

A woman with short brown hair and glasses, wearing a white hoodie and green gloves, is working on a white washing machine in a factory setting. She is focused on the internal components of the machine. The background shows other washing machines and factory equipment.

Energy Efficient Housing Products for Multifamily Buildings

**A GUIDE TO MANUFACTURING SUPPLY CHAINS,
HEALTHY PRODUCTS AND MARKET OPPORTUNITIES**

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Introduction

In recent years the growing national interest to reduce energy costs in the housing sector has led to increased activity in the retrofit of multifamily buildings to make them more energy efficient. Not only do more energy efficient buildings reduce costs to tenants and contribute to a healthier environment, they also provide an economic development benefit.

With prospects of accelerated growth in the multifamily retrofit market, the BlueGreen Alliance Foundation is conducting a project designed to identify the job creation and economic development benefits that can be generated as a result of increased manufacturing activity in building products that contribute to energy efficiency. The information provided in this handbook is a useful tool for state economic development officials, contractors sourcing energy efficiency products and manufacturers looking to diversify their product lines.

This report, examining the broad range of energy efficient products, their supply chains and market opportunities, complements our database/website, which contains information on some 1,300 companies and completes the first phase of our project. In addition, the handbook includes a special section on energy efficient products containing harmful chemicals that may be hazardous to the health of tenants and installers.

Economic development opportunities in the retrofit sector are significant. [The Political Economy Research Institute at the University of Massachusetts, Amherst](#), concludes that every \$1 million invested in energy efficiency retrofits will create over 17 jobs.

In addition, most of the products used in energy efficiency retrofits have over 90 percent of the content made right here in the USA. Sheet metal for ductwork, for example is over 99 percent domestically sourced, vinyl windows are 98 percent American made, and rigid foam insulation is over 95 percent made in America. Even major mechanical equipment like furnaces (94 percent made in the U.S.A.) and air conditioning and heat pumps (82 percent American made) have a much larger share of U.S. content than other products, with the domestic share of production for all products in the United States hovering just above 76 percent.

These types of jobs are also better for U.S. small businesses. According to research conducted by the [Energy Future Coalition](#), 91 percent of the firms involved in retrofits are actually small businesses: Insulation, for example, is installed by more than 22,000 firms, 85 percent of which employ less than 20 people; Roofing insulation is installed by nearly 20,000 contractors around the country, 88 percent of which employ less than 20 people.

The production and installation of heating, ventilation, and air conditioning equipment employs around 2 million people in the United States, and nearly 90 percent of them work for firms of less than 20 people. While nearly 850,000 people manufacture or install interior or exterior lighting equipment in the United States—nearly 90 percent work for firms of less than 20 people.

These results are confirmed by [a recent study of the European commission](#), which also found that the sectors with the greatest levels of energy efficiency jobs were those that produce, or are part of the supply chain for goods. This includes jobs in the manufacturing of the machinery and equipment that enables the production of energy efficient goods, as well as the energy efficient goods themselves.

This project was made possible through the generous support of:



What's an Energy Efficient Product?

Energy efficient building products are those that are classified as reducing unnecessary energy consumption and greenhouse gas emissions. They simultaneously provide healthier living conditions and offer homeowners significant money savings over other types of products. In this context, it's also important to note that *products labeled as 'green' are not necessarily energy efficiency products.*

These types of products fall into five major categories: HVAC, Appliances, Building Shell, Lighting and Water. The most authoritative listing of these products is provided by the [U.S. Environmental Protection Agency \(EPA\)](#), which manages the voluntary Energy Star program. Through this initiative, EPA labels products that meet or exceed standards set by the EPA for energy efficiency.

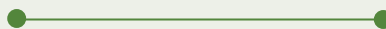
In addition to products used in residential and commercial buildings, the EPA has also developed specific energy efficiency standards for the following product categories:

- Commercial Food Service Equipment
- Electronics and Office Equipment

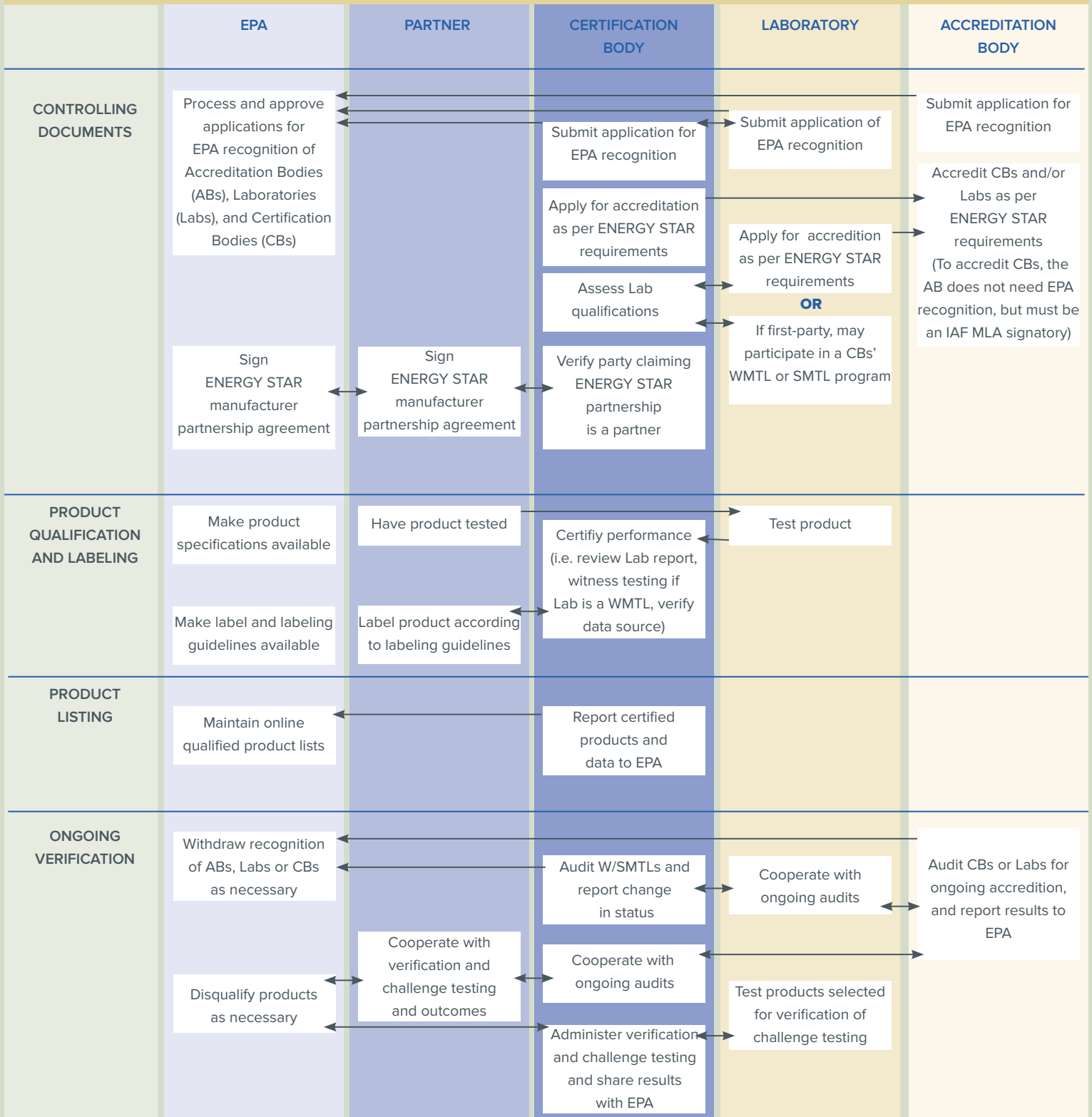
In order to earn the Energy Star label, products must be third party certified based on testing in EPA-recognized laboratories. In addition to up-front testing, a percentage of all Energy Star products are subject to "off-the-shelf" verification testing each year. The goal of this testing is to ensure that changes or variations in the manufacturing process do not undermine a product's qualification with Energy Star requirements.

Tenants, contractors and building owners should also recognize that it is the product itself that receives an Energy Star label, not the company manufacturing the product. As a result, *many companies manufacture and sell a range of similar products that both have and do not have the Energy Star label.* The chart on the following page describes the process by which EPA evaluates products to receive the Energy Star label.

Products labeled as 'green' are not necessarily energy efficiency products.



ENERGY STAR PROCESS FLOW DIAGRAM



BlueGreen Alliance Foundation Industry Database

A companion piece to this handbook is the **BGAF database of energy efficient housing products**, which contains information on close to 1,300 manufacturing companies. This tool provides additional information and guidance to building owners, contractors, suppliers, product manufacturers and tenant organizations concerning the selection of housing products and materials.

Our data (www.bgadata.org/housing) includes information on products manufactured by Original Equipment Manufacturers (OEM) as well as Tier 1 through Tier 3 suppliers in the HVAC, lighting, appliances, water and building shell sectors, which represent the five major energy efficiency housing product categories as defined by EPA's Energy Star initiative. The building shell category currently focuses on insulation products.

A section of the database is also devoted to housing products and materials that may contain harmful chemicals. While energy efficient housing products decrease energy bills and provide environmental

benefits, our research has indicated that insulation products are the primary energy efficient materials that may be harmful to the health of tenants and installers. This section identifies specific chemicals that are known to carry potential health hazards and highlights housing products that contain these types of chemicals as well as potential health hazards.

Most OEM companies listed in our database manufacture EPA Energy Star and [Watersense](#) certified products. Exceptions to this include Tiers 1 through Tier 3 companies that contribute components to the construction of the finished product.

Additionally, while a company's product listing may include one or more products, not necessarily all products are EPA certified. Users are also able to search individual companies, major product categories or subsectors by also using [CSI MasterFormat codes](#) (see [Sidebar](#)).

Our research to date also indicates that the majority of energy efficiency housing products are manufactured by U.S. owned companies. Though our database is not 100% inclusive, it does represent a significant cross-section sampling of companies collected from a variety of online sources as well as conversations with industry representatives. The following chart represents companies in database and their ownership.

BY THE NUMBERS

BlueGreen Alliance Products Database	Totals (Qty & %)	US Owned (Qty & % of Sector)	US Owned, Imports Only (Qty & % of Sector)	Foreign Owned (Qty & % of Sector)	Foreign Owned w/US Mfg. (Qty & % of Sector)
HVAC	188 or 15%	113 or 60%	36 or 19%	75 or 40%	19 or 10%
Lighting	380 or 30%	227 or 60%	158 or 42%	153 or 40%	9 or 2%
Appliance	145 or 11%	91 or 63%	18 or 12%	54 or 37%	13 or 9%
Water	202 or 16%	115 or 57%	75 or 37%	87 or 43%	7 or 3%
Building Shell	355 or 28%	311 or 88%	9 or 3%	44 or 12%	31 or 9%
Database Aggregated	1,270	857 or 67%	296 or 23%	413 or 33%	79 or 6%

U.S. Owned: Includes all U.S. owned companies.

U.S. Owned – Imports Only: Includes only U.S. owned and based companies that manufacture abroad and import finished products to the U.S.

Foreign Owned: Includes all foreign owned companies based in the U.S. who manufacture domestically as well as import foreign made products to the U.S. Also includes companies based overseas who export finished products to the U.S.

Foreign Owned w/ U.S. Manufacturing: Includes only foreign owned companies who have manufacturing operations in the U.S.

CSI MASTER FORMAT SYSTEM

MasterFormat is the master list of titles and numbers used to organize specifications and other project information for most building design and construction projects in North America. It lists titles and section numbers for organizing data about construction requirements, products, and activities. By standardizing such information, MasterFormat facilitates communication among architects, specifiers, contractors and suppliers, which helps them meet building owners' requirements, timelines and budgets.

The MasterFormat system is used widely across a broad spectrum of Energy Efficiency market sector involved parties ranging from the architects & design firms initially specifying, to the construction firms actually installing. The MasterFormat, a publication of the **Construction Specifications Institute**, is primarily used to organize project manuals and detailed cost information, and to relate drawing notations to specifications.

Multifamily Housing Retrofits A Database of Energy Efficient Products and Harmful Chemicals



BUILDING SHELL



HVAC



APPLIANCES



LIGHTING



WATER



HAZARDOUS CHEMICALS

AN INITIATIVE OF THE **BLUEGREEN** ALLIANCE FOUNDATION

www.bgadata.org/housing

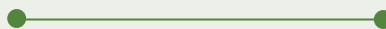
Market Overview

Following is a brief overview of each industry sector for energy efficient housing products. These markets are going through a rapid transformation as energy efficiency is fast becoming a central part of corporate and government strategies to reduce carbon emissions. Governments worldwide are introducing policies aimed at promoting energy efficiency through incentives, prescriptive measures and building codes. New technologies are also being developed to monitor and control energy usage in buildings.

The U.S. is well positioned to play a leading role in these markets. [A report by Navigant Research](#) indicates these markets will grow from some \$300 billion globally in 2014 to \$620 billion in 2023. Domestically, U.S. owned companies dominate each of the energy efficiency sectors. And though sourcing of components globally continues to play a significant role, there do exist niche market opportunities in each industry sector for U.S. companies. For example, while imports represent by far the largest portion of the low end market for consumer light fixtures, domestic companies are the major players in the market for high end commercial lighting products.

*Energy efficient housing products will grow from
\$300 billion globally in 2014 to \$620 billion in 2023.*

-Navigant Research



CONSERVATION PYRAMID



HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

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.

HVACR, which includes refrigeration, makes up the largest sub-sector of U.S. exported building products. In 2013, the [International Trade Administration](#) recorded over \$20 billion in exports in this sub-sector alone with the market growing 5.2% between 2010 and 2013.



SUPPLY CHAIN OPPORTUNITIES

The HVAC market sector consists of a very mature supply chain that is continually evolving with the industry and the development of new technologies. A large number of companies have been part of the supplier base for many

years and have developed significant long-standing relationships with industry leaders that a) afford some level of supply chain stability and b) pose significant challenges for new incoming sub tier supply chain companies.

However, products in the HVAC category are mixed when it comes to domestic content. Heavier, more logistically challenged, HVAC products such as central air conditioning, furnaces, and boilers are manufactured in the U.S. by longstanding domestically owned Original Equipment Manufacturers (OEM) like York, Lennox and United Technologies Corporation who manufactures the Carrier and Bryant brands. Lighter, less logistically challenged, HVAC products including room air conditioners, portable A/C units, ceiling fans, and de/humidifiers, are primarily manufactured in Asia or Mexico, imported and sold by U.S. based foreign or domestically owned OEM's.

However, there are older U.S. made brands like Goodman that have been bought out by foreign companies from Asia and Europe but still manufacture products for the U.S. market domestically. While the market is dominated by these larger OEM's, there are also 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.

INDUSTRY LEADERS

COMPANY NAME: Goodman (Daikin Group)
U.S. HEADQUARTERS: Houston, TX
OWNERSHIP: Foreign (Japan)
ADDITIONAL BRANDS: Amana

COMPANY NAME: Lennox International
U.S. HEADQUARTERS: Richardson, TX
OWNERSHIP: U.S.

COMPANY NAME: Rheem
U.S. HEADQUARTERS: Fort Smith, AK
OWNERSHIP: U.S.

COMPANY NAME: Trane (Ingersol Rand)
U.S. HEADQUARTERS: Piscataway, NJ
OWNERSHIP: Foreign (Ireland)
ADDITIONAL BRANDS: American Standard

COMPANY NAME: United Technologies Corporation
U.S. HEADQUARTERS: Farmington, CT
OWNERSHIP: U.S.
ADDITIONAL BRANDS: Carrier, Bryant

COMPANY NAME: York Unitary Products Group (Johnson Controls)
U.S. HEADQUARTERS: York, PA
OWNERSHIP: U.S.
ADDITIONAL BRANDS: Luxaire, Coleman, Fraser-Johnston, Guardian

APPLIANCES

INDUSTRY LEADERS

COMPANY NAME: A.O. Smith
U.S. HEADQUARTERS: Milwaukee, WI
OWNERSHIP: U.S.
ADDITIONAL BRANDS: Lochinvar

COMPANY NAME: Electrolux
U.S. HEADQUARTERS: Charlotte, NC
OWNERSHIP: Foreign (Sweden)

COMPANY NAME: General Electric (GE)
Appliances
U.S. HEADQUARTERS: Louisville, KY
OWNERSHIP: U.S. (currently – sale pending)

COMPANY NAME: Kenmore Appliances
(Sears)
U.S. HEADQUARTERS: Hoffman Estates, IL
OWNERSHIP: U.S.

COMPANY NAME: Samsung Electronics N.A.
U.S. HEADQUARTERS: Ridgefield Park, NJ
OWNERSHIP: Foreign (South Korea)

COMPANY NAME: Whirlpool
U.S. HEADQUARTERS: Benton Harbor, MI
OWNERSHIP: U.S.
ADDITIONAL BRANDS: Maytag, Amana,
Jenn-Air, KitchenAid

In 2012 the [U.S. Census Bureau](#) valued shipments from manufacturing establishments including domestic cooking appliances, refrigerators, freezers, water heaters and small electrical appliances at over \$12 billion. This value was down compared to a 2007 pre-recession total of \$15.3 billion with the exception of water heaters whose shipments actually increased during that time period.

However, with the recovery of the housing market new home construction and remodeling projects are on the rise, which will contribute to the increased manufacturing and sale of durable goods.

Similar to the HVAC sector, many of the larger appliances such as refrigerators, dishwashers, ranges, water heaters, and washers/dryers are manufactured domestically by both foreign and U.S. owned OEM's. However, some foreign owned companies still build and ship large appliances from overseas including familiar South Korean brands like [Samsung](#) and [LG](#).

Smaller appliances like microwave ovens are exclusively manufactured overseas even if the OEM manufactures a majority of their other appliances in the U.S. On the other hand, the manufacturing of some smaller consumer goods has been brought back to the U.S. including the [Kitchen Aid](#) and [Vitamix brand mixers](#), which are once again being made in Greenville and Strongsville, Ohio.

[Whirlpool](#) still boasts the highest U.S. market share for appliances and remains a U.S. owned company with multiple domestic manufacturing locations. Smaller, but significant high end manufacturers like [SubZero](#) and [Viking](#) along with a number of independent boiler makers who build indirect fired water heaters also manufacture in the U.S. with high domestic content.

SUPPLY CHAIN OPPORTUNITIES

There are established supply chains in the U.S. for the larger appliance market. [GE Appliances](#) prides itself on the domestic content of its appliance offerings manufactured in the U.S., which contain 70%-90% U.S. made components. However, not all U.S. made appliances contain domestic content similar to GE's products.

In recent years the appliance market has gone through significant changes as OEM's consolidate and acquire or divest themselves of certain product lines. Whirlpool's purchase of [Maytag](#) in



2008 grew its market share and product offerings significantly by adding such recognizable brands as [Amana](#), [Jenn-Air](#) and [KitchenAid](#). GE is experiencing something similar as it looks to sell off its appliance division to concentrate on other markets. As a result, companies in the existing supply chains are also facing disruptions, making it increasingly difficult for new suppliers to enter the market.

Despite these challenges, sub tier opportunities for highly localized/logistically sensitive commodities are available. Examples of this are pressure vessels associated with hot water heating and the sheet metal work associated with major appliance exteriors.

LIGHTING

As one of quickest ways to realize energy savings in any setting, lighting will always be one of the first products people turn to for greening new construction and retrofit projects. Companies in this industry manufacture a range of products, including electric light bulbs, light-emitting diodes (LED's), tubes, parts, components and lighting fixtures.

According to the [International Trade Administration](#), lighting represented over \$3 billion in exports in 2013 and grew 4.4% between 2010 and 2013. Growth in this industry is primarily due to



increased interest in the solid state lighting market with many newer U.S. companies coming online who are developing and manufacturing innovative product lines.

The traditional lighting and bulb manufacturing industry has remained stagnant or declined in recent years due to more imports and product input costs. Bulbs, like CFL's and LED's that would be used in a residential/multifamily setting, are mostly being manufactured overseas and imported to the U.S.

The one exception is [Cree](#), who assembles their residential LED bulbs at a manufacturing facility in North Carolina. However, key pieces of the supply chain for LED's are the diodes, which are exclusively manufactured in Asia and imported to the U.S.

The manufacturing picture is somewhat different for residential fixtures with the larger companies and retailers like [Home Depot](#) and [Lowe's](#) who import their products as opposed to some smaller, custom/high-end companies who are still making fixtures in the U.S.

As increasing attention is paid to not only the energy benefits, but the non-energy health and well-being benefits of technologically advanced lighting products, growth in this section of the lighting market may offer the most opportunity for potential suppliers.

SUPPLY CHAIN OPPORTUNITIES

The lighting industry represents a mix of supply chain natures based upon the specific sub tier. While the bulb and reflector sub sectors remain highly globalized and competitive, the fixture sub sector, especially those associated with higher end designs, are mixed between being domestic and globalized. For this reason, opportunities may exist for sub tier manufacturers servicing this market.

INDUSTRY LEADERS

COMPANY NAME: Acuity Lighting Brands
U.S. HEADQUARTERS: Atlanta, GA
OWNERSHIP: U.S.
ADDITIONAL BRANDS: Gotham, Lithonia, American Electric, Peerless, Winona

COMPANY NAME: Cree
U.S. HEADQUARTERS: Durham, NC
OWNERSHIP: U.S.

COMPANY NAME: General Electric (GE) Lighting
U.S. HEADQUARTERS: East Cleveland, OH
OWNERSHIP: U.S.

COMPANY NAME: Lightolier (Philips Lighting)
U.S. HEADQUARTERS: Fall River, MA
OWNERSHIP: Foreign (Netherlands)

COMPANY NAME: Osram-Sylvania
U.S. HEADQUARTERS: Wilmington, MA
OWNERSHIP: Foreign (Germany)

COMPANY NAME: Philips Lighting
U.S. HEADQUARTERS: Somerset, NJ
OWNERSHIP: Foreign (Netherlands)

WATER

INDUSTRY LEADERS

COMPANY NAME: American Standard
(LIXIL Corporation)
U.S. HEADQUARTERS: Piscataway, NJ
OWNERSHIP: Foreign (Japan)

COMPANY NAME: Kohler
U.S. HEADQUARTERS: Kohler, WI
OWNERSHIP: U.S.

COMPANY NAME: Masco Corporation
U.S. HEADQUARTERS: Taylor, MI
OWNERSHIP: U.S.
ADDITIONAL BRANDS: Delta, Brasscraft,
Brizo, Hansgrohe

COMPANY NAME: Moen
U.S. HEADQUARTERS: North Olmsted, OH
OWNERSHIP: U.S.

COMPANY NAME: Toto
U.S. HEADQUARTERS: Morrow, GA
OWNERSHIP: Foreign (Japan)

Of all the energy efficiency sectors, water saving products are the most likely to be imported. Out of the more than 200 water product manufacturers researched for this project, about 75% of them are manufacturing overseas and importing their products to the U.S. However, among the 25% of those companies that are making these products in the U.S., three of them are some of the most recognizable names in the industry and still U.S. owned and operated—Kohler, Delta and Moen.

Our research focused on the three categories of residential products that the EPA's WaterSense program currently conducts research on and certifies. The categories include bathroom sink faucets & accessories, showerheads and toilets. Water efficient versions of these products can save billions of gallons of water per year and installing them can, on average, save tenants and building owners over one quarter of their yearly water and sewer bill.

Because of shipping costs and rising wages in countries like China, toilet manufacturing in the U.S. has seen a turnaround recently with companies like Colombian owned Mansfield and Japanese owned American Standard and Toto producing toilets on U.S. soil. Kohler currently operates 3 of the remaining 7 U.S. plants manufacturing toilets.

U.S. demand for plumbing products is also rising and expected to grow in the coming years as new construction, retrofitting and remodeling for energy and water efficiency grows. Despite the relocation of some plumbing product relat-

ed jobs to the U.S., much of this demand will be met with imported goods as overseas production and therefore product prices are much less. It is common in this market for OEM's to operate their own manufacturing facilities overseas or multiple OEM's will contract with the same overseas manufacturer to produce their brands. Either way imports are exceeding exports.

In fact, the ITA states that exports in this market grew only 1.5% between 2010 and 2013. This number accounts for both finished products like toilets, faucets and showerheads and unfinished



plumbing products like piping. Because the U.S. is one of only three countries not using the metric system, exporting within the rough materials markets is difficult. Water conservation standard differences among other countries compared to the U.S. also impact our export possibilities.

BUILDING SHELL—INSULATION

Though EPA's Energy Star certifies three main "Building Products" categories within their program: residential windows, doors and skylights; roof products; and seal and insulate, this section focuses solely on insulation products, which is the material that most professionals look to help reduce energy costs and make a building more energy efficient.

New building construction and energy efficiency retrofits of existing buildings are on the rise. The 2012 International Energy Conservation Code (IECC) created tougher building codes that are requiring a building to have a tighter envelope and ducts, higher efficiency lighting,



better windows and more insulation. Because of this, insulation demand is expected to rise in the U.S. 7.0 percent annually to \$10.4 billion in 2019.

This is good news for an industry that has a large manufacturing presence in the U.S. and the ability to serve both domestic and export markets with a variety of insulation product choices. The U.S. export market for insulation grew over 7% between 2010 and 2013 and is projected at \$1.3 billion in 2017 with Canada and Mexico receiving the vast majority of those exports. Fiberglass insulation carried 48% of the market demand in 2014 and is a common product choice among professional and DIY installers. Foamed plastic insulation came in second in market share to

fiberglass and is expected to grow into a \$4.6 billion market by 2019. Although traditionally used in nonresidential markets, foamed plastic is gaining popularity in residential settings given its high R-value and the need for compliance with the 2012 IECC codes.

SUPPLY CHAIN OPPORTUNITIES

The supply chain, which is pretty minimal for insulation products, is also for the most part domestically sourced. Some gaps that were uncovered related to a chemical compound that currently (but not always) has a shortage in the USA and some of the facers that are used on the outside of rigid insulation products.

Insulation products are not only associated with energy efficiency; some products also are known to cause harmful health effects as a result of the chemicals used to produce them. As a result, manufacturers with products that take into account health impact are seeing more opportunities than in the past thus expanding market opportunities at not only the OEM level but also at the sub tier supply chain level.

HEALTHY PRODUCT CHOICES IN INSULATION

The particular challenge currently facing companies manufacturing insulation materials is product transparency. Increasingly, from tenants to building owners to architects, a premium is being placed on creating healthy buildings and there is pressure on manufacturers to supply the data needed to make that assessment.

This is not an easy, quick or cheap process—but it is a necessary one. More and more often, building industry professionals are recognizing companies that provide content and hazard listings and moving them to the top of the list when considering product purchases. Chemical content rarely is the only factor in specifying a product, but is an increasingly important consideration.

INDUSTRY LEADERS

COMPANY NAME: Applegate Insulation
U.S. HEADQUARTERS: Webberville, MI
OWNERSHIP: U.S.
MATERIAL: Cellulose

COMPANY NAME: CertainTeed Corp.
 (Saint-Gobain)
U.S. HEADQUARTERS: Malvern, PA
OWNERSHIP: Foreign (France)
MATERIAL: Fiberglass,
 Spray Foam, Mineral Wool,
 Expanded Polystyrene

COMPANY NAME: Dow Corning
U.S. HEADQUARTERS: Midland, MI
OWNERSHIP: U.S.
MATERIAL: Building Insulation
 Blankets, Insulation
 Components and
 Ancillary Supplies

COMPANY NAME: Johns Manville
 (Berkshire Hathaway)
U.S. HEADQUARTERS: Denver, CO
OWNERSHIP: U.S.
MATERIAL: Fiberglass,
 Mineral Wool,
 Polyurethane Foam

COMPANY NAME: Knauf Insulation
U.S. HEADQUARTERS: Shelbyville, IN
OWNERSHIP: Foreign (Germany)
MATERIAL: Glass Mineral Wool
 and Blowing Wool Insulation

COMPANY NAME: Owens Corning
U.S. HEADQUARTERS: Toledo, OH
OWNERSHIP: U.S.
MATERIAL: Fiberglass,
 Extruded Polystyrene (XPS)

Supply Chain Market Opportunities

With the number and variety of energy efficient housing products being manufactured and consumed within the United States as well as exported overseas, supply chain opportunities can be found virtually in all areas of the market.

For example, many larger appliances and HVAC products are manufactured domestically and typically contain thousands of components. Only a hundred or so of these parts are actually procured by the OEM with the bulk being provided to them by significant Tier 1 integrators. Because of this it is important to pay special attention to the associated sub tier markets and building relationships within them as this is where the majority of opportunities exist. Additionally, building shell products such as windows, insulation and roofing are typically manufactured on a local and regional basis. Although the supply chains are far simpler, the number of companies manufacturing in these spaces in the US remains large and may provide additional supply chain opportunities.

According to the [International Trade Administration's "2015 Top Markets Report for Building Products and Sustainable Construction,"](#) the export markets for energy efficient products are expanding as construction, especially sustainable construction, grows on a global basis. This growing interest in sustainability positions many of the U.S. manufacturers making high quality products to meet this demand.

What follows is a deeper look into the energy efficient housing products market and manufacturing footprint the industry has in New York State. The company data included below was procured from the

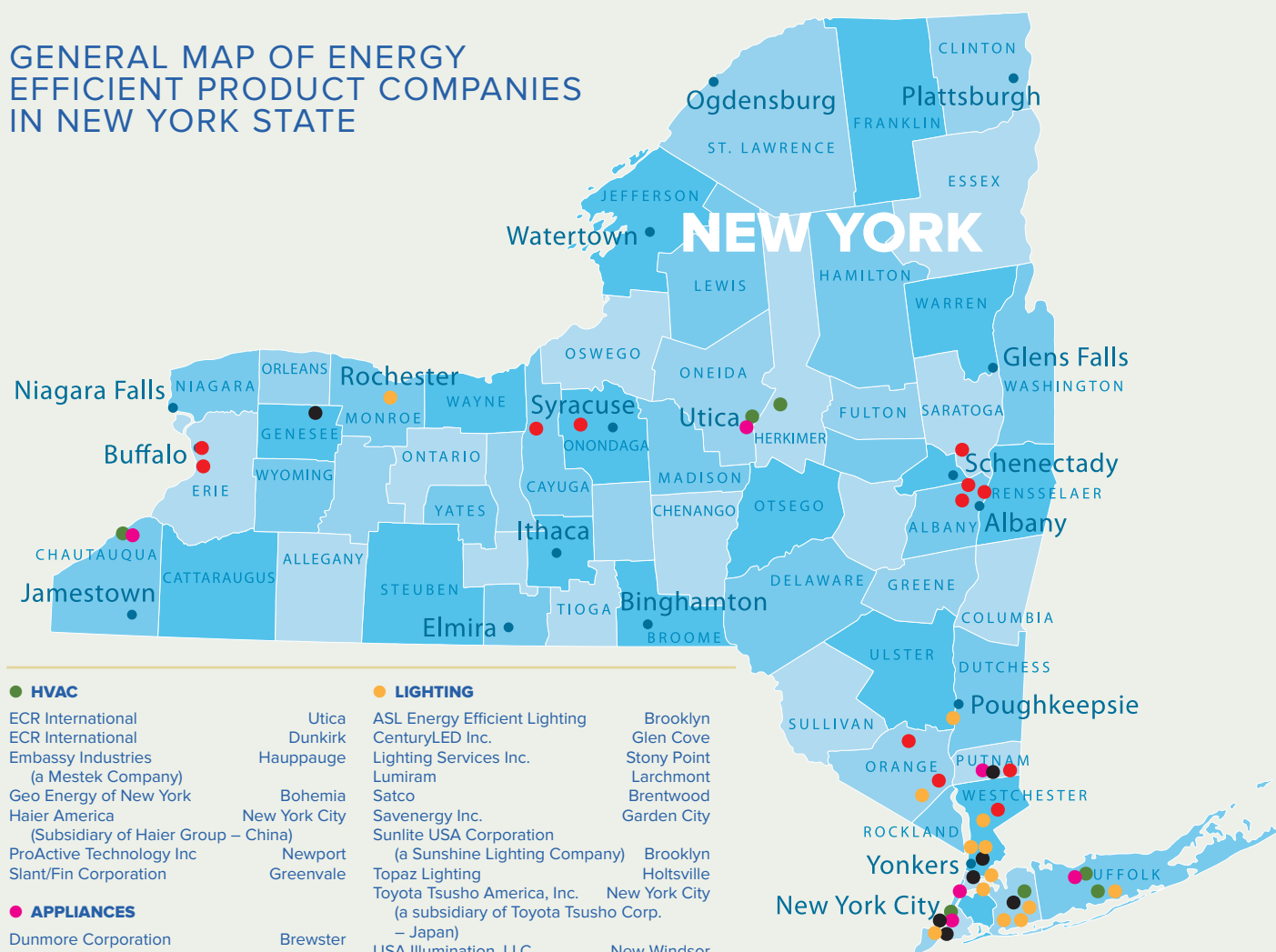
[Blue Green Alliance Foundation's online database tool](#) that allows users to research company locations by state via an interactive supply chain map. Note that the data included here is subject to change as updates are made to reflect company openings, closures and as additional energy efficient product information is added to the database. Please refer to www.bgadata.org/housing for the most up to date information.

New York State has energy efficient product companies operating in all five (5) market sectors and a solid number of them actually manufacture and/or assemble their products within the state. The lighting and building shell sectors currently represent the largest number of companies in New York. However, only a small number of those lighting companies are actually manufacturing facilities while the remainder are manufacturing their product overseas and importing it for sale and distribution from their US base.

On the other hand, all of the companies manufacturing insulation products are doing so onsite at their facilities in New York. Again, this list only represents a small segment of the building shell category (insulation) and would grow significantly upon including other regionally produced products like windows and roofing materials.

Although HVAC and appliance companies make up a smaller portion of those in New York a majority are manufacturing products within the state. Looking at a regional picture of these two markets reveals a collection of manufacturers in the same industry including nine (9) boiler manufacturers who operate in cities just to the North and West of Philadelphia. This kind of manufacturing cluster can offer opportunities to potential suppliers and can be easily researched online via [BGAF's database](#).

GENERAL MAP OF ENERGY EFFICIENT PRODUCT COMPANIES IN NEW YORK STATE



● HVAC

ECR International
ECR International
Embassy Industries
(a Mestek Company)
Geo Energy of New York
Haier America
(Subsidiary of Haier Group – China)
ProActive Technology Inc
Slant/Fin Corporation

Utica
Dunkirk
Hauppauge
Bohemia
New York City
Newport
Greenvale

● APPLIANCES

Dunmore Corporation
ECR International
ECR International
Slant/Fin Corporation
Smeg USA Inc.
Summit Appliance Division
(a Felix Storch Inc. Company)

Brewster
Utica
Dunkirk
Greenvale
New York City
Bronx

● WATER

Fantini USA Inc. (Italy)
Giagni
Jandon
Kraus USA, Inc.
Liberty Pumps
Matco-Norca
Rivuss
Royal Line
Sherle Wagner International

New York City
Mt. Vernon
Maspeth
Port Washington
Bergen
Brewster
Hicksville
Seaford
New York City

● LIGHTING

ASL Energy Efficient Lighting
CenturyLED Inc.
Lighting Services Inc.
Lumiram
Satco
Savenergy Inc.
Sunlite USA Corporation
(a Sunshine Lighting Company)
Topaz Lighting
Toyota Tsusho America, Inc.
(a subsidiary of Toyota Tsusho Corp. – Japan)
USA Illumination, LLC
WAC Lighting
Wegmans Food Markets
Xeleum Lighting LLC
Zumtobel Lighting, Inc. USA
(Austria)

Brooklyn
Glen Cove
Stony Point
Larchmont
Brentwood
Garden City

Brooklyn
Holtsville
New York City
New Windsor
Port Washington
Rochester
Mt. Kisco
Highland

● BUILDING SHELL / INSULATION

Air Krete
Armstrong
C.P. Chemical Company
Dunmore Corporation
Green Fiber
Hunter Panels
(a Carlisle Construction Materials Company)
Momentive Performance Materials
Owens Corning
Shelter Enterprises Inc.
Thermal Foams Inc.
Thermal Foams Inc.
Syracuse (AFM Licensed Facility)
Urethane Technology Company, Inc.

Weedsport
West Seneca
White Plains
Brewster
Hagaman
Montgomery

Waterford
Delmar
Cohoes
Buffalo

Cicero
Newburgh

NUMBER OF COMPANIES BY MARKET SECTOR IN NEW YORK STATE AS OF JANUARY 2016:

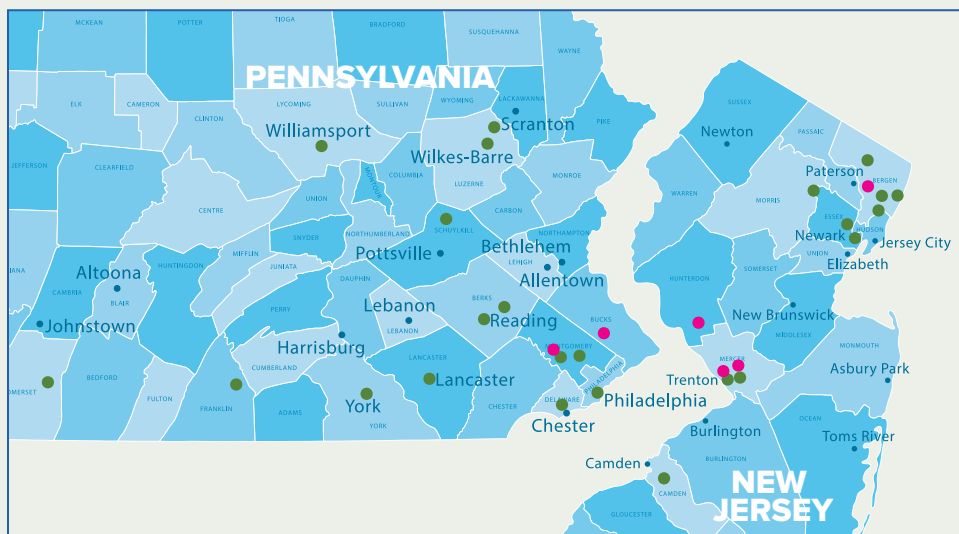
HVAC	7
Appliances	6
Lighting	14
Water	9
Building Shell (Insulation)	12

Note: Three (3) companies participate in more than one market sector

PROJECTED TOP 5 MARKETS FOR EXPORTS FOR BUILDING PRODUCTS AND SUSTAINABLE CONSTRUCTION MATERIALS 2015 - 2017

1. CANADA
2. MEXICO
3. CHINA
4. JAPAN
5. AUSTRALIA

REGIONAL MAP OF HVAC AND APPLIANCE COMPANIES OPERATING IN NORTHERN NEW JERSEY AND EASTERN PENNSYLVANIA



NEW JERSEY

● HVAC

Triangle Tube/Phase III Co., Inc. Blackwood
(Subsidiary of ACV Manufacturing - Belgium)

Blackwood Monitor Products Robbinsville
Incorporated (a wholly owned subsidiary of Tokyo Boeki USA - Japan)

Trane (an Ingersoll Rand Company – Ireland) Trenton

LG HVAC Englewood Cliffs
(Subsidiary of LG Electronics USA - Korea)

Panasonic Corporation Newark
of North America (Japan)

Samsung Electronics Redgefield Park
Company Co. Ltd. (South Korea)

Fagor America Inc. (Spain) Hackensack

Fujitsu General America Inc. Fairfield
(owned by Fujitsu - China)

Sharp Electronics USA Mahwah
(Subsidiary of Sharp Corporation – Japan)

Midea America Parsippany
(Division of the Midea Group – China)

● APPLIANCES

SOLEC – Solar Energy Corp. Ewing

Miele, Inc. (Germany) Princeton

Energy Kinetics System Lebanon

Emerson Radio Corp. Hackensack

PENNSYLVANIA

● HVAC

Crown Boiler Company Philadelphia
Air-King, Ltd. West Chester
(subsidiary of Lasko)

New Yorker Boiler Company, Inc. Lansdale
(subsidiary of Burnham Holdings, Inc.)

Columbia Boiler Stowe

Boyertown Furnace Company Boyertown

Peerless Boiler/PB Heat LLC Bally

Advanced Geothermal Technology Reading

Impecca USA Wilkes-Barre

Quietflex Manufacturing Jenkins Township
Company (a subsidiary of the Goodman Global Group, Inc. - a Daikin Industries Ltd. Company - Japan)

TDC Manufacturing Inc. Schuylkill Haven

Clean Burn Inc. Lancaster

U.S. Boiler Company, Inc. Lancaster
(Subsidiary of Burnham Holdings, Inc.)

GEA PHE Systems York
(part of the GEA Heat Exchangers portion of the GEA Group - Germany)

Axeman - Anderson Williamsport

EarthNet Energy Chambersburg

● APPLIANCES

Dunmore Corporation Bristol

IKEA North America Conshohocken
Services, LLC

KEY ENERGY EFFICIENT PRODUCT COMPANIES HEADQUARTERED AND MANUFACTURING IN NEW YORK STATE

SUMMIT APPLIANCE

(Bronx, NY)

An independent, family-owned manufacturer that is a leading supplier of specialty, professional, commercial, and medical refrigerators and freezers, as well as cooking appliances since 1969.

ECR INTERNATIONAL

(Utica and Dunkirk, NY)

Manufacturer of boilers, furnaces, indirect fired water heaters and air conditioning units for over 90 years.

LIGHTING SERVICES INC.

(Stony Point, NY)

Premier manufacturer of track, accent, display and LED lighting systems.

ASL ENERGY EFFICIENT LIGHTING

(Brooklyn, NY):

Fabricate and assemble green indoor and outdoor lighting fixtures including decorative, utility, vanity, sconces, pendants, security, lanterns, brackets, bulkheads, wall packs, floods, cutoffs, emergency and exit signs.

THERMAL FOAMS INC.

(Buffalo and Cicero, NY)

Manufacture THERMCO and Foam-Control brands of expanded polystyrene

AIRKRETE

(Weedsport, NY)

Ultralight Cement Injection Foam Insulation manufacturer.

Anatomy of an Energy Efficient System and its Supply Chain

As the second largest use of energy within a home, water heaters are an important appliance and can have a big impact on energy bills. Energy saving models can save a household up to 50% on water bills and are a growing market in the U.S.

There are a variety of energy efficient water heaters manufactured in the U.S. including gas, electric, hybrid, tankless, solar and indirect water heater/boiler systems. These systems look and function differently but are built with similar components, which may equate to a variety of supply chain opportunities for manufacturers.

The supply chains for these systems are structured similarly to other complex products. OEM's sell finished brand name products ready for the marketplace. They purchase from Tier 1 companies who produce sub-assemblies of sub-tier components such as glass lined steel tanks and thermostats. Tier 1's purchase the sub-tier components from Tier 2's including sheet metal for tanks, piping, electrical components, tank insulation, and fasteners. Supply chain structures and the associated OEM to Tier relationships are further explained in Section III of this Guide.

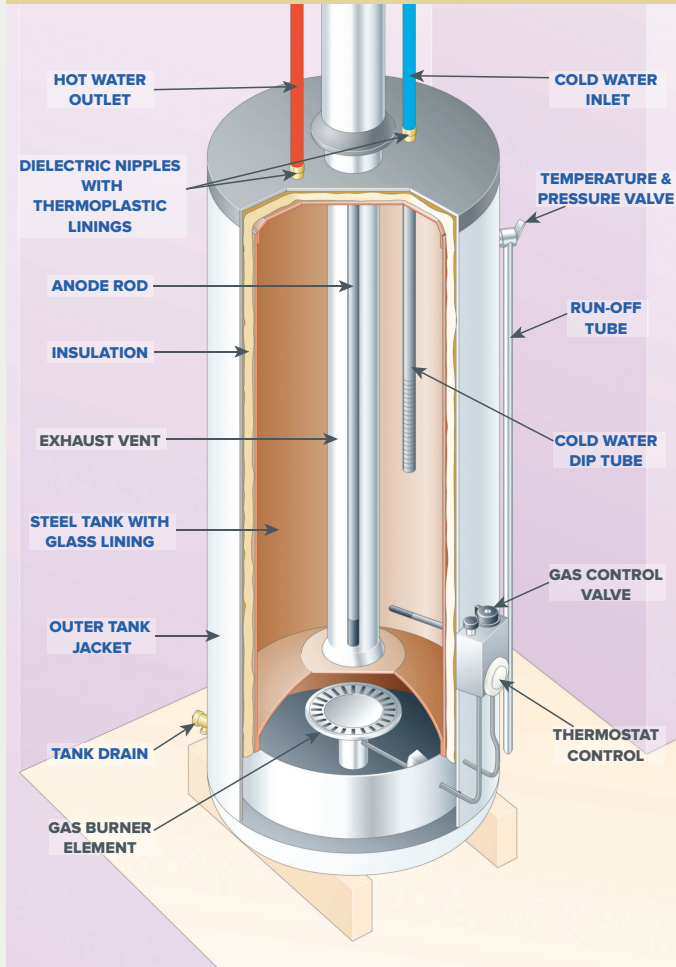
Pictured on the following page is a diagram highlighting the basic componentry of a typical gas hot water heater. Except for the differences in heating elements, gas and electric models are similar in structure and contain many of the same parts.

Hybrid hot water heaters maximize efficiency by using a heat pump to heat water in combination with an electric heating element to meet hot water needs in times of high demand. Solar heaters can cut annual hot water bills in half and are most often used in conjunction with back-up gas or electric units. With a relatively short term return on investment, both hybrid and solar units are growing in popularity as interest in energy efficiency grows and these systems become more affordable for the average household.

Tankless water heaters produce hot water on demand and provide energy savings from not having to heat stored water. Tankless systems are often a great option for households who use less water overall and have twice the average lifetime of traditional gas or electric water heaters.

An indirect water heater works in conjunction with a boiler to heat water and can be gas, electric or oil. They are used and often built in the Midwest and Northeastern part of the USA and along the border into Canada. Manufacturers tend to build both pieces of the water heating system but not always.

TYPICAL GAS HOT WATER HEATER CONFIGURATION



Note: Items labeled in blue are common to most conventional Electric Hot Water Heaters.

All of these hot water heaters, with the exception of tankless units, are comprised of an exterior sheet metal façade that surrounds a pressure vessel. Most sheet metal fabricators can produce this piece however the interior pressure vessel must be built by an American Society of Mechanical Engineers (ASME) certified facility. Although both areas offer potential supply chain opportunities for U.S. manufacturers, companies with ASME designation may have a particular advantage as there are fewer facilities that meet this need.

Insulation is another product commonly used in the construction of most hot water heaters but also in other appliances like dishwashers, as well as around hot water pipes and HVAC ductwork. For the multitude of companies manufacturing insulation in the U.S. this can mean additional markets for their products although several larger insulation manufacturers are already diversified.

Generally speaking, most of the supply chain associated with water heaters may offer opportunities for manufacturers including drain pans, piping, combustion chambers and heat exchangers. As noted in the market opportunities section of this handbook, there are increasing commitments from manufacturers to domesticate their supply chain for a variety of reasons including price, quality and a growing interest among the public to purchase U.S. manufactured products with high domestic content.

Doing Business with the OEMs

To fully understand the energy efficiency marketplace and its associated supply chain, it's first critical to understand the role of today's OEM's (Original Equipment Manufacturers) within the space. OEM's are the companies aggregating all of the sub-tier materials along with their own culminating in a finished product. A typical major appliance may contain 2,000 parts though the OEM may in reality only be purchasing 200 parts or sub-assemblies. The remaining 1,500 parts are being provided to the OEM as part of sub-assemblies through the associated supply chain tiers.

TIER STRUCTURE

The diagram on page 21 will help to illustrate this relationship. It's critical when understanding this relationship to recognize that opportunities for market suppliers and manufacturers in many cases will exist within the sub-tier levels and not at the OEM level. Note that providers often times are involved in the supply chains on multiple levels or tiers. In some cases, it's even possible for an OEM to provide a complete product and while also serving in the capacity of a sub-tier providing product materials to another OEM or tier.

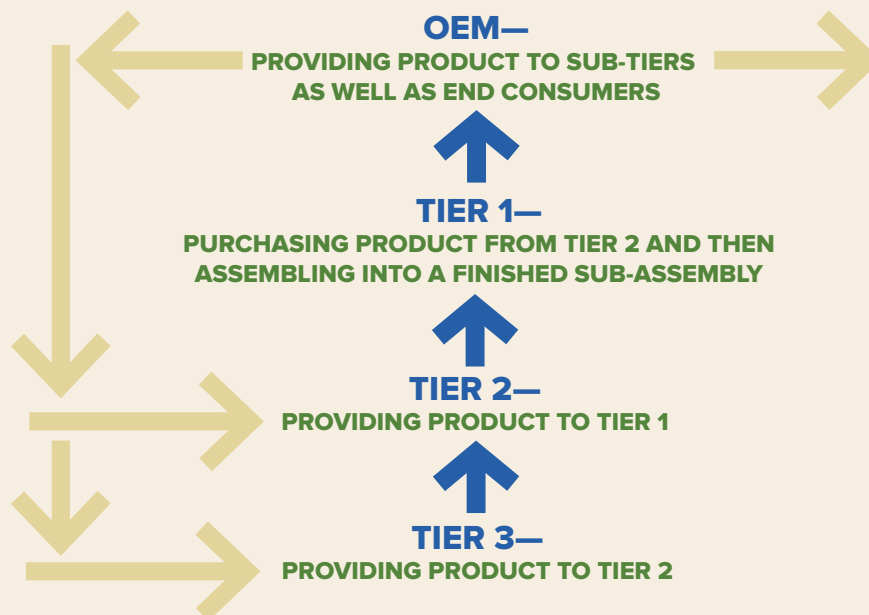
THE ROLE OF INTEGRATORS

Often times we see Tier 1's also serving as Integrators where they are purchasing product materials but also providing sub-assembly services. In scenarios like this, the Tier 1 is purchasing product from Tier 2's and then combining into some sub-assembly. Upon completion, this sub-assembly is then provided to the OEM where it is finally assembled into a finished product. An example of this expanded supply chain relationship is shown on the following page.

TIER STRUCTURE



THE ROLE OF INTEGRATORS



Meeting OEM Requirements

OEM's by their very nature succeed by being Risk Adverse. This cautious nature filters to the sub-tier supply chain partners. Reasons for this might be obvious to some and obscure to others. Key aspects include product visibility, product application, product longevity and the cost of failures.

The energy efficient marketplace represents a cutting edge multi-national driven space. Success in this space will generally require all involved parties to function at a complimentary level of proficiency.

WHAT'S EXPECTED OF SUPPLIERS

- Production Capabilities
 - High Mix – High Volume
 - Available Capacity Expandable
- Reliability of Delivery
 - Equipment Redundancy
 - Vendor Redundancy
 - Demonstrated Results
- Consistent Quality & Competitiveness
 - ISO, Lean Six Sigma,
 - 5S Commercial & Financial Stability

MARKET ENTRY TIPS— UNDERSTAND AND CONTROL THE 3C'S

COMPETITIVENESS

- Operational Efficiencies
 - Take time and waste out of the process
 - World Class Lean—with expected yearly cost reductions

- Subsidized Off-Shore Competition
- Dynamic Raw Material Costing & Availability Capital

CAPITAL

- Specialized Equipment
- Facilities Investments
- Certifications
- Quality Systems
- Supplier Qualification Processes Connections

CONNECTIONS

- Mature supply chain that is challenging to connect into
- Understanding where ones fit exists and at what Tier

WHAT SUCCESSFUL COMPANIES HAVE DONE

1. Found the Best Fit

- a. What market sector
- b. What Tier
- c. Initial supply or after sale support / O&M

2. Planned for Needed Investments

- a. Process improvement
- b. Quality systems
- c. Capital

3. Developed Marketing Strategy

- a. Identified target customers
- b. Create a winning “pitch” for the desire market being targeted
- c. Launch cost effective sales effort

4. Leverage the Power of Communication

- a. Volumes of data exist within the Energy Efficiency market place. Leverage it.
- b. Attend events, webinars
- c. Follow social media for cutting edge intelligence

Harmful Chemicals in Insulation Products

Among all the energy efficient products, insulation is the primary material that can pose harm to tenants. Those who install the insulation also are at risk if appropriate safeguards are not followed.

The problem with insulation comes from the chemicals used to bind, formulate or even make insulation “safer” through fire resistance. Despite this risk, insulation is a key component of efficiency retrofits because of its excellent ability to reduce energy usage, and thus saves

both money and carbon dioxide emissions. Thus, tradeoffs must be made among cost, product performance and health concerns—but that only happens if specifiers and others have the information they need to know about product content and health dangers.

The following chart shows the serious illnesses linked to some insulation products. Because the impact can be so severe, people building and living in the home are demanding product content disclosure so they can make informed decisions on which insulation products to use. The same is true for the thousands of other building products available for use.

HARMFUL CHEMICALS IN INSULATION

CHEMICAL	PURPOSE	TOP HAZARDS	HIGHEST WARNING*	TYPE OF INSULATION
BROMINATED FLAME RETARDANTS (BFR)	Fire protection	Bioaccumulation toxin; endocrine disruptor	Purple - very high concern	Expanded and extruded polystyrene foam (EPS and XPS)
CHLORINATED FLAME RETARDANTS (CFR)	Fire protection	Bioaccumulation toxin	Purple - very high concern	Spray polyurethane foam (SPF); polyisocyanurate (polyiso)
ETHANOLAMINE	Binder	Developmental; asthma	Orange - medium concern	Spray polyurethane foam (SPF)
FORMALDEHYDE	Binder	Cancer; asthma	Red - high concern	Fiberglass**; mineral wool
ISOCYANATES	Building block of polyurethane foam	Respiratory; cancer	Red - high concern	Spray polyurethane foam (SPF)
POLYETHYLENE GLYCOL NONYLPHENYL ETHER	Foaming aid in spray polyurethane foam (SPF)	Bioaccumulation toxin; reproductive toxin	Purple - very high concern	Spray polyurethane foam (SPF)
STYRENE	Building block of polystyrene foam	Cancer; reproductive toxin	Red - high concern	Expanded and extruded polystyrene foam (EPS and XPS)

**As calculated for the chemical in Healthy Building Network's Pharos Chemical and Material Library*

***Heavy-density and board applications only, usually for commercial or industrial application.*

APPENDIX A

Harmful Chemicals in Insulation Products

Supplying Chemical Data

Though some content information is available through government-mandated material safety data sheets, MSDS regulations do not require manufacturers to provide actual chemical names. Nor do they include ingredients found in low quantities, some of which can be quite hazardous.

The newer form of MSDS, the SDS, or safety data sheets, contains some improvements. This system does a better job of capturing substances that represent risks due to long-term exposure in addition to the acute exposure risks. But it also allows for the protection of confidential business information, non-reporting of low-concentration ingredients and only requires the listing of substances that have been well documented to represent a health or safety risk—not those for which the evidence of such risks is just emerging.

To satisfy the demands of those in today's transparency movement, companies must be proactive by voluntarily getting certified by third-party organizations, or completing an in-depth inventory of the chemical makeup of their products.

The primary document that architects and designers are demanding is a Health Product Declaration, or HPD. For this, manufacturers provide a list of ingredients in the finished product, and then reveal the percentage of that substance in the product and any known health hazard. Ingredient names may be withheld in the final report.

The HPD requires seven basic steps toward disclosure:

- IDENTIFY.** Fill out manufacturer information and product description.
- INVENTORY.** Collect the documentation and list product contents.
- ASSESS.** Review contents against authoritative chemical Hazard Lists.
- COMPLIANCE.** Provide the details of product testing and compliance.
- ACCESSORIES.** Note installation / maintenance / cleaning / operations materials.
- SUMMARIZE.** Confirm the summary page, fill in explanatory notes & release date.
- PUBLISH.** Share with your customers.

SAMPLE HPD FORM

APPENDIX A – HPD TEMPLATE

Name
Product ID
Website
Manufacturer
Address
Address Line 2
City, State, Code
Description

Classification
Contact Name
Title
Phone
Email

Release Date
Expiry Date
HPD URL

☐ Self-declared
☐ Second Party
☐ Third Party

Certifier
Certificate #

SUMMARY
The content of this product was assessed for health hazard warnings as required using

Responsible Disclosure
☐ Measured 100 ppm (ideal)
☐ Measured 1000 ppm
☐ Predicted by process chemistry
☐ As per MSDS (1,000 & 10,000 ppm)
☐ Not disclosed
☐ Other

Full Disclosure of Intentional Ingredients
☐ Yes ☒ No

Disclosure Notes
☐ Yes ☒ No

Contents in Descending Order of Quantity (if the area below is full, refer to the following pages for additional listings)

Hazards
☐ PBT
☐ Persistent and Bioaccumulative Toxicity
☐ Cancer
☐ Gene mutation
☐ Development
☐ Reproductive
☐ Endocrine
☐ Respiratory
☐ Neurotoxicity
☐ Immune
☐ Skin or Eye
☐ Aquatic toxicity
☐ Land toxicity
☐ Physical hazard
☐ Irritant warning
☐ Ozone depletion

Highest concern GreenScreen score - no ingredients benchmarked
☐ Multiple
☐ Unknown

Total VOC Content
Material (g/l)
Regulatory (g/l)
Content Notes

Does the product contain exempt VOCs?
Are VOC-free links available?
☐ N/A ☐ Yes ☐ No
☐ N/A ☐ Yes ☐ No

Certifications and Compliance (if the area below is full, refer to the following pages for additional listings)
VOC Emissions
VOC Content

Health Product Declaration Standard v1.0
hpdcollaborative.org

Health Product Declaration v1.0 (15 Dec 2012) - Summary - hpdcollaborative.org - Page 1 of 7

An HPD is no guarantee of a healthy product; it is simply a giant first step to give consistent baseline information on product content. Certification organizations have collaborated to make the HPD a one-stop shop for providing needed data for their different certifications. However it is not mandatory.

Once the data is received, certification programs from Declare and Cradle to Cradle use it to assess a product's hazards, either against a multi-level rating system or a straight forward content requirement.

In some cases the results—including ingredients—are made public, but this decision is frequently left to the manufacturer. Building professionals know that the Cradle to Cradle process, for example, requires full disclosure of content only to evaluators, while Declare encourages full public release of ingredients.

CERTIFICATION/ASSESSMENT SYSTEMS

PROGRAM	DESCRIPTION	PRO	CON
Material Safety Data Sheets (MSDS)	Required reporting that provides basic information about chemical ingredients and emissions.	Captures short-term risks.	Does not capture long-term risks, chemical names, or risks from chemicals in low quantities.
Safety Data Sheets (SDS)	The reporting format that is replacing MSDS sheets, with mandates taking effect in June 2015.	Captures acute and chronic risks.	Protects identity of low-concentration ingredients. Does not require listing emerging chemicals of concern.
Health Product Declaration (HPD)	A format to disclose product contents, emissions and health hazards.	Discloses product contents and known hazards from those contents, based on the GreenScreen framework.	Exposure pathways are not considered. Ingredient names may be withheld.
Cradle to Cradle (C2C)	A multi-attribute certification that uses five categories of evaluation criteria: energy use, water use, corporate social responsibility, material reutilization and material toxicity.	Rigorous screening by trained auditors based on multiple tiers of red list, including some based exposure assessment.	Chemical ingredients are not disclosed publically.
C2C Material Health Certificate	A new certification option from C2C that just addresses materials toxicity (one of the five categories of impacts addressed by C2C).	Same as above.	Same as above; also tradeoffs with impact other than materials toxicity is not incorporated.
Declare	A database of products with at least 99 percent of their ingredients publically disclosed.	Even proprietary ingredients constituting greater than 1 percent of the product must be disclosed; flags any ingredients on the Living Building Challenge Red List of highly dangerous chemicals.	Products can be listed regardless of toxicity.
GREENGUARD	A certification that proves a product meets set emissions thresholds based on actual testing off-gassing from the product.	Actual testing is a good way to determine air quality impacts from having a product in a space.	Doesn't address exposure routes for toxic ingredients other than inhalation; doesn't address product contents that are not volatile and listed on relevant lists.
SCS Indoor Advantage	Similar to GREENGUARD Children and Schools	Same as above.	Same as above.

APPENDIX A

Harmful Chemicals in Insulation Products

The Path Toward Safer Chemicals

The research for safer chemical alternatives is a slow-moving field. To learn more, explore the following organizations, which are leading the charge for safer and healthier products in the built environment:

BUILDINGGREEN	www2.buildinggreen.com
CHEMHAT	www.ChemHat.org
CLEAN PRODUCTION ACTION	www.cleanproduction.org
CRADLE TO CRADLE CERTIFIED PRODUCTS PROGRAM	www.c2ccertified.org
HEALTH PRODUCT DECLARATION COLLABORATIVE	www.hpdcollaborative.org
HEALTHY BUILDING NETWORK	www.healthybuilding.net
INTERNATIONAL LIVING FUTURE INSTITUTE	www.living-future.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.

CLEAN ECONOMY

MANUFACTURING CENTER

The **Clean Economy Manufacturing Center (CEMC)**, an initiative of the BlueGreen Alliance Foundation, focuses on job creation opportunities in the emerging clean economy industries such as renewables and energy efficient products. The Center serves as a ‘one-stop shop’ for public officials looking to develop clean economy strategies for their communities as well as manufacturers looking to participate in supply chains in these markets.



www.bgafoundation.org