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Why Cooling is Key:

How to decarbonize buildings with one weird trick

A report by the Building Decarbonization Coalition

About the Building Decarbonization Coalition: The Building Decarbonization Coalition (BDC) unites critical stakeholders on a path to transform the nation's buildings through clean energy, using policy, research, market development and public engagement. The BDC and its members are charting the course to eliminate fossil fuels in buildings to improve people's health, cut climate and air pollution, prioritize high-road jobs, and ensure that our communities are more resilient to the impacts of climate change.

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Introduction

The frequency and severity of heat waves across the United States has already increased significantly with climate change, and deadly extreme heat events will only continue to worsen. The World Meteorological Organization predicts with 98% certainty that the next five years will be the hottest on record globally. By 2053, a staggering 107 million people across the U.S. could experience temperatures above the National Weather Service's "extreme danger" category, or when the heat index is more than 125 degrees Fahrenheit. That is compared to around 8 million people in the U.S. last year.

In response to new exposure to extreme heat, shipments of central air conditioning (AC) units, which are already the most shipped HVAC equipment in many states, have increased a substantial 15% in the U.S. over the past ten years in comparison to the previous decade. This trend is likely to accelerate dramatically in the coming decades, and will be especially prominent in regions with historically mild climates, like Northern California and the Pacific Northwest.

At the same time as central AC sales are surging across the country, policymakers at the state, local, and national level are pursuing strategies to cut greenhouse gas emissions from homes and buildings by displacing fossil fuel heating systems through increased adoption of a technology that provides both heating and cooling: the electric heat pump.

Heat pumps are available at a similar price point to central AC units and have similar installation requirements. This means that if a household is planning to install a central AC system, they can just as easily install a heat pump, as the installation requirements and electrical system demands for the home are comparable.

Opting for a heat pump instead of a central AC brings enormous co-benefits. For about the same price as central AC in mild climate zones – and just slightly higher cost in cold climate zones — heat pumps can provide more efficient cooling, which can lower operating costs while also lowering overall energy demand, particularly in times of high heat which leads to power supply strains. What's more, the home with a heat pump is gaining fossil fuel-free heating. The next time the furnace breaks, this home will not need to replace it, saving on future tech and installation costs – and cutting climate and local air pollution in the process.

Yet this opportunity to choose a heat pump over a central AC is going largely unnoticed by consumers and by policymakers alike. While heat pump sales have reached new heights recently, they are still far outpaced by central AC units – and consumers most often do not know there is another option. Accelerating the installation of heat pumps is a major policy goal for local, state and the national government, but most policies to date focus on driving installation when a fossil fuel furnace burns out. The San Francisco Bay Area, for example, has moved to phase out the sale of new fossil fuel heating appliances starting in 2029, in a move that is likely to be replicated across the state of California by 2030.

This report analyzes the opportunity to electrify space heating in homes by replacing central AC units with central heat pumps–which are functionally identical as an air conditioning system, while tending to be superior in efficiency. We find that converting AC to heat pump sales would be a notably effective and cost-efficient strategy to dramatically accelerate electrification in homes across the U.S.

Methodology

BDC analyzed data from the U.S. EIA (Energy Information Administration) and HARDI (Heating, Air-conditioning & Refrigeration Distributors International) to complete this analysis. EIA data comes from the 2020 issue of the Residential Energy Consumption Survey (RECS), which provides information about the characteristics of the U.S. building stock as it existed in 2020. HARDI's data include the number of shipments for central AC systems, furnaces, and heat pumps from 2013 through 2021, as well as their efficiency and other characteristics.

Using these data, BDC evaluated the potential for central AC-to-ASHP conversions in California, Maryland, Massachusetts, New Jersey, and New York. BDC arrived at the conclusions contained in this document by comparing the prevalence of existing residential central AC systems in these states, the rate of central AC and ASHP shipments over the past decade, and the efficiency characteristics of these systems.

Households can save big by choosing a heat pump

Central AC sales currently far outpace air source heat pump sales in all five states analyzed in this report. Additionally, in many states, nearly all growth in heat pump sales is attributable to the ductless marketplace. But if a household is prepared to install a central AC unit, they could just as easily install a central heat pump, and in doing so, gain a heating appliance that can run on renewable electricity instead of fossil fuels.

This is true both in mild and cold climates. Thanks to technology innovations resulting from the Department of Energy's Cold Climate Heat Pump Technology Challenge, and the increasing mainstream demand for heat pumps, centrally-ducted cold climate heat pumps are now hitting the market that can serve residents in temperatures as low as -22 degrees Fahrenheit without the need for back-up heating.[1] This technology innovation is set to make the conversion to heat pumps even more desirable for residents.

Starting later this year, incentives through the Inflation Reduction Act will also become available that will dramatically lower the upfront cost of installing a heat pump, especially for low-income households. Low-income homeowners will be able to take advantage of up to $8,000 in rebates for air-source heat pumps, up to $2,500 for electrical wiring, up to $1,600 for weatherization. The IRA's tax credit program is estimated to result in the installation of 7.2 million heat pumps in the U.S. by 2030. In addition to federal incentives, many states, local governments, and utilities have additional incentives for electric heat pumps.

Households that install heat pumps will also often save on utility bills in comparison to central AC. The heat pumps that are sold around the country tend to be significantly more efficient than central AC units, lowering the cost of keeping households cool during the summer months.

In addition to lowering cooling costs, upgrading to a heat pump for space heating can also deliver significant savings on future heating costs by displacing fossil fuel heating. Electricity prices are much less vulnerable to seasonal price spikes and fluctuations that are inherent to the market for gas.

Heat pumps bolster grid resilience

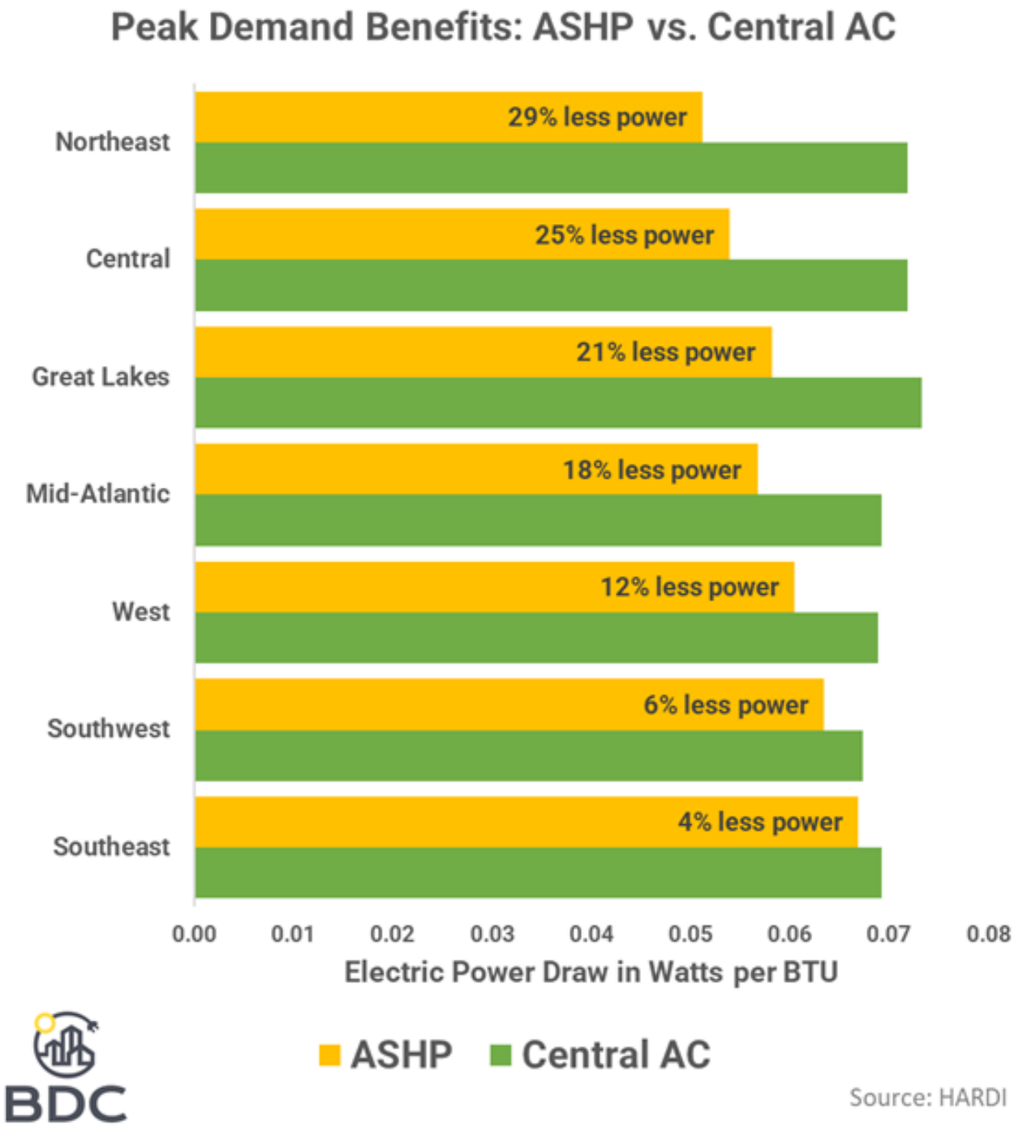
Extreme weather fueled by climate change is posing new challenges for electricity grids across the nation, leading to a growing threat of rolling blackouts during the summer months. Electricity demand for cooling is the single largest contributor to summer gird strain. In some parts of the United States, space cooling can represent more than 70% of peak residential electrical demand on extremely hot days.

As demand for cooling at homes continues to grow in the coming decades, so will the strain on regional electricity grids. Converting central AC sales to heat pumps is an important tool policymakers can leverage to protect against grid strain, due to the efficiency benefits that heat pumps deliver in comparison to central AC.

[1] Ground-source (or geothermal) heat pumps, a long-proven technology, work well in all climates regardless of the outdoor air temperature.

In every region of the U.S. the average heat pump sold is more efficient than the average central AC unit, and in places where heat pump demand has only recently picked up, the efficiency gap is significant. Nationally, the average heat pump sold draws up to 29% less electricity during periods of peak demand than a central AC unit. These efficiency gains could make or break regional electricity grids on the hottest days of the year.

Due to these efficiency gains, Energy Star, a program run by the U.S. Environmental Protection Agency and U.S. Department of Energy promotes energy efficiency, recently proposed sunsetting the certification pathway for central AC units, a move that will encourage the installation of heat pumps.



Converting central AC unit sales to heat pumps can dramatically accelerate the electrification of homes and buildings

Transitioning homes and buildings from fossil fuel heating appliances – like gas and fuel oil furnaces – to electric heat pumps is a critical tool for meeting state climate targets. Homes and buildings are the second-largest source of greenhouse gas emissions nationwide, just behind transportation. Electrification of space heating is by far the most cost-effective strategy for eliminating this pollution.

Policymakers at the state, local, and national level are pursuing strategies to cut greenhouse gas emissions from homes and buildings by increasing the adoption of electric heat pumps in both new construction and existing homes.

New York recently passed legislation to phase out gas connection in the vast majority of new homes and buildings. California and Washington also have building codes on the books that include highly efficient electric heat pumps as a baseline technology. In the San Francisco Bay Area, air regulators voted to phase out the sale of new gas heating appliances starting in 2029, a move that will lay the groundwork for a widespread transition to electric heat pumps in homes.

To advance the transition to electric heat in homes at the pace necessary to meet state climate targets, policymakers will need to build on these important policy steps. The prevalence of central AC sales over heat pump sales in the states examined shows that converting the market for AC sales to electric heat pumps is an important policy lever that could dramatically accelerate the electrification of homes and buildings.

Moreover, the report finds that continuing the installation of central AC units could represent a significant barrier to electrification. Households that make a major economic investment in a central AC unit are less likely to invest in a heat pump when their fossil fuel furnace burns out because they are already equipped with an appliance for cooling.

Seattle, Washington Skyline

CALIFORNIA

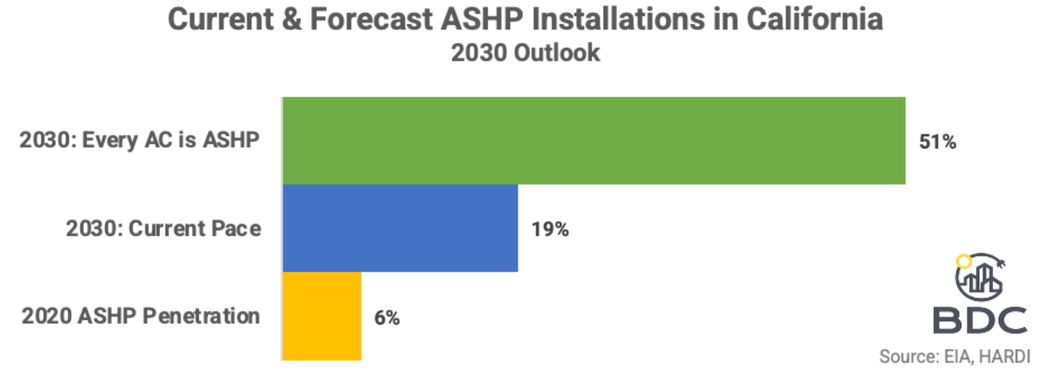
California, with its mild winters and ambitious targets for electrifying homes and buildings, is ideally positioned to convert its market for central AC to heat pumps. What's more, rising temperatures are already driving a surge in AC installations – demand that California policymakers can leverage to rapidly accelerate the state's progress towards its electrification targets.

AC penetration is relatively low in California compared to other warm states. Statewide, roughly 25% of homes are not equipped with cooling, and in the historically temperate San Francisco metropolitan area, the number is a stunning 53%. This means California is likely to see millions of new cooling appliance sales in the coming decade, as households rush to upgrade to stay cool in the face of new weather extremes. Schools are consistently adding AC to keep teachers and students comfortable in the classroom and heat pumps solve the comfort, indoor, and outdoor air quality with one piece of equipment.

Policymakers have an opportunity this year to lay the groundwork to convert the growing market for central AC in California to heat pumps, ensuring that new demand for cooling is met by more efficient appliances that displace fossil fuel heating, reduce grid strain, and save households money.

As California Energy Commission considers updates to its 2025 building code, policymakers could enact a requirement to ensure that when a cooling appliance burns out, it is replaced with an electric heat pump, rather than a central AC. This policy move would lay the groundwork to achieve the target California Governor Gavin Newsom set last year of installing 6 million heat pumps by 2030.

Converting the market for central AC to heat pumps will also help the state prepare for new state and regional policies phasing out the sale of gas furnaces to go into effect. In the San Francisco Bay Area, air regulators voted to phase out the sale of residential gas furnaces starting in 2029, and state regulators have committed to enacting a similar policy to go into effect by 2030.



California could electrify space heating in more than half of California homes by converting central AC sales to heat pumps.

Pairing California's zero-emission appliance standards for furnaces with policies to ensure that the cooling appliances households install are heat pumps is now a critical step to protect households from making an unnecessary economic investment in central AC, when they may need to install a heat pump a few years down the line when their gas furnace breaks down and California's appliance standards are in effect.

Squandering the opportunity to convert the market for central AC to heat pumps would have major consequences. According to the U.S. Energy Information Agency, California has approximately 5.5 million residential central air conditioning units, 35% of which are greater than 14 years of age, and thus approaching burnout. If these appliance installations are largely met by central AC, California could see the installation of millions of inefficient appliances at the expense of the state's climate, air quality, and climate-resilience goals.

California homes at a glance:

- 13.18 million homes in California
- 72% / 9.54 million homes use air conditioning, including heat pumps.
- 62% / 8.20 million homes have a furnace

Converting AC sales to heat pumps:

- If every homeowner in California shopping for an AC unit in the summertime chose an air source heat pump instead and used it to replace a gas furnace when theirs breaks, the state could fully electrify 51% of all home heating by 2030. The state's existing pace to electrify is 19% by 2030.

Extreme heat:

- Heat waves, defined as a period of consecutive days above 90°F, are increasing in their frequency and intensity across California as a result of climate change. 40 years ago, Los Angeles and Fresno experienced an average of 54-92 days over 90 degrees F each year, respectively. Those numbers have leaped to 67-107 days in recent years. Researchers estimate that by the 2060s, these parts of California may have 87-120 days over 90 degrees each year.

San Francisco, California

NEW YORK

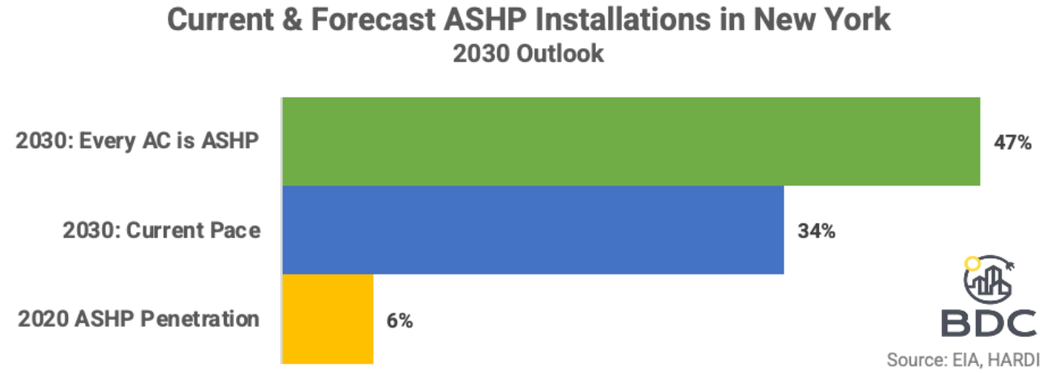
New York has put forth some of the most ambitious targets in the nation for electrifying homes and buildings – and yet as temperatures rise, state policymakers are continuing to overlook targeting the market for cooling as an effective strategy to achieve these goals.

In May 2023, the state passed the nation's first legislation to phase out fossil fuels in new buildings beginning in 2025, a move that will expand access to heat pumps in homes. New York has also set a goal to achieve a minimum of 1 million electrified homes and up to 1 million electrification-ready homes by 2030. These milestones build on targeted efforts to increase affordability and access to clean heating and cooling for low-income New Yorkers, including $70 million in initial funding to develop and produce 30,000 new heat pumps for New York City Public Housing facilities as a part of the Clean Heat for All Challenge.

For income-eligible New Yorkers, the State offers rebates up to $10,000 alongside programs like EmPower.

New York homes at a glance:

- 7.52 million homes in New York
- 88% / 6.60 million homes use air conditioning, including heat pumps.
- 44% / 3.31 million homes use a furnace, and 35% / 2.65 million homes use a boiler



Converting AC sales to heat pumps:

- Given current shipment trends, if every homeowner in New York shopping for an AC unit in the summertime chose an air source heat pump instead and used it to replace a gas furnace in winter, the state could electrify space heating in 47% of all homes by 2030. The state's existing pace to electrify homes is 34% by 2030.

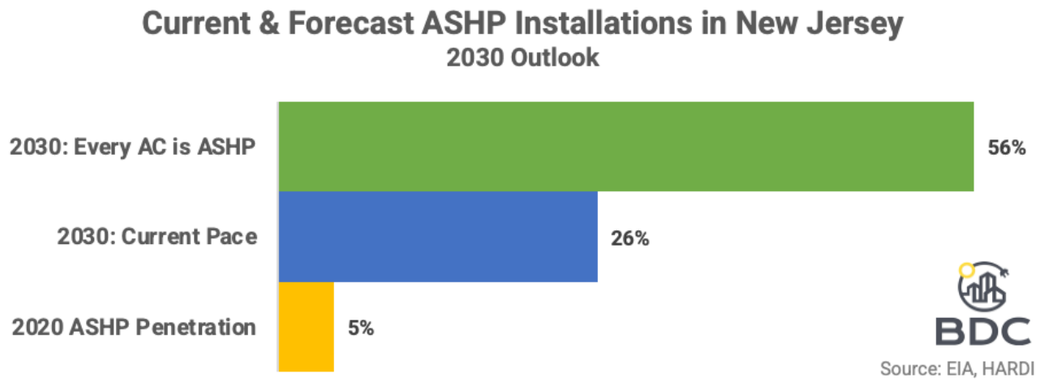
Extreme heat:

- New York is set to see average temperatures rise in the coming decades. In New York City, the number of average days over 90 degrees F has increased 38% in the past 40 years, a number that could more than triple to 26 days on average by the 2060s.

NEW JERSEY

New Jersey has set ambitious targets around clean energy, including a goal by Governor Phil Murphy to install heat pumps in 400,000 New Jersey homes and 20,000 commercial properties by 2030 as well as making 10% of all low-to-moderate income properties electrification-ready by 2030. Currently, New Jersey offers consumers $390 to $1,000 in rebates for cold climate air source heat pumps.

New Jersey homes at a glance:
- 3.39 million homes in New Jersey
- 96% / 6.60 million homes use air conditioning, including heat pumps.
- 61% / 2.07 million homes use furnaces, and 25% / 850,000 use boilers



Converting AC sales to heat pumps:
- Given current shipment trends, if every homeowner in New Jersey shopping for an AC unit in the summertime chose an air source heat pump instead and used it to replace a gas furnace in winter, the state could electrify space heating in 56% of all homes by 2030. The state's existing pace to electrify is 25% by 2030.

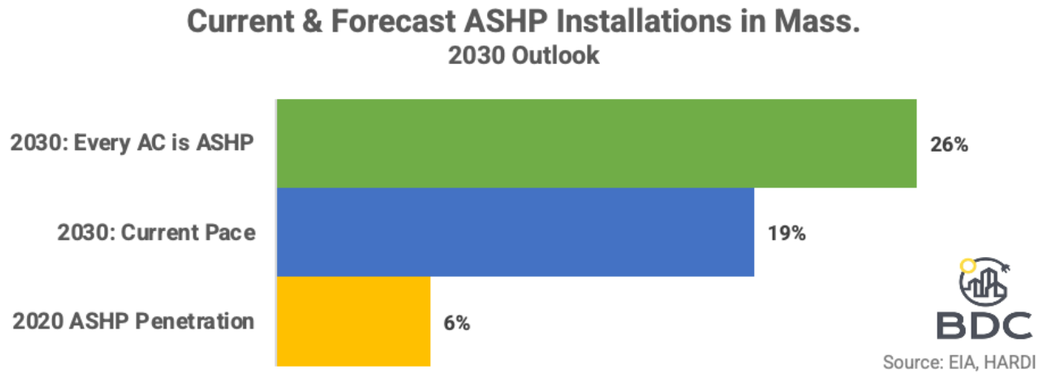
Extreme heat:
- New Jersey is set to see average temperatures rise in the coming decades. Trenton, New Jersey has seen the average number of days over 90 degrees F increase 7% in the past 40 years, a number that could more than double by the 2060s. Expanding access to electrification, including heat pumps, is clearly a priority for New Jersey leaders, and yet as temperatures rise, state policymakers are overlooking an effective strategy to achieve these goals while boosting resilience in the face of extreme heat.

MASSACHUSETTS

Massachusetts has set ambitious goals to decarbonize buildings. In 2022, the State Legislature passed the legislation to allow 10 municipalities to build homes free from fossil fuels and remaining municipalities can adopt a specialized stretch code to build electric-ready new construction. Governor Healey's predecessor, Charlie Baker–a Republican–set a goal to deploy 1 million heat pumps in Massachusetts homes by 2030 with targeted efforts to help increase affordability for consumers.

In February 2023, the Healey administration announced a grant program of $50 million to help fund retrofits for low- to moderate-income households. Mass Save, the state energy efficiency program, offers rebates and incentives for efficiency upgrades, including covering 100% of appliances like heat pumps and efficiency-boosting measures for low-income households. For those who make 60-80% of the state median income, the state will cover the cost of some upgrades and offer savings plans. For market rate homeowners willing to switch from natural gas heating to an electric heat pump system, the state will offer up to $10,000 in rebates.

Massachusetts homes at a glance:
- 2.71 million homes in Massachusetts
- 87% / 2.37 million homes use air conditioning, including heat pumps.
- 55% / 1.49 million homes use furnaces, and 26% / 700,000 use boilers



Converting AC sales to heat pumps:
- Given current shipment trends, if every homeowner in Massachusetts shopping for an AC unit in the summertime chose an air source heat pump instead and used it to replace a gas furnace in winter, the state could electrify space heating in 26% of all homes by 2030. The state's existing pace to electrify is 19% by 2030.

Growing demand for space cooling:

- Heat waves, defined as a period of consecutive days above 90°F, are increasing in their frequency and intensity across Massachusetts as a result of climate change. 40 years ago, Springfield experienced an average of 8 days over 90 degrees F each year. This number has increased to 9 days in recent years. Researchers estimate that by the 2060s, Springfield may have 25 days over 90 degrees each year.

Annapolis, Maryland

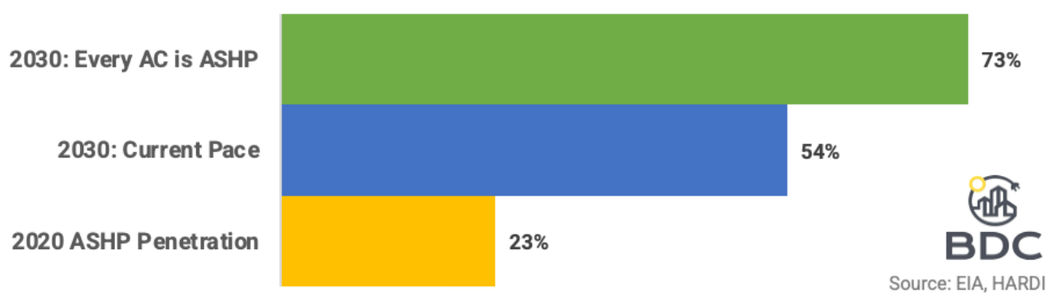
MARYLAND

Maryland is already a leader in heat pump installations, with close to a quarter of all homes equipped with heat pumps currently.[1] In 2022, the Maryland State Legislature passed legislation creating a building energy performance standard for buildings over 35,000 square feet with requirements to reduce emissions and eventually achieve net-zero carbon emissions by 2040. Montgomery County, Maryland, the state's largest county and home to 1.1 million residents, also passed legislation to phase out the use of fossil fuels in new construction beginning in 2027. Neighboring Howard County, Maryland followed suit and passed legislation to begin to phase out fossil fuels in new construction.

Despite this momentum, the EmPOWER Maryland program currently does not offer incentives to switch from fossil fuel appliances to electric alternatives. While legislation was introduced to build on the EmPOWER program and offer incentives to electrify for the first time, this legislation did not pass.

Maryland homes at a glance:

- 2.28 million homes in Maryland
- 91% / 2.08 million homes use air conditioning, including heat pumps.
- 64% / 1.46 million homes use furnaces, and 7% / 160,000 use boilers



Converting AC sales to heat pumps:

- Given current shipment trends, if every homeowner in Maryland shopping for an AC unit in the summertime chose an air source heat pump instead and used it to replace a gas furnace in winter, the state could electrify space heating in 73% of all homes by 2030. The state's existing pace to electrify is 54% by 2030.

Extreme heat:

- Maryland is set to see average temperatures rise in the coming decades. Baltimore has seen the average number of days over 90 degrees F rise 39% over the past 40 years, a number that could more than double by the 2060s.

[2] Residential Energy Consumption Survey, 2020 issue. United States Energy Information Administration. Found here.

Conclusion and Recommendations

Tapping into consumer demand for central AC units as an entry point for heat pump adoption and acceleration in coming years could provide a key policy tool to help decarbonize a substantial number of homes by displacing the eventual need for fossil fuel heating. That's on top of enormous co-benefits like lower grid stress, lower operating and up-front costs generated by only needing one appliance instead of two, and improved air pollution from reduced fossil fuel use. To make this shift possible, the following strategies should be undertaken:

Policy shifts:[1] **There are several policy tools available to local, state, and national leaders to encourage heat pump adoption for cooling.**

- State buildings codes can require that commercial and residential buildings seeking to replace a central AC unit instead choose a heat pump heating and cooling system. This option is currently available in California, as the California Energy Commission considers updates to the state's 2025 building code. Local, state and federal tax credits and incentives can also help shape the market and expand the customer base for heat pumps.
- Removing barriers such as restrictions on fuel switching will ensure that utility funds or incentives can be used to transition appliances from gas to electric. When a customer can use incentives to replace their gas furnace with an electric heat pump, they will also be installing a new AC system.

Consumer Awareness: Current consumer awareness that heat pumps act as smart AC systems - providing both heating and cooling - is distinctly lacking. Growing this awareness, particularly before people need an urgent AC replacement - is critical to ensure homeowners and property managers can make an informed decision. Entities with a stake in the transition to highly efficient cooling - including local, state and the federal government, electric utilities and heat pump manufacturers - should all invest in consumer education programs and advertising to reach this market.

Contractor awareness:

- Contractors play a critical role as a conduit of information to homeowners and property managers about their options when purchasing or replacing cooling systems. Investing in contractor awareness both on the benefits of heat pumps over central AC from an economic, climate and efficiency perspective is critical to harnessing these sales and converting them from AC to heat pumps.
- This awareness must include a clear value proposition for selling heat pumps instead of central AC. Policies and programs must be designed to make heat pumps so profitable to contractors – and so beneficial to consumers – that contractors begin to recommend transitioning from an inefficient AC system to an efficient heat pump in advance of their current system's failure. Federal incentive programs like the IRA, coupled with state and utility incentive programs, will make it easier to build programs that give contractors what they need to proactively sell heat pumps. Stable policies and program infrastructure will also communicate to contractors that building their business around heat pumps is a safe bet for the future.

[3] Special thanks to CLASP, RAP, NBI, and others for their work to promote the opportunities inherent in switching one-way air conditioners for heat pumps. See for example: "Combating High Fuel Prices with Hybrid Heating: the Case for Swapping Air Conditioners for Heat Pumps." July 2022.

Workforce Development:

- Workforce development is a necessary component of the clean energy transition; new training requirements, programs, or facilities for residential contractors are not. These resources already exist, and can be used to educate the current workforce and reduce start-up training costs and ensure future labor supply.
- While the current workforce can meet the near-term demand for building electrification, contractors are concerned that not enough high school graduates are joining the trades. States should communicate the wage, student debt, and career advancement benefits of working in the trades to young people through secondary education programs and the media.

CREDITS

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