



The Supply Chain for Energy Efficient Product Manufacturing

Gaps in Commodity Components Cut Across Sectors



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INTRODUCTION

The BlueGreen Alliance Foundation examined four key energy efficient building product market sectors—plumbing, HVAC, appliances, and lighting—to identify supply chain gaps and growth opportunities for U.S. manufacturers. Other energy efficient market sectors such as insulation, sealants, windows/doors/skylights, and roofing were not included in this research because of their small supply chains and high domestic content, which limits manufacturing opportunities.

Supply chain and/or marketing contacts were interviewed at 129 companies to understand where their products are manufactured, the percent of U.S. content their products contain, and what supply chain gaps and opportunities exist for domestic manufacturers in these markets. The companies we spoke with ranged from large original equipment manufacturers (OEMs) producing on a global level with complex supply chains to smaller OEMs and tiered suppliers who manufacture products primarily for the U.S. market.

Multinational manufacturers have a tendency to change their suppliers frequently based on price or the quality of manufacturing. However, they switch between established suppliers making it hard for new suppliers to enter these markets. Mid-size, smaller, and family-owned manufacturers have longer-term supplier relationships, though many are becoming more sophisticated as price and market competition squeeze profit margins.

In HVAC, appliances, and in some cases plumbing, production is driven by the size and weight of finished products. Items such as boilers, large air conditioners, and toilets tend to be manufactured closer to where they are used. As a result, some of these products contain 70 percent to nearly 100 percent domestic content.

In general, we found that supply chain opportunities in the four energy efficient product sectors we researched are limited, but not nonexistent. Manufacturing opportunities varied by product sector, the product being manufactured, and the maturity of the market and supply chain in that sector.

Many of the opportunities we found in the supply chain concerned commodity products that manufacturers repeatedly mentioned they had trouble getting either because of shortages or price fluctuations. The market sector—rather than the company size—served as an indicator of higher domestic content in finished products. In certain sectors—such as lighting and plumbing—some components are almost exclusively made overseas.

Components with the greatest immediate supply chain opportunities included:

- Pumps
- Motors
- Castings (iron)
- Control Valves
- Gas Valves

When looking at these opportunities, it is important to understand that each of them can be associated with multiple market sectors. For example, motors could be used in HVAC, plumbing, and appliance products. Component pieces that solve a need within more than one sector can represent a significant opportunity.

In the following pages, we give a brief overview of each of the examined sectors, the supply chain, and market concerns raised by manufacturers in those sectors.

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PLUMBING: A MIXED BAG OF SOURCES



Companies who manufacture water-efficient plumbing products were the primary focus of our supply chain research in this market. This included the three categories of EPA WaterSense certified products—toilets, faucets, and showerheads—as well as products related to plumbing infrastructure such as valves and pumps. New construction and infrastructure spending drive this market.

Three-quarters of the plumbing product manufacturers researched for this project are manufacturing their products outside the United States. However, the remaining 25 percent of companies who do manufacture in the United States currently meet 75 percent of the domestic demand. Most of the finished water-efficient plumbing products that are made in this country are manufactured by large, well-known OEMs.

Raw material costs and shipping prices combine to determine where items are manufactured. For example, smaller OEMs who make stainless steel faucets for the U.S. market generally produce their faucets overseas. This is in contrast to their other product lines such as sinks, which given their size and shipping costs, more often are made from

100 percent U.S. steel and are Buy America/ARRA compliant. Pricing pressure in the stainless steel markets has been a deterrent to returning faucet manufacturing to U.S. shore. The Chinese government currently subsidizes nickel for the steel industry, an element that improves the quality of stainless steel when used at low temperatures.

High-margin specialized valves, fittings, and other flow control devices for water infrastructure projects and commercial/industrial purposes are a growing export market for U.S. manufacturers. Products manufactured by U.S. companies in this sector tend to have high (80 percent - 100 percent) domestic content. However, these valve exports fall short of the number of imported generic valves used in residential construction and light manufacturing.

Porcelain products such as toilets are heavy and require hand finishing. Because of high shipping costs and rising wages in countries like China, some toilet manufacturing has returned from overseas with both foreign- and U.S.-owned companies currently producing toilets.

HVAC: PRODUCT SIZE DOES MATTER

The HVAC market is the largest energy efficient product sector in the U.S. in terms of dollar volume and boasts a significant amount of domestic manufacturing. Products made here feed the domestic market and are exported to some 230 markets around the world.

Overall the market for efficient HVAC products is growing, fueled primarily by the replacement of older, less efficient units as well as continued progress from the government on energy efficiency standards. More than half of the U.S. market for HVAC equipment is to replace old units.

HVAC equipment such as central air conditioners, furnaces, and boilers continue to be made in the United States with significant domestic content while smaller items such as window air conditioning units, de/humidifiers, and ceiling fans (except for high-end) are almost exclusively imported.

Some U.S.-based OEMs source and assemble the vast majority of the product in the United States, but import the motor, which is the biggest and most expensive component. Broan Nutone manufactures 65 percent of their product line at their flagship U.S. manufacturing facility with 85 percent domestic content. This company actually is expanding their U.S. manufacturing base to meet increased export demand from China.

Foreign manufacturers of ventilation products export finished goods to the U.S. that contain no U.S. assembly or content. One large foreign OEM in the ventilation market, who also manufactures small motors and power switching supplies, indicated an interest in relocating production to the United States as labor costs in China are increasing while the labor pool is shrinking. However, this would be dependent upon automating part of the manufacturing process as it is currently too labor intensive. A slowing economy in China—a key HVAC exporter—could encourage large global OEMs to expand their U.S. manufacturing footprint.

Interestingly, the concentration of large manufacturers in the HVAC market is relatively low with the top four companies expected to account for just under 30 percent of total industry revenue. The diverse set of products manufactured for the HVAC market has attracted the investment of a high number of small- to medium-sized manufacturers, many of them with 50 employees or less.

While the larger OEMs are more nationally recognized, there are still smaller, independently owned and operated U.S. manufacturers making products such as boilers and geothermal systems to meet regional market needs. Additionally, products associated with HVAC installation like ductwork and insulation are also manufactured domestically.



Regulations and policies impacting the HVAC industry go beyond just efficiency standards. This includes:

- Eliminating the production and importation of ozone-depleting HCFCs by 2020, which is requiring companies to spend money on innovating new types of refrigerants for their air conditioners; and
- Offering rebates and on-bill financing for installation of geothermal systems, which have a high upfront cost. Geothermal systems typically are made in the United States with significant domestic content.

APPLIANCES: BRAND NAMES RULE



Many large appliances such as refrigerators, dishwashers, water heaters, washer/dryers, and ranges have traditionally been, and continue to be, manufactured in the United States with high U.S. content by both foreign and domestically owned companies. Small appliances, such as microwaves and dehumidifiers, are made exclusively outside the United States. However, appliance imports are expected to grow in the coming years given rising material (steel and plastic) costs.

The appliances market is very mature with consumers preferring established brands. This provides little space for new companies to enter the market and compete. In contrast to the HVAC market, the concentration of large OEMs in the appliance industry is very high with the top four companies accounting for more than 78 percent of industry revenue in 2016. One U.S.-owned OEM—Whirlpool—has almost 40 percent of the market.

OEMs are betting heavily on consumer demand for smart appliances, which can be programmed to operate when energy is most abundant and the cheapest. Another trend driving sales are tankless water heaters, which have traditionally been manufactured by Asian OEMs. As they grow in popularity here, U.S.-based manufacturers are starting production, and shifting supply chain sourcing to this country as well.

Here again, manufacturers credit energy efficiency standards and rebates for helping grow market size. Some product categories, such as laundry appliances, are expected to surpass even the current standards. Out of all of the market sectors researched for this project, appliance manufacturers have the greatest commitment to Buy America policies and promotion of Made in USA regardless of whether they are foreign or U.S. owned.

LIGHTING: A KEY ENERGY SAVER

Lighting is one of the easiest ways to realize energy savings in a retrofit and the push to achieve significant savings through innovative lighting technologies is greater than ever. One of the biggest areas of growth is expected to be for smart lighting controls which have the ability to analyze data and adjust lights automatically.

But the lighting and bulb market, which includes incandescent, CFL, halogen, and high-intensity discharge lamps, has been in a steady decline since 2007 when Congress passed legislation requiring 25 percent more efficiency from incandescent bulbs.

Combined with LED costs decreasing and growing consumer acceptance, there is an explosion of LEDs, which are categorized as solid-state technology since they produce light from electronic chips. In just five years the LED market share grew from 1.5 percent in 2011 to more than 27 percent in 2016. Most new housing construction only has LED installation.

This switch to LEDs has driven production of the older lighting technologies offshore. But LED manufacturing has not kept pace in replacing those facilities, though there is much more production in the United States than most assume. More than half of U.S. demand for lighting is met through imports—mostly from China.

The lighting market has a highly globalized supply chain with certain components—such as LED capacitors which power the lighting—almost exclusively manufactured overseas. This makes it difficult to increase U.S. content. Where U.S. components are used they tend to cost more in part because of better quality control and advanced technology.

LED products used in commercial, architectural, institutional and other large settings tend to have a higher percentage of U.S. content (both parts and assembly) than those used in residential settings. Of the residential products, those that are custom, niche, or higher-end tend to have more U.S. content and assembly versus those found on big box store shelves.



One U.S.-based company currently manufactures two high-end residential and architectural brands in the United States with 65 percent domestic content. So, the domestic supply chain does exist, but high tooling costs, small profit margins, and significant competition make it difficult to manufacture affordable U.S.-made products for the average homeowner or tenant.



*The market sector—rather than the company size—
served as an indicator of higher domestic content in finished products.*



SUPPLY CHAIN OPPORTUNITIES

The origin of supply chain components for HVAC, appliance, lighting, and plumbing product sectors varies by market sector, component, and sub-component. Items that are highly sensitive to logistics costing (larger, heavier) tend to be more domestic in nature and at times even regional to their point of retail consumption (ex. boiler manufacturing in the Northeast). Items less sensitive to those costs, such as thermostats, small HVAC/appliance products, faucets/showerheads and residential lighting tend to be more globalized in their supply chains.

Stand-alone supply chain gaps were observed in many sectors. However, any opportunity to enter the market is best focused on component gaps that cut across market sectors. Observed supply

chain opportunities are listed in the chart included in this report. It should be noted that while most items are multi-market, a few are a bit more specific. These have been included because of the redundancy with which shortages, gaps, and opportunities were heard.

Market pricing pressure remains significant across all sectors, which leads to a dynamic environment for manufacturers who are looking to remain competitive in a tough marketplace. This pressure can vary seasonally, by region, by technology, and by specific product or sub-component. Suppliers to these markets have to remain flexible in their capabilities and costs in order to participate.

OBSERVED SUPPLY CHAIN GAPS

Sector	Sub-sector	Opportunity
Lighting	fixtures, sub-components	glass, glass for shades
Lighting	residential indoor and outdoor lighting	tooling (creating mold) and electronic boards
Lighting	retrofit plug and play LED conversion for existing recessed light	transformers
Lighting	complete LED lighting solutions, light fixtures, LED bulbs	packaging, LED light bulbs, lighting fixtures
Water	water filtration systems	filtration membrane
Water	water filtration systems	activated carbon for filtration systems
Plumbing	valves, fittings, adapters	castings, logistics
Plumbing	submersible pumps	motors (2hp & lower, 115v and 230v)
Appliances	hot water heating, tankless systems	control/gass valves
Appliances	cooking appliances	cast iron grates, burners
Appliances	hot water systems	blower motors, gas valves, circuit boards
HVAC	ventilation, exhaust fans, venting products	competitively priced variable speed motors
HVAC	bathroom and whole house ventilation	ERVs, air flow regulators
HVAC	ventilation, exhaust fans, venting products	metal spinners for in-line duct fans
HVAC	in wall heating products	gas valves, pumps, and control modules
HVAC	water to water heat pumps (geothermal)	coils
HVAC	complete HVAC equipment solutions	injection molding, automated controls
HVAC	in wall heating products	gas valves and associated sub-components
HVAC	heat recovery water heaters, house ventilation dehumidifier	compressors

ADVICE ON ENTERING ENERGY EFFICIENT PRODUCT SUPPLY CHAINS

A company's focus should first be on understanding their best fit within a given market sector, the supply chain origin, and supply chain saturation (i.e., the number of suppliers currently supplying to that market). Care must be exercised by manufacturers entering energy efficient products component supply chains either for the first time or when further diversifying into the manufacturing of complementary product. A complementary product is that which requires similar resources and technology in order to produce.

OEMs have technological, product-development, and design expertise that is difficult for other players in these markets to match. Most OEMs today are still largely focused on pure product sales, either directly to customers or through one of their various channel partners. These markets are under pressure from two directions. First, stronger systems integration across technologies is shifting the channel structure toward providers of end-to-end solutions—pushing OEMs

farther away from the end customer. Second, as these providers build scale, they are gaining growing leverage in procurement, tilting the competitive odds increasingly in their favor.

To avoid the increasing commoditization of their equipment, OEMs must protect their access to end customers by developing proprietary channels in the energy efficiency market. If OEMs decide to establish an active market presence unilaterally, they will need to move beyond a pure contracting model and develop end-to-end customer service.

Alternatively, OEMs could choose to work on developing compelling sales propositions aimed at energy efficiency contractors in an effort to become the industry's supplier of choice. Or, OEMs could form close partnerships with utilities to try to squeeze out intermediary contractors. Regardless, most of the market activity will be on an OEM level, with limited opportunity to break into the supply chain.



Building Clean is an initiative of the BlueGreen Alliance Foundation. The project gathers information on energy efficient products manufactured in the United States. It also looks at possible health impacts from product ingredients. More details can be found at www.BuildingClean.org

The **BlueGreen Alliance Foundation** is a non-profit, 501(c)(3) organization that conducts research and educates the public and media about solutions to environmental challenges that create economic opportunities for the American people.

The **BlueGreen Alliance Foundation** works with the BlueGreen Alliance—a national partnership that unites America’s largest labor unions and its most influential environmental organizations to identify ways today’s environmental challenges can create and maintain quality jobs and build a stronger, fairer economy— to achieve its mission.



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