ENERGY EFFICIENCY SHOULD BE MADE IN THE UNITED STATES

Many of the products used for energy efficiency and other building retrofits are made in the United States. Strong industrial policy is necessary to keep it that way.

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EXECUTIVE SUMMARY

The United States is manufacturing less of the materials and equipment we need to make our homes and businesses more energy efficient than we were a decade ago.

The United States is manufacturing less of the materials and equipment we need to make our homes and businesses more energy efficient than we were a decade ago. In 2010, the Home Performance Resource Center and Newport Partners released a report entitled, Domestic Manufacturing Shares of Common Energy Remodeling Products.[1] That report used 2007 data to show a very high domestic content share for the retrofit products studied—above 90% for most product categories. This new analysis by the BlueGreen Alliance Foundation and Newport Partners updates that analysis with data from 2018-2020 and shows that the domestic content share has declined since 2007.

While the domestic content share remains high, the average decline across all products is five percentage points, with the largest declines seen in appliances (11 percentage points) and heating, ventilation, air conditioning, and cooling (HVAC) systems (10 percentage points). Over the same period, total domestic production of all energy efficiency products has fallen 10% and employment has fallen 13%.

The all-too-familiar pattern of globalization, outsourcing, and disinvestment is pushing the manufacturing of appliances, HVAC components, and other needed technologies to other nations. The same companies that became dominant with largely unionized domestic workforces have sought to increase profits and reduce costs by closing plants and moving production abroad. This pattern of deindustrialization has hurt families and communities and cut off pathways to the middle class.

Congress and the Biden administration have recently sought to promote energy efficiency retrofits through both legislation and executive action. These investments have the potential to reverse the decline in domestic production of retrofit products and create high-paying, community-supporting manufacturing jobs. However, strong industrial policy will be required to realize this potential.

We recommend a set of policies to pair energy efficiency investment with requirements and incentives for domestically produced products; to further increase investment in energy efficiency; and to provide direct support to the manufacturers of

these products. Recent federal policy—including the Inflation Reduction Act, Bipartisan Infrastructure Law (BIL), and executive action—have included provisions along these lines.

However, there are opportunities to do even more. The Buy America, Build America Act (BABA) was passed as part of the BIL. It strengthens domestic content requirement for infrastructure spending, but risks leaving out many federally funded energy efficiency projects. Federal agencies should use the discretion available to them to ensure that as much energy efficiency spending as possible is covered by BABA, and state and local governments tasked with allocating federal funds should offer incentives for the use of domestic retrofit products. Additionally, Congress and the administration should follow up on their recent direct investments in heat pump manufacturing with advanced market commitments and support from the Export-Import Bank and the U.S. Department of Energy's (DOE) Loan Program Office. Finally, the government should ensure that companies receiving federal support are committed to supporting their workers and communities by following recommendations from the BlueGreen Alliance's Checklist for Federal Funding Applications.[2]

INTRODUCTION

In 2007, the last Maytag factory in Newton, Iowa closed its doors.

In 2007, the last Maytag factory in Newton, Iowa closed its doors. For a century, the prosperity of the community and the company were intertwined, with roughly a quarter of the town's 16,000 residents employed by Maytag at the company's peak.[3] The unionized manufacturing jobs provided good pay, good benefits, and a good life for generations of workers and their families. In 2017, former employee Jim Schutte told *The World* that, if the factory had stayed open another decade, he would have retired that year with "full medical benefits and a nice pension." He was asked what his current retirement plans are and replied, "probably never."[4]

The closure was announced alongside the shutdown of other Maytag plants when Whirlpool purchased the company in 2006 and redesigned Maytag's appliances to use Whirlpool's chassis. Production was moved to existing Whirlpool facilities, including a non-union plant in Ohio where workers earned several dollars an hour less than their counterparts in Newton. Many of the jobs also went to Mexico to workers earning less than a fifth as much.[5, 6]

In 2016, Whirlpool Vice President of Communications and Public Relations Jeff Noel told *Michigan Bridge* that Newton had been just "one example of a small community that's been more adversely impacted because the company didn't do the things it needed to grow." Specifically, that Maytag hadn't been "aggressively global." Noel claimed that there was a bright side for workers of the acquisition and plant closures: "We employ more in Benton Harbor than we ever have," referring to the company's headquarters in Benton Harbor, Michigan. He did not mention in this statement that, while Whirlpool's corporate headcount may have grown their "aggressively global" strategy had included the closure of the company's last Benton Harbor factory just a few years earlier.[7]

These closures aren't isolated incidents. Since the late 20th century, Whirlpool's strategy has been to diversify its manufacturing footprint by shuttering U.S. factories and offshoring jobs to lower-wage countries. Currently, only nine of its 36 production locations are domestic. In an increasingly competitive industry in an increasingly globalized world, Whirlpool isn't alone in pursuing this strategy.[8]

New appliances like those made by Whirlpool are often installed as part of building energy efficiency retrofits—along with a range of other products including windows, insulation, and HVAC systems. These products have been manufactured in the United States for generations, and they continue to be made here today. According to the most recent U.S. Energy and Employment Report, the energy efficiency sector employs over 2.2 million workers, with over 300,000 in manufacturing industries.[9] The American Council for an Energy-Efficient Economy calls energy efficiency "the heart of a clean energy future," but it's also a critical part of the economy today.[10]

Energy efficiency retrofits of existing homes and buildings are a crucial element of the nation's current climate and energy policy. In the past two years, the Biden administration and Congress have sought to incentivize energy efficiency through the BIL, the Inflation Reduction Act, and executive action.[11, 12, 13] Policies such as these will help conserve valuable energy resources and reduce costs in low-income homes facing a high energy burden, while also reducing greenhouse gas emissions and other harmful forms of pollution. They can also support the U.S. economy and create and sustain good jobs across the country, including the types of highly paid, family-supporting manufacturing jobs that have long helped build and sustain communities such as Newton.

To unlock these economic benefits, we must do more than just invest in energy efficiency. Policies should be written and implemented to ensure that these efficiency retrofits use products that are made in the United States. This means investing directly in domestic manufacturing of critical efficiency products, as well as requiring or incentivizing the use of domestically manufactured products in efficiency projects receiving government funding. The Biden administration has already staked out an industrial policy with a strong focus on U.S. manufacturing and begun to put it into effect through the Inflation Reduction Act, the CHIPS and Science Act, and the BIL.[14] But there is room to do more in many areas, including the manufacturing of energy efficiency products.

In 2010, the Home Performance Resource Center and Newport Partners released a report entitled, *Domestic Manufacturing Shares of Common Energy Remodeling Products*.[15] That report used data from 2007 to demonstrate that the products commonly used in residential energy efficiency retrofits had very high domestic content—above 90% for most of the product categories evaluated.

This report, released by the BlueGreen Alliance Foundation and Newport Partners, offers an update and expansion of that analysis. Using data from 2018-2020, we find that the domestic content share of energy efficiency and other residential retrofit products remains high. However, there has been a

mild decline in the domestic content share across these products since 2007. The average decline across all products is five percentage points, with the largest declines seen in HVAC systems (10 percentage points) and appliances (11 percentage points). Over the same time period, total domestic production has fallen 10% and employment in these industries has fallen 13%.

Based on these findings, we recommend a series of policies that will support the domestic manufacturing of energy efficiency products. We emphasize that because of the relatively high domestic content of these products, any investment in energy efficiency will support the U.S. manufacturing sector and if done right, include the myriad of benefits that industry can offer its workers, their families, and their communities. We also suggest policies that should be enacted to ensure the domestic content share of these products stays high and increases as these efficiency investments increase. Building a more energy efficient future starts at home.

KEY FINDINGS

This report compares the domestic manufacturing share of energy efficiency products between two time periods. The estimated domestic manufacturing shares for the first period use the same 2007 data that was used in the Home Performance Resource Center's *Domestic Manufacturing Shares of Common Energy Remodeling Products* report from 2010.[16] For the second period, we use data from the same sources for the years 2018-2020. This report somewhat expands the scope of products being considered, so the 2007 domestic shares are not identical to what was published in the 2010 report, even though the methodology and sources are the same. For a more complete description of the data and analysis, see the Methodology section.

All product categories we analyzed have at least some domestic manufacturing presence, and some have little to no import penetration at all. On average across all categories, we find that energy efficiency products have a domestic content share of 79%. While this is undoubtedly high compared to many other consumer products, it represents a five percentage point decline from the 2007 average of 84%. Over the same time period, total domestic output of these categories declined by 10% and employment in the industries producing them declined by 13%.

As shown in Table 1, most categories have seen little to no change in the domestic share between the 2007 and 2018-2020 periods. Metal plumbing fixtures experienced a five percentage point increase, the largest of any category. Lighting as a whole experienced only a one percentage point increase, though this was driven by a seven percentage point decrease in the domestic share of light fixtures and a 14 percentage point increase in light bulbs.[17]

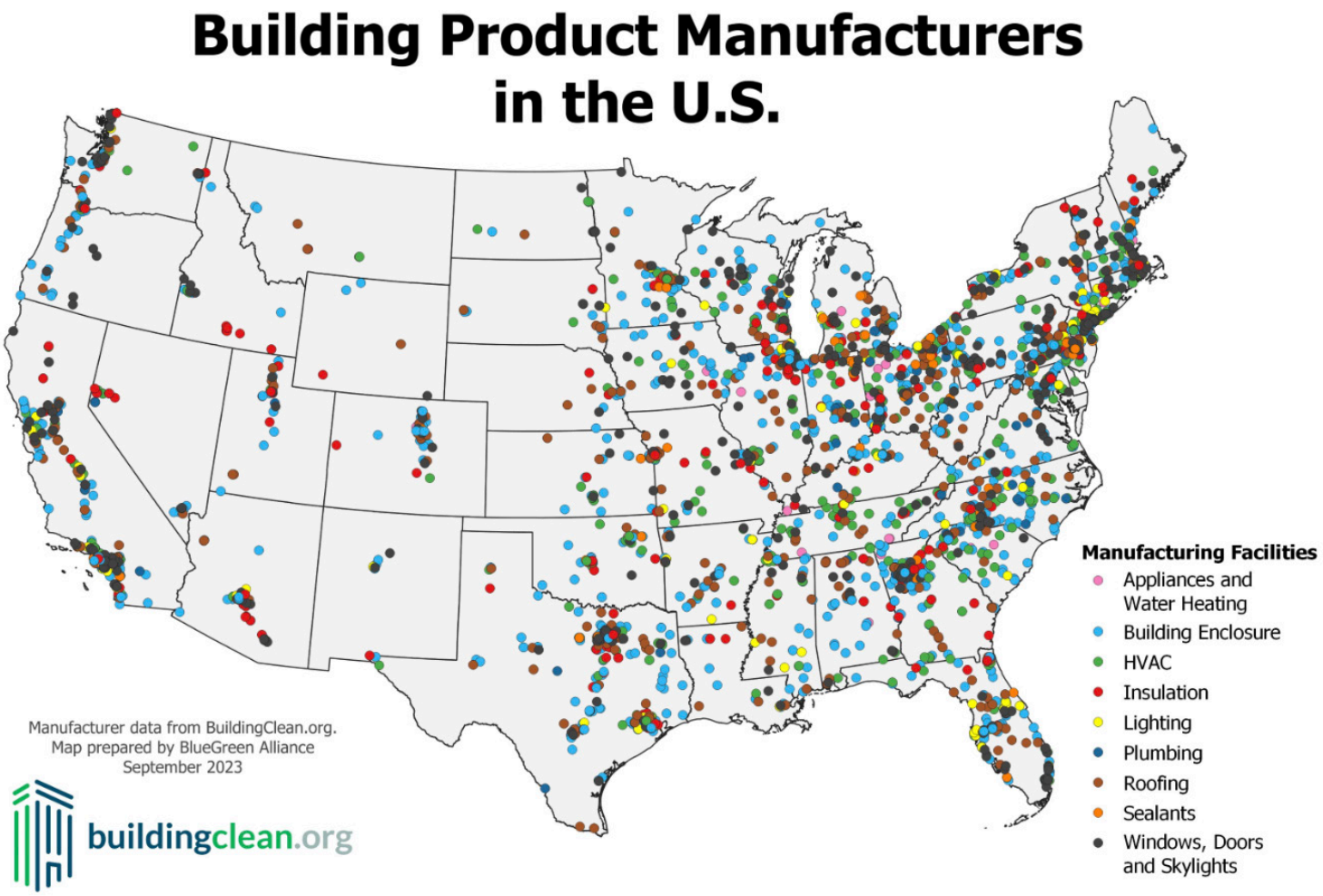
The two categories which experienced significant declines were appliances, which declined by 11 percentage points, from 64% to 53%, and HVAC, which declined by eight percentage points, from 86% to 78%. Of the five subcategories that fall under HVAC, sheet metal ductwork experienced no change, compressors experienced the largest decline of 19%, and the other subcategories had more moderate declines of 6%-9%.

Table 1: Domestic manufacturing shares in the 2007 period, the 2018-2020 period, and the change between them for all categories and subcategories of energy efficiency products studied.

Energy Efficiency Product Category	Subcategory	2007 Domestic Share	2018-2020 Domestic Share	Change in Domestic Share
Building Enclosure	Structural Concrete	99%	99%	1%
	Gypsum Board	98%	98%	-1%
	Building Enclosure Total	**98%**	**98%**	**0%**
Windows, Doors, and Skylights	Vinyl Framing	94%	93%	-1%
	Wood Windows and Doors	94%	94%	1%
	Metal Windows and Doors	94%	92%	-2%
	Windows, Doors, and Skylights Total	**94%**	**93%**	**-1%**
HVAC	Heating (not forced air)	83%	78%	-6%
	Heating/Cooling (air based)	81%	74%	-7%
	Thermostats	74%	65%	-9%
	Compressors	79%	59%	-19%
	Sheet Metal Ductwork	100%	100%	0%
	HVAC Systems (excluding ductwork)	**80%**	**71%**	**-10%**
	HVAC Total	**86%**	**78%**	**-8%**
Lighting	Light Fixtures	52%	45%	-7%
	Light Bulbs	45%	58%	14%
	Lighting Total	**48%**	**49%**	**1%**
Roofing	**Asphalt Roofing**	**99%**	**98%**	**-1%**
Plumbing	**Metal Plumbing Fixtures**	**74%**	**79%**	**5%**
Appliances	**General Appliances**	**64%**	**53%**	**-11%**
Air Sealing	**Caulk/Adhesives**	**95%**	**94%**	**-1%**
Insulation	**Fiber Insulation**	**92%**	**91%**	**-1%**
Total, All Categories		**84%**	**79%**	**-5%**

** Values may not sum exactly due to rounding.*

Figure 1: Manufacturers of energy efficiency products in the Building Clean database.



The manufacturing footprint of these industries is well documented in the BlueGreen Alliance Foundation's Building Clean database, which contains details and locations of thousands of energy efficiency product manufacturers across the country, as shown in Figure 1 and Table 2. The database also includes data on which sites employ union workers.

Table 2: The number of facilities for each energy efficiency product category in the Building Clean database, as well as links to the relevant sector pages in the database. Because some facilities manufacture products in multiple categories, category values will not sum to the total.

Energy Efficiency Category and Link to Building Clean Data	Number of U.S. Manufacturing Facilities
Appliances and Water Heaters	77
Building Enclosure	1,594
HVAC	584
Insulation	304
Joint Sealants	80
Lighting	166
Plumbing	77
Roofing	521
Windows, Doors, and Skylights	540
Total	3,943

The larger declines in HVAC and appliance manufacturing are driven by recent outsourcing. While both industries are mature and well-established in the United States, they are also highly globalized with the ability to move production around the world. In recent years, major companies in both industries have relocated production overseas in search of cheap labor and looser environmental regulations.[18, 19]

While the market for appliances has remained highly globalized for some time, import penetration has been increasing in recent years.[20] By contrast, the HVAC market has historically been less globalized, but is facing increased international pressure.[21] There is still much to lose for U.S. companies, workers, and communities that have relied on domestic manufacturing for these industries.

As energy efficiency standards grow more stringent and new technology gains popularity, we need to invest in manufacturing cutting-edge, highly efficient appliances and HVAC systems or risk that domestic manufacturing could continue to lose out. For instance, ductless mini-split HVAC systems have become increasingly popular for home heating and cooling. However, of the leading brands identified by the New York Times—Mitsubishi, Fujitsu, LG, Daikin, and Panasonic—only one (Daikin) has any U.S. manufacturing presence.[22, 23, 24, 25, 26, 27] Trane, which has a significant U.S. manufacturing presence and the largest domestic market share in the heating and air conditioning industry, does not manufacture its own mini-split systems in the United States. Instead, in 2018 it formed a joint venture with Mitsubishi Electric to sell mini-splits under the brands American

Standard, Trane, and Mitsubishi.[28, 29] Despite being headquartered in Georgia, the company's systems are manufactured by Mitsubishi Electric, which has no U.S. manufacturing presence.[30, 31]

Over the past several decades, U.S. companies that traditionally made HVAC systems domestically have been outsourcing production and closing factories. A particularly high-profile example of this was the Carrier furnace plant in Indianapolis, which was slated to close in 2016 and relocate production to Mexico. After $7 Million in state tax credits were given to the company by then-governor and incoming Vice President Mike Pence, Carrier announced that the plant would stay open. But workers soon learned that over 600 jobs would still be cut, leaving many feeling betrayed.[32] This wasn't an isolated incident, either. Carrier closed numerous plants and sent jobs overseas throughout the 1990s and 2000s.[33, 34, 35]

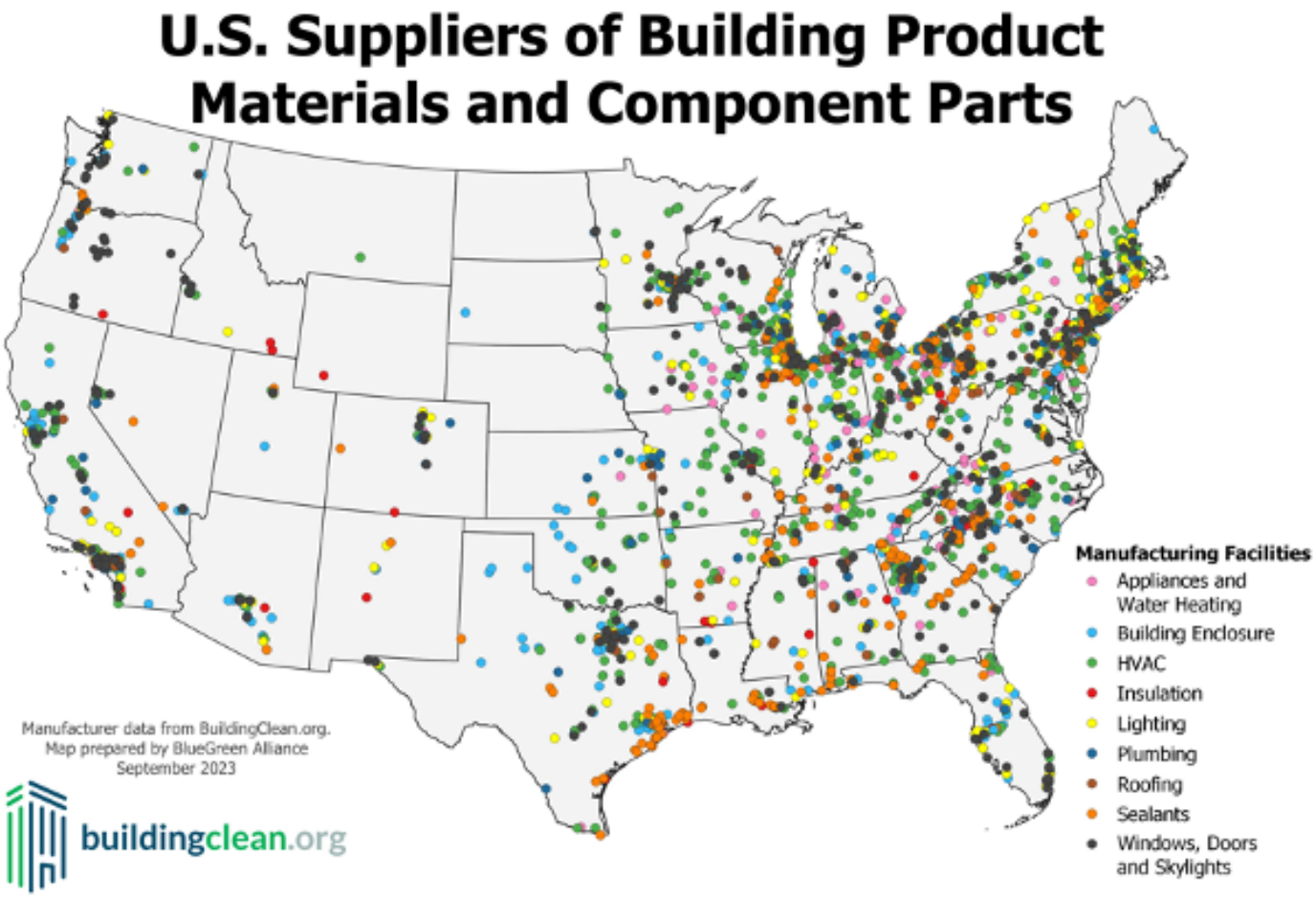
> U.S. companies that traditionally made HVAC systems domestically have been outsourcing production and closing factories over the past few decades.

THE BENEFITS OF MANUFACTURING JOBS TO WORKERS AND COMMUNITIES

The analysis presented in this report focuses on the manufacturing of end-use energy efficiency products—such as refrigerators, heat pumps, and batts of insulation. But manufacturing these products in the U.S. doesn't just benefit the workers who make them. Domestic production of energy efficiency products generates additional economic activity and jobs up and down an extensive supply chain and in communities all around the country.

The supply chain for energy efficiency products includes everything from major materials like steel and gypsum; electronic and mechanical components for HVAC systems and appliances; and chemical inputs for insulation and sealants. As shown in Figure 2, there are over 4,000 facilities that supply building product component parts and materials—direct and indirect inputs that go into the end-use energy efficiency products that are ultimately sold to builders, contractors, and consumers. According to the Economic Policy Institute, a factory employing 100 workers in a "Durable Goods Manufacturing" industry supports an average of 289 additional jobs in the supply chain, which is the third highest ratio of all the major industry categories studied.[36]

Figure 2: Supplier manufacturing facility locations from 2022 Building Clean data.



In addition to supporting jobs in the supply chain, factories support additional economic activity in the communities where they are located. The same 100-person factory supports an average of 455 induced jobs, or jobs at the stores, restaurants, and other businesses where the factory workers spend their money. This is the second highest ratio of induced job support of the major industry categories studied.[37]

Domestic production of products such as appliances and HVAC systems can help support U.S. industries producing the raw materials that these products are made of, like steel and aluminum. According to an independent analysis conducted for the BlueGreen Alliance Foundation by Barrett Economics, every $1 million invested in domestic HVAC or appliance manufacturing generates an average $125,000 of indirect demand for the U.S. steel and aluminum industry. A U.S. appliance or HVAC factory employing 100 workers will result in an average of 13 indirect jobs in domestic steel and aluminum to meet this increased demand. Of all the manufacturing supply chain jobs supporting domestic HVAC and appliance manufacturing, 29% are in steel and aluminum (see Appendix 2 for details).

Purchasing products made with domestic steel and aluminum has environmental as well as economic benefits. Even before accounting for transportation emissions, producing steel and aluminum in the United States is less carbon intensive on average than in other countries that are major exporters.[38, 39]

Therefore, domestically produced appliances, HVAC systems, and other large metal products made from domestic metal will tend to have less embodied carbon compared to imports. Embodied carbon represents the carbon released during the production and installation of products and building materials. For the construction industry as a whole, these emissions represent 11% of total global CO2 emissions, so taking these emissions into account alongside the emissions of heating, cooling, and operating a building is critical.[40]

Manufacturing provides a pathway to the middle class for many workers and their families, and especially workers without a college degree.[41] In recent years, however, manufacturers of both appliances and HVAC systems have sought to suppress wages and maximize profits by relocating factories to low-wage regions in the U.S. and by offshoring production to even lower-wage countries.[42, 43] The benefits that manufacturing jobs provide to workers, their families, and their communities cannot be taken for granted, and must be supported and expanded through robust industrial policy.

POLICY RECOMMENDATIONS

While the declines in the domestic share of energy efficiency products presented in this report are relatively modest, they represent a worrying trend and have the potential to get worse in the coming years. Therefore, federal, state, and local governments must work to reverse these trends and ensure that these critical domestic industries are able to grow and thrive. Industrial policy to support these industries will have an immediate benefit to existing workers and communities and will help sustain these benefits for generations to come.

We recommend three basic types of policies that could help accomplish this goal:

1. **Policies that require or incentivize the use of domestic products in government-subsidized energy efficiency retrofits, such as "Buy America" requirements**. These policies will ensure that taxpayer-funded investments in energy efficiency benefit domestic manufacturers rather than outsourced production and help raise the domestic share of these products.
2. **Policies to increase demand for domestic energy efficiency products**. This could include investment in the retrofits of buildings, as well as direct subsidies to consumers who purchase products such as high-efficiency HVAC systems.
3. **Policies that directly invest in the supply of domestic energy efficiency products, such as direct investments in manufacturers**. These policies can support a robust domestic industry even in cases where demand for products is uncertain.

A number of recent policies enacted by Congress and the Biden administration already contain provisions along these lines, as part of the **Inflation Reduction Act,** the **Bipartisan Infrastructure Law** (BIL, also known as the Infrastructure Investment and Jobs Act or IIJA), and through executive action.

First, as part of the BIL, Congress passed the **Build America, Buy America** (BABA) act, which strengthened existing Buy America requirements for federal spending on public infrastructure. This policy ensures much of the money allocated by the BIL and Inflation Reduction Act will support domestic manufacturing through infrastructure projects. The definition of "infrastructure" used in determining BABA applicability clearly includes buildings.[44]

BABA applies to "articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project," but not to "equipment and furnishings, such as movable chairs, desks, and portable computer equipment that are used at or within the finished infrastructure project but are not an integral part of or permanently affixed to the structure."[45] According to these criteria, all energy efficiency products in public infrastructure projects are covered by BABA, including HVAC systems and large appliances which are permanently fixed and not moveable.

Second, both the BIL and the Inflation Reduction Act include a variety of provisions to support energy efficiency in many types of buildings:

- The BIL's **State Energy Program** provides $500 million to states to reduce carbon emissions, including through building efficiency programs.[46]
- The BIL's **Energy Efficiency Revolving Loan Fund** provides $250 million to states to establish loan funds to help leverage private capital investments in energy efficiency.[47]
- The BIL's **Energy Efficiency and Conservation Block Grant Program** provides $550 million to states, local governments, and Tribes to implement a variety of strategies to improve energy efficiency and reduce greenhouse gas emissions.[48]
- The BIL invests an additional $3.5 billion to the existing **Weatherization Assistance Program** and $500 million to the **Low Income Home Energy Assistance Program (LIHEAP)**, both of which fund states and Tribal governments to support residential energy efficiency retrofits for low-income owners and residents.[49, 50]
- The BIL broadens the eligibility of loans issued by **Title 17 State Energy Financing Institutions** to include residential energy efficiency upgrades. The Inflation Reduction Act provided an additional $40 billion of loan authority for DOE to support projects receiving loans from these institutions.[51]
- The Inflation Reduction Act's **Home Energy Rebate Programs** provide $8.8 billion to the Office of State and Community Energy Programs to create rebate and retrofit programs for residential buildings.[52]
- The Inflation Reduction Act's **Green and Resilient Retrofit Program** provides the Department of Housing and Urban Development with $837.5 million in grants and $4 billion in loan authority for energy efficiency retrofits, health, and climate resilience of multifamily assisted housing.[53]
- The Inflation Reduction Act makes several investments in the General Service Administration's **Public Building Service**, including $250 million for improving energy efficiency and reducing the carbon footprint of federal buildings.[54]
- Three tax incentives in the Inflation Reduction Act: the **179D Commercial Buildings Energy-Efficiency Tax Deduction**, the **45L New Energy Efficient Home Credit**, and the **25C Credit for Energy Efficiency Home Improvements** either create or expand tax incentives for both energy efficiency retrofits and new construction of residential and commercial buildings.[55, 56, 57]

Finally, the Inflation Reduction Act, the BIL, and the Biden administration have recently initiated policy for direct investment in domestic manufacturing capacity of energy efficiency products, alongside other clean energy technologies:

- In June of 2022, President Biden invoked the **Defense Production Act** to ensure that domestic manufacturers ramp up production of several clean energy technologies, including heat pumps and insulation.
- The Inflation Reduction Act included $500 million in funding to help manufacturers meet this requirement, $250 million of which is specifically set aside for heat pump manufacturing.[58]
- The Inflation Reduction Act's **48C Advanced Energy Project Credit** allocates $10 billion in tax credits directly to manufacturers of clean energy technology, which includes energy efficiency products such as insulation and ultra-efficient heat pumps and hot water heaters. This provision is intended to support the supply of energy efficiency products receiving a demand subsidy through the 179D and 25C tax incentives discussed previously.[59]
- The BIL's **Advanced Energy Manufacturing and Recycling Grant Program** allocates $750 million in grant funding to small-and-medium sized manufacturing firms in communities that have experienced the closure of a coal mine or coal power plant. Eligible firms include those manufacturing residential and commercial energy efficiency products.[60]

All of these policies represent major steps in the right direction and should help boost domestic manufacturing and the domestic share of energy efficiency products. However, there is still much more that could be done.

First, building retrofits subsidized by the federal government through any of the Inflation Reduction Act or BIL energy efficiency provisions should use U.S.-made energy efficiency products unless they are unavailable or exceed a specific cost threshold. BABA is the most natural way to accomplish this goal. However, a too-narrow definition of "public infrastructure" in BABA may exempt many energy efficiency projects. When considering BABA applicability, agencies are instructed to consider "whether the project is publicly owned and operated, privately operated on behalf of the public, or is a place of public accommodation, as opposed to a project that is privately owned and not open to the public."[61]

Much of the funding in the BIL and the Inflation Reduction Act will support energy efficiency projects in private residential and commercial buildings, which may not be deemed "public infrastructure" under this definition. However, many private buildings operate with public funding and could be interpreted as operating on behalf of the public. Agencies are given discretion in interpreting the definition of "public infrastructure," specifically regarding which projects serve a "public function."[62] Agencies should use this discretion to apply BABA broadly and reasonably to publicly funded energy efficiency projects. Additionally, Congress should strengthen BABA in future legislation by expanding and clarifying its applicability.

Even when BABA clearly applies to a project, grantees can obtain time-limited cost or non-availability waivers that allow funding to be disbursed for products without readily available U.S.-made options. However, as demonstrated by the data in this report, building materials and products used in energy efficiency retrofits have a strong manufacturing base in the United States. Therefore, in cases where Buy America applies to energy efficiency retrofits, waivers should very rarely be necessary, and should only be given when a funding recipient can affirmatively demonstrate a lack of domestically produced options for a specific product or when the product is above a high cost threshold. The rare application of supply and/or cost waivers are adequate to address potential issues with BABA compliance and diminishes claims of the need for what are referred to as "general applicability waivers" or "general waivers," which only serve as blanket dismissals of the law and provide no market signals to U.S. manufacturers or policymakers.

For federally funded energy efficiency projects that do not currently fall under Buy America, federal agencies should use whatever discretion they have available to incentivize or require domestic content to the broadest range of products possible. Additionally, several BIL and Inflation Reduction Act programs allocate money to states, Tribes, and local governments to set up their own programs, which could also add domestic content requirements or incentives even if doing so was not directed by the federal government.

Alternatively, in cases where Buy America requirements or preferences do not currently exist, federal agencies, states, Tribes, and local governments should offer more favorable rebates or incentives to support retrofit projects using domestic products. Some smaller scale retrofit programs already offer incentives along these lines. For instance, the electric utilities ComEd in Illinois and Consumers Energy in Michigan both offer rebate programs for customers to purchase energy efficiency products, and both offer additional rebates for products that are manufactured or assembled in-state.[63, 64] Four states have either voluntary incentives or mandatory requirements for subsidized affordable housing projects authorized through the states' Qualified Allocation Plans to make use of locally sourced building products.[65]

Second, Congress, the Biden administration, and state and local governments should continue increasing investments in building energy efficiency retrofits, even beyond what was passed in the BIL and the Inflation Reduction Act. Buildings make up a majority of carbon emissions in some urban areas and reaching net-zero carbon emissions will require the United States to triple its current pace of building retrofits.[66]The White House is leading by example to tackle the climate crisis through President Biden's Federal Sustainability Plan, which establishes an ambitious path to achieve net-zero emissions from federal buildings by 2045. However, much more will need to be done to ensure deep emissions reductions from private and non-federally owned buildings.[67] Previous research from the BlueGreen Alliance Foundation found that doubling the residential retrofit rate could create 170,000 manufacturing

jobs, provided that products were made domestically and the retrofits performed included energy efficiency measures like insulation, window replacement, efficient appliances, and HVAC.[68]

Third, the Biden administration and Congress should offer additional direct support to manufacturers of critical energy efficiency products to ensure that rising demand for these products will be met with adequate supply. This could include expanding the invocation of the Defense Production Act (DPA) to cover a broader suite of energy efficiency products, such as high efficiency appliances. Heat pump and insulation manufacturers—which are covered by the administration's invocation of the DPA—could be further supported with funds from the DOE's Loan Program Office and the Export-Import Bank's Make More in America Program.[69]

While the $500 million in DPA funding included in the Inflation Reduction Act represents an excellent start, further appropriation from Congress could more effectively leverage the DPA to support the domestic heat pump industry and alleviate energy insecurity for millions of households. Congress and the DOE should consider Advanced Market Commitments for heat pumps. Such purchase commitments will reduce uncertainty for manufacturers and ensure steady growth in the industry to meet rising demand. Additionally, the purchased heat pumps can be made available at reduced cost to low-income households that are currently dependent on expensive delivered oil or propane heating.[70]

Finally, agencies overseeing funding that is given directly to manufacturers—through the DPA, 48C, or similar programs—should ensure that companies are committed to supporting their workers and communities. The BlueGreen Alliance's Checklist for Federal Funding Applications goes into more detail on these and other labor standards and how they can be applied to BIL and Inflation Reduction Act programs.[71] For example, agencies should:

- Require companies to affirmatively recognize workers' right to organize. This includes the right to form a union, engage in collective bargaining, and engage in other organized activities to improve representation and protection. Additionally, agencies should categorically prohibit the use of grant or loan funds for any activity in opposition to union organizing, whether directly or indirectly.
- Prioritize companies that have binding agreements with unions and community groups to deliver locally defined economic, health, and environmental benefits, including Project Labor Agreements, Collective Bargaining Agreements, and Community Benefits Agreements.
- Ensure investments are targeted to hard-hit communities, including low-income communities and communities of color identified by the Council on Environmental Quality's Climate and Economic Justice Screening Tool and/or state level screening tools, as well as deindustrialized and energy transition communities.[72]

Heat Pumps and Other New Technologies

Over the past few years, heat pumps have emerged as a critical technology for reducing the energy used to heat and cool buildings across the country. These systems work similarly to a refrigerator, using compressors and refrigerant to move thermal energy from the outside of the building to heat the inside in winter, and vice versa in summer.[73]

Demand for heat pumps has been growing steadily. In 2020, the number of households using this technology reached 18 million, which represented a 50% increase from 2015.[74] More than 4 million heat pumps were sold in 2022.[75] Additionally, a 2021 research paper found that 32% of U.S. households would benefit economically from installing a heat pump, so demand is not expected to slow down any time soon.[76]

This rise in demand has led to a sharp increase in imports. While heat pumps are not currently traded internationally at high volumes, the U.S. International Trade Commission data used in this report show that heat pump imports increased by more than seven-fold over the study period.[77]

Absent industrial policy to ensure that U.S. manufacturers remain on the cutting edge, the transition to this more efficient technology risks leaving U.S. manufacturing workers behind. Fortunately, the domestic heat pump industry has been given a boost by the Biden administration's use of the Defense Production Act for heat pump manufacturing and the money appropriated to support it in the Inflation Reduction Act.

Other types of energy-efficient products are also seeing technological advancements and changes in consumer demand. For example, induction stoves are gaining popularity, and almost 70% of respondents in the U.S. say they would consider switching to induction in a recent poll.[78] The COVID-19 pandemic and recent incidents of poor air quality due to wildfire smoke has also resulted in growing demand for indoor air purifiers.[79] These technological trends will have real health and environmental benefits, but ensuring that they also economically benefit U.S. manufacturing workers and not just outsourced production will require policymakers to act.

Examples of Recent Positive Developments

Offshoring of energy efficient manufacturing facilities has harmed workers and communities, and will continue to do so if recent declines in domestic content shares continue. However, there have also been promising signs of reinvestment and new domestic innovation in these industries—in many cases with the support of the Biden administration's industrial policies.

Bradford White, a domestic and union-represented manufacturer, invested in a new research facility at the end of 2022 to improve the efficiency of its systems, with a focus on heat-pump water heaters.[80, 81]

The week after the passage of the Inflation Reduction Act, Carrier designated its union-represented.[82] Collierville, Tennessee facility as a "Center of Excellence" for the production of highly efficient heat pumps using low Global Warming Potential refrigerants. This announcement came as part of a $2 billion commitment in efficiency and sustainability by the company. The announcement also coincided with the Senate's ratification of the Kigali Amendment to the Montreal Protocols to phase out the global use of hydrofluorocarbons, which are high global warming potential refrigerants from devices such as heat pumps.[83]

In 2021, the U.S. DOE launched the "Residential Cold Climate Technology Heat Pump Challenge," partnering with manufacturers to support the development of heat pumps optimized to operate at temperatures as low as -15°F. Current generation heat pumps operate less efficiently at very cold temperatures, so innovation is necessary for widespread adoption in the coldest regions of the country.[84] So far, five manufacturers—Rheem, Lennox, Trane, Carrier, and Johnson Controls—have successfully developed prototypes for field testing.[85] All of these manufacturers have union factories in the United States.[86, 87, 88, 89, 90]

CONCLUSION

Energy efficiency products have been made in America for generations. Communities across the country have relied on the production of everything from washing machines to windows to fiberglass insulation. However, the continued stability of these industries—and the jobs that rely on them—require robust industrial policy and cannot be taken for granted.

This report finds that most energy efficiency products still have very high domestic shares, but also shows a troubling downward trend. Since 2007, the average domestic share of the product categories studied fell by five percentage points, from 84% to 79%. HVAC products and appliances—two of the most globalized industries analyzed—have experienced the largest declines. Over the same time, total domestic production has declined by 10% and employment has declined by 13%. Meanwhile, we risk missing out on manufacturing opportunities for new and growing technologies like heat pumps and induction stovetops.

Reversing these declines and ensuring the resilience of domestic manufacturing of these products will require government action. Policymakers should aim to

- increase the rate of building retrofits,
- require or incentivize domestic content in government-subsidized retrofit projects, and
- invest directly in energy efficiency product manufacturing.

Policies supporting these industries should also require that employers recognize the right to organize, hire skilled, union labor, and make meaningful commitments to equity and environmental justice. Fortunately, recent legislative and executive action include such provisions, but more can still be done.

Energy efficiency is critical to meeting our nation's climate goals, and also to the economic resilience of communities across the country. With the right policies, we can grow this critical sector in support of workers, communities, and climate action alike.

Appendix 1: Additional Analysis

In addition to calculating the change in domestic shares for each energy efficiency product category shared in Key Findings (Table 1), we also analyzed the change in total domestic production and employment between the same two time periods. In aggregate, these two measures fell more sharply than domestic share, with a 10% decline in domestic production and a 13% decline in employment, compared to a five percentage point decline in domestic share.

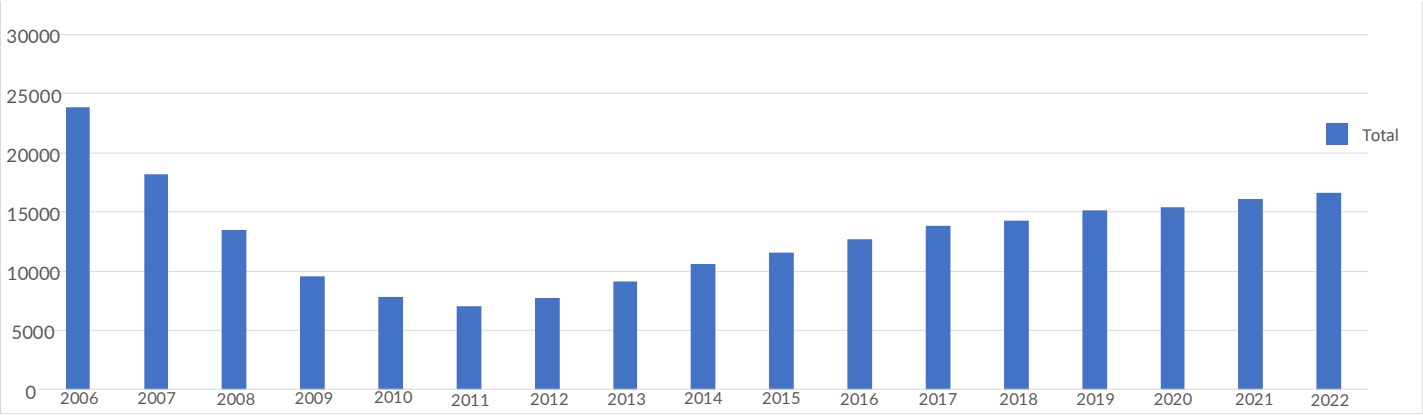
Table A1: Change in total domestic production and employment between the 2007 period and the 2018-2020 period for all categories and subcategories of energy efficiency products studied.

EE Product Category	Subcategory	Change in total domestic production from 2007 to 2018-2020	Change in employment from 2007 to 2018-2020
Building Enclosure	Structural Concrete	-25%	-22%
	Gypsum Board	-19%	-97%
	Building Enclosure Total	**-22%**	**-21%**
Windows, Doors, and Skylights	Vinyl Framing	42%	-8%
	Wood Windows and Doors	-27%	-28%
	Metal Windows and Doors	-21%	-14%
	Windows, Doors, and Skylights Total	**-15%**	**-19%**
HVAC	Heating (not forced air)	11%	-17%
	Heating/Cooling (air based)	-9%	-13%
	Thermostats	-17%	-37%
	Compressors	-24%	-8%
	Sheet Metal Ductwork	-1%	5%
	HVAC Systems (Excluding Ductwork)	**-11%**	**-16%**
	HVAC Total	**-11%**	**-16%**
Lighting	Light Fixtures	-30%	-30%
	Light Bulbs	-17%	-48%
	Lighting Total	**-25%**	**-39%**
Roofing	**Asphalt Roofing**	**-13%**	**-13%**
Plumbing	**Metal Plumbing Fixtures**	**2%**	**-4%**
Appliances	**General Appliances**	**-13%**	**-14%**
Air Sealing	**Caulk/Adhesives**	**13%**	**9%**
Insulation	**Fiber Insulation**	**0%**	**-9%**
Total, All Categories		**-10%**	**-13%**

Additionally, the declines in these measures are more widespread than the changes in domestic share. Every category except plumbing, air sealing, and insulation experienced more than 10% declines in both domestic production and employment.

This is likely due in part to the slowdown in construction that occurred following the subprime mortgage crisis of 2007-2010. That crisis was just beginning when the 2007 data used in this report were being collected.[91] As shown in figure A1, housing construction fell dramatically over the following years. While the market improved slowly over the next decade, housing completions had still not reached their 2007 level by 2020. Reduced construction likely resulted in reduced demand for energy efficiency products.

Figure A1: New privately-owned housing units completed, 2006-2022. Data from FRED.[92]



The fact that volatility in the housing market and construction industry can result in such a dramatic and prolonged slowdown of domestic energy efficiency product manufacturing further underscores the need for policy to support this industry. In particular, policies to support a faster pace of building retrofits can help bolster demand for these products even in the event of another housing slowdown. Additionally, policies such as the expansion of the Defense Production Act to add more energy efficiency products, direct investments to manufacturers, and the direct subsidization of their purchase by consumers can help ensure robust demand and bolster domestic output and employment.

Appendix 2: Healthy Retrofit Products

Many chemicals used in building products that make up our indoor spaces are known or suspected to cause long-term harm to human health. Chemical and health transparency labels for building products such as DECLARE and Health Product Declarations (HPDs), alongside third-party certifications indicating whether a product is limited in or free from hazardous content, are making it easier to understand the potential health impacts of exposure to chemicals in products and healthier options. As green building certifications increasingly incentivize or mandate the use of healthier building products in their certification criteria, and government and utility sponsored building efficiency programs recognize and prioritize the importance of building and retrofitting healthier spaces, the demand for building products that are both efficient and healthier will grow. U.S. manufacturers are well positioned to take advantage of that growth.

Table A2 looks at building products in five market sectors and ascribes a "good, better, best" ranking to indicate which products present fewer health risks due to hazardous content. U.S. manufacturing for some of these products is limited or non-existent and may offer opportunities to domestic manufacturers. For more information on hazardous chemicals in building products and their health impacts visit https://buildingclean.org/products-and-health/chemicals-building-products.

Table A2: Products with health hazards and recommended alternatives.

FLOORING

Avoid	Good	Better	Best
Vinyl Flooring	Carpeting and rubber tile that are certified to be free of the most hazardous chemicals	Polyvinyl Chloride (PVC)-free resilient flooring	Pre-finished wood flooring
Flooring with recycled content		Low-VOC certified and pre-finished engineered wood and laminate	Linoleum (foreign product)
Per- and polyfluoroalkyl substances (PFAS)-based stain and oil repellents (water/stain repellency)		Site- finished hardwood flooring with low-VOC stains or finishes	Concrete flooring (without densifiers containing PFAS)
Flooring advertised as anti-microbial			U.S.-made ceramic tiles

BOARD INSULATION

Avoid	Good	Better	Best
Foam products within the air barrier-walls, floors, and ceilings	Foam board in exterior grade application only	Unfaced fiberglass boards (formaldehyde-free)	Cellular glass
	Halogenated-free polyisocyanurate	Mineral wool board (formaldehyde-free and Greenguard Gold certified)	Expanded cork board (foreign product)
			Wood fiber board

BATT AND FILL INSULATION

Avoid	Good	Better	Best
Foam products within the air barrier-walls, floors, and ceilings	Cellulose	Sheep's wool blown and batts	Fiberglass (formaldehyde-free or Greenguard Gold certified)
	Cotton (recycled denim)	Hemp-fiber batts	Help-lime (hempcrete) case in place or preformed blocks
	Kraft-faced fiberglass batts	Wood fiber batts and boards	Wood fiber (loose fill and dense pack)

PAINTS AND WALLCOVERINGS

Avoid	Good	Better	Best
Recycled paints	Low-VOC content paint	Paints that are Alkylphenol ethoxylate (APE)-free and low VOC content and emissions, with low VOC tinting	Paints containing GS-11 certification
Specialty paints (dry erase, magnetic)			APE-free paints
Labeled as antimicrobial			Paints with low-VOC emissions and content
Oil-based paints			Milk based paints
Vinyl wallcoverings	Low-VOC certified wallcoverings and adhesives	Greenguard GOLD certified	Red List Free or Cradle to Cradle certified wallcoverings

WINDOWS, DOORS, AND SKYLIGHTS

Avoid	Good	Better	Best
Vinyl products	California Air Resources Board (CARB) phase 2 compliant indoor doors with low-formaldehyde emissions	CARB phase 2/TSCA Title VI with Ultra Low Emitting Formaldehyde Label	ENERGY STAR fiberglass or wood windows and doors
			Pre-finished solid wood doors
			Composite wood products tested and approved as NAF (no added formaldehyde)
			Use low-VOC certified adhesives

JOINT SEALANTS

Application	Good	Better	Best
Small gaps	Silicone sealant or phthalate free, modified polymer sealant	Acrylic latex or siliconized acrylic sealant	Acrylic latex or siliconized acrylic sealant with a VOC content of < 25 g/L
Large gaps		Non-isocyanate spray foam sealant with a Health Product Declaration with all contents characterized, screened, and identified at 1000 ppm or lower threshold	Preformed foam sealant tape or drywall and acrylic latex or siliconized acrylic sealant with a VOC content of < 25 g/L
Fire-rated (flame spread)	Acrylic latex sealant, siliconized acrylic sealant, or intumescent acrylic latex firestop sealant	Acrylic latex sealant, siliconized acrylic sealant, or intumescent acrylic latex firestop sealant with a VOC content of < 25 g/L	Noncombustible sodium silicate caulk
Air ducts	Wet-applied mastic sealant, free of halogenated flame retardants and APEs	Foil-backed butyl tape	Foil-backed butyl tape with a VOC content of < 1 g/L

In addition to the categories discussed in Key Findings (Table 1), we analyzed the change in domestic content for three types of products that are not related to energy efficiency, but still commonly used in building retrofits and have high potential health impacts for building occupants. Like the energy efficiency products, these had generally high domestic content ratios, but with some declines between the 2007 and 2018-2020 periods. As seen in Table A3, paints and wall coverings remained flat at 96% domestic content, wood flooring fell modestly from 87% to 83%, and carpet fell more sharply, from 86% to 74%.

Table A3: Domestic manufacturing shares in the 2007 period, the 2018-2020 period, and the change between them for select categories of retrofit products with high potential health impacts.

Product	2007 Domestic Share	2018-2020 Domestic Share	Change in Domestic Share
Carpet	86%	74%	-11%
Wood Flooring	87%	83%	-4%
Paints and Wallcoverings	96%	96%	0%

Domestic carpet manufacturing has historically been a strong and important industry in the Southeast, with three-quarters of America's flooring coming from the area around Dalton, GA, the "Carpet Capital of the World". When the housing bubble burst, demand for carpet plummeted and the industry contracted, crippling the area's economy.[93] Immigrant workers from Latin America, whose work had been critical when the industry was booming, suddenly found themselves scapegoated by their neighbors. The state created the Immigration Enforcement Review Board to crack down on undocumented workers, resulting in increased enforcement and deportation as well as hundreds of families leaving the area in fear.[94]

While demand for carpet has grown again in more recent years, the industry in Dalton never fully recovered.[95, 96, 97] Over the last five years, growing demand has been met in large part with growing imports, especially from India and Turkey. Some companies have been forced out of the industry altogether by this increasing import pressure, while many others have had reduced sales and profitability. Shaw Industries—one of the largest domestic manufacturers—has also begun investing in manufacturing plants overseas.[98]

Foreign importers can offer extremely competitive pricing, and often undercut domestic manufacturers. However, a major competitive advantage of the domestic carpet industry is that advanced technology and the skilled U.S. workforce can produce higher-quality products. This includes traditional quality markers like durability, but also health impacts such as allergen-resistance.[99] Therefore, greater demand for healthier flooring products would also help boost demand for domestic carpeting over imports.

Appendix 3: Methodology

Domestically produced shares of energy efficiency products were calculated using two government data sets. Domestic production was sourced from shipments of domestically produced manufactured products from the Annual Survey of Manufacturers conducted by the United States Census Bureau from 2007, and from 2018-2020.[100] The Value of imports for the same years were sourced from the U.S. International Trade Commission Dataweb.[101] The product shipment data are classified according to the North American Industry Classification System (NAICS), with 6-digit product codes based on the 6-digit codes used to classify industries. Imports are also reported based on the 6-digit NAICS system, with more detailed product categories available in the form of HTS codes with up to 10 digits. In order to match the import and domestic production data as closely as possible, the analysis was done at the aggregated NAICS level for both domestic production and imports.

As the less detailed NAICS categories were used, the comparisons in this analysis often had to be calculated with a somewhat broader range of products than just those used in energy remodels. For example, the data do not distinguish between a code-minimum 14 SEER air conditioner and an ENERGY STAR 16 SEER unit. Likewise, the import and shipments data for products such as refrigerators or clothes washers include both standard and efficient units. In some cases, the NAICS categories used may cover some products that are unrelated to building retrofits entirely, such as industrial gas compressors. Therefore, the analysis presented in this report assumes that the domestic content of these somewhat broader product categories is representative of the energy efficiency products that we focused on.

EE Product Category	Subcategory	NAICS category used
Building Enclosure	Structural Concrete	327331 Concrete block and brick manufacturing
	Gypsum Board	327420 Gypsum product manufacturing
Windows, Doors, and Skylights	Vinyl Framing	326121 Unlaminated plastics profile shape manufacturing
	Wood Windows & Doors	321911 Wood window and door manufacturing
	Metal Windows & Doors	332321 Metal window and door manufacturing

Table A4: NAICS categories used for each energy efficiency product category and subcategory.

EE Product Category	Subcategory	NAICS category used
HVAC	Heating (not forced air)	333414 Heating equipment, except warm air furnaces
	Heating/Cooling (air based)	333415 Ac, refrigeration, and forced air heating
	Thermostats	334512 Automatic environmental control manufacturing
	Compressors	333912 Air and gas compressor manufacturing
	Sheet Metal Ductwork	332322 Sheet metal work manufacturing
Lighting	Light Fixtures	335121 Residential electric lighting fixture manufacturing
	Light bulbs	335110 Electric lamp bulb and part manufacturing
Roofing	Asphalt Roofing	324122 Asphalt shingle and coating materials mfg.
Plumbing	Metal Plumbing Fixtures	332913 Plumbing fixture fitting and trim mfg.
Appliances	General Appliances	33522 Major household appliance manufacturing
Air Sealing	Caulk/Adhesives	325520 Adhesive manufacturing
Insulation	Fiber Insulation	327993 Mineral wool manufacturing

This report represents an update of an analysis presented in the 2010 report *Domestic Manufacturing Shares of Common Energy Remodeling Products* from the Home Performance Resource Center.[102] The report had both a more narrow scope and was able to use more granular HTS-based data due to better data availability at that period in time. For instance, the 2010 report was able to present data on individual appliance types, such as refrigerators and clothes washers, while this report aggregates all appliance types together. For this reason, the 2007 data presented in this report is a new analysis based on the same level of granularity available for the 2018-2020 data, and the values and categories presented do not exactly match what was published in the 2010 report. However, the 2007 domestic content values in both reports are quite similar for similar product categories, which offers strong support for our assumption that the domestic content of the broader NAICS-based categories used in this report is representative of energy efficiency products.

Table A5: 2007 data as presented in the 2010 report "Domestic Manufacturing Shares of Common Energy Remodeling Products" from the Home Performance Resource Center.[103] In comparison to the data used in this report, the 2010 report uses a slightly different list of categories and a more granular categorization scheme in the source data.

Remodel Category	Subcategory	2007 Domestic Share in 2010 Report
Air Sealing	Caulk	95.7%
	Spray Foam	90.4%
Duct Sealing and Replacement	Caulk (includes duct mastic)	95.7%
	Duct Sheet Metal	99.4%
Wall Insulation	Fiberglass and Mineral Wool	93.4%
	Spray Foam	90.4%
	Rigid Foam (Polystyrene)	95.9%
Crawl Space Insulation	Fiberglass and Mineral Wool	93.4%
	Spray Foam	90.4%
	Rigid Foam (Polystyrene)	95.9%
Attic Insulation	Fiberglass and Mineral Wool	93.7%
Window Replacement	Vinyl Windows	98.4%
Furnace	Gas Furnaces and Other	94.2%
A/C and Heat Pump	Air and Ground Source	82.3%
Water Heaters	Electric, Gas, Solar (tank and tankless)	77.9%
Refrigerators	Household Refrigerators and Parts	62.3%
Clothes Washers	Household Clothes Washers and Parts	76.8%

To calculate the change in total domestic production presented in Appendix 1, we compared the dollar values of domestic production for each category from the 2007 period to the 2018-2020 period, without taking imports into account. To account for inflation, the 2007 values were adjusted to 2019 dollars using the Producer Price Index for each product category's NAICS code.[104]

The change in employment presented in Appendix 1 is based on employment values for each product category's NAICS code from 2007 and 2019 in the Bureau of Labor Statistics' Quarterly Survey of Employment and Wages.[105]

To calculate the impacts of HVAC and appliance manufacturing on the steel and aluminum industries, we commissioned an additional economic analysis from Barrett Economics. This analysis used IMPLAN, an input-output model, to determine how a $1 Million in investment in each of the six different HVAC and appliance sub-industries would affect demand and employment across the rest of the economy.

When modeling the effects of a given investment, IMPLAN generates three different categories of economic effects for output and employment. *Direct* employment is generated by the investment in the facilities that receive it; a $1 Million investment in the HVAC industry will result in workers being directly hired by newly created and expanded HVAC factories. *Indirect* output and employment represent the economic activity generated in the supply chain; that same $1 Million invested in HVAC manufacturing will generate further monetary investment in industries ranging from component suppliers to legal firms, and those investments will also create jobs. *Induced* output and employment represent further economic activity generated across the economy as the direct and indirectly hired workers spend their wages.

For this analysis, we were interested in indirect output (or demand) and indirect employment generated in the steel and aluminum industry as a result of $1 Million invested in the HVAC or appliance industry. IMPLAN has 6 different industries covering HVAC and Appliance manufacturing[106] and 14 covering steel and aluminum manufacturing.[107] For each of the 6 HVAC or appliance industries, we modeled the effect of $1 Million investment, and summed the indirect effects for the 14 steel and aluminum industries. We then averaged the results of these six investment models together. Table A6 shows the results of these investment scenarios individually.

Table A6: Indirect output and employment as a result of $1 Million invested in each of the six Appliance and HVAC industries in IMPLAN.

Input sector	Indirect Steel & Aluminum Output	Indirect Steel & Aluminum Jobs	Direct Jobs in Input Sector	Indirect Jobs in all Manufacturing Sectors	Steel & Aluminum Jobs per 100 Direct Jobs	Steel & Aluminum Jobs as a Percentage of Manufacturing Jobs
Air conditioning, refrigeration, and warm air heating equipment manufacturing	$79,663	0.14	2.41	0.6	5.81	23.33%
Heating equipment (except warm air furnaces) manufacturing	$91,802	0.14	2.96	0.56	4.73	25.00%
Household cooking appliance manufacturing	$186,289	0.43	1.74	1.02	24.71	42.16%
Household refrigerator and home freezer manufacturing	$126,595	0.24	1.74	0.86	13.79	27.91%
Household laundry equipment manufacturing	$122,822	0.21	1.74	0.83	12.07	25.30%
Other major household appliance manufacturing	$144,632	0.28	1.74	0.88	16.09	31.82%
Average	$125,301	0.24	2.055	0.79	12.87	29.25%

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