Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Dear Delegate Kumar P. Barve, Chair; Delegate Dana Stein, , Vice Chair; and Committee Members:

Thank you for this opportunity to provide comments relative to HB 831. The American Petroleum Institute (API)[1] opposes HB 831 and strongly encourages the committee to refrain from passing a ban on the use of natural gas in new building construction and encourages the legislature to preserve consumer choice with respect to space- and water-heating options. Additionally, this legislation will also require electric heating systems for certain existing commercial and multifamily residential buildings be retrofitted which can be unduly complicated and expensive.

Need to Preserve Consumer Choice

Policymakers should strive to give consumers options. Competition is imperative to protect consumers while driving innovation, ingenuity and progress. Legislators should not pick winners and losers but should allow resources and technologies to compete. Free market policies provide the consumer with options to select products that best fit their unique circumstances. This legislation would remove natural gas from the space- and water-heating markets, stripping the consumer of the right to select a heating fuel that is comfortable, economical and reliable. A ban on heating fuels represents the worst type of ban because it effectively affords consumers only one option – electric heating. Additionally problematic is the fact that a ban when there is only one substitute leaves consumers with no options and no hedge if the cost of the substitute rises due to increased demand. API believes Maryland's current energy policy that allows consumers to choose both natural gas and electric options is reasonable and is good public policy.

Potential for Significant Cost and Reliability Concerns

As you analyze this legislation, API encourages you to consider potential cost impacts this bill may have on consumers, especially those in overburdened communities. This legislation will likely increase building and operating costs for commercial, industrial, and residential buildings, including affordable housing. According to research conducted for the National Association of Home Builders, all-electric homes cost more upfront in

[1] The American Petroleum Institute represents all segments of America's natural gas and oil industry, which supports more than 11 million U.S. jobs. Our nearly 600 members produce, process, and distribute the majority of the nation's energy. API members participate in API Energy Excellence,[1] through which they commit to a systematic approach to safeguard our employees, environment and the communities in which they operate. Formed in 1919 as a standards-setting organization, API has developed more than 700 standards to enhance operational and environmental safety, efficiency, and sustainability.

Michael S. Giaimo
Northeast Region Director
giaimom@api.org
603.777.0467 (cell)

comparison to gas homes.[2] Specifically, the overall range of estimated electrification costs for an electric reference house compared to a baseline gas reference house in cold weather climates was between $11,000 and $15,000.[3] The higher costs in colder, heating-dominated climates are due to the need for more expenisive heat pumps rated to operate in colder temperatures. The more expensive electric equipment can also result in higher energy use costs by $84 to $404 annually compared to a baseline gas house, and by $238 to $650 annually compared to a gas house with high efficiency equipment. Consumers in colder climates will therefore likely be faced with higher upfront construction costs and higher operating costs throughout the life of the equipment.[4]

The legislation will also require electric heating systems for certain existing public and privately owned commercial and multifamily residential buildings (25,000 plus square feet) by 2030 and 2035.[5] Requiring all new buildings to be all-electric is straightforward enough; however, requiring that existing buildings be retrofitted is another matter entirely. The costs can be very high—perhaps in the tens of thousands of dollars per unit. In many homes the electric system does not have sufficient capacity and would need to be completely redone.[6]

An all-electric heat mandate is bad public policy. Maryland is looking toward a future with greater electrification in the transportation and building sectors. These policies will likely increase the demand for electricity significantly, which in turn may force the state to rely on the the use of old and less efficient power plants in other states. This committee must realize and appreciate that policies that increase electrification may also necessitate investments in large-scale electric transmission infrastructure which is expensive and frequently controversial. Electrification can also result in increased imports and utilization of power derived from carbon-emitting resources.

---

[2] *See* https://www.nahb.org/-/media/NAHB/nahb-community/docs/committees/construction-codes-and-standards-committee/home-innovation-electrification-report-2021.pdf.

[3] The study included the cold weather climates of Denver and Minneapolis.

[4] *Ibid*. Climate zone had a strong influence on both construction costs and energy use costs. In colder climates, heat pumps with variable refrigerant flow rated for operation during low outdoor temperatures are needed. Often referred to as cold climate heat pumps, these systems are more expensive: $8,000-$9,000 more compared to a gas furnace.

[5] As for current buildings, the bill would require reduction of building greenhouse gas emissions to net-zero by 2040. Any commercial or multifamily residential buildings that have a gross floor area of 25,000 square feet or more, excluding parking, must begin measuring and reporting their direct emissions in 2025. These buildings will then need to report a 20 percent reduction in net greenhouse gas emissions by 2030, a 40 percent reduction by 2035, and net-zero emissions by 2040. Those buildings that cannot perform the required reductions, would have to pay an unspecified fee for emissions exceeding the standards that must be more than the "special cost of greenhouse gases" as adopted by the Maryland Department of Environment.

Consider that in April 2019, the New York City Council adopted a major law, Local Law 97, that requires large (over 25,000 square feet in 2017) existing buildings in New York City to reduce their greenhouse gas emissions by 40 percent by 2030 and 80 percent by 2050. Approximately 75 percent of covered buildings do not comply with the 2030 emissions limits, resulting in close to 37,500 buildings required to undertake some level of retrofit before then. These costs alone are estimated to reach $21 to $24 billion. *See* "Big Questions (and Some Answers) About the Climate Mobilization Act" (PowerPoint), April 23, 2020, NYCBAR 44. *See also* "Retrofit Now! Reducing Carbon and Complying with LL97," CUNY Building Performance Lab.

[6] Two reports out of California, one from San Francisco and the other from Palo Alto, provide additional examples of the potential cost implications of all-electrification. In April 2021, San Francisco's Budget and Legislative Analyst's Office issued a memo that notes that the estimated costs of electrical appliance retrofitting of homes range from $14,363 per housing unit (both multi-family and single-family units) to $19,574 for multi-family units, and $34,790 for single-family homes at the higher end, and that the city-wide cost to retrofit all residential units currently using natural gas-fueled appliances with those fueled by electricity ranges from $3.5 to $5.9 billion. Budget and Legislative Analyst's Office, *Memo to Supervisor Mar* (Apr. 22. 2021), *available at* https://sfbos.org/sites/default/files/BLA.ResidentialDecarbonization.042221.pdf. In November 2016, a report submitted to the City of Palo Alto estimated that to accommodate electric space heating in California, it would cost $4,700 to upgrade the electricity service for an existing single-family building and $35,000 for a low-rise multifamily building. Peter Pernijad, *Palo Alto Electrification Study*, TRC Energy Services (Nov. 16, 2016) *available at* https://www.cityofpaloalto.org/files/assets/public/development-services/advisory-groups/electrification-task-force/palo-alto-electrification-study-11162016.pdf.

American Petroleum Institute
Northeast Region

Michael S. Giaimo
Northeast Region Director
giaimom@api.org
603.777.0467 (cell)

A move to all-electric heating will also leave Marylanders at the mercy of a power grid that is increasingly reliant on intermittent renewables. We have seen the potential consequences of this in Texas and California – both of which rely heavily on wind and solar. When these resources underperform, grid stability and reliability can be compromised and residents can be left in the dark and cold.

A study from GTI Energy found that power system outages are more than 100 times more frequent than gas system outages. It further notes that extreme weather is more likely to impact power systems than gas systems.[7] This means that an all-electric home and building requirement could leave residents more exposed to heating system failure. The use of natural gas for heating provides a hedge against the potential reliability challenges associated with an aging and overburdened grid that relies heavily on intermittent generation, and therefore the state should not ban it. The use of gas for heating provides a hedge against potential reliability challenges.

Unintended Consequences

Legislators should appreciate that moving the state to electric heat and heat pumps can have the profound and unintended consequence of incentivizing customers to purchase and use backup generators that run on fossil fuels. These generators can be loud, dangerous, and costly if operated improperly. For example, one county in Texas reported that it had 300 suspected cases of carbon monoxide poisoning during Winter Storm Uri last February, many of which were related to residents running backup generators indoors to stay warm when their electric heating systems were not functioning.[8]

Maryland lawmakers must first understand and appreciate the economic and environmental cosequences of additional backup generators before embarking on a future of only electric heat in new construction. Additionally, the state should fully appreciate that a policy that requires the installation of heat pumps can result in building construction delays and increased costs as global demand for heat pumps increase (particularly as other states and countries consider implementing an all-electric building policy).

Conclusion

For all of the reasons outlined above, API respectfully *opposes the bill* as introduced because it removes consumer choice with respect to heating fuels, can be costly, and can produce unintended results.

Respectfully submitted,

Michael S. Giaimo
Northeast Region Director
American Petroleum Institute

[7] *See* https://www.gti.energy/wp-content/uploads/2018/11/Assessment-of-Natural-Gas-Electric-Distribution-Service-Reliability-TopicalReport-Jul2018.pdf.

[8] *See* https://www.bbc.com/news/world-us-canada-56095479.

February 25, 2022

HOUSE ENVIRONMENT AND TRANSPORTATION COMMITTEE
HB 831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Statement in Opposition

Chesapeake Utilities Corporation ("Chesapeake Utilities") respectfully **OPPOSES** certain provisions contained in HB 831. Among other things, HB 831 seeks to: (1) ban natural gas in all new residential and commercial buildings on or before January 1, 2023; and (2) impose strict emission limitations on existing commercial and multi-family residential buildings over 25,000 square feet[1] that decrease significantly over the next several years and impose severe fees on the owners of those buildings if they cannot convert off of natural gas service.

Chesapeake Utilities operates natural gas local distribution companies that serve approximately 31,000 customers on Maryland's Eastern Shore in Caroline, Cecil, Dorchester, Somerset, Wicomico and Worcester Counties. These public utilities are regulated by the Maryland Public Service Commission and have provided in the coldest months of the year safe, reliable, resilient and affordable service in the State for decades. As a company, Chesapeake Utilities serves as a positive and informed resource in the ongoing energy and climate change discussions. In fact, the natural gas industry in general (and Chesapeake Utilities in particular) has been a part of the largest reduction in greenhouse gas emissions in this country and will continue to drive the practical solutions needed to move forward. Chesapeake Utilities is committed to being part of the solution as Maryland considers legislation addressing greenhouse gas emissions.

Having said that, we oppose HB 831 because of the extraordinary uncertainty and costs it would impose on *each and every* Maryland utility ratepayer, which are significantly greater than any purported benefits the bill allegedly might provide. In addition, HB 831 is unnecessary because alternatives exist that can achieve greenhouse gas reductions in a practical and affordable manner; and under a realistic timeline that would not place the reliability of our electric grid at risk. Finally, HB 831 would eliminate thousands of good paying jobs (with family-sustaining wages) for energy workers.

HB 831 will significantly increase costs for Maryland residents. According to the Maryland Commission on Climate Change ("MCCC"), building direct use emissions account for 13% of economy-wide GHG emissions in Maryland.[2] To attempt to achieve this purported 13% reduction, the MCCC estimated that implementing a natural gas ban on new and existing buildings would result in a number of significant costs:

---

[1] We are aware of only two other states (Colorado and Washington) that have enacted similar legislation – but those laws apply only to buildings 50,000 square feet or larger

[2] *See* E3's *Maryland Building Decarbonization Study*, September 16, 2021 at 5

- Incremental total resource costs ramp up almost immediately and reach between $3 billion and $5 billion by 2045 ($2021).[3]
- *Annual* incremental electric grid investment costs ramp up over time and reach approximately $1.2 billion in 2045 ($2021).[4]
- Electricity rates increase between 2 and 3 cents per kilowatt-hour by 2045.[5]
- Gas rates increase to the $40- 50/MMBtu range by 2045.[6]

Relating to the gas rates increase, the MCC stated:

> By eliminating new natural gas connections and decreasing the natural gas customer base, gas delivery rates could increase more than 20–times the current rate for consumers left on the gas system, leading to significant equity concerns.[7]

In addition, a recent study by the Consumer Energy Alliance titled *The Hidden Costs of a Maryland Natural Gas Ban,* noted:

> *With more than 40% of Maryland homes relying on natural gas during the winter for heat, banning such a critical resource would be a devastating blow to families who would have to pay more than $26,000 to involuntarily reconfigure their home and purchase new appliances. A ban on natural gas would also lead to an increase in energy bills, placing an unnecessary burden on the nearly one in 10 Marylanders who live at or below the poverty level, those on fixed incomes, and businesses still recovering from the hardships of COVID-19.* [8]

HB 831 unnecessarily eliminates energy choice, compromises Maryland's electric grid and fails to recognize alternatives to a gas ban. Natural gas is a product that Maryland businesses and residents want and need. For example, obtaining natural gas service in Somerset County has been a priority of the Somerset County Commissioners for decades. We recently partnered with the State to bring a natural gas line to the University of

---

[3] MCCC *Building Energy Transition Plan*, November 2021 at 11 (assumes commercial building owners would pay $100/tCO2 for remaining emissions beginning in 2030, modeled as "alternative compliance" costs).
[4] *Id*. at 12. Maryland retail electricity rates are currently higher than the national average. *See* eia.gov.
[5] Id. at 14.
[6] *Id*. at 13. For comparison, EIA currently forecasts natural gas prices to remain near $4 per MMBtu in 2022 and decrease in 2023. *See* EIA.gov.
[7] MCCC *Building Energy Transition Plan*, November 2021 at 9
[8] *See* "Forced electrification could cost Maryland consumers more than $26,000, report finds" *The Star Democrat*, dated January 28, 2022

Maryland Eastern Shore and the Eastern Correctional Institute in Somerset County. This project allowed UMES and ECI to transition off other less clean fuels (fuel oil and wood chips) that had served those institutions for decades – immediately reducing GHG emissions in this community. HB 831 would have prevented this Somerset County project. Today, Maryland residents who live in areas served by natural gas can choose to use gas or not. However, HB 831 would take that choice away and force Maryland residents to use only electricity in their new homes.

Also, banning and reducing the use of natural gas will significantly increase the amount of electricity required to be delivered to Maryland customers, which ironically is generated by natural gas. Delivering this increased amount for electricity into Maryland will require billions of dollars of annual investments in the Nation's and State's electric generation, transmission and distribution systems. Electric transmission and distribution system planning is a complicated and time-consuming process – as it should be. It can take years to obtain the regulatory and federal/state/local permit approvals necessary to construct electric transmission lines, substations and related facilities. HB 831 would significantly and artificially increase the demand for electricity in Maryland without any plan (or reasonable timeline) to ensure that Maryland's electric grid can reliably deliver this energy.

Finally, we note that natural gas companies have been and will continue to be valuable contributors to lower GHG emissions. Chesapeake Utilities currently partners with developers of renewable natural gas projects in Maryland that turn chicken litter and other organic material into pipeline quality natural gas. In addition, we are actively involved in the transportation of hydrogen for blending with natural gas for utilization in the generation of electricity in other states. Chesapeake strongly supports these (and other) innovative advancements in technology and the continued utilization of the natural gas industry's established and already built infrastructure to increase the likelihood of achieving net-zero targets while minimizing customer impacts.[9]

HB 831 is a job killer for Maryland workers. Mandating electrification and banning access to affordable and plentiful natural gas to all new buildings in the State is a job killer for both union and non-union Maryland workers.

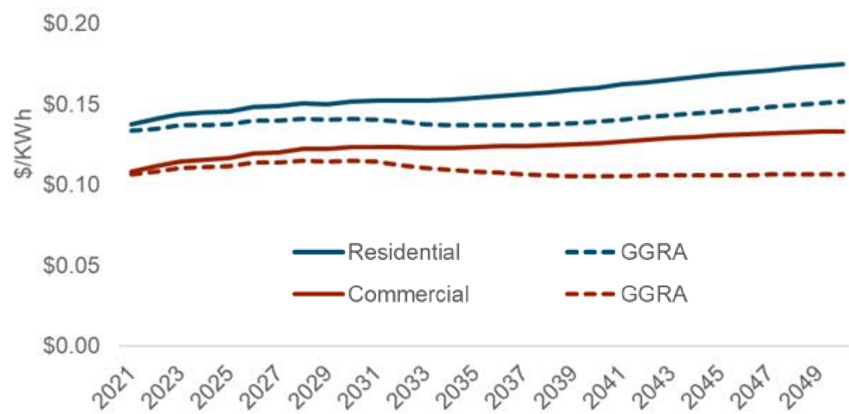
On behalf of Chesapeake Utilities, and our thousands of employees and their families who contribute every day in the communities where they live and work, we respectfully request an unfavorable vote on HB 831.

[9] https://www.aga.org/netzero.

Electricity and Gas Rate Impacts

Electricity rates increase gradually in the MWG Policy scenario to pay for the incremental electricity system costs. Rates are projected to increase from around 14 cents/kWh in 2021 to 17 cents/kWh in 2045 for residential customers and from around 11 cents/kWh in 2021 to 13 cents/kWh in 2045 for commercial customers. For both customer classes, rates are projected to increase by 2 cents/kWh by 2045 compared to the reference case.

Figure 6: Electricity Rates in the MWG Policy scenario



Although gas rate impacts are smaller in the MWG Policy scenario than any other scenario modeled, gas rates increase as consumers leave the gas system, leaving fewer consumers to pay for gas system costs. Gas rates remain flat through the 2020s but then climb to the $40-50/MMBtu range by 2045. This Plan recommends transitioning 100 percent of low-income households to heat pumps by 2030 to reduce energy burden for the most vulnerable Marylanders. Heat pump adoption in the commercial sector and the rest of the residential sector would ramp up in the 2030s as the costs of operating gas heating systems increase.

Figure 7: Residential Gas Rates

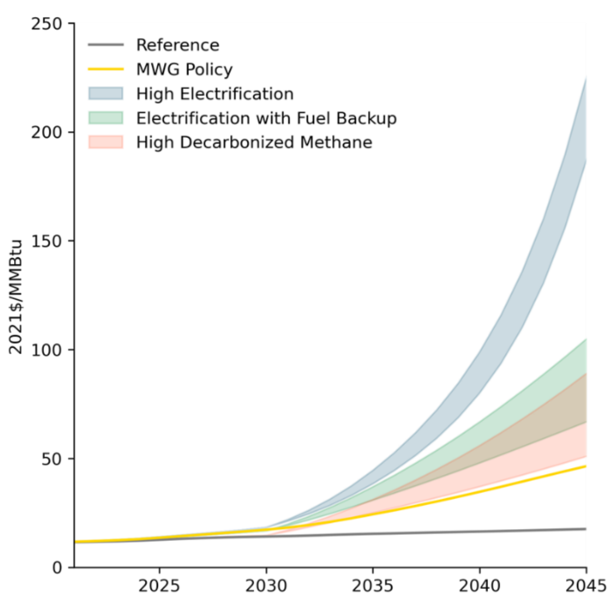
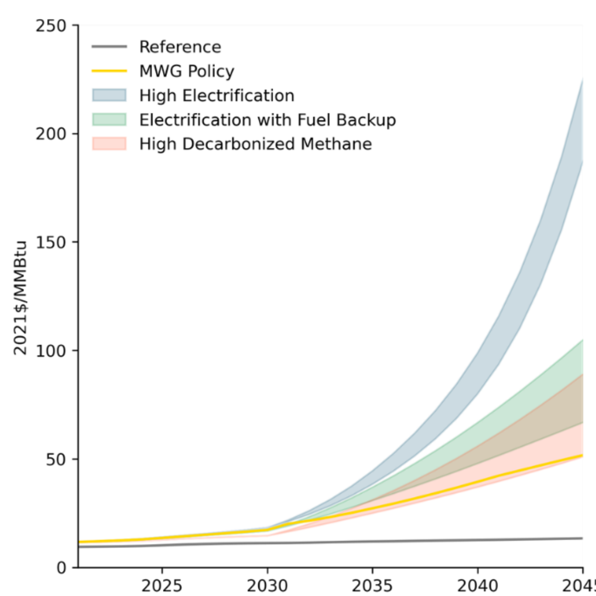


Figure 8: Commercial Gas Rates



BGE - HB 831 Reducing Greenhouse Gas Emissions - C

Uploaded by: Charles Washington

Position: UNF

bge
AN EXELON COMPANY

Position Statement

OPPOSE
Environment & Transportation
2/25/2021

House Bill 831: Reducing Greenhouse Gas Emissions
Commercial and Residential Buildings

Baltimore Gas and Electric Company (BGE) respectfully opposes *House Bill 831: Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings.* House Bill 831 seeks to dramatically alter Maryland's established greenhouse gas emission (GHG) goals in the Commercial and Residential building sector. This proposed legislation requires the Maryland Department of Environment (MDE) to establish building emissions standards for large commercial or multifamily residential Maryland buildings. House Bill 831 would further require the Department of Labor to adopt building performance standards by January 1, 2023, that require new residential and commercial buildings to meet all water and space heating demand without the use of fossil fuels, unless certain exceptions can be demonstrated. The bill would also require MDE to establish the Building Energy Transition Implementation Task Force to study and make recommendations regarding the development of complementary programs, policies and incentives aimed at reducing GHG emissions from the building sector that does not include key stakeholders in the process.

BGE is committed to electrification and decarbonization. The company announced our *Path to Clean:* a commitment to cut our own operational emissions by at least 50% by 2030 and achieve net-zero operations-driven emissions by 2050, in line with the ambitions of the nation. To achieve these goals, BGE will implement a series of initiatives designed to modernize our energy delivery systems; reduce energy use in our offices and buildings; increase our use of renewable-powered energy; and electrify our company's vehicle fleet. Within this very legislative session, BGE has demonstrated support for other key aspects of the suite of policies aimed at reducing emissions in the transportation sector, which makes up for about 45% of Maryland's greenhouse gas emissions, relative to buildings, which account for 13%. In addition, BGE's Empower Maryland programs have been highly successful in lowering energy usage and GHG emissions for residential and commercial customers, generating over 5 million MWh of energy savings valued at approximately $6 billion in lifecycle customer bill savings, and reducing over 4 million metric tons of GHG emissions. BGE's STRIDE (gas delivery modernization) program has also supported greenhouse gas reductions. Since 2014, pipe replacements have reduced the emission of about 55,000 metric tons of greenhouse gas. When BGE's STRIDE plan is complete, GHG emissions will have been reduced by 210,000 metric tons per year compared to 2013.

BGE is an electric and gas delivery company, whose key responsibilities are to deliver energy, regardless of whether it is electricity or gas, in a manner that is safe, reliable, and affordable. **As such, BGE has concerns about House Bill 831 for the following reasons:**

1. **The mandate for all electric building code requirement set forth in the bill presents: a) significant challenges from an electric system planning and reliability perspective; b) increased costs to customers; c) reduced optionality for customers; and d) impaired economic recovery and development in the state.**
2. **The Building Energy Transition Implementation Task Force does not include the participation and input of the very entities that need to plan for and construct the infrastructure necessary to accommodate such a transition in energy usage.**

Necessary Electric Infrastructure Investments

The BGE territory serves 54% of Maryland's residential gas customers and 55% of commercial and industrial gas customers. Collectively, these customers represent nearly half of statewide natural gas use in Maryland's buildings and industry. Of this natural gas use, approximately 25% is for harder to electrify large commercial and industrial users.

BGE is supportive of fully-informed efforts to decarbonize the building stock in our service territory. Such a meaningful shift to the state's economy, as the one contemplated in House Bill 831, however, requires time for planning and implementation. Electrification will drive a requirement for significant incremental investments in our electric infrastructure to serve the resulting load reliably and with resilience in mind. While the exact scope of the required investments cannot be fully modeled without detailed knowledge of where growth will occur on the system, directional analysis that we have conducted indicates the need for major infrastructure components, including in the very near-term multiple substations and many new feeder lines.

Planning and construction of this new infrastructure will require significant time to: (1) analyze the detailed capacity needs on the system; (2) find and acquire land for new infrastructure in areas acceptable to our customers; (3) plan and design capital projects; (4) obtain the required permits and approvals; and (5) construct the required substations and feeders. In addition, there will be the need to ensure the availability of the workforce necessary to construct this infrastructure. This process is further complicated by escalating supply chain challenges that are increasing the lead time for critical infrastructure equipment. For example, lead times for distribution transformers have increased fivefold from their typical timeframes.

BGE is concerned that the implementation timelines within House Bill 831 do not provide adequate time to prepare for load growth on the electric system and to construct the infrastructure needed to ensure a safe, reliable, and resilient grid. In addition, House Bill 831 does not provide the tools necessary to expedite the planning, siting, permitting, and construction of such electric system infrastructure and limits optionality for new technological advancements that may help to lower decarbonization costs over time and/or smooth end-user disruption during the transition. Without the required time and tools, it is possible that the grid will be unable to serve new load during times of peak energy usage. The bill also does not address and acknowledge the critical importance of energy diversity, so that as a state we do not effectively "put all of our eggs into one basket", thus increasing our risk to disruptive events such as severe storms, cyber-attacks, and other threats to our essential energy supply.

Customer Costs & Optionality

House Bill 831 will drive costs higher for BGE's existing customers. According to modeling of the BGE territory, residential gas customers can expect to pay $10,000 or more per household for heating costs and retrofits, if this legislation is enacted. In aggregate, this shift will cost our residential and commercial gas customers no less than $2.8 billion. These projections do not include the electric infrastructure costs described above to ready the system for load growth. Even the Maryland Climate Commission's report acknowledges these costs will be significant. The combined impact will be billions of dollars for BGE's customers alone, and even higher statewide. Rather than mandating an outcome for Maryland residents, an incentive based program (such as EMPOWER) could help Maryland achieve its decarbonization goals without arbitrarily removing residents' options.

Economic Development Impact

No state in the country has adopted a statewide building code that prohibits the use of natural gas for space and water heating. While states like California, New York, and Massachusetts are considering decarbonization policies, all are more measured in the timelines for implementing building decarbonization efforts. Even legislation proposed by smaller jurisdictions better accounts for the challenges, feasibility, necessary exceptions, and economic impacts inherent is such a transformative policy shift. Neighboring jurisdictions, such as Virginia and Pennsylvania, are in the process of enacting policies that would ban the very type of action that House Bill 831 seeks to implement. As such, this proposal would put Maryland at a competitive disadvantage with other states.

BGE supports electrification and decarbonization. However, the company opposes House Bill 831, as it forces a rapid and seismic shift in the state's economy without appreciating the impacts of such a rapid change on all energy customers in Maryland. This legislation proposes the nation's most aggressive electrification and decarbonization targets without leveraging the collective wisdom of diverse stakeholders to evaluate all options to achieve the desired reductions, to understand the likely consequences of those options on our customers and communities and on the state's economy, and to ensure the continued delivery of safe, reliable, and affordable energy delivery service. For these reasons, BGE opposes House Bill 831 and respectfully requests an unfavorable committee report.

February 23, 2022

The Honorable Kumar P. Barve
Environment and Transportation Committee
Room 251
House Office Building
Annapolis, MD 21401

Re: HB 831-Reducing Greenhouse Gas Emissions-Commercial and Residential Buildings Letter of Opposition

Dear Chairman Barve and Committee Members:

On behalf of the Commissioners for Somerset County, this is written to express our respectful, but strong, opposition to certain provisions within HB 831. First and foremost, Somerset County has a long history of taking actions to reduce the effects of climate change. And although there are many provisions within HB 831 (*e.g.*, electrifying the state vehicle fleet) we favor, we oppose the provisions in the bill that would: (1) ban natural gas in all new buildings on or before January 1, 2023; and (2) impose strict emission limitations on certain existing commercial and multi-family residential buildings that ratchet down over the next several years and impose severe fees on the owners of those buildings if they cannot convert off of gas service.

As you may know, a natural gas company recently completed the construction of a line that will bring natural gas service to the University of Maryland – Eastern Shore, the Eastern Correctional Institution and the US 13 corridor. This gas line has been a priority of Somerset County for decades and we greatly appreciate the help the State provided in making this happen. For years, potential employers have been hesitant to locate in Somerset County due to its lack of natural gas service. Now that the line is finished, employers and property owners (including certain agri-businesses, the Princess Anne Industrial Park and home builders) are counting on the ability to connect to natural gas.

This natural gas line will lower overall CO2 emissions in the County (by replacing dirtier fuels like propane and fuel oil) and will serve as a driver for economic development. Accordingly, the Somerset County Commissioners are extremely concerned about the negative impact certain provisions of HB 831 would have in our County. According to the Maryland Commission on Climate Change ("MCCC"), building direct use emissions account for 13% of economy-wide GHG emissions in Maryland. In an attempt to achieve this purported 13% reduction, the MCCC estimated that implementing a natural gas ban on new and existing buildings would result in significant compliance costs for building owners and require billions of dollars of upgrades to the electric grid that serves Maryland. All of these costs will be borne by Maryland residents.

Among other things, HB 831 requires the Maryland Department of Labor to adopt regulations that ban the use of natural gas in **all new buildings (NO exceptions) on or before January 1, 2023.** In addition, the bill requires the Maryland Department of the Environment to adopt strict building emissions standards applicable to "covered buildings" (*i.e.*, all commercial and multi-family residential buildings with a gross floor area of 25,000 square feet or more) phased in over several years until the buildings achieve a net-zero energy balance. We are aware of only two other states (Colorado and Washington) that have enacted similar legislation – but those laws apply only to buildings 50,000 square feet or larger.

HB 831 authorizes local governments to grant a variance from the natural gas ban for a new building - but only if the new building can pass a "cost-effectiveness" test and demonstrate that cost to comply with the gas ban is greater than the "social cost of the greenhouse gases that would be reduced by complying with the requirements." The bill dictates the requirements of this "cost-effectiveness" to include certain "projections" that skew the results in a way that make it difficult (if not impossible) for any building to pass. For example, HB 831 requires the "cost-effectiveness" test to "account for *projected* utility cost rates and emissions rates" as adopted by MDE or the U.S. EPA, whichever is greater. We understand that the reliability of many of the assumptions that support the calculation of "projected" increases in utility rates and emission rates are subject to significant debate by experts. In practice, we believe this "cost-effectiveness" test is illusory and we have real concerns about this variance process.

Finally, the Maryland Commission on Climate Change ("MCCC") recently approved a Building Energy Transition Plan. This Plan's recommendations are quite similar to the natural gas ban and existing building emissions standards proposed by HB 831.The MCCC's Building Energy Transition Plan estimates that the costs for its recommendations are in the multiple billion-dollar range annually (ranging from $1.5 to $4 billion annually just in electric transmission and capacity upgrades, $3 billion in alternative compliance payments; higher electric and gas rates, *etc*.). Moreover, we understand the basis for these cost estimates are questionable and therefore these costs could be much *higher*.

In summary, we are extremely concerned about the above-mentioned provisions within HB 831. Respectfully, we believe that artificially choking off the ability of customers to choose natural gas will defeat all of the hard work the Somerset County has expended over the last several years to bring the natural gas line to the County. We ask that you please consider our serious concerns as you review and debate Reducing Greenhouse Gas Emissions-Commercial and Residential Buildings . Most certainly, please do not adopt <u>any</u> natural gas ban or existing building emission standards until they are subject to much more scrutiny and study.

Sincerely,

Craig N. Mathies, Sr.
President

Cc: Senator Carozza
Delegate Otto

HB0831 -- 02.25.22 -- Reducing Greenhouse Gas Emis

Uploaded by: Donald Fry
Position: UNF

gbc POSITION STATEMENT

**TESTIMONY PRESENTED TO THE
HOUSE ENVIRONMENT AND TRANSPORTATION COMMITTEE**

**HOUSE BILL 831 – REDUCING GREENHOUSE GAS EMISSIONS – COMMERCIAL AND RESIDENTIAL BUILDINGS
Sponsors – Delegates Stein and Barve**

February 25, 2022

**DONALD C. FRY
PRESIDENT & CEO
GREATER BALTIMORE COMMITTEE**

Position: Oppose

The Greater Baltimore Committee appreciates and supports the need to establish plans and standards to address the climate crisis. A collaborative approach between government, the private sector, and citizens is essential to meet the challenges being brought about by climate change. The GBC membership, comprised of businesses, nonprofit organizations, and educational institutions, recognizes that our institutions cannot thrive with ecological and public health problems brought about by our changing environment. Extreme weather disasters are becoming more frequent, imposing real costs on companies and the communities they help support. Climate change threatens facilities and operations, supply and distribution chains, and access to electricity and water. It can also impairs employees' access to employment and impacts customers from buying products or services.

Legislation passed in Maryland to address climate change should be ambitious but achievable, consist of an incremental framework that provides for significant greenhouse gas reductions over a reasonable period of time, and not impose excessive costs on businesses that can ill afford to meet the standards in the law or consumers of energy. Requirements should also not vary greatly from any federal requirements in order to prevent a patchwork of conflicting regulatory requirements. Provisions to provide generous financial assistance in the form of grants or low interest loans should be made available to businesses that are required to make costly investments in new technology. Unfortunately, House Bill 831 does not meet this description.

House Bill 831 requires the owner of any existing commercial and multifamily residential buildings that have a gross floor area of 25,000 square feet or more, excluding parking, to begin measuring and reporting its direct emissions in 2025. Building owners would need to report a 20 percent reduction in net greenhouse gas emissions by 2030 and net-zero emissions by 2040. For those buildings that cannot perform the required reductions, an unspecified fee would have to be paid for emissions exceeding the standards.

All new buildings would be prohibited from using natural gas or heating oil beginning in 2023. The legislation would also require all future construction to meet green energy code standards and cease fossil fuel hookups.

Natural gas is a critical fuel option for many Maryland based businesses. For years, businesses have relied heavily on natural gas to run their operations. Imposing restrictions on natural gas will likely lead to higher commodity cost. Reducing or removing accessibility to natural gas and forcing conversion to electric for commercial and industrial customers would present a considerable capital cost forcing businesses to invest significant funds to retrofit their operations.

The added cost of significantly altering business operations would jeopardize a company's ability to remain profitable and competitive. This would result in businesses looking to the state to subsidize the cost through financial assistance in the form of grants or low interest loans to meet the new state greenhouse gas standards.

The Greater Baltimore Committee believes that addressing climate concerns requires commitment from all parties, but the state must set reasonable and attainable goals and acknowledge realistic expectations regarding the cost of compliance for businesses. Commercial and industrial companies are important economic drivers and job creators in Maryland. Maryland businesses are still struggling from the effects of the COVID-19 pandemic recession, and adding costly new requirements too quickly could hamper economic growth and job creation.

The Greater Baltimore Committee report entitled Gaining a Competitive Edge outlines eight key pillars that promote economic growth and job creation. At least three of the pillars that are identified in the report are challenged by the passage of the climate control legislation as introduced:

1) **Government leadership that unites with business as a partner.**
   Maryland leaders must set a welcoming tone that communicates positive support for business, respect for the private sector as a partner, not an adversary, and reflects a strategic plan for business growth and job creation.

2) **Regulatory policies that are streamlined, stable, and predictable.**
   Maryland must project to businesses within and outside the state that its government regulatory policies are reasonable, relevant, free of surprises or redundancy, and considerate of businesses' sense of urgency.

3) **Competitive costs of doing business.**
   Public policies must reflect a government predisposition to nurture business growth and to avoid arbitrarily or disproportionately imposing additional overhead upon the business sector.

For the reasons set forth above, the Greater Baltimore Committee urges the Maryland General Assembly to give due consideration to the business competitiveness and cost concerns outlined above in the passage of climate change legislation. As such, the GBC respectfully requests that the Environment and Transportation Committee give House Bill 831 an unfavorable report.

The Greater Baltimore Committee (GBC) is a non-partisan, independent, regional business advocacy organization comprised of hundreds of businesses -- large, medium and small -- educational institutions, nonprofit organizations and foundations located in Anne Arundel, Baltimore, Carroll, Harford, and Howard counties as well as Baltimore City. The GBC is a 67-year-old, private-sector membership organization with a rich legacy of working with government to find solutions to problems that negatively affect our competitiveness and viability.

Final House Bill 831 Written Testimony_WGL.pdf

Uploaded by: Dytonia Reed Reed

Position: UNF

1000 Maine Avenue, SW| Suite 700 | Washington, DC 20024 | www.washingtongas.com

TESTIMONY OF

THE

WASHINGTON GAS LIGHT COMPANY

BEFORE THE

COMMITTEE

FEBRUARY 25, 2021

HOUSE BILL 831 – REDUCING GREENHOUSE GAS EMISSIONS - COMMERCIAL AND RESIDENTIAL BUILDINGS

POSITION: OPPOSE

Washington Gas Light Company (Washington Gas) provides these written comments regarding House Bill 831, the Reducing Greenhouse Gas Emissions --Commercial and Residential Buildings (HB 831). HB 831 seeks to further address climate change within the State of Maryland by requiring the State and its agencies to promulgate rules and take other actions that would require public and private actors to achieve net-zero statewide greenhouse gas emissions standards by 2045.

Washington Gas supports the overall goal of reducing greenhouse gas emissions and recognizes the scientific consensus that human activity – primarily greenhouse gas emissions and the conversion of land for agriculture and development – is contributing to changes in the global climate including changing weather patterns, rising sea levels and more extreme weather events. We believe that actions must be taken now to stabilize and reduce emissions. We are taking those actions.

Washington Gas also recognizes that we have a duty to support our customers and communities and to help the State develop and implement policies that help us provide affordable, safe, and reliable energy without restricting our customer's energy choices, including source. Natural gas is an extremely affordable and reliable heating fuel available to residents and businesses in Maryland and many families and restaurants find it is a preferred option for cooking. Much of the recent success for the United States in addressing its climate impact in recent decades has been through the increase in use of natural gas as fuel input for power generation, displacing coal and oil.

A bit more about our background and focus. Washington was a small town when Washington Gas brought light to its first customer, the U.S. Capitol, in 1848. We have grown with this community ever since and care deeply about the 1.2 million customers we serve today, with over 500,000 customers in Maryland alone[1]. We deliver affordable energy to heat homes, cook food, and enjoy hot showers. This safe and reliable energy is easy to take for granted, but it is only available because of our over dedicated employees, including over 600 in Maryland, and our repeated investments to maintain a vast network of essential infrastructure. We are proud to be there for our customers and will continue to work every day to earn their trust and confidence. WGL is committed to meeting changing energy needs in a sustainable, low-carbon future.

Washington Gas hears the voice of policymakers in the State as it relates to climate change. We feel, however, that HB 831 will strip our customers of energy choice, will have significant unintended consequences, and will pre-determine a pathway focused on policy-driven economy-wide electrification without adequate recognition of reliability, resiliency, and affordability.

This opposition to HB 831 should not be understood to mean that Washington Gas is not actively taking concrete actions today to address decarbonization and is not fully ready to invest further in the pursuit of fuel neutral decarbonization pathways as emerging solutions and technologies continue to develop, mature, and become commercially viable. Washington Gas' role in a decarbonized future, we believe, is framed around four key areas – 1) end use and efficiency, 2) sourcing and supply, 3) infrastructure and operations, and 4) transportation.

Washington Gas is actively working on all these elements. For example, we continue to work to expand our work with Maryland customers on delivering household energy efficiency. We have also recently signed a novel contract with WSSC Water to advance an innovative bioenergy project. In addition, we have delivered certified natural gas to our customers during 2021. Finally, we are working on options to further decarbonize our truck fleet, as well as working with other transportation fleet teams across our footprint to discuss new transportation solutions and alternative fueled vehicles.

OUR CONCERNS

Our primary concern with HB 831 is the structural focus of the legislation on economy-wide electrification without understanding what this will mean for the affordability, customer choice, reliability, and resiliency of our customer's energy needs over time. We recommend that the legislation be modified to provide fair support for all potential decarbonization pathways, recognizing that technologies, markets, and solutions will continue to develop over the coming years and decades.

One specific issue with HB 831 is the "*requirement that new buildings meet all water and space demand without the use of fossil fuels*" (Ln 10-13, pg. 8). Stated more directly, HB 831 prohibits

[1] 1 Washington Gas provides service to 506,791 residential and commercial customers throughout Prince George's, Montgomery, Calvert, Charles, Frederick, and St. Mary's counties.

the use of fossil fuels, i.e., natural gas, in newly constructed buildings in the State in the very near-term. While the legislation at the highest policy level is focused on net-zero statewide greenhouse gas emissions by 2045, this explicit restriction goes beyond this goal and forces businesses and private actors to lose energy choices that they may find valuable for their enterprise and organization. And which may be a more affordable and cleaner solution.

Maryland residents, current and future, want energy choices. More than 40% of Maryland homes today rely on natural gas.[2] According to recent polling, 66% of Marylanders prefer to continue using natural gas.[3]

This bill's directive to prohibit the direct use of natural gas and require building electrification for all growth and development may have an unintended effect of increasing in the near-term emissions given that largest source of electricity used in the State of Maryland is derived from power plants burning natural gas to generate electricity.[4] Washington Gas offers that the direct use of natural gas on-site for heating and hot water is far more efficient that using natural gas to generate electricity, transmit through the transmission and distribution system, and then use that energy for electric resistive or heat pump space heating. If this bill passes, there will need to be significant investments in the power supply infrastructure to serve Maryland, without any consideration for reliability and resiliency. Moreover, it will cause an increase in electricity generated by out of state natural gas or other fossil fuels power plants providing no local job benefit and potentially cause an increase in greenhouse gas emissions.

HB 831 also establishes new building emissions standards that require commercial or multifamily residential buildings with a gross floor area of 25,000 square feet or more that directly produce emissions onsite to reduce their net greenhouse gas emission by 20% on or before January 1, 2030.[5] While the bill provides for an alternative compliance plan, those operating under an alternative compliance plan will be subject to a "*fee*" (Ln.10-13, pg. 3) that is akin to a tax on customers.
Washington Gas supports policies that promote energy resiliency and sustainability by leveraging the reliability of the current natural gas delivery system. Phasing out natural gas will require an increase in electricity production and transmission as buildings consume more electric power for their heating systems. Thus, this natural gas ban may simply shift emissions rather than reducing them. Unfortunately, HB831 does not provide the flexibility, nor does it support technological innovation to reduce emissions through focusing on proven solutions like modernization of our physical infrastructure.

For instance, our Strategic Infrastructure Development and Enhancement Plan (STRIDE) program accelerates our pipeline replacement. This ongoing pipeline replacement project has enhanced

---

[2] Consumer Energy Alliance, pg. 2 https://consumerenergyalliance.org/2022/01/forced-electrification-could-cost-maryland-consumers-more-than-26000-per-household-new-cea-report-finds/

[3] Public Opinion Strategies conducted a statewide poll surveying 600 Marylanders across the state from January 22, 2022 through January 26, 2022.

[4] https://www.pjm.com/markets-and-operations.aspx

[5] The bill applies to *"covered buildings not owned by the State"* defined as a commercial or multifamily residential building with a gross floor area of 25,000 square feet or more that directly produces emissions on site. (Ln 29-31, pg. 23). This bill is limited to commercial and multi-family units.

safety and reduced emissions throughout our service territories. As of 2018, Washington Gas has reduced state GHG emissions by 32,000 metric tons because of these infrastructure enhancements.

Washington Gas would also support this Committee working together to promote efforts to decarbonize the energy supplied through our distribution network. There are two ways to reduce emissions associated with natural gas supply. The first is introducing low/no carbon non-fossil-based gases into the natural gas delivery system. For instance, renewable natural gas (with feedstocks from municipal solid waste landfills, wastewater from treatment plants, livestock farms, food production facilities and organic waste management operations) and green hydrogen are options that have strong decarbonization potential. They also require no action on the part of customers to implement and bring to scale. The second is to avoid methane emissions from upstream natural gas extraction. This involves sourcing natural gas from higher quality producing firms. These technologies and options will be imperative as Maryland moves to a cleaner future. And are available today to our customers. Washington Gas looks forward to working with the Legislature to seek to bring additional cleaner supplies to its customers.

Maryland Commission on Climate Change Recommendations

House Bill 831 purports to be a policy recommendation offered by the Maryland Commission on Climate Change's E3 report, which analyzed three pathways to meet the State's climate goals. While three pathways were assessed, the Maryland report ("MD report"), published in October 2021, indicated that a fuel neutral approach to decarbonization goals is more affordable and certainly will provide a framework for a more reliable and resilient energy system.[6] A few months later, on February 15, 2022, E3 published a pathway report for Massachusetts ("MA report")[7]. The MA report is much more detailed than the Maryland report with respect to customer assumptions, analysis, discussion, and number of pathways considered (8 pathways were offered but consolidated to 5).

In addition to presenting a more balanced perspective, the MA report relies on more realistic assumptions regarding customer conversion costs. The estimates to develop electric transmission to deliver off-shore wind power and to modernize the distribution grid to accommodate distributed resources were somewhat improved but still require detailed planning studies. Overall, most of the pathways call for enormous renewable generation and significant electrification of buildings. The MA report overall provides a more thorough discussion of why this is untenable from both a practical and financial perspective. Perhaps most importantly, the MA report analysis assumes that the transition will be driven by customers – not mandated conversions – and that financial support will be needed for low-resource customers. Neither report concludes that an all-electrification pathway is the preferred option.

[6] AGA Study on Baltimore Electrification Customer Impacts https://www.aga.org/contentassets/6628ffb835194ba1b89a0bb2ebc3b8a2/md-grounded-in-reality_exec-summary.pdf

[7] Pg. 8, Massachusetts D.P.U. 20-80.

CONCLUSION

Washington Gas works every day to earn our customers trust and confidence. We support the overall goal of reducing greenhouse gas emissions. We believe the best option is to support a fuel neutral decarbonization pathway that allows for the benefits of the entire energy system to be brought to bear on resolving sustainability goals, while also considering affordability. Washington Gas strongly objects to policies which reduce customer choice and mandate electrification. We will remain focused on ensuring energy security – reliability and resiliency – in any policy change. We are confident that there is a path forward, but do not see that HB 831, as drafted, is the right approach.

Dytonia "Dy" Reed, Esq., State Government Relations and Public Policy Manager
M 202.379.6993 | dytonia.reed@washgas.com

Jason Ascher - Oppose - HB 831 - Reducing Grenhous
Uploaded by: Jason Ascher
Position: UNF

MID-ATLANTIC PIPE TRADES ASSOCIATION
PLUMBERS - STEAMFITTERS - SPRINKLER FITTERS
PIPE FITTERS - PIPE WELDERS - HVAC SERVICE TECH

7050 Oakland Mills Road
Suite 180
Columbia, MD 21046

Phone: 410-290-3890
www.midatlanticpipetrades.o

House Environment and Transportation Committee

To: Delegate Barve, Chair; Delegate Stein, Vice-Chair; and Members of the Committee.
From: Jason Ascher, Political Director, Mid-Atlantic Pipe Trades Association – United Association of Plumbers and Steamfitters

OPPOSE HB 831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

On behalf of the Mid-Atlantic Pipe Trades Association, our five United Association of Plumbers and Steamfitters Locals, and our over 10,000 members plus their families across all corners of Maryland, I ask you to **OPPOSE HB 831**.

As we move to renewable energy sources and eliminate fossil fuels, the state needs to keep track of three essential things. Protecting the workers, protecting the stability of the electric grid, and protecting taxpayers from high transition costs. As an organization, we are not against renewable energy. However, we believe workers, better known as taxpayers, need to be the priority in this process. We will never support the wholesale elimination of natural gas from the energy sector, especially while renewable energy infrastructure cannot replace it.

Hard-working Marylanders build and maintain the infrastructure needed to operate our electric grid. These workers earn good family-sustaining wages with benefits so they can take care of their families, spend money in the community to help support local businesses, and pay taxes. Eliminating fossil fuel infrastructure would cost many hard-working Marylanders their jobs and ability to do these things. The jobs created to replace them in the renewable energy sector are typically lower-paying than those they will lose and do not include the same benefits. This legislation says nothing about the workers who build these buildings that will lose jobs.

Everyone wants to be able to use their cell phones and computers. They also enjoy watching TV and Movies. To continue to do these things, you need a safe and constant flow of electricity. Removing fossil fuels from buildings before enough renewable infrastructure is built to replace them could cause significant issues and lead to people not having the ability to use their phones, computers, and televisions. We need to make sure that these buildings have enough power that the residents can use all their electric devices without worry.

Finally, if you require taxpayers to replace fossil fuel operating HVAC, water heaters, etc., there is a cost that many would not be able to afford. There would also be a need for these taxpayers to upgrade the electrical wiring. Studies have shown that these upgrades could cost as much as $30,000 to $40,000 per home. These upgrades are an expense that many working-class taxpayers cannot afford. For renters, this is also true because landlords would pass on the cost to their tenants to make these upgrades. The language on use for “no upfront costs” for these upgrades does not prevent homeowners and renters from paying for the exorbitant cost of these upgrades.

For these reasons, I ask you to **OPPOSE HB 831**

Sincerely,

Jason Ascher
Political Director
Mid-Atlantic Pipe Trades Association

2022-HB831_PHI_UNF_Final.pdf
Uploaded by: Katie Lanzarotto
Position: UNF

February 25, 2022

112 West Street
Annapolis, MD 21401

Oppose – House Bill 831
Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Potomac Electric Power Company (Pepco) and Delmarva Power & Light Company (Delmarva Power) respectfully oppose **House Bill 831 Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings.** House Bill 831 would require the Department of the Environment (MDE) to establish building emissions standards for covered buildings that achieve 20% reduction in direct building emissions on or before January 1, 2030 from 2025 levels or an alternate baseline of not earlier than 2020 under certain circumstances, and net-zero direct building emissions on or before January 1, 2040. It would require MDE to require owners of covered buildings to measure and report direct emissions to MDE annually beginning in 2025 and establish the Building Energy Transition Implementation Task Force to study and make recommendations regarding the development of complementary programs, policies and incentives aimed at reducing GHG emissions from the building sector.

As part of the Exelon family of companies, Pepco and Delmarva Power joined Exelon's ongoing commitment to protect the environment and take actions to address climate change through Exelon's Path to Clean. In 2021, Exelon announced a new goal targeting a reduction in operations-driven GHG emissions of at least 50% below 2015 levels by 2030, and net zero emissions by 2050. At Pepco and Delmarva Power, we are working to align our operations, grid investments, and customer product offerings and services to advance Maryland's state and country climate change and clean energy goals. This means reducing our own GHG emissions from operations on a trajectory that meets or exceeds the state's reductions goals and working to inform and advocate for policies and processes that enable further decarbonization. Additionally, we strive to support our customers and the larger community by providing the tools, programs such as EmPower and resources needed to enable the transition to a more equitable and inclusive clean energy future and greater resilience in the face of a changing climate. In order to drive down GHG emissions to the level necessary to avoid the worst impacts of climate change, actions must be taken to decarbonize all sectors of the economy, while advancing efficiency, resilience, equity, inclusion and innovation.

Pepco and Delmarva are supportive of efforts to decarbonize Maryland. House Bill 831 advances Maryland's efforts to decarbonize, however, the details and timeline set forth in the bill will be difficult to implement from an operational readiness perspective and likely cost customers more money than would a longer-term, deliberate plan to decarbonize that accounts for equity and affordability. The timeframe in this bill will require real estate developers to modify electric needs, which have been incorporated into existing planning to ensure safe and reliable service. The timeframe outlined in this bill is not sufficient to receive new interconnection requests from these customers, re-engineer interconnections, analyze modifications to planned investments, and implement new investments. Further, the impact on new investment needs may be considerable in fast growing areas of the system, and ongoing supply chain delays, as well as siting and permitting issues will likely slow the progress of infrastructure projects needed to support the move to electrification. Pepco and Delmarva Power, as the electric distribution companies, will need to plan for, invest in, and build these upgrades to ensure a reliable system for customers and to ensure the system can adapt to increased electrification.

For example, this body should consider whether an integrated delivery energy network may offer a more cost-effective means to reach Maryland's ambitious climate goals. Four key tools to consider, which can be facilitated by this integrated delivery energy network, are electrification, further work on energy efficiency, integration of clean energy sources to the transmission and distribution system and introduction of clean fuels, such as hydrogen or renewable natural gas. This integrated approach can provide opportunities to reduce cost increases, maximize equity and provide flexibility for future economic development.

Finally, the task force specified in the bill should include utility representatives and in fact, should include a representative from each utility that is willing to participate. Each utility distribution system will be impacted differently depending on whether customers within the service territory are utilizing fossil fuels for their heating needs or utilizing other sources (geothermal, electric heat pumps, etc.).

Pepco and Delmarva Power are committed to proactively addressing climate change through our Path to Clean and partnering with our key stakeholders, the communities we are privileged to serve, the State, the legislature, the Public Service Commission and others to create a cogent, integrated plan for decarbonization on a timeline that is achievable.

For the above reasons Pepco and Delmarva Power respectfully request an unfavorable vote on House Bill 831.

Contact:
Alexis Gallagher
State Affairs Manager

Katie Lanzarotto
Senior Legislative Specialist

609-412-6345
Alexis.gallagher@exeloncorp.com

202-428-1309
Kathryn.lanzarotto@exeloncorp.com

HB 831 Evers Superior Fireplace and Garage Door
Uploaded by: Kurt Evers
Position: UNF

Good afternoon Delegates,

I am Kurt Evers a partner at Superior Fireplace and Hot Tubs, located in Prince Frederick and La Plata. I also represent the Mid Atlantic Hearth Patio and Barbeque Association for MD. Superior Fireplace is Family Owned and Operated since March of 2010. We currently employ ten people and have had up to 15.

I am a lifelong Marylander, Grew up in Landover Hills, Early on I dedicated my life to public service, I was a volunteer Firefighter at Riverdale Fire Department for twenty-five years and a Career Firefighter with Montgomery County Fire Department for twenty. I am honored to have served the citizens of this great state.

Delegates, Superior Fireplace and The Hearth industry in MD oppose HB 831 as it is currently written; we agree that something must be done about the climate. However, HB 831 is a very aggressive carbon free bill that goes above and beyond the GGRA 2030 and the recommendations of the MCCC.

Did you Know:

1) Maryland produces a little over 1/10th of a **percent** of the worlds Carbon. That is .00123 of the world's carbon.
2) Per Capita Maryland is one of the lowest Carbon Producing states.
3) MD Currently imports about 46% of its electricity now.
4) There are twenty states that have Fuel choice laws.
5) Relying on Electricity as the sole source of energy is dangerous. This is stated in the MCCC report as well as by power provides throughout the state.
6) Maryland recently experienced widespread power outage, due to a winter storm. Power failure (as you know) was particularly problematic for Residents who own ALL Electric Homes and businesses; However, Power Failure is Not as problematic for homes & businesses that have fuel choice, such as gas, electric, back up generation etc.
7) IF Maryland's Residents are forced to switch to all electric, there will be no other source of energy to fall back on in the future. This will impact the elderly and the medically frail, most. I am also concerned with the inefficiencies of Heat pumps when temperatures drop, people will resort to some type of additional heat (KEROSEAN) or just suffer.
8) Electrification puts too much of a burden on Maryland's Residents, especially the low to middle income and retirees, it's already too expensive to live in Maryland. Look at how many people leave the state in their golden years.
9) Forced electrification from, HB 831, in the short term will be worse for the environment as more fossil fuels will have to be burned to generate electricity to meet demand. Technology is not available to completely move renewable electricity "
10) There are no options, in the bill for any type of renewable or Bio products if one becomes available.
11) The effects on the economy, business and industry are huge. This bill will affect so many sectors I am not sure we know how many will be affected. Not to mention lose of tax dollars from business that fail.
12) Job Loss, I estimate this will cost the hearth industry about 150 to 200 jobs.

Kurt Evers
2521 Plum Point Rd
Huntingtown, MD 20639
443-532-5173

Superior Fireplace and Hot Tub
5246 Cutter Ct.
Prince Frederick, MD 20678
410-535-0704

Letter of Opposition- HB 831- Climate Action Now A
Uploaded by: LeeAnn Linton
Position: UNF

Somerset County
Economic Development Commission

11916 Somerset Avenue, Suite 202
Princess Anne, Maryland 21853
www.somersetcountyedc.org

Daniel K. Thompson
Executive Director

Telephone: 410.651.0500
Fax: 410.651.3836
Email: edc@somersetmd.us

February 14, 2022

Delegate Kumar P. Barve
Chairman of Environment and Transportation Rules and Executive Nominations Committee
251 Taylor House Office Building
6 Bladen Street
Annapolis, MD 21401

Re: SB 528/ HB 831 "Climate Action Now Act of 2022

Dear Delegate Barve and Committee Members:

As the Executive Director for the Somerset County Economic Development Commission (EDC), we would like to submit this letter opposing SB 528/ HB 831 "Climate Action Now Act of 2022" which will ban efforts of bringing future Natural Gas initiatives to the State of Maryland, specifically Somerset County.

It is the mission of the Somerset County EDC to actively pursue businesses to expand and locate in Somerset. I am writing to you today to underscore the importance of Natural Gas and provide you with some statistics as an overview of the economic impact that Natural Gas availability would have in Somerset County.

The County has explored various energy projects over the years to include wind, solar, waste to energy, etc. Natural Gas is one that the county has pursued for over 2 decades. It would be unfortunate to deny access to our local businesses and residents having pursued this endeavor for 20 plus years. Many of the issues were carefully thought out by the Board of Public Works durng this process.

Some projects that will benefit immediately include:

- Mountaire Farms, who is waiting to invest additional $5 million and add 5-7 new jobs
- Peraton (formerly Northrop Grumman), who is waiting to invest $6 million and add 10-15 new jobs
- Princess Anne Industrial Park (2 companies currently have contracts on park property and have referenced the benefit of natural gas accessibility)
    1. $2.5 million and 20 jobs
    2. $1.5 million and 12-15 jobs

- Somerset Crossing, a 63 acre property locate along Rt. 13 in Princess Anne is now in site review. This will include mixed use projects such as a Hotel (100 rooms), Office Space 50,000 sq. ft., and Retail 150,000 sq. ft., 3 pad sites. Creating a total of approximately 75-100 jobs.

- Renewable Energy Projects (proposed)
    - Clean Bay - $175 million and 20 jobs
    - Planet Found - $25 million and 10 jobs

These are just a few projects that are currently in need of Natural Gas. There have been countless projects that have been lost over the years to other jurisdictions due to the lack of supply in Somerset. Mainly, those industries were affiliated with boat manufacturing, welding, processing, etc.

Certainly the extension of the natural gas pipeline brings prosperity to local businesses by decreasing their energy cost and in return will be able to invest more in their business which means added job growth. However, I think what is lost is the true benefit to our local residents.

Somerset County has many challenges such as high unemployment, high poverty rates, high energy cost, etc. Therefore, why should one of the most challenged counties in Maryland not have access to natural gas, when other counties enjoy the benefits? Below are some resources and facts that may help you better understand:

- Unemployment as of December 2021 5.8% which is second highest in state (next highest was Worcester County at 7.0%)
  MonthlyLaborReview12_Dec21.pdf (maryland.gov)

- Poverty rate is 22.2% which is highest in the state (next closest is Baltimore City at 20.0%)
  U.S. Census Bureau QuickFacts: Somerset County, Maryland; United States

- Median Household Income is $37,803 (which is the lowest in the State of Maryland)
  U.S. Census Bureau QuickFacts: Somerset County, Maryland; United States

Over the years Somerset County has missed out on opportunities for companies to locate or expand in the county and should not be held hostage at a time when added growth is vital.

Bringing Natural Gas to the County will result in great economic development success by providing additional tax revenue to the County as well as much needed jobs. Natural Gas will play an energetic role in promoting commercial, industrial, and agribusiness to locate here.

We certainly encourage your consideration in opposing SB 528/ HB 831 and support our endeavor of continuing to grow the local economy in Somerset County. If you have any questions, please don't hesitate to contact our office.

Sincerely,

Daniel K Thompson

Daniel K. Thompson
Executive Director

MBIA Letter of Opposition HB 831.pdf
Uploaded by: Lori Graf
Position: UNF

MARYLAND BUILDING INDUSTRY ASSOCIATION
11825 West Market Place | Fulton, MD 20759 | 301-776-6242

February 25, 2022

The Honorable Kumar P. Barve
Environment & Transportation Committee
House Office Building, Room 251,
6 Bladen St., Annapolis, MD, 21401

RE: Opposition HB 831 – Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Dear Chairman Barve:

The Maryland Building Industry Association, representing 100,000 employees statewide, appreciates the opportunity to participate in the discussion surrounding **HB 831 – Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings**. MBIA **Opposes** the Act in its current version.

While the MBIA supports initiatives to support Climate Change. This bill would create new state-wide greenhouse gas emissions standard for residential and commercial buildings in the State of Maryland. MBIA respectfully opposes this measure. This bill has a variety of unintended consequences that will negatively impact the residents of the State of Maryland and disproportionately target lower income residents.

The bill requires that the Department of Energy develop a building emissions standard that would reduce direct building emissions by 20% and require that all heating systems to operate with out the use of fossil fuels after January 1, 2023. This creates major issue because the legislation as written makes no allowances for buildings that are already under construction with plans to install a gas heating system. This bill could potentially require significant and expensive retrofits on newly constructed buildings that have already outlaid the initial expense of installing a new and modern heating system. It is unfair and unjust to approve plans that specifically allow for the installation of these systems only to change regulations mid-project and require tens of thousands of dollars in additional retrofits. In order to act in good faith, Maryland should exempt projects currently under construction and projects that break ground before the DOE issues its new guidelines. If future policy continues to mandate the electrification of buildings, then there should be a provision allowing for exceptions for the lifecycles of these new heating systems.

In addition to concerns about the efficiency and economic expense of requiring the installation of new heating systems, there are significant doubts that the current electrical infrastructure of Maryland can handle the load that would be created by dramatically increasing the usage of the electrical grid. A 2020 estimate of federal infrastructure investment estimates that we are underinvesting by hundreds of billions of dollars over the next 30 years to meet the demands of increased electrical reliance as we attempt to battle climate change. The increased strain on an aged and out of date electrical grid will result in more brownouts for residents unless the infrastructure is put in place that can handle the additional load.

In addition to the adjusted heating requirements, this bill will impose carbon reduction targets on existing buildings. These reduction targets require a 20% reduction in emissions by 2030 and a zero emission target by 2040 or require that the building pay a fee. This policy will unfairly raise the costs of living for low income individuals in the State of Maryland and dramatically exacerbate economic inequality. Landlords that are required to retrofit these buildings will pass those costs on to their tenants resulting in a dramatic increase in rents. Since lower income people are more likely to rent and less likely to own a home they will bear the burden of these new costs. Lower income homeowners will also be affected by these requirements, even with the financial incentives program many of them will be unable to meet these climate goals since they bear a significant up-front cost in order to achieve the required reductions. Since those people will then be subject to additional fees, these requirements will amount to an additional electricity tax on people that cannot afford to meet the requirements due to having a lower income. While MBIA lauds the requirement that low income houses be supported as they make these changes, this provision does not take into account how costs will be passed down in properties under commercial use.

The bill also creates additional expenses for low income individuals by driving up the cost of the residences remaining on natural gas systems. Since the number of consumers of gas will decrease, the people that are unable to meet these requirements and are forced to stay on gas heating systems will see their costs rise as utility companies make up the revenue shortfall by increasing their prices on the remaining consumers. So not only will low income individuals see rents rise to cover those costs of retrofitting the buildings, but they will also see a spike in heating costs because the people that could afford to retrofit their properties or could pass that cost to tenants who stop being gas consumers.

This bill also lacks any incentives for consumer or builders. There are many programs that other states have implemented and in all cases there are many incentives offered. For example, Massachusetts has an incentive package valued at $3billion for their various programs. Homeowners who opt out of gas heat entirely in favor of an electric heat pump system can get up to $10,000 in rebates. Those who install heat pumps but elect to keep their existing gas system as a back up are eligible to receive less money back. These options should be further explored and part of any legislation that is passed.

For more information about this position, please contact Lori Graf at 410-800-7327 or lgraf@marylandbuilders.org.

cc: Members of the House Environment & Transportation Committee

HB 831_Reducing Greenhouse Gas Emissions-Commercia
Uploaded by: Maddy Voytek
Position: UNF

MARYLAND
Chamber of Commerce

LEGISLATIVE POSITION:
UNFAVORABLE
House Bill 831
Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings
House Environment and Transportation Committee

Friday, February 25, 2021

Dear Chairman Barve and Members of the Committee:

Founded in 1968, the Maryland Chamber of Commerce is the leading voice for business in Maryland. We are a statewide coalition of more than 5,500 members and federated partners, and we work to develop and promote strong public policy that ensures sustained economic recovery and growth for Maryland businesses, employees, and families.

HB 831 requires the Maryland Department of the Environment to establish and adopt new building emissions standards for commercial and residential building. The bill also establishes a task force to study and make recommendation on ways to reduce greenhouse gas emissions from the building sector and on future ways of alleviating the cost of retrofitting buildings to meet the new emissions reduction standards. The Chamber's primary concerns include:

1. This legislation calls for new and aggressive requirements for all commercial buildings, except those designated as historic. HB 831 requires MDE to adopt new building emission standards that produce a 20% reduction in direct building emissions by 2030 and net-zero by 2040. This net-zero requirement is **ten years ahead** of the goals set by the federal government, which most companies have based their GHG/sustainability plans on. With an extraordinarily quick adoption time, HB 831 is setting commercial buildings up for compliance failure.

2. Further, HB 831 imposes a building tax on existing commercial buildings that are unable to reduce their carbon emissions by the schedule outlined in the legislation. The fee for this tax will be at least $51 per ton. For a sector that is under enormous pressure from the economic fallout of COVID-19, levying an additional tax will only further harm anemic recovery.

3. Finally, although well-intentioned, the Building Energy Transition Implementation Task Force will not realistically be able to study and produce recommendations on ways to offset the enormous cost of retrofitting commercial buildings in a timeframe that will

provide real relief to those on the hook for the retrofit. For commercial buildings to meet the fast-paced timeline in HB 831 they will need to begin their reduction strategies now, which will likely include some level of retrofit. Incentives and other cost savings measures are years away under HB 831.

HB 831 creates significant challenges for existing businesses and future economic development in Maryland. This legislation requires costly retrofits and upgrades on commercial buildings without any real or immediate means of offsetting costs or providing incentives. Further, it adds a new tax on those businesses that cannot comply, which is likely under the timeframe. It also upends many corporate GHG reduction and sustainability plans by setting goals out of line with our federal government and international organizations. Finally, it places Maryland at a significant regional economic competitiveness disadvantage by ultimately phasing out the use of other affordable energy sources for commercial buildings that are critical to **every** jurisdiction in our State.

For these reasons, the Maryland Chamber of Commerce respectfully requests an **unfavorable report** on HB 831.

Opposition Testimony of HB831 with Ag Amendments.p
Uploaded by: Michael Powell
Position: UNF

GORDON·FEINBLATT LLC
ATTORNEYS AT LAW

HB831

MICHAEL C. POWELL
PHONE/FAX 410.576.4175
mpowell@gfrlaw.com

1001 FLEET STREET
SUITE 700
BALTIMORE, MD 21202-4346
410.576.4000
www.gfrlaw.com

February 23, 2022

VIA EMAIL
Honorable Kumar P. Barve, Chair
House Environment and Transportation Committee
6 Bladen St., Annapolis, MD 21401

Re: **Opposition to HB 831**

Dear Chairman Barve:

On behalf of NAIOP, MBIA and JVW Investments (an affiliate of SunMed Growers and Tidal Creek Growers) I am writing to request an unfavorable report on House Bill 831.

All of these organizations favor the adoption of reasonable strategies and responsible, technically sound regulations designed to reduce greenhouse gases on schedules and using methods that minimize economic disruption and result in an orderly energy transition for buildings and tenants. Unfortunately, House Bill 831 calls for measures that go too far, too fast and will cause significant harm to an important sector of our economy; a sector which is already under great stress. The Bill also fails to exempt structures that cannot feasibly transition to all-electric heat including greenhouses such as those operated and currently under development by SunMed Growers and Tidal Creek Growers.

All-Electric Building Code

HB 831 calls for building codes to ban new fossil fuel hookups for heating and hot water by January 1, 2024. This is simply too fast. Many projects that have been in development for lengthy periods as they navigated a way through zoning approvals or pandemic supply problems will be disrupted. If the Committee decides to adjust building codes, then the change should allow more time for the transition and a grandfathering provision for projects that are in the pipeline.

Many large commercial and multi-family buildings, in particular, face unique challenges. Many of these large structures may be unable to make the transition to all-electric heating without the development of new technologies and engineering improvements. The adoption of new building codes needs to allow time for those advancements to occur.

Any transition should also have a less strenuous test for waivers. The bill calls for a test that weighs the lifetime cost of fossil fuel plus a lifetime "social cost" of at least $51 per ton of carbon against the cost of constructing a building that solely uses electricity for hearing and hot water. That "social cost" is variable depending on EPA's estimates. During the Obama Administration, the EPA proposed a "social cost" of as much as $125 – which would more than double the tax imposed by HB 831 – and the Biden Administration has indicated that it may return to that valuation. Few, if any, buildings will pass this test, but buildings vary greatly in size and purpose.

The waiver provision fails to recognize differences in the technical feasibility of converting to all-electric regardless of the size and function of the building. It is much easier, for example, to heat a single-family home with a heat pump than to heat a large commercial warehouse with the same technology. The cost effectiveness waiver, or the underlying building code, should recognize the differences among building types. To put it simply, more flexibility is needed in drafting building codes to allow waivers.

Any ban on new hookups should include a later deadline, a grandfathering exception, and more flexibility in the provisions of building codes and waivers.

Carbon Tax for Existing Buildings

The bill calls for a large carbon tax on existing buildings without providing any incentives or tax credits to help offset the enormous cost of compliance.

When the Maryland Commission on Climate Change developed their Building Transition Plan, the Commission stressed the need for new incentives such as grants or tax credits to help offset the cost of retrofitting existing buildings and reduce the payback periods. This is essential because the cost of the HVAC equipment, building and grid upgrades needed to reach the net-zero goal of the bill's "high electrification" scenario was modeled at between $7,000,000,000 and $14,000,000,000. Seven to fourteen billion (with a b) dollars, without offsetting incentives and credits, would devastate the commercial and multi-family residential building sectors.

The Maryland Commission on Climate Change recognized that substantial financial incentives would be needed to retrofit existing buildings, yet HB 831 does not guarantee any incentives. Even buildings such as senior citizen retirement homes, hospitals and schools would not receive any assistance. Instead, the Building Energy Transition Implementation Task Force is expected to make recommendations for incentives that may, or may not, be adopted in the future. The Bill does not even dedicate the fees collected to grants assisting building owners in meeting the requirements.

Instead of providing assistance, HB 831, utilizes an entirely punitive approach where an escalating tax punishes any building which fail to reduce emissions in the next eight years and then increases the tax five years after that and a second increase five years after the first increase. The thin reed of a possible recommendation for incentives during some future session is inadequate. *The building tax should not be adopted without a simultaneous adoption of a system of incentives.*

The tax requires every covered building to reduce emissions by 20% compared to 2025 regardless of where the building's emissions started. This has the adverse impact of requiring buildings that start with low emissions to make more expensive changes than buildings that start with high emissions. An all-electric building will have difficulty achieving a 20% or 40% reduction from existing levels where an older building with oil boilers, for example, may be able to spend less.

Effective Date

In addition to a lack of offsetting incentives, the Bill sets an implementation date earlier that recommended by the Building Subgroup of the Maryland Climate Change Commission. That group recommended that an effective date of 2027. The Group had recognized that as part of any move to all-electric buildings, the PSC would need to develop a Utility Transition Plan which would include electric system enhancements, additional demand management during winter peaks, and ratepayer protections. Most importantly, the Commission called for any Building Transition to include studies to identify "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." Obviously if parts of the grid cannot sustain new all-electric buildings, then it may not sustain the wholesale retrofitting of existing buildings. *The bill should allow time for the PSC to complete those studies before forcing all new buildings to connect to the grid.*

HB 831 adopts a tax system that charges ahead with building mandates without these additional provisions that would assist building owners with the cost of retrofitting and without the necessary studies to assure that the electricity grid would support the transition.

Agricultural Exemption

In addition to large commercial and multifamily buildings, large agricultural operations will also be unable to comply with the requirements. For example, greenhouses (including those under development by Tidal Creek Growers for its bedding plant and garden center business and SunMed Growers for the medical cannabis business) cannot be reliably heated by heat pumps. Greenhouses, of course, are roofed by glass which make them unsuitable for electric heat or readiness for installation of roof solar energy systems.

Many agricultural operations are located in sparsely populated areas that lack available robust electrical grid infrastructure for their energy requirements and such operations are served by natural gas and propane. Such operations include mushroom farms, indoor vegetable grow spaces, poultry barns, grain drying silos, etc., all of which require reliable uninterrupted heat sources, and where a power failure could mean the loss of entire businesses.

Maryland has long recognized and actively supported the special needs and requirements of the State's agriculture industry and it should continue to do so. An agricultural exemption should be provided for both the new construction and retrofit provisions of HB 831. *At a minimum,* *HB831 should not be passed unless an explicit agricultural exception is added to the bill.* I have attached language that would enact such an exception.

Sincerely,

Michael C. Powell

Michael C. Powell

MCP/MCP

AMENDMENTS TO HOUSE BILL 831
(First Reading File Bill)

AMENDMENT NO. 1

On page 2, in line 7, after "Code", insert "**EXCEPT AS PROVIDED IN SUBSECTION (C)(3) OF THIS SECTION.**";

On page 2, after line 12, insert:

(3) "BUILDING" AND "COVERED BUILDING" DOES NOT INCLUDE ANY STRUCTURE USED PRIMARILY TO CULTIVATE, MANUFACTURE, PROCESS OR PRODUCE AGRICULTURAL CROPS, RAW MATERIALS, PRODUCTS, OR COMMODITIES, INCLUDING, WITHOUT LIMITATION, GREENHOUSES AND OTHER AGRICULTURAL CULTIVATION, PROCESSING OR SUPPORT STRUCTURES.

AMENDMENT NO. 2

On page 8, in line 10, after "**(II)**", insert "**AND SUBPARAGRAPH (II)**";

On page 8, in line 20, before "**(II)**", insert

(II) ANY STANDARDS ADOPTED PURSUANT TO THIS PARAGRAPH SHALL SPECIFICALLY EXCLUDE ANY STRUCTURE USED PRIMARILY TO CULTIVATE, MANUFACTURE, PROCESS OR PRODUCE AGRICULTURAL CROPS, RAW MATERIALS, PRODUCTS, OR COMMODITIES, INCLUDING, WITHOUT LIMITATION, GREENHOUSES AND OTHER AGRICULTURAL CULTIVATION, PROCESSING OR SUPPORT STRUCTURES.

On page 8, in line 20, and page 9, in line 9, strike existing "**(II)**" and "**(III)**", respectively, and substitute "**(III)**" and "**(IV)**", respectively.

Submitted by Michael Powell on behalf of SunMed Growers and Tidal Creek Growers (affiliates of JVW Investments)

HB831 22Session Testimony.pdf
Uploaded by: Theresa Kuhns
Position: UNF

House Bill 831 – Reducing Greenhouse Gas Emissions- Commercial and Residential Buildings
Position: Unfavorable

Maryland REALTORS® are committed to advocating for Maryland private property owners rights and acknowledge there is a need to balance climate mitigation with the growing challenge of affordable housing. We are concerned that HB831 will impact future investments in Maryland from both a housing perspective as well as commercial venture side. It also would create financial burdens on current commercial owners and some multi family properties.

Maryland is currently estimated to have a housing undersupply of over 80,000 units which includes both for sale and residential rental property. Moreover, according to the "Maryland Housing Needs Assessment and 10-Year Strategic Plan (Needs Assessment)," Maryland will be adding 178,000 new households between 2020 and 2030. The Needs Assessment also estimates that in 2030 more than half of all new households in Maryland will qualify as low-income. As the requirements for new additional units expand to meet the eventual net-zero requirements, the cost impacts on new residential housing are unclear. While costs today would certainly impact affordability, it is unclear how technology will increase these same costs in the next 15 years. It is also unclear what sources of energy will provide the electric generation that will be needed for housing and transportation given that in 2020, 60% of Maryland is powered by fossil fuels.

In addition to residential impacts, HB 831 will impact 17,000 Maryland commercial buildings which continue to struggle during the global pandemic. Commercial lending volume decreased approximately 60% in 2020, and it is important to note, lender losses in the commercial sector exceeded those of the 2008 financial crisis. National economists also predict short-term price declines for retail, office, and hotel properties of 4-7%. The unknown of the commercial recovery from Covid must be considered particularly as it is affected by retrofit requirements.

The upfront costs to construct a net-zero commercial building can be up to 15% more than conventional construction. A combination of increased construction costs and decreased lending availability will pose challenges to many projects including adaptive reuse of existing structures, which remains an important component of smart growth. These investments can be easily directed to our neighboring jurisdictions and only continue to raise the price of housing for our most vulnerable citizens.

While Maryland can continue to be a leader in Climate Change legislation, advancing net-zero requirements for buildings by 2045 will make this job more costly and impact both residential and commercial property affordability. For these reasons, the REALTORS® recommend an unfavorable report.

For more information, contact

bill.castelli@mdrealtor.org, susan.mitchell@mdrealtor.org,

lisa.may@mdrealtor.org or theresa.kuhns@mdrealtor.org

200 Harry S Truman Parkway – Suite 200 • Annapolis, Maryland 21401-7348
800-638-6425 • Fax: 443-716-3510 • **www.mdrealtor.org**

HB 831 Reducing GHG - Buildings - NAIOP Testimony

Uploaded by: Tom Ballentine

Position: UNF

February 25, 2022

The Honorable Kumar P. Barve, Chair
House Environment and Transportation Committee
House Office Building, Room 251
6 Bladen St., Annapolis, MD 21401

Oppose: HB 831 – Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Dear, Chair Barve and Committee Members:

The NAIOP Maryland Chapters represent 700 companies involved in development and ownership of commercial, mixed-use, and light industrial real estate, including some of the largest property owners in the state. NAIOP's membership is comprised of a mix of local firms and publicly traded real estate investment trusts that are invested in the future of Maryland but also have experience in national and international markets. On behalf of our member companies, I am writing in opposition to House Bill 831.

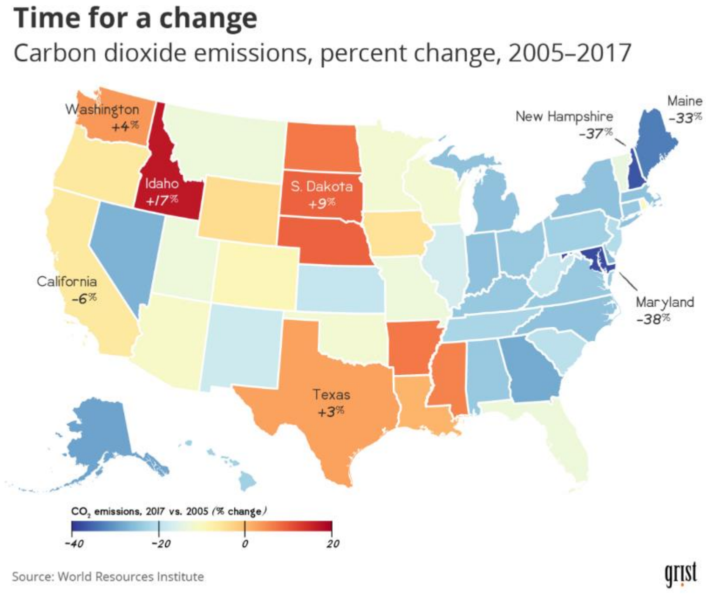
NAIOP's Commitment to the Greenhouse Gas Reduction Act

NAIOP supports adoption of reasonable strategies and responsible, technically sound regulations designed to reduce greenhouse gas emissions on schedules and using methods that minimize economic disruption and result in an orderly energy transition for building owners and occupants. We are concerned that HB 831 will result in an abrupt, unstructured, expensive and disruptive transition.

Success in climate mitigation fits the ambition and values of NAIOP's members. NAIOP supported adoption and reauthorization of the Greenhouse Gas Reduction Act. [GGRA] The GGRA ensures that Maryland's climate mitigation plans meet specific performance criteria that reduce greenhouse gas emissions but also generate economic benefits, maintain stable energy markets and present the public with least cost and practical compliance options.

Maryland's Progress to Date

Developing sets of practices that meet the intent of the GGRA principles can be challenging but it has produced strong results. In 2008 the state estimated that without action, emissions in Maryland would reach 128.3 million metric tons [MMT] by 2020. The GGRA 2030 Plan model results indicate emissions of ~67MMT in 2020.



A 2020 report from the World Resources Institute entitled, *"America's New Climate Economy"* ranked Maryland first out of 41 states that had both reduced emissions and grown their economies.

As climate mitigation gets harder it will be more important than ever that policymakers adhere to the performance characteristics called out by the GGRA.
If political demands are allowed to bypass or lower the performance standards set by the GGRA, then our view

Why Do Supporters of Climate Mitigation Oppose HB 381?

The bill mandates abrupt, unaffordable actions without the financial or policy support necessary to overcome barriers and meet the accelerated deadlines.

Cost-Effectiveness

1) **The state's climate consultant estimated the building costs** necessary to implement the *high electrification scenario* that is the basis for HB 831 **would be between $7.7 and $14 billion per year.** HB 381 imposes requirements without incentives fill funding gaps.
2) The HB 831 *High Electrification* scenario **costs 8 to 16 times more per ton of carbon mitigation than the 2030 GGRA Plan.** As explained below, **the state's climate consultant modeled other scenarios that were found to be less expensive and less risky.**
3) Even though the Maryland Commission on Climate Change recommended that any retrofit program should include ***"commercial tax credits and direct subsidy payments … large enough to reduce the simple payback period to between 3 and 7 years."***
4) Electrifying heat loads **will stress the electric grid triggering costly upgrades.** The cost and logistical complications of utility grid improvements and bringing expanded electric service capacity to commercial buildings are immense. Because the rate of return for public utilities is guaranteed, the **electric grid improvements will primarily be paid for by building owners and tenants.**
5) There will be **a subset of smaller residential and commercial buildings that can reasonably electrify.** But **for most larger commercial and multi-family buildings required changes will increase capital and operating costs resulting in long or non-existent payback periods** that exceed the life of the equipment.
6) **As customers are removed from the natural gas system, costs will sharply increase for remaining customers** because fewer participants will have to pay for operations, maintenance of the system.
7) Electrifying heat loads **will increase peak electricity loads,** triggering higher peak demand charges in commercial utility rates.
8) The bill's **cost effectiveness test** for new construction **monetizes speculative, future benefits that ignore current costs and will not be recognized in loan underwriting.**
9) **There is no grandfathering** for mature projects and existing buildings that made long-term investments in infrastructure and equipment resulting in stranded costs.
10) The bill's **deadlines do not allow time for** equipment **performance and price improvement** or the time for **equipment to be replaced at the end of its useful life.**

Technical Limitations of Using Electric Equipment All the Time in All Buildings

11) The **technical limitations of heat pumps** make them difficult to scale up to meet the space hearing needs of large buildings.
12) High volume **hot water heat pump technologies are not commercially available**, and electric resistance hot water heating is inefficient and disqualified by energy codes.
13) **Maryland industrial sites will be at a competitive disadvantage** because they will no longer meet common site selection criteria and there is no accommodation for natural gas for industrial buildings.
14) The bill requires all buildings to use **electric equipment for secondary heat and emergency power which is insecure and impractical.**
15) **The bill does not recognize the special circumstances of Combined Heat and Power** plants, industrial users, commercial kitchens, medical, life sciences, small incinerators, **or other special uses**.
16) **The exemption for historic buildings is narrowly applied** to registered properties and **does not include contributing structures within a historic district.**

The Compliance Deadlines

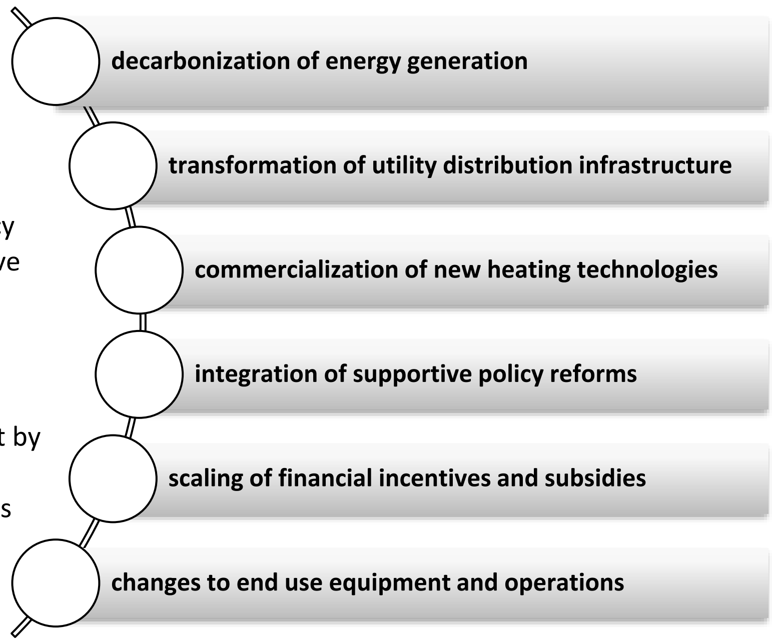
17) **The requirements for buildings to decarbonize are faster and deeper than recommended by the Maryland Commission on Climate Change**, the **World Green Building Council**, International Energy Administration, and the UN Intergovernmental Panel on Climate Change. [U.N. IPCC]
18) The rate of **private building carbon reductions is faster than the public utility requirements** to reduce energy use which is easier to accomplish. State law carefully protects utility rate of returns no protections for private building owners and occupants.
19) The existing buildings provisions of HB 381 include a state administered **carbon fee expected to be $100/ton of annual emissions beginning in 2030, ten years before the final deadline**. This is a parochial outdated approach that prevents access to established carbon trading markets.
20) Installation of solar, electric vehicle charging, and grid integration **equipment is mandated regardless of the suitability of the building** and **before the state has removed regulatory barriers** to meaningful use of solar on commercial buildings **or apportioned any of the costs to the other beneficiaries** - charging companies, utilities and automobile manufacturers.
21) Banning use of gas in buildings now, predates arrival of the 100% RPS / CARES report locking in a narrow pathway forward
22) **Because the emissions standards for existing buildings apply to all greenhouse gases emissions,** secondary pollutants from HVAC refrigerants and **tenant activities** including those operating under state air quality permits **will have to be reduced to net-zero by 2040. The IPCC target for reducing secondary pollutants is after 2050.**

Supportive Policy Elements Are Not There

Building decarbonization depends on coordinated progress across six interrelated policy and market areas that start with renewable energy generation and end at building level changes to heat and hot water equipment. The bill mandates changes to end use equipment and operations but does not provide answers to these other unresolved, interrelated policy issues or financial assistance to overcome the negative economics of building decarbonization.

A general lack of readiness in these important policy areas prevents building owners from believing that building electrification on the abrupt pathway set out by the bill will result in positive economic and environmental outcomes. Without more of a systems approach to thinking about climate mitigation and a structured, orderly framework the possibility of transition risks and policy mistakes become much more likely.

Six Essential Elements of Building Decarbonization Policy



Electric Generation, Transmission and Distribution System Is Not Build to Accommodate

Today, 55% of the total energy consumed in Maryland buildings is supplied by natural gas, fuel oil and propane. The bill would require all those loads reach net zero by 2040 which would roughly double electric demand from buildings. The electric generation and distribution capacity was sized based on the knowledge that natural gas and other fuels would be serving a high percentage of energy load and not ready to meet HB 831.

About 30% of Maryland's power comes from out of state. The increase in loads from buildings pressures in-state and out of state supplies. Just last year the Pennsylvania Utility Commission denied approval to a high voltage transmission line because most of the benefits would be realized by Maryland electric customers.

Only about 9% of electricity consumed in Maryland is from renewable resources but it is required to reach 50% by 2040 - the same period that the bill requires that thermal loads from buildings are electrified. The connection of renewable generating capacity has fallen behind what is necessary to reach the renewable goals established by the states in the Northeast. The grid operator PJM recently declared a 2-year moratorium on applications to interconnect renewable power generating facilities.

The Wall Street Journal recently reported on the stressed electric grid, and the difficulties of balancing supply and demand on a grid increasingly served by renewable generating sources. The New York Independent System Operator recently warned of rolling blackout as soon as next summer.

Moving thermal loads from buildings to the electric grid under the timetable in the bill raises major concerns about reliability, energy price and the cost of bringing additional capacity to building sites. The costs of these upgrades will be charged by the utilities back to building owners and occupants.

More than 1.5 Billion Square Feet of Apartment and Commercial Space –

The scale of the work necessary to meet the mandate, and the inherent economic barriers to carbon emissions reductions in buildings make the building sector particularly challenging. The bill applies to more than 1.5 billion square feet of apartment and commercial space. 585 million are located in suburban Maryland counties. More than 818 million square feet are in the Baltimore area. Baltimore City has 250 million square feet. 78 million of that was built before 1960.

Buildings and Square Footage by Planning Region

Region	Buildings	Square Feet
Baltimore Metro	7,726	818,818,379
Lower Eastern Shore	510	47,701,744
Southern Maryland	467	36,512,649
Suburban Maryland	4,918	585,781,058
Upper Eastern Shore	486	47,820,051
Western Maryland	666	65,300,855
Total	**14,713**	**1,596,934,736**

Source: Costar

Baltimore City – Buildings by Year Constructed

Year	Buildings	Square Feet
1811-1919	329	26,106,206
1920-1939	241	20,730,190
1940-1959	290	32,740,828
1960-1989	631	79,809347
1990-2009	245	31,500,469
2010-2021	193	30,334,981
Unknown	150	20,417,923
Total	**2,079**	**250,752,904**

Source: Costar

Economic Barriers and the Importance of Incentives

While there will be some cost-effective opportunities to electrify heat and hot water in smaller buildings, for many commercial buildings, electrification will not provide a return on investment during the lifetime of the equipment.
A research report by the American Council for an Energy Efficient Economy evaluated electrification of space heating in existing commercial buildings. The charts below show the simple payback period for buildings replacing gas fired furnaces and boilers with a commercial heat pumps system. Only 27% of commercial floor area will achieve a simple payback period of 10 years or less. The percentage that payback at the building level can be increased to 60% with incentive payments. The data are nation-wide, and the report notes much better heat pump economics in parts of the country that have mild winters and for building types with modest heating demand.

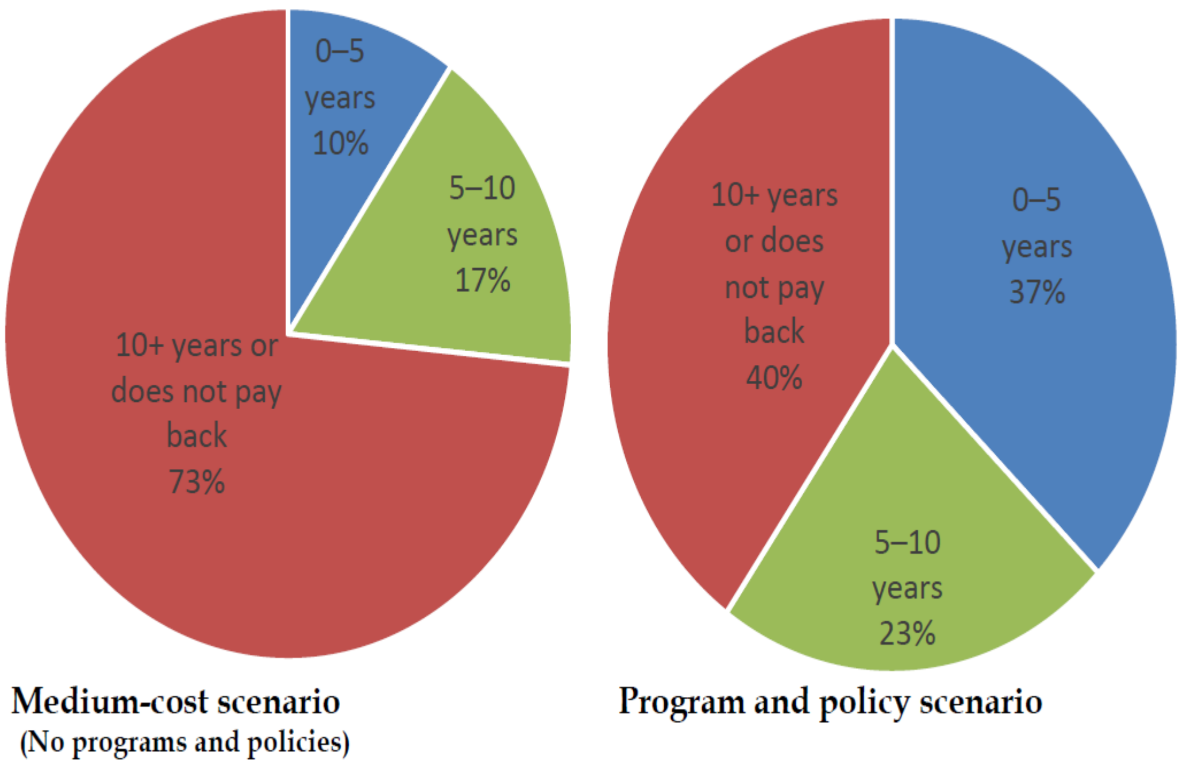
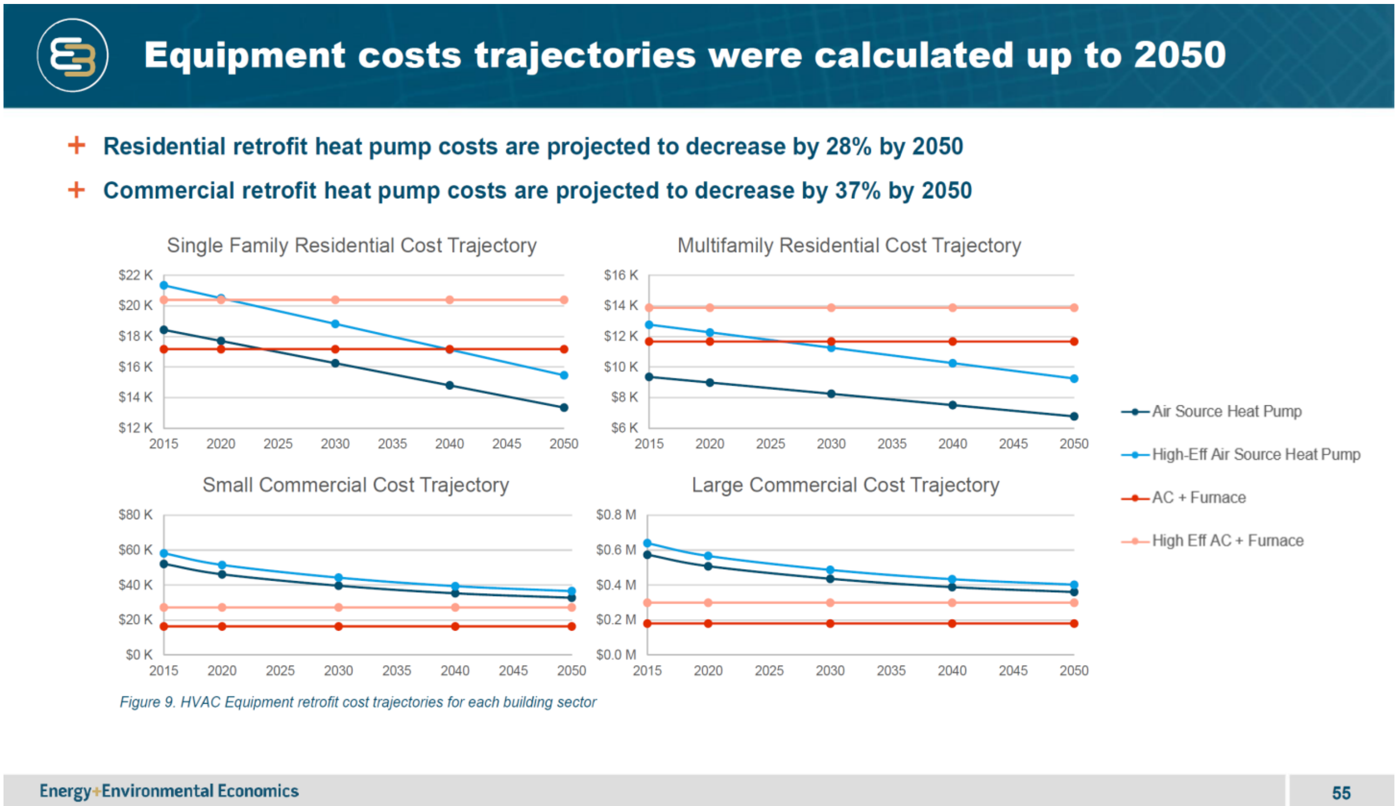


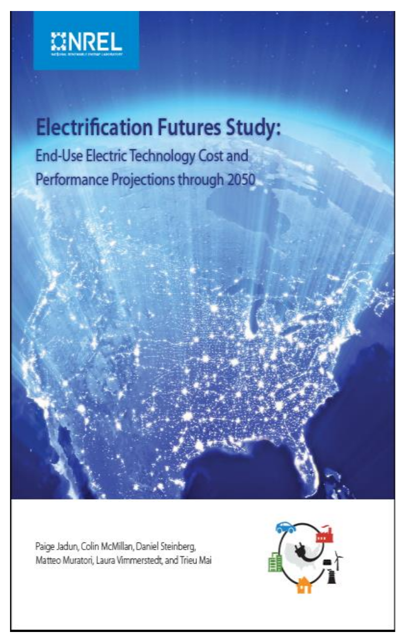
Figure ES-1. Distribution of the simple payback period by floor area for converting gas-fired rooftop systems, furnaces, space heaters, and small boilers to heat pumps when existing equipment needs to be replaced

Equipment Cost and Performance Barriers

For large commercial building types, heat pump and hot water heat pump technologies will not be cost competitive until price and performance improve. How quickly that happens will determine how quickly commercial buildings may be able to electrify.

The line graphs below were produced by MDE's climate consultant as part of analysis of the building energy transition plan. The consultant's reporting is based on assumptions that the cost of heat pump technologies will decrease 37% by 2050. Even with that optimistic level of improvement, the commercial heat pumps and heat pump water heaters [blue lines] are still more expensive to install in 2050 than other types of equipment.





National Renewable Energy Laboratory [NREL] – *Electrification Futures Study: End-Use Electric Technology Cost and Performance Projections through 2050* – Evaluates the levelized costs and forecast the rate of advancement in the price and performance of technologies important to building electrification.

Key takeaways from the report related to the feasibility of electrifying commercial buildings:

"In the commercial sector heat pump technologies for space heating applications in warm or moderate climates can become cost competitive by the end of 2040."

"In contrast commercial ccASHP (cold climate Air Source Heat Pumps) require substantial improvements to achieve cost parity with incumbent gas technologies, but with advancement…. could do so over the next two decades."

The report goes on to say that for a cost driven shift in adoption to take place, from gas fired *water heaters* to commercial *heat pump water heaters*, cost and performance would have to improve by 50%.

We relay this information to guard against the tendency to conflate the ability of some buildings to effectively electrify with the ability of **all** buildings to electrify. For many suitable equipment is not commercially available.

Heat pump technologies do not scale up well for deployment in large commercial buildings and will not be cost-effective for most commercial uses until technical performance improves, and costs decline.

There is a need for more rapid advancement in the performance and availability of refrigerants with lower global warming potential

The emphasis on energy efficiency and reducing peak energy demand through building code provisions means the energy models do not allow the use of electric resistance heat or hot water. For large apartment and commercial buildings there are no heat pump hot water systems.

Under an all-electric scenario large commercial building will use inefficient electric resistance equipment which will increase peak energy demand and electricity costs in ways not contemplated by MDE's scenario planning for building electrification.

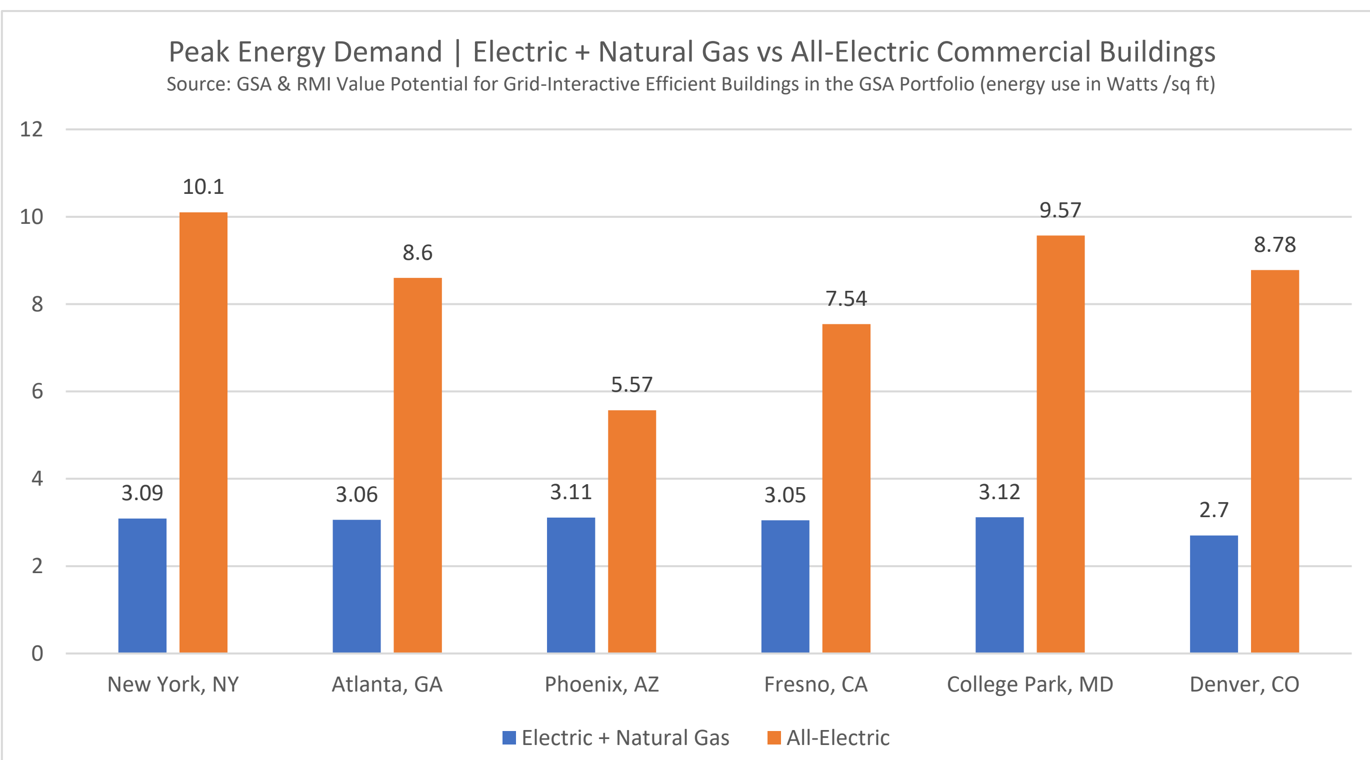
Cost Benefit Test Does Not Follow Accepted Methodologies

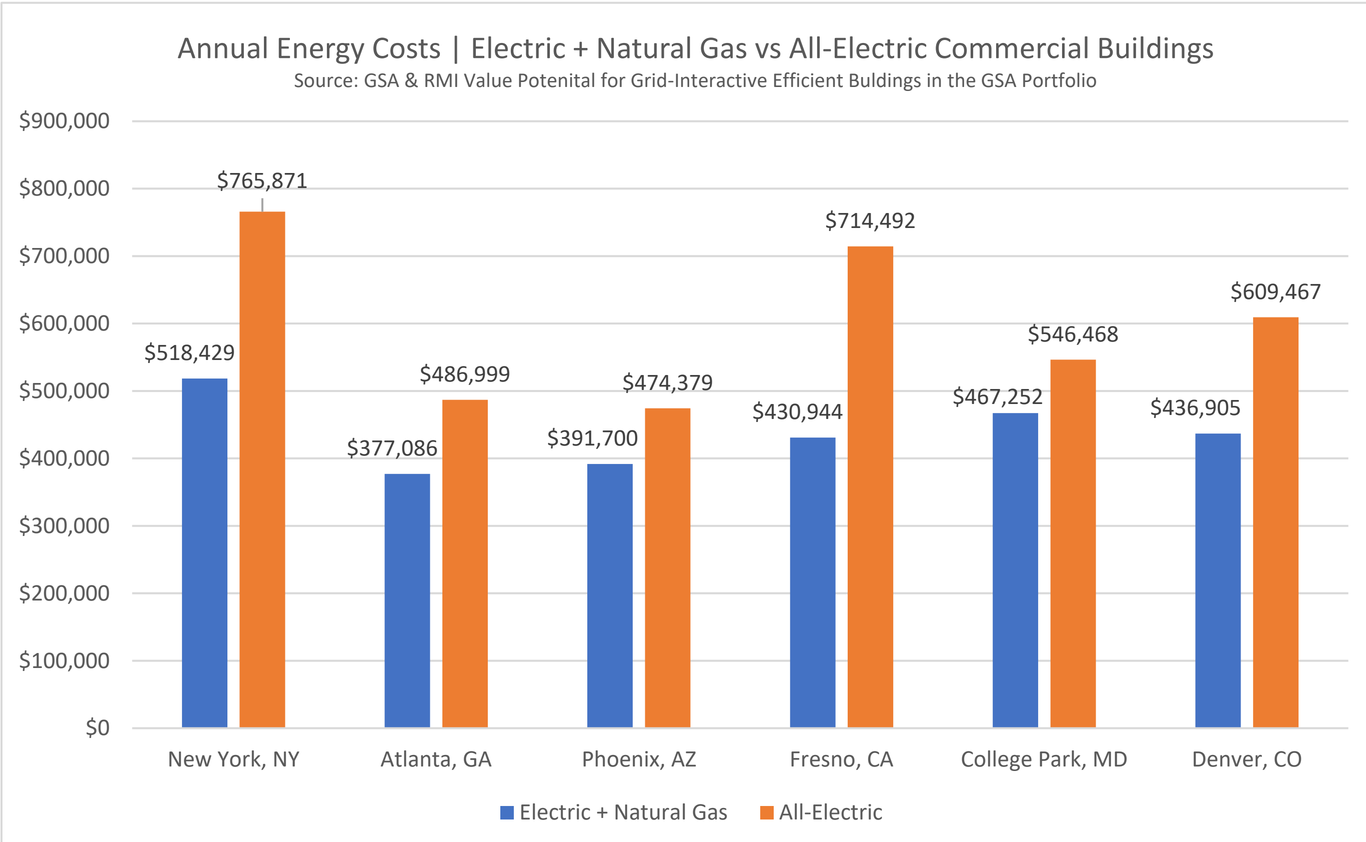
The bill allows for a variance to be granted but the cost-effectiveness test changes the logic used by US EPA's Energy Star Portfolio Manager and the Department of Energy to evaluate building codes and energy performance.

The method in the bill compares the incremental construction cost of full electrification to the to the social costs of carbon emissions that would be generated by the building. [p. 35, line 10] The calculation also requires use of idealized future assumptions about equipment costs, utility emissions rates, energy prices and utility distribution charges used by the Department of Environment in modeling mitigation scenarios. [p.35, line 23]

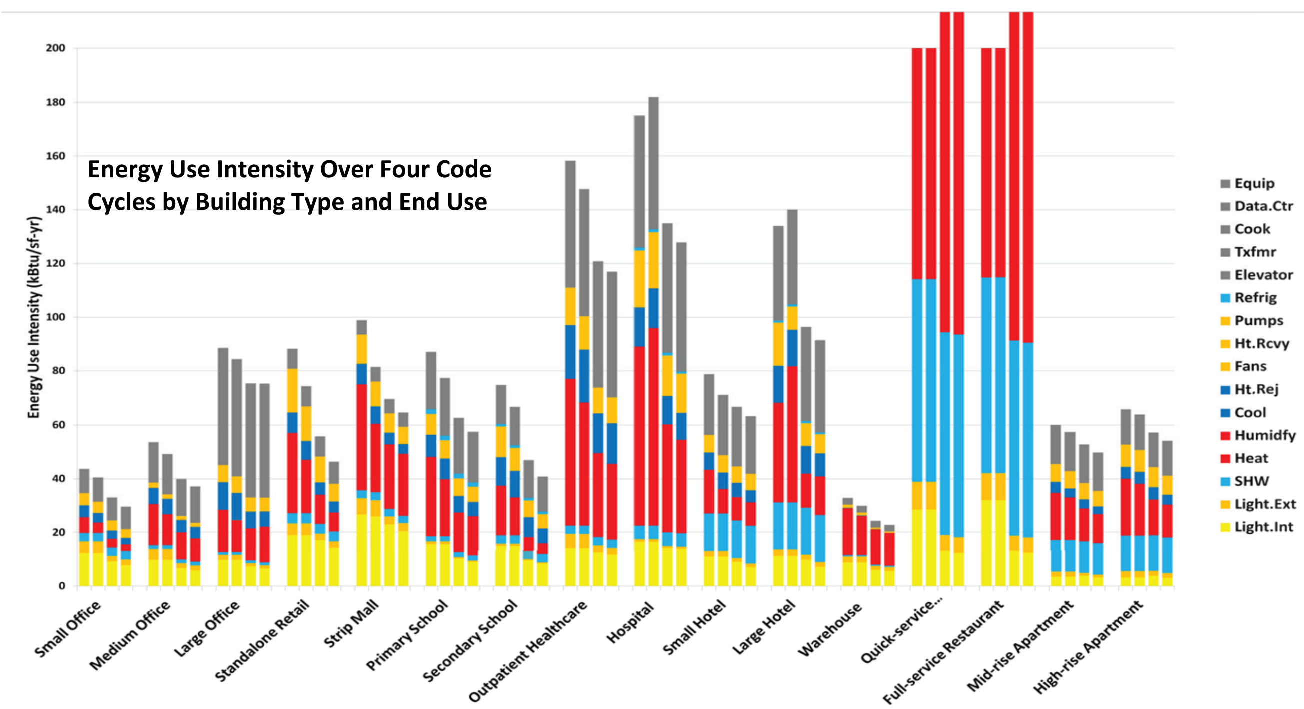
These societal benefits that cannot be monetized at the building level and will not be considered by banks and investors in financing decisions. The design changes they trigger will increase the construction cost of the building with little or no return on that investment.

Peak Energy Loads and Total Energy Costs Increase with Electrification





The Level of Difficulty Will Vary by Building Type



For decades, the commercial real estate industry in Maryland has been committed to energy efficiency, conservation, and high-performance construction. This experience leads NAIOP to consider deep reductions in carbon emissions from buildings to be the most challenging of the sectors. In the bar graph above most of the red bars will be fossil fuel heat.

Electrification and decarbonization will be technically and economically challenging for many building types. Feasibility is particularly challenging for large commercial buildings that have energy intensive occupants – restaurants, education, hotels, medical providers and 24/7 365 operations. the red bars are heating loads that would be primarily fueled by natural gas. Deep reductions will be technically and economically challenging for many building types.

The World Green Building Council and other thought leaders say industry-wide decarbonization needs to happen by 2050. Decarbonizing the commercial building stock on a 2050 timeframe with goal of 2045 if it is feasible would be a challenge even under optimistic scenarios for technology advancement, renewable energy deploymentand and with favorable economic conditions. Requiring 40% of commercial building emissions to be abated by 2035 is unreasonable and it is not realistic to apply an industry-wide net zero 2040 mandate on the building sector.

Maryland Should not Decouple from the International Building and Energy Codes

NAIOP is has major concerns that decoupling from the building codes will force the use of unproven technologies and costly, untested code provisions.

Building codes and technical standards are carefully developed to balance building performance and cost through a process that has the capacity and expertise to ensure the standards and requirements are technically feasible, commercially available and cost effective for builders and occupants.

The International Code Council [ICC] writes the building and energy codes adopted by Maryland and most other states. The ICC is following a standards-based approach to development of low carbon and near zero carbon construction. Those products will provide a technically sound and managed code transition. Maryland should support that policy transition instead of adopting an arbitrary, calendar-based prohibition on fuel use. The state should wait for this work product to be finished rather than decoupling.

NAIOP believes success will be more likely through a technology and fuel neutral approach that resists component-based, piecemeal mandates and fuel bans. A holistic approach recognizes that buildings are complex, integrated systems that can provide multiple pathways to achieve performance objectives provided design teams have the freedom to make trade-offs and take advantage of synergistic opportunities. A fuel and technology neutral approach is taken by the ICC building and energy codes, International Green Construction Code, as well as EPA Energy Star, LEED, and other voluntary high-performance building certification programs.

A mixed fuel and technology neutral approach was modeled by MDE's climate consultant over the interim and showed the "*lowest overall cost while also reducing reliance on technologies that have not been widely commercialized.*" [Please see details below]

Whether electrification of large commercial buildings increases or decreases carbon emissions is dependent on the carbon intensity of utility generated electricity provided during peak heating periods. Peak heating demand occurs during early morning hours of the winter when renewable electricity generation and heat pump performance are both weak.

Under the definition secondary and back-up power generation are not permitted to be served by fossil fuels.

There are no provisions for grandfathering mature projects already designed for fossil fuel equipment construction in developments that have already installed gas infrastructure.

The bill provides various provisions that require state entities to comply only if they receive compensation for the incremental costs or allow requirements to be waived based on the suitability of equipment, site constraints, or the building use. Private buildings do not get this kind of consideration.

Building Energy Transition to Net Zero - Conceptual Framework

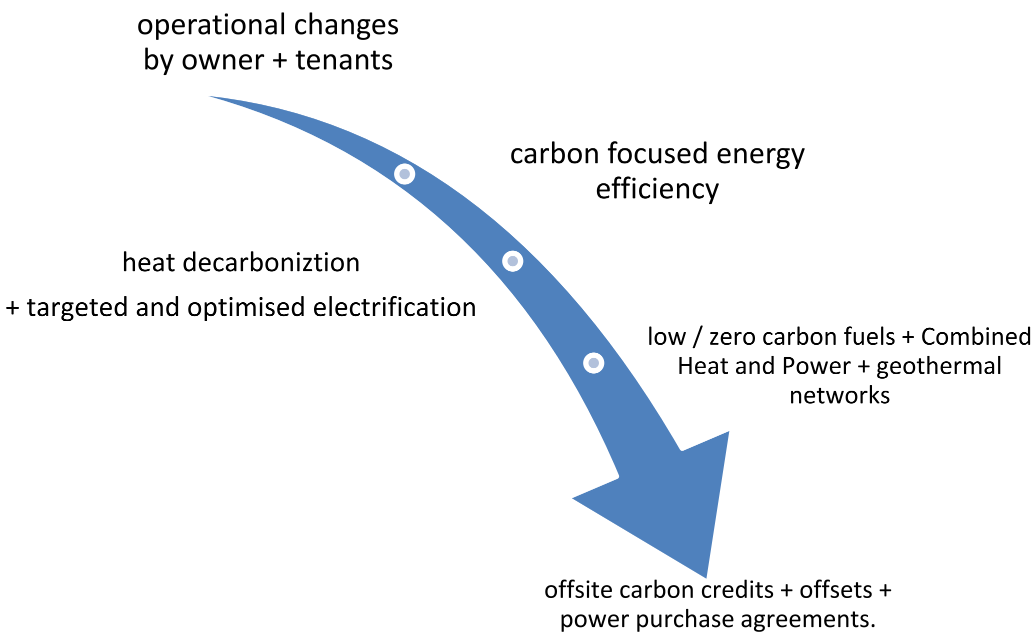
The tools many building owners plan to use for energy transition are not available in the narrow framework of SB 528. Co-generation and Combined Heat and Power plants that serve downtown Baltimore, institutions and hospitals are ignored by the bill. These technologies are usually considered strategic pieces of a energy plan for clusters of large buildings.

The bill does not target electrification to cases where it is beneficial at the consumer level. The almost immediate draw down of natural gas customers will weaken the system and reduce the chances that the infrastructure can be used to transport low and the no carbon fuels in the future.

It sets performance mandates and penalties but does not provide financial support to overcome the negative economics of electrifying large commercial buildings and apartments.

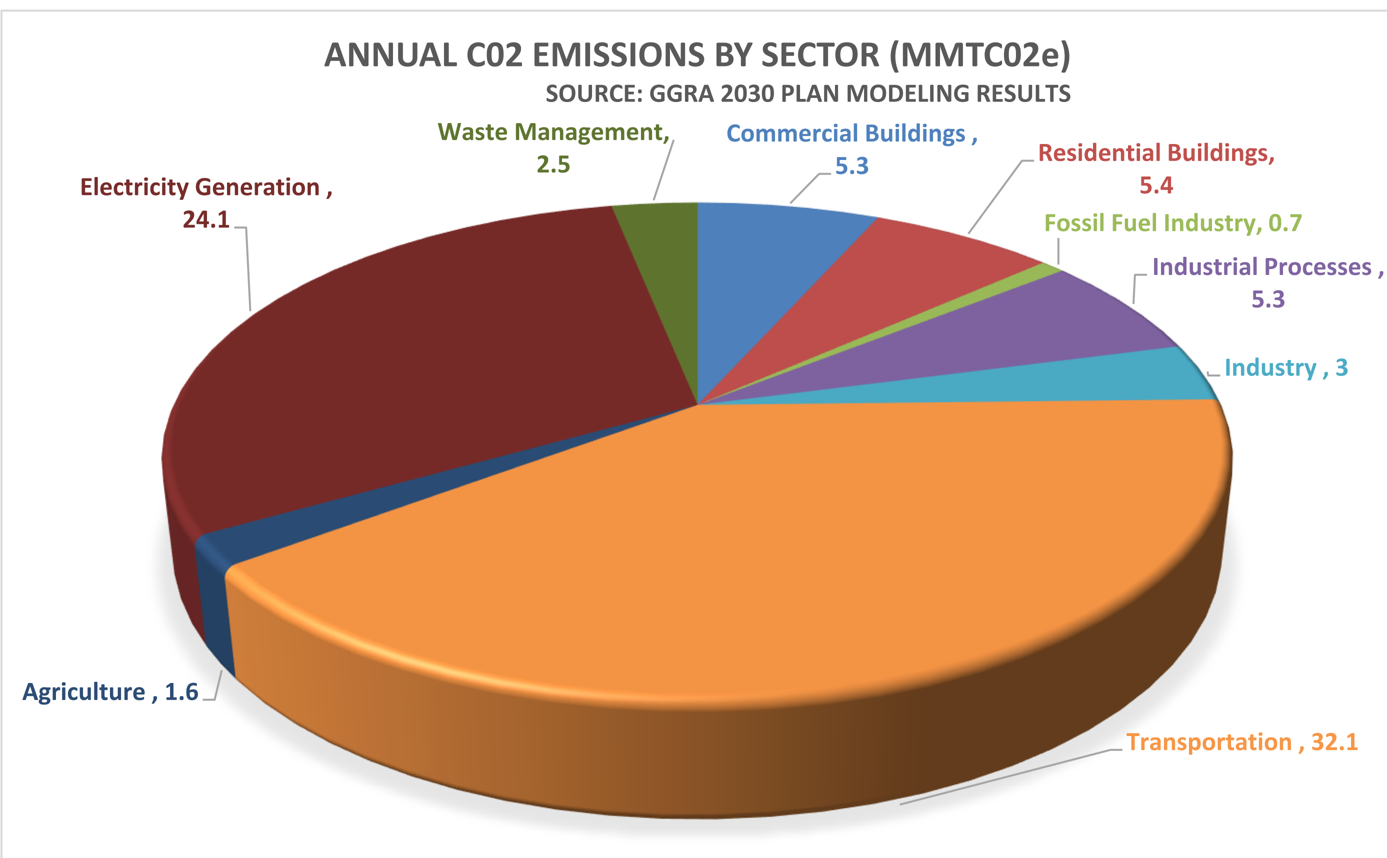
The deadlines in the bill do not provide time to address persistent issues related to the readiness of the utility grid, time for heating equipment in buildings to turnover at the end of its natural life, or for advancement in heat pump technologies. All of these things will increase the cost and difficulty of an energy transition in buildings.

The bill hastily decouples from the International Code Council [ICC] building and energy codes rather than allow ICC to complete development of its low carbon and zero carbon code pathways which would provide a technically sound and managed transition.



Perspective on the Amount of Building Emissions in Maryland

Emissions from commercial buildings are 5.3 million metric tons representing 7% of Maryland's economy-wide emissions total of 80 million metric tons. Emissions from natural gas use in commercial buildings are about 4MMT per year representing 5% of emissions.

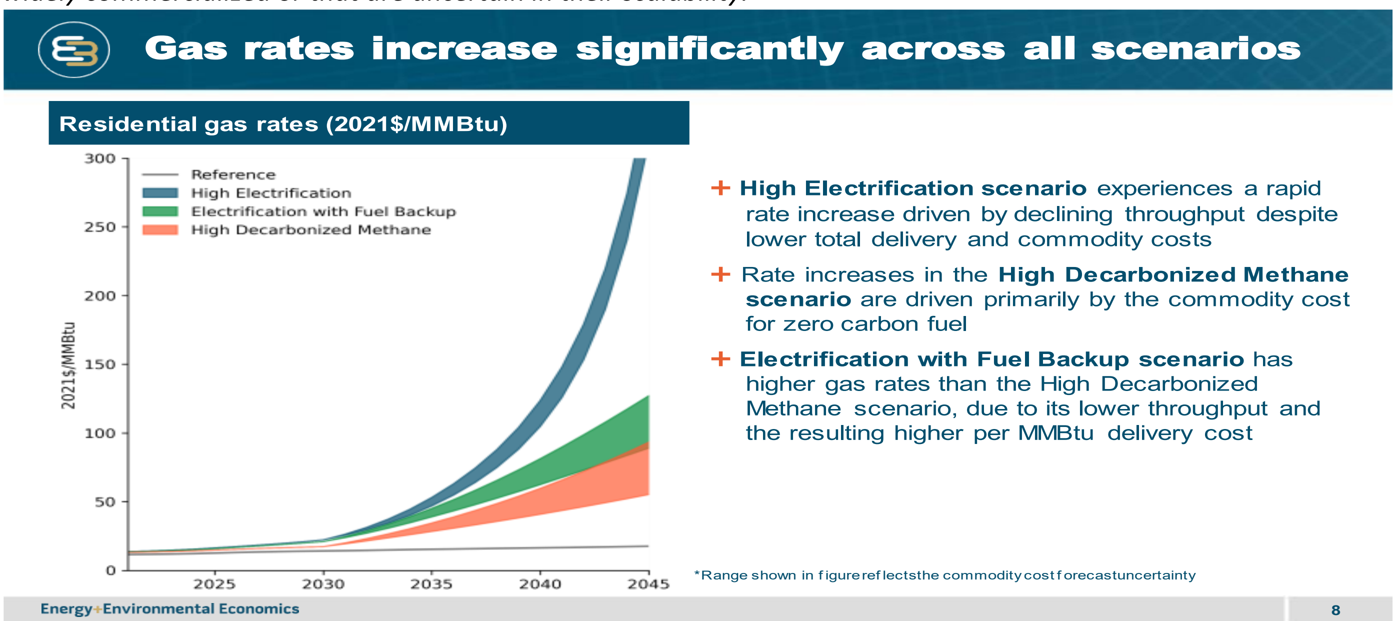


A Less Costly, Less Risky Energy Pathway to Net Zero than HB 831

During the 2021 interim MDE's climate consultant E3 [Energy and Environmental Economics] Modeled three scenarios that achieved net zero emissions in the building sector by 2025.

The High Electrification Scenario that is the basis for SB 528 was estimated to cost $7.7b to $14b per year. The costs were driven by the need for expanded electric generation and distribution as well as capital costs to replace heat and hot water systems as well as insulating buildings.

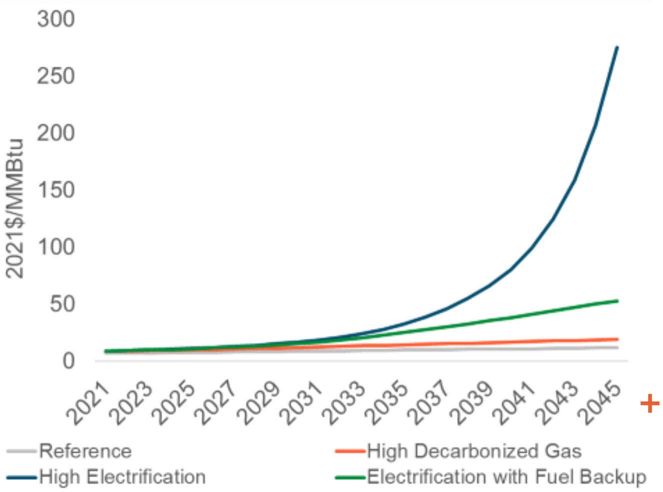
An alternative approach, the Electrification with Fuel Backup pathway scored better. The consultant concluded that the pathway, *"shows lowest overall costs while also reducing reliance on technologies that have not yet been widely commercialized or that are uncertain in their scalability."*



While gas rates increase in all scenarios, the departure of customers in the high electrification scenario creates a rapid rise in prices and distribution costs after 2030. This is a major concern for our members who may remain on the gas system until later in the transition period.

Delivery costs of gas increase dramatically as more and more households electrify

Residential gas delivery costs (2021$/MMBtu)



+ **High Electrification scenario experiences a rapid increase in per unit delivery costs after 2025 due to the reduced gas throughput, regardless of the fact that total delivery cost is lower than in other scenarios**
  - High Electrification scenario assumes earning on rate base, depreciation, and O&M growth rates halved after 2025 leading to a 25% decline in total delivery costs by 2045.
  - As gas throughput and peak gas demand declines in the High Electrification scenario, reinvestment and maintenance for the gas system are expected to scale down.
+ **Reference, High Decarbonized Gas, and Electrification with Fuel Backup scenarios assume the historical earning on rate base growth rate is halved beginning 2035 assuming STRIDE is completed.**

Sources& assumptionscurrent RevenueRequirement(RR) is estimatedusingMarylandspecificdeliverypricesper sectorfrom EIA. Rate baseincreasesare basedon historicalaveragesand flat capitalexpenditures(see Appendix).Scenariosassumea "Businessas Usual"allocationof RevenueRequirementto customergroups.Cost allocationsmightshiftas the ratioof consumptionchanges.

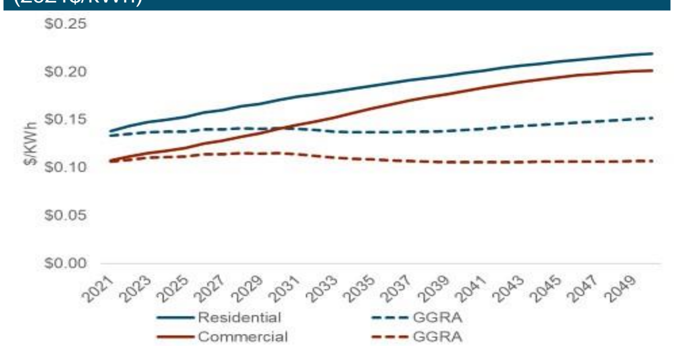
Energy+Environmental Economics 10

Electric rates increase more in the High Electrification scenario because of the need to build our more generating capacity and distribution. The peak demand moves from the summer to winter because of the electrifying space heating.

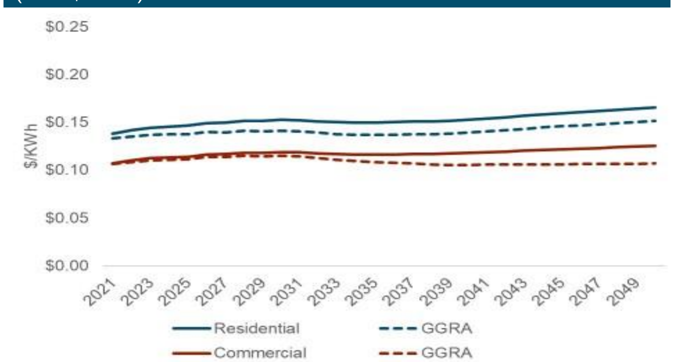
High Electrification scenario shows a more rapid electric rate increase compared to Electrification with Gas Back Up

+ **The Electrification + Gas Back-up scenario is projected to have a lower rate increase because it has a smaller load factor and manages to avoid the expensive peak capacity investment.**

Electricrates in the High ElectrificationScenario (2021$/kWh)



Electricrates in the Electrification+ Gas Back-up Scenario (2021$/kWh)



Energy+Environmental Economics 11

For these reasons NAIOP respectfully requests your unfavorable report on HB 831.

Sincerely.

Tom Ballentine, Vice President for Policy
NAIOP Maryland Chapters -*The Association for Commercial Real Estate*

cc: House Environment and Transportation Committee
Nick Manis – Manis, Canning Assoc.

MD Legis Building Electrif__2__23__22.pdf
Uploaded by: David Farnsworth
Position: INFO

Beneficial Electrification

Presentation to the Environment & Transportation Committee of the Maryland General Assembly

David Farnsworth Regulatory Assistance Project

February 25, 2022

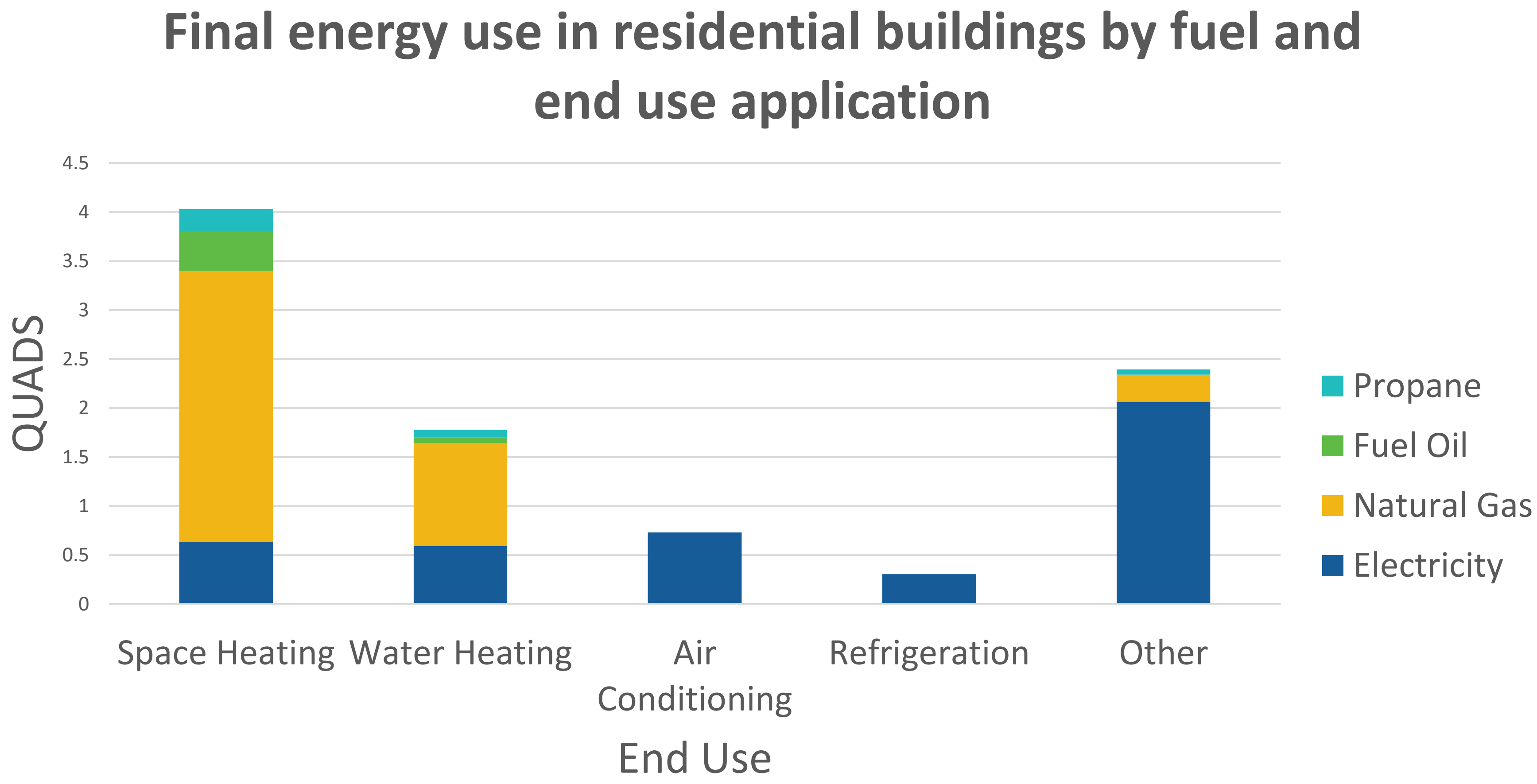
Status Quo: Inherited Policies

While many technologies and the policies supporting them have served us well in the past …

Regulation Needs Renovation

… new policy priorities and technologies are driving a need for change.

Fossil Fuels Still Dominate Space and Water Heating



Source: EIA's Residential Consumption Survey (RECS) 2015

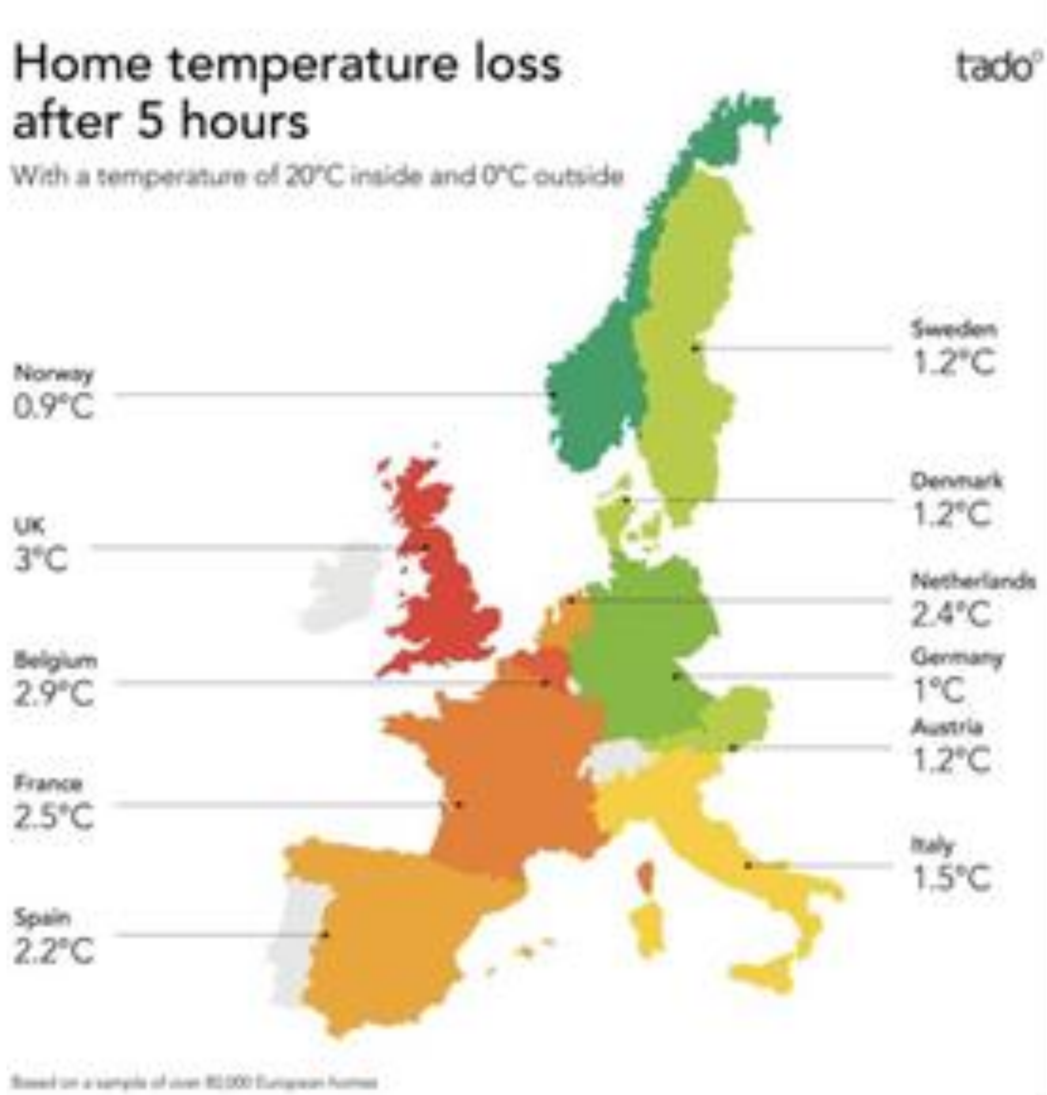
The Opportunity

- Efficient, clean, and controllable – cost-effective electric end-use technologies installed in US buildings will produce benefits:
  - Cost savings
  - Grid flexibility
  - Lower emissions

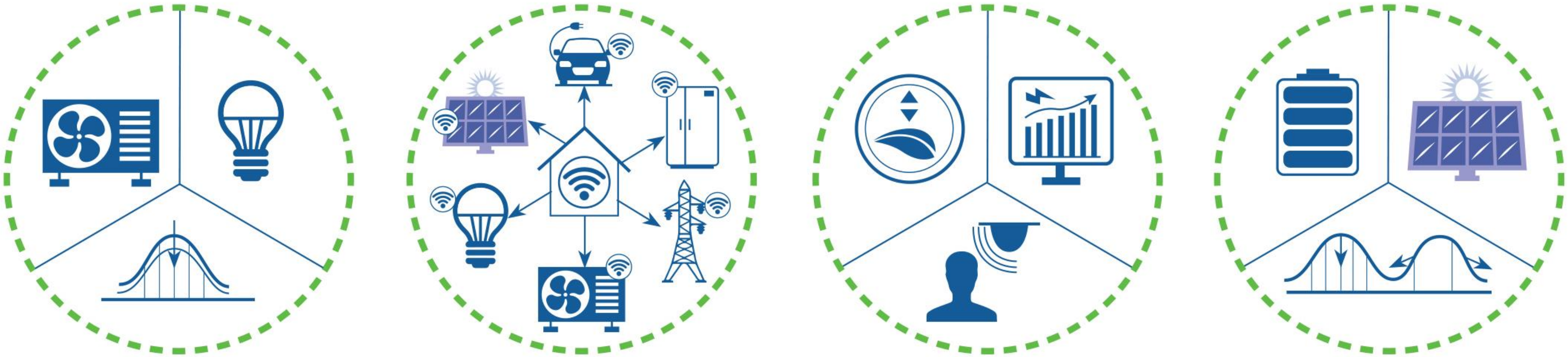
The Opportunity

Buildings = thermal storage

This storage adds further flexibility to the grid



Buildings as Grid Resources



Efficient
Persistent low energy use minimizes demand on grid resources and infrastructure.

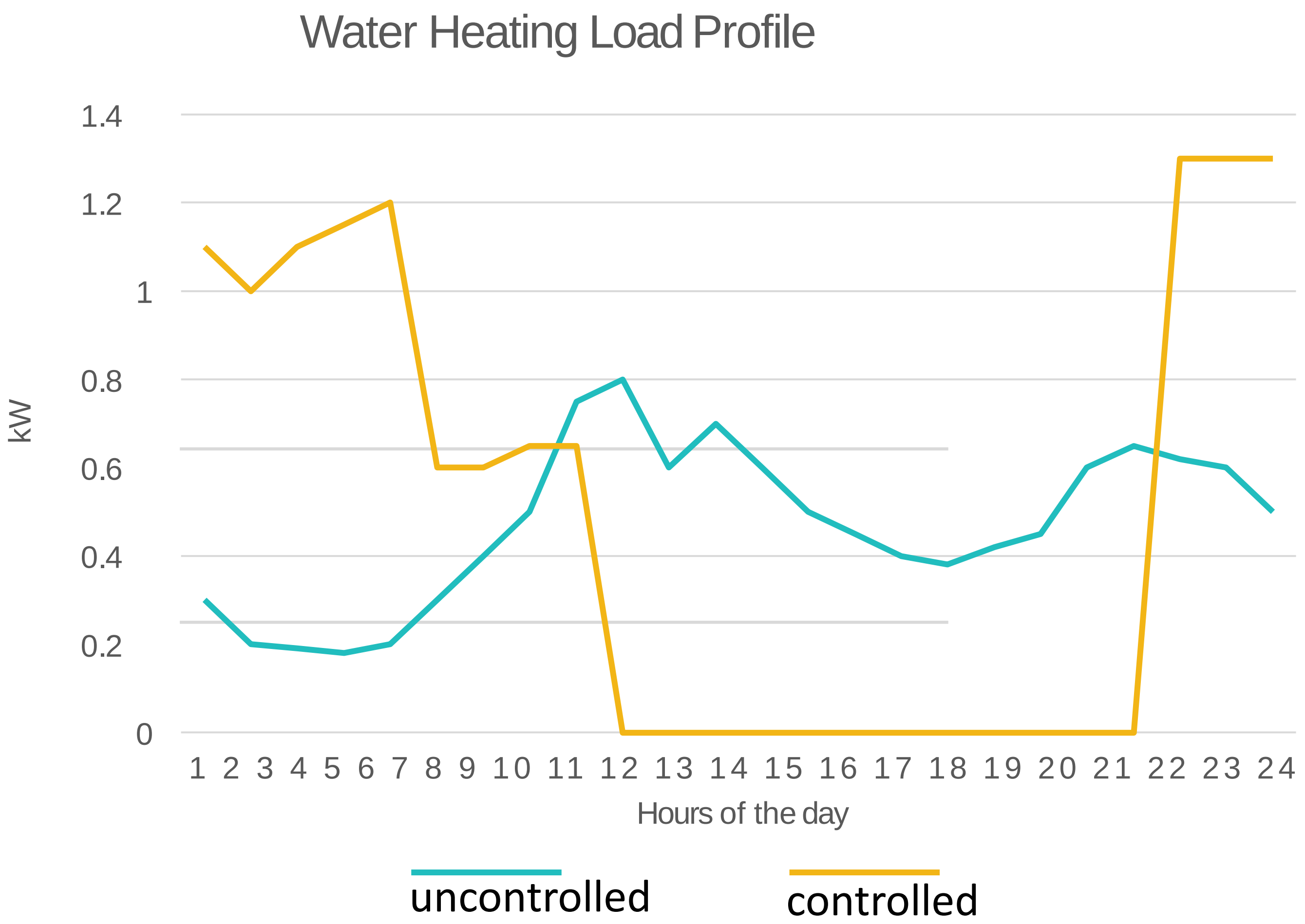
Connected
Two-way communication with flexible technologies, the grid and occupants.

Smart
Analytics supported by sensors and controls co-optimize efficiency, flexibility and occupant preferences.

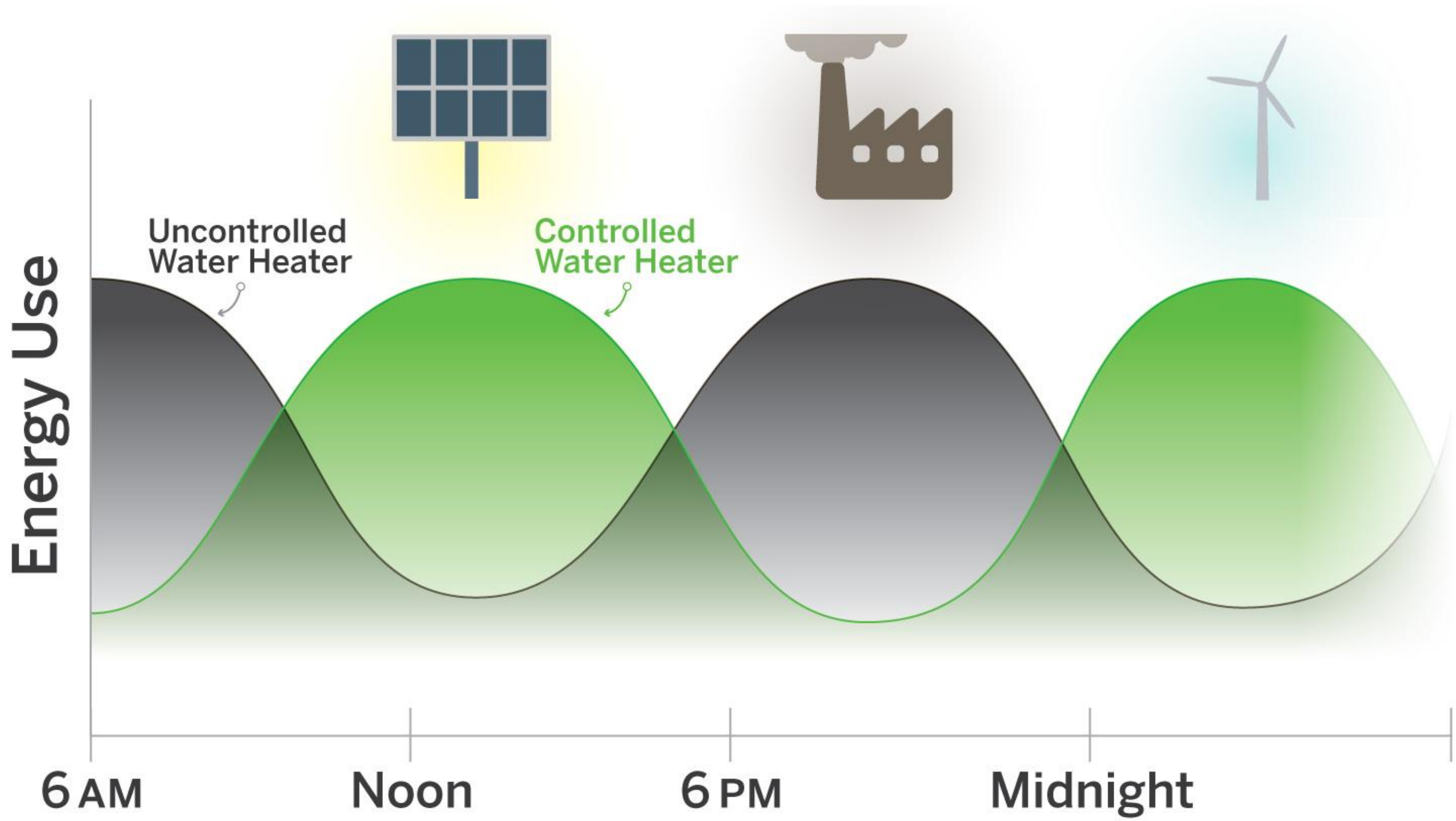
Flexible
Flexible loads and distributed generation/storage can be used to reduce, shift or modulate energy use.

Source: Neukomm, M., Nubbe, V., and Fares, R. (2019). Grid-Interactive Efficient Buildings.

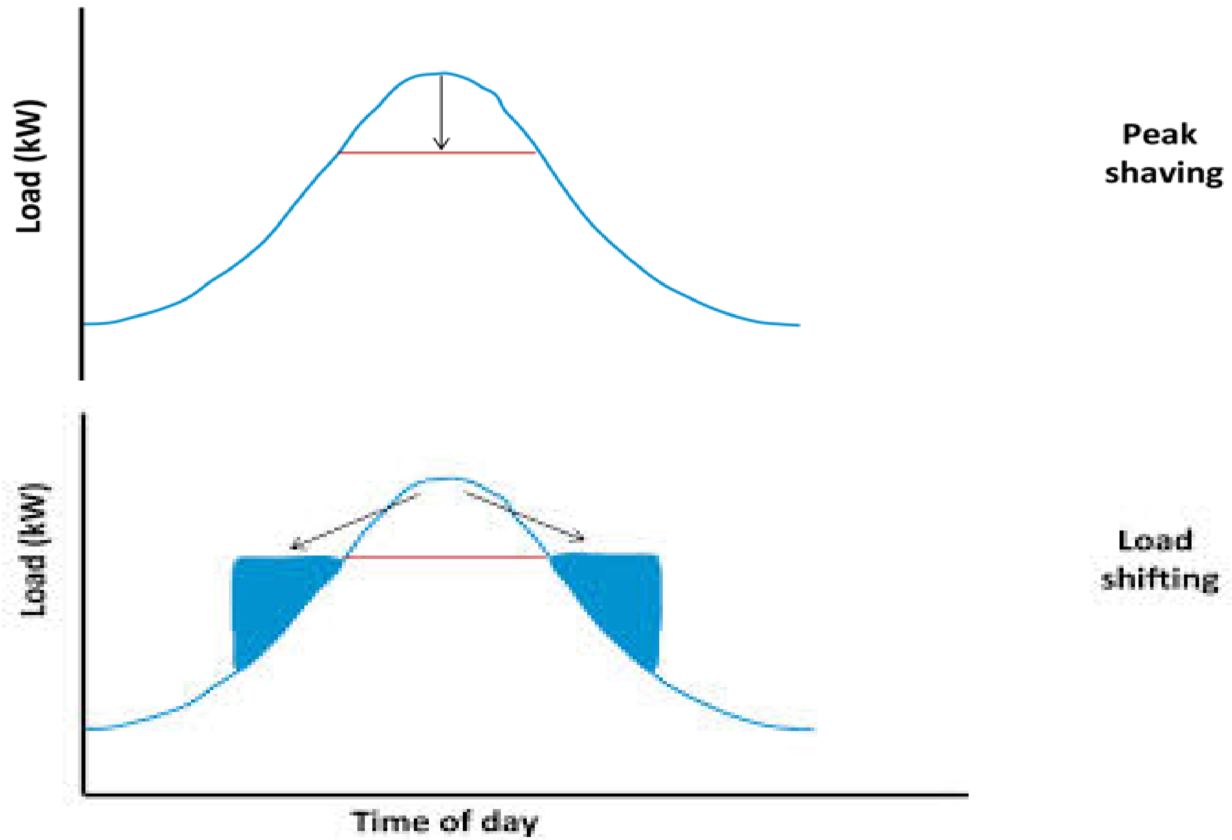
What is Load Flexibility?



Recognize the Value of Flexible Load: Grid Operations

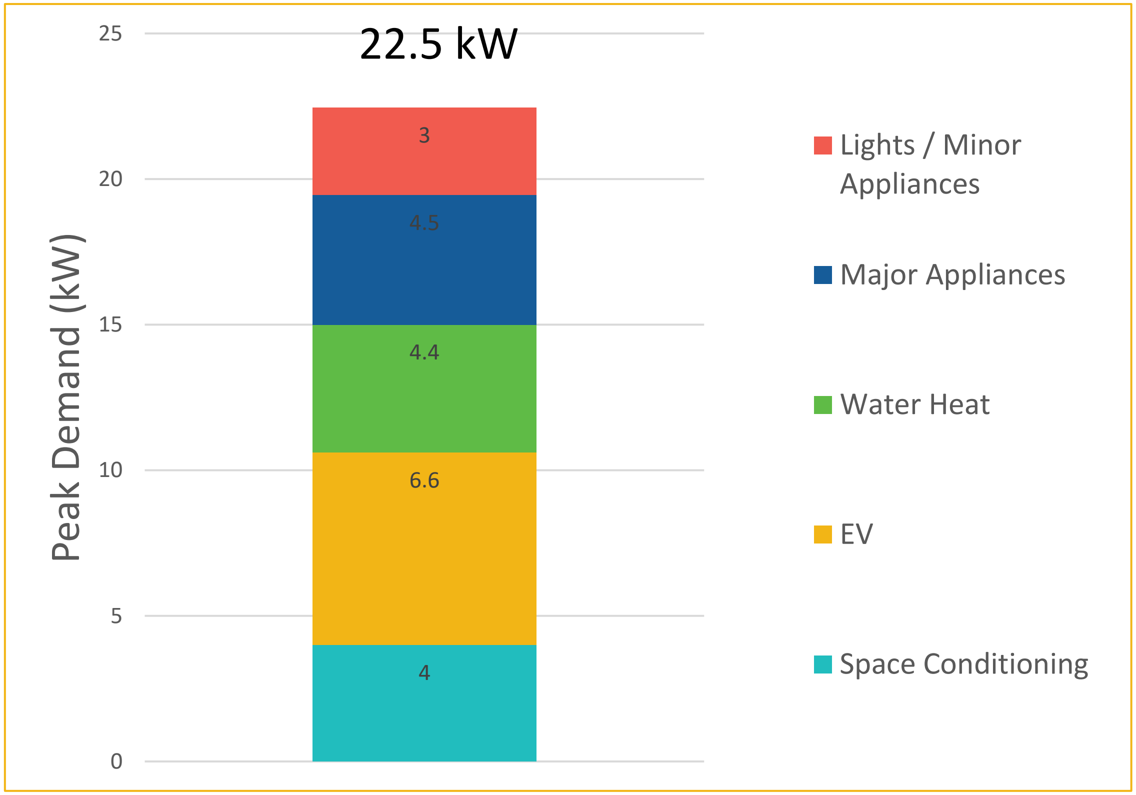


Traditional DR: Emergency peak management

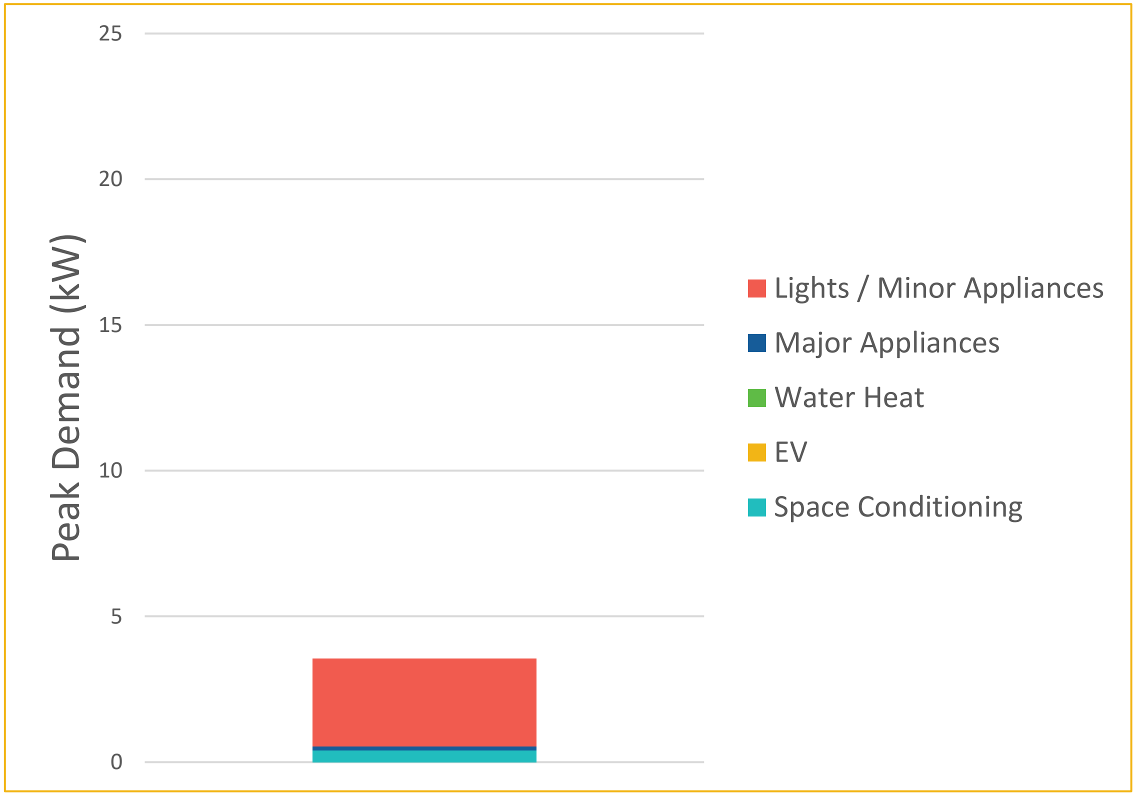


Source: Marsden Jacob Associates' analysis, 2011

Uncontrolled Household Loads Add Up



Flexibility Cuts Peak Demand: Shift EV, water heat, major appliances, and pre-condition spaces



***Beneficial* Electrification**
Will Better Position Utilities and Consumers for the Future

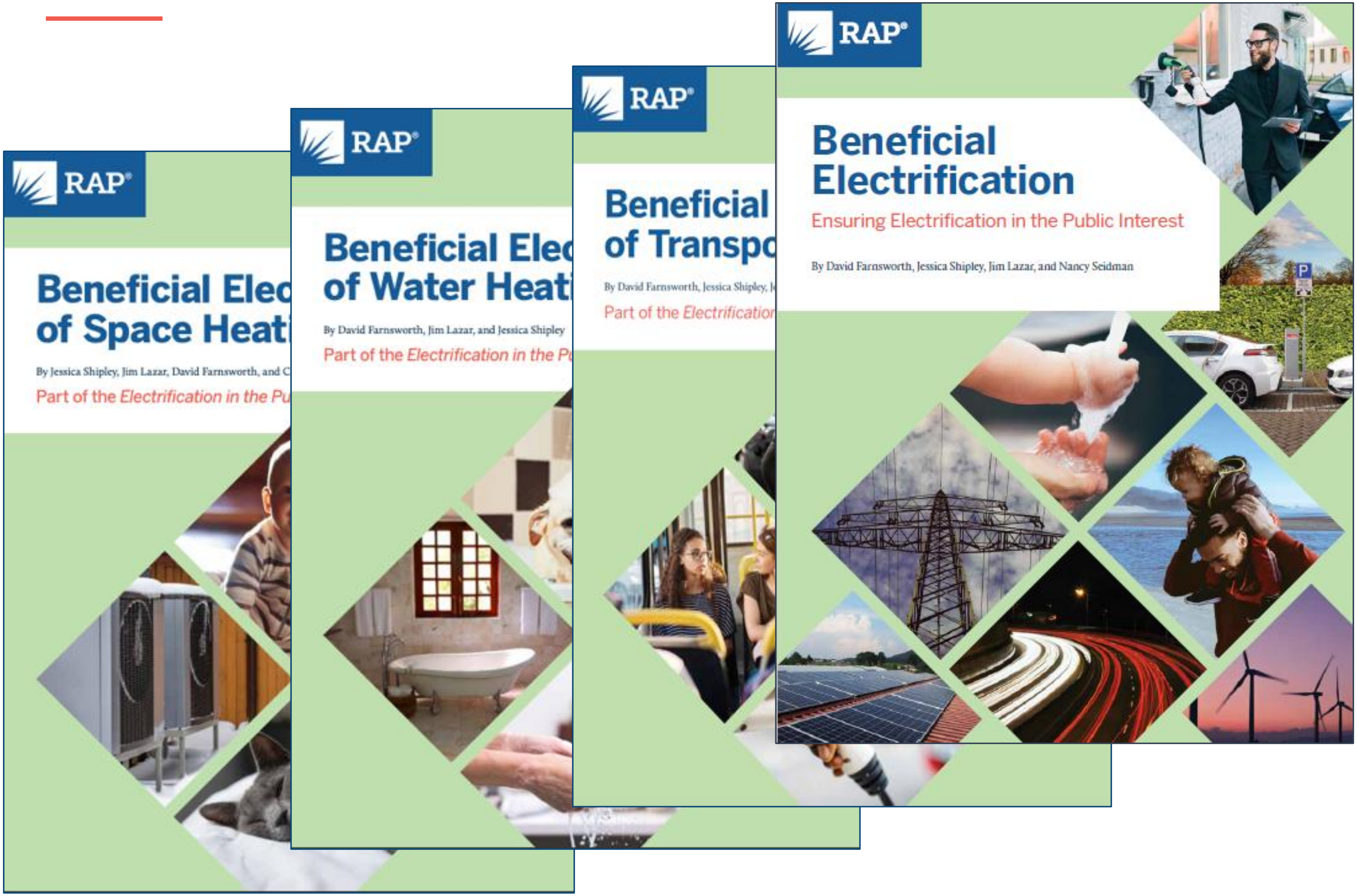
1. Saves Customers Money Long-Term; More Services

2. Reduces Environmental Impacts

3. Enables Better Grid Management

Beneficial Electrification Resources from RAP

- Beneficial Electrification: Ensuring Electrification in the Public Interest
- Utilities Can Get a "LEG" Up with Beneficial Electrification—But Regulators Also Have to be Ready
- Beneficial Electrification: A Growth Opportunity
- Beneficial Electrification: A Key to Better Grid Management
- Environmentally Beneficial Electrification: The Dawn of Emissions Efficiency (Electricity Journal)


RAP
Beneficial Electrification
Ensuring Electrification in the Public Interest
By David Farnsworth, Jessica Shipley, Jim Lazar, and Nancy Seidman

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

David Farnsworth
Principal
The Regulatory Assistance Project®
+1 802 498 0708

'22 HB 831 Reducing GHG Emissions-Commercial & Res

Uploaded by: Ellen Robertson

Position: INFO

Larry Hogan
Governor

Boyd K. Rutherford
Lt Governor

Maryland
DEPARTMENT OF GENERAL SERVICES

Ellington E. Churchill, Jr.
Secretary

Nelson E. Reichart
Deputy Secretary

OFFICE OF THE SECRETARY

BILL:	**House Bill 831**
	Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings
COMMITTEE:	House Environment and Transportation
DATE:	February 25, 2022
POSITION:	Letter of Information

Upon review of House Bill 831 - Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings, the Maryland Department of General Services (DGS), provides these comments for your consideration.

The bill aims to reduce greenhouse gas emissions from commercial and residential buildings through the provisions outlined in this legislation. This impacts on DGS are:

- All buildings over 25,000 square feet will be required to reduce direct building emissions by 20% before 2030 and achieve net zero by 2040. The first requirement can potentially be met by replacing end-of-life fossil-fueled HVAC and water heating equipment with electric units. Alternatively, replacing this equipment with electric equipment before its end-of-life would increase capital costs and require building occupants to temporarily relocate, which poses a logistical and operational cost. The burden of relocation could be mitigated by utilizing telework policies. Additionally, owners of these buildings would be responsible to measure and report these emissions to the Maryland Department of the Environment (MDE), which would require two (2) additional staff for DGS to achieve this.

- All new commercial buildings would be required to meet all water and space heating demands without the use of fossil fuels, forcing these demands to be met by electric systems. New buildings constructed by the State would need to be designed and constructed with electric systems which has far-reaching implications for State facilities.

- New commercial buildings would also be required to be ready for the installation of solar energy systems and electric vehicle (EV) charging equipment, increasing Capital construction costs. DGS is already pursuing the requirements as it pertains to EV charging equipment, however, is it not mandatory for newly designed and constructed buildings. To have all buildings be EV charging ready would require an additional cost increase of 0.02-0.04%. Designing new buildings to be solar ready would require an additional cost increase of 0.05-0.08%.

- New commercial buildings would be required to be ready for building-grid interaction, which newly constructed buildings by DGS are ready to participate in utility demand-side management programs.

For additional information, contact Ellen Robertson at 410-260-2908.

301 West Preston Street
Baltimore, Maryland 21201
(410) 767-4960
FAX (410) 333-5480

Toll Free 1-800-449-4347
email: Ellington.Churchill@maryland.gov
email: Nelson.Reichart@maryland.gov
TTY users 1-800-735-2258

Proposed_Amend_Clark_HB831
Uploaded by: Gerry Clark
Position: INFO

HB0831/693722/1

AMENDMENTS
PREPARED
BY THE
DEPT. OF LEGISLATIVE
SERVICES

25 FEB 22
09:53:50

BY: Delegate Clark
(To be offered in the Environment and Transportation Committee)

AMENDMENTS TO HOUSE BILL 831
(First Reading File Bill)

AMENDMENT NO. 1

On page 1, in line 12, strike "2–1603" and substitute "2–1604".

AMENDMENT NO. 2

On page 2, after line 5, insert:

"**(B) "BARBECUE APPLIANCE" MEANS AN APPLIANCE THAT COOKS FOOD BY APPLYING HEAT AS A RESULT OF BURNING SOLID FUEL, GAS FUEL, WOOD FUEL, OR PELLET FUEL.**";

in lines 6, 8, and 13, strike "**(B)**", "**(C)**", and "**(D)**", respectively, and substitute "**(C)**", "**(D)**", and "**(E)**", respectively; and after line 14, insert:

"**(F) "HEARTH PRODUCT APPLIANCE" MEANS A FIREPLACE, FIREPLACE INSERT, STOVE, OR LOG SET THAT OFFERS A DECORATIVE VIEW OF FLAMES AND MAY BE FUELED BY SOLID FUEL, GAS FUEL, WOOD FUEL, OR PELLET FUEL.**

(G) (1) "OUTDOOR PATIO APPLIANCE" MEANS AN APPLIANCE THAT IS LOCATED OUTDOORS AND MAY BE FUELED BY SOLID FUEL, GAS FUEL, WOOD FUEL, OR PELLET FUEL.

(2) "OUTDOOR PATIO APPLIANCE" INCLUDES FREESTANDING, MOUNTED, OR BUILT–IN APPLIANCES, STOVES, FIREPLACES, FIRE PITS, AND INSERTS.".

On page 6, after line 6, insert:

"**2–1604.**

NOTHING IN THIS SUBTITLE SHALL BE CONSTRUED TO PROHIBIT THE INSTALLATION, SERVICE, OR REPAIR OF A BARBECUE APPLIANCE, A HEARTH PRODUCT APPLIANCE, OR AN OUTDOOR PATIO APPLIANCE IN OR ON THE PROPERTY OF A NEWLY CONSTRUCTED OR EXISTING HOME OR BUSINESS.".

AMENDMENT NO. 3

On page 9, after line 15, insert:

"**(4) STANDARDS ADOPTED UNDER THIS SUBSECTION MAY NOT BE CONSTRUED TO PROHIBIT THE INSTALLATION, SERVICE, OR REPAIR OF A BARBECUE APPLIANCE, A HEARTH PRODUCT APPLIANCE, OR AN OUTDOOR PATIO APPLIANCE, AS DEFINED UNDER § 2–1601 OF THE ENVIRONMENT ARTICLE, IN OR ON THE PROPERTY OF A NEWLY CONSTRUCTED OR EXISTING HOME OR BUSINESS.**".

HB831_Stanek_Info.pdf
Uploaded by: Jason Stanek
Position: INFO

STATE OF MARYLAND

PUBLIC SERVICE COMMISSION

February 25, 2022

Chair Kumar P. Barve
Environment and Transportation Committee, Room 251
House Office Building
Annapolis, Maryland 21401

RE: INFORMATION – HB 831 – Reducing Greenhouse Gas Emissions – Commercial and Residential Buildings

Dear Chair Barve and Committee Members:

HB 831 envisions broad modifications to the building sector across the State to address climate change, some of which would impact the utility industry and ratepayers. While the Maryland Public Service Commission does not oppose these changes, I would offer an observation regarding the proposed building code changes.

HB 831 proposes to limit the amount of greenhouse gas emissions directly from buildings and prohibits the use of fossil fuels in new buildings for water and space heating. To achieve these goals, the electric and natural gas utilities regulated by the Commission will be impacted in significant ways. Specifically, the proposed changes to prohibit new buildings from using fossil fuels to serve water and space heating demands will impact how the utilities plan their systems, meet customer needs, and the rates customers pay on their utility bills. The size of the rate impact on customers is unknown without further study.

The Commission appreciates the opportunity to provide information on HB 831. Please contact Lisa Smith, Director of Legislative Affairs, at (410) 336-6288 if you have any questions.

Sincerely,

Jason M. Stanek
Chairman

WILLIAM DONALD SCHAEFER TOWER 6 ST. PAUL STREET BALTIMORE, MARYLAND 21202-6806
410-767-8000 Toll Free: 1-800-492-0474 FAX: 410-333-6495

HB 831 Reducing Green House Gas Emissions Commerci

Uploaded by: Jeffry Guido

Position: INFO

BALTIMORE - D.C. METRO BUILDING TRADES COUNCIL

Value on Display... Every Day

May 14, 2021

Electrical Workers

Insulators

Boilermakers

United Association

Plumbers & Gas Fitters

Sprinkler Fitters

Steam Fitters

Roofers

Cement Masons

Teamsters

Laborers

Bricklayers

Ironworkers

Sheet Metal Workers

Elevator Constructors

Painters

Operating Engineers

Carpenters

Maryland House of Delegates Environment and Transportation Committee

Chair: Kumar P. Barve

Vice Chair: Dana Stein

House Bill 831 Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings

Position: **Informational**

The Baltimore DC Metro Building Trades Council is providing information pertinent to House bill 831. As our International Unions are part of the Blue Green Alliance and as Local Building Trades Unions with green construction as part of our journey person and apprenticeship training we have a vested interest in the retrofitting and new construction of buildings as described in the legislation. As our tax dollars are being spent on renewable energy, energy efficiency, energy storage and environmental protection the application of labor standards are imperative to protect the living standards and the empowerment of Maryland's working families. These standards include paying the area prevailing wage standard for each trade, including the wages and fringe benefits per trade, and be subject to all state reporting and compliance requirements. Participation in an apprenticeship program registered with the State of Maryland for each trade employed on the project. Contractors that have been compliant with federal and state wage and hour laws in the previous three years. The establishment and execution of a plan for outreach, recruitment, and retention of Maryland residents to perform work on the project—including residents who are returning citizens, women, minority individuals, and veterans —with an aspirational goal of 25 percent of total work hours performed by Maryland residents, including individuals in one or more of the groups identified. The implementation of green standards in public works projects requests for proposals to bid to include green roofs, thermal pane windows, geothermal, rainwater catchment solar and wind et al will do more to reduce the carbon footprint than an all or nothing attack on fossil fuels. Our members are certified and licensed skilled crafts persons that install these systems safely and economically.

We ask the committee for consideration when casting a vote.

Thank you.

Respectfully, Jeffry Guido -Baltimore-DC Metro Building Trades Council

Value on Display... Everyday.

HB0831 - LOI - Reducing Greenhouse Gas Emissions -
Uploaded by: Landon Fahrig
Position: INFO

Maryland Energy Administration

Larry Hogan, Governor
Boyd K. Rutherford, Lt. Governor
Mary Beth Tung, Director

TO: Members, House Environment and Transportation Committee
FROM: Mary Beth Tung – Director, MEA
SUBJECT: HB 831 - Reducing Greenhouse Gas Emissions - Commercial and Residential Buildings
DATE: February 25, 2022

MEA POSITION: Letter of Concern

The Maryland Energy Administration (MEA) strongly supports policies that ensure energy reliability and resilience, as continuous access to energy has become a necessity, rather than a luxury. MEA does this while simultaneously supporting the development of renewable energy and creating meaningful reductions in greenhouse gas emissions.

House Bill 831 requires MEA to terminate support for new construction within its programs that incentivize natural gas as an on-site resiliency measure as well as a generation asset. This may hinder or **eliminate the deployment of highly efficient combined heat and power, or "CHP", that is popular for use in critical infrastructure facilities, such as hospitals and government facilities, as it helps them continue operations during catastrophic events**. It may also hinder or eliminate support for new construction in the existing Resilient Maryland Program which assists in the design phase of resilient campuses that can provide their own power during outages. These projects often use multiple energy sources, including, but not limited to natural gas. Lastly, the Maryland Energy Infrastructure Program may also face significant challenges, which has expanded energy options and aided in the development of energy infrastructure for historically underserved communities in Maryland, specifically in Baltimore City and Somerset County.

MEA appreciates the committee's consideration of these remarks.