

Energy Efficiency Supply Chain Study

FINAL REPORT
October 14, 2010





ABOUT THE WDC

The Workforce Development Council of Seattle-King County (WDC) is a nonprofit workforce “think tank” and grant-making organization whose mission is to support a strong economy and ensure the ability of each person to achieve self-sufficiency. Established in 2000 by the King County Executive and the Mayor of Seattle, the WDC is led by a board of directors with a private-sector majority. We oversee a wide range of employment-related programs and initiatives, serving thousands of King County youth, adults and businesses each year.

To learn more about the WDC, visit www.seakingwdc.org.



ABOUT SKILLUP WASHINGTON

SkillUp Washington is a collaborative of state, city, foundation, and education champions for success - for potential workers and employers - with a specific, proven plan for altering the way we seize opportunity within the King County community. SkillUp Washington’s primary goal is to build a stronger economy that benefits local employers and working adults through increased postsecondary attainment for low-income working adults, increased advancement into family-supporting jobs that support long-term career plans among low-income working adults, and increased employer access to qualified workforce.

To learn more about the SkillUp Washington, visit www.skillupwa.org.

Project Context and Objectives

The Northwest Energy Efficiency Opportunities Project has led an effort to explore related opportunities in manufacturing and leveraging the region's strengths in energy service companies. This study focuses on:

- 1) Understanding where component parts installed during a commercial building retrofit are manufactured; and
- 2) Identifying likely opportunities for local manufacturing job creation in the commercial building energy efficiency retrofit industry.

Targeted interviews were conducted with key individuals and firms in the commercial retrofit industry in order to collect information about the retrofit market and potential economic development opportunities.

SUMMARY OF FINDINGS

- **Puget Sound's strength in this market is our expertise in energy efficiency services (ESCOs).** Given the progressive stances that utilities have taken on energy efficiency in this region, Washington has developed a robust set of firms, energy service companies (ESCOs), specializing in energy efficiency goods and services.
- **Most components used in an energy efficiency retrofit are not manufactured in the Puget Sound region,** and there appears to be limited opportunity for local entry into the major component market for commercial building retrofits. Most manufacturers in these markets are large, well-established corporations in their respective industries and have dominant market share. Manufacturing locations are concentrated in the Midwest, South, and East regions of the U.S. and outside of the U.S.
- There are a **handful of firms in the region that were identified which are manufacturing, fabricating, or installing key components** in the commercial building retrofit market. While not a large number, these companies demonstrate that local firms can be competitive in these markets. These firms have been able to carve out smaller, more specialized market niches for their goods and services.
- Leveraging the region's unique competitive assets against likely market opportunities, the Puget Sound's region's best economic development prospects are likely to be in three different areas:
 - **Capturing a greater share of the local market in building envelope manufacturing/fabrication.** As demand matures for commercial building retrofits, there is an opportunity to support a greater amount of local manufacture of components in building cladding products for retrofits throughout the larger region (Vancouver, British Columbia in the north and Portland, Oregon in the south). By out-competing other firms in this region, local firms could capture a greater market share.

- **Creating goods and services in the optimization of building components and systems.** The optimization of building components is a dynamic and young market, and much of it remains unsettled. While some of the market has traditional building controls manufacturers, there are also some relatively smaller companies that focus on particular systems or market segments in an effort to specialize. There are a few local companies participating in this market.
- **Creating goods and services in building system integration and building efficiency performance.** This market opportunity addresses a key supply-side constraint: the vast majority of the market for commercial retrofits is in private buildings, and this market is not growing above the replacement rate for energy efficient components because vendors are not able to guarantee a level of building efficiency and cost savings. The region is taking a lead in crafting economic development strategies to address this challenge with the end result of creating firms, jobs, and products in the system integration field that will spur this market. The products are likely to feature both a software and hardware interface.
- Based on the opportunities listed above, most of the **local workforce needs are suggested to fall out from the material in building controls system integration work.** While there is some expected growth in manufacturing sectors, **most firms in this area did not cite the need for traditional manufacturing skills** and instead use on-the-job training to pass on any custom or specialized skills related to manufacturing or fabrication. For building systems integration work, most industry experts cited a need for workers with general skills including general engineering, software and programming, design, and energy auditing; and more specialized skills in installation and technical expertise in building controls and energy system optimization.

ENERGY EFFICIENCY SUPPLY CHAIN STUDY

BACKGROUND

Energy efficiency and commercial energy retrofits are a key part of the of current national policy discussions around the issues of building cost-savings, greenhouse gas reductions, energy independence, and economic productivity. In the Puget Sound region, the presence of many nationally prominent energy services companies (ESCOs) and funding from the American Recovery and Reinvestment Act have generated the interest of local policy makers seeking to understand how opportunities in this area may increase the regional's economic, social, and environmental welfare. Commercial energy retrofits have been identified in multiple recent studies as a high growth sector, with significant potential to create new jobs for people with targeted post-secondary training and appropriate skills.

Project Objectives

- Describe the commercial building energy efficiency retrofit market
- Describe the major components and manufactured parts in a commercial building retrofit
- Identify local firms in the commercial building energy efficiency retrofit supply
- Identify additional manufacturing opportunities in the retrofit supply chain
- Identify local workforce needs in manufacturing and other sectors

In 2009 SkillUp Washington provided support for the creation of NEWOP; a workforce intermediary that brings together industry representatives, government, labor and college partners for a robust discussion around the energy efficiency industry. The Workforce Development Council of Seattle-King County (WDC) has facilitated all NEWOP meetings, convening and guided the development of several NEWOP products.

NEWOP has sponsored this effort to explore related opportunities in manufacturing, leveraging the region's strengths in energy services companies. This study focuses on 1) understanding where component parts installed during a commercial building retrofit are manufactured; and 2) identifying likely opportunities for local job creation.

While manufacturers are the focus of this study, it is important to acknowledge the diversity of jobs and skill sets involved in building retrofits, including engineering and building trades. Further, ESCOs are a diverse set of companies that are involved in all phases of a retrofit chain project.

Given the region's relative concentration of ESCOs, this study will examine how this expertise can be leveraged to enhance local firms' participation in the commercial building retrofit process, as well as consider the workforce implications of growth in this market.

INVESTIGATIVE METHODS

In the short amount of time available for this project, targeted interviews with key individuals and firms in the commercial retrofit industry were conducted in order to collect information about the retrofit market. A word of thanks is extended to the many NEWOP members who served as invaluable resources in informing the understanding and direction of this study. Appendix A presents a list of all interviewees. Interviews were selected across three principal focus areas:

Key industry participants

These individuals were selected based on their ability to provide a broad perspective on the energy efficiency retrofit market, its players, and key dynamics. They played a role in describing components and key manufactured parts, as well as identifying local economic development opportunities.

Retrofit contractors and component distributors

These individuals represented the buyers and distributors of components sourced as part of any given local commercial retrofit. They played a significant role in identifying manufacturers of major components used in commercial retrofits.

Local firms in the energy efficiency retrofit industry

Throughout the interviews, a great deal of attention was directed at identifying local firms in the industry and trying to understand their location decisions and business issues. Interviews with such firms focused on the local area's strengths and challenges in this market, as well as where they thought the local economic development opportunities might lay.

The manufacturing location(s) of companies identified in this study were the result of contacting the actual company or through web research.

Sample Questions from Interviews

- What are the major component pieces that can comprise a commercial building energy efficiency retrofit?
- How do commercial retrofitters source their components? What does the product distribution system look like?
- How do you fit into the energy efficiency retrofit market for commercial buildings? Who do you work with? Who do you buy from and sell to? Who are your major competitors locally/nationally?
- Looking along the supply chain, what do you see as the major opportunities for the Puget Sound?
- What do you see as the comparative advantage of the Puget Sound area? What other kinds of businesses like yours are you seeing in the market?

DESCRIPTION OF ENERGY EFFICIENCY RETROFITS

Retrofit Market Dynamics

A retrofit is the addition of new technology and features to older existing systems in a building. Making a building more energy efficient can be achieved through a range of different measures, from exchanging light bulbs to upgrading mechanical systems. This study focuses on retrofits in commercial buildings, which include office, retail, and mixed use buildings. Retrofits of industrial buildings are not included in this study; preliminary research indicates that industrial retrofits tend to be highly specialized and focused on increasing efficiency within the industrial processes itself, rather than on the building.

Customer Segmentation

The commercial retrofit market can be segmented into two distinct customer types:

- **Institutional customers** include public agencies, universities, schools, and hospitals. Federal and state funding for greater building energy efficiency is helping create demand for retrofits in this customer segment.
- **Private customers** include privately-owned offices, hotels, and mixed-use buildings. Given current economic conditions and uncertainties, these customers are not as active in the retrofit market, but there is significant market potential.

Market Drivers

Retrofits are part of a building's lifecycle. As buildings age, energy efficient retrofits may be implemented as a result of equipment failure or due to the early retirement of equipment to achieve greater energy efficiency. Currently, the demand for retrofits is being stimulated by incentives from public agencies:

- **Utility incentives:** Public utilities encourage both commercial and residential customers to become more energy efficient through a host of financial incentives and tools. For example, Puget Sound Energy offers businesses grants for energy efficiency retrofits and new construction, rebates for specific energy efficient products, programs to enhance operations and maintenance practices, and tools to monitor energy usage.
- **Federal and state funding:** Investment in green buildings, and energy efficiency retrofits in particular, for institutional customers has been a focus of federal and state grant programs. In 2009 and 2010, the Puget Sound Region received \$117.7 million in American Recovery and Reinvestment Act funds for green building and energy efficiency related activities. At the state level, the Department of Commerce and the Office of Superintendent of Public Instruction received a total of \$100 million of state funding for energy efficient school retrofits.

In addition to the financial incentives described above, there are a number of broader market trends that poise the retrofit market for growth in the future, including rising energy costs, increasing concern regarding greenhouse gas emissions, and a greater overall awareness of energy efficiency and “being green.” Building certification programs, such as the U.S. Green Building Council’s LEED program, are setting standards and providing third party verification of building performance.

Market Challenges

While there is significant growth potential for the commercial retrofit market, there are also current market constraints, including the following:

- **Current economic conditions and uncertainty.** The current recession has deterred investment in building retrofits, particularly among private building owners.
- **Uncertainty in return on investment and retrofit efficacy.** By increasing the energy efficiency of building systems, retrofits can result in cost savings over the lifecycle of a building. However, the time horizons may be too long for existing owners to realize benefits. In addition, it is often difficult to guarantee energy savings, given new technology and the complex interplay between building systems and how building occupants use those systems.

Regional Market Characteristics

When asked about the Puget Sound region and the retrofit market, stakeholders interviewed identified the following noteworthy characteristics:

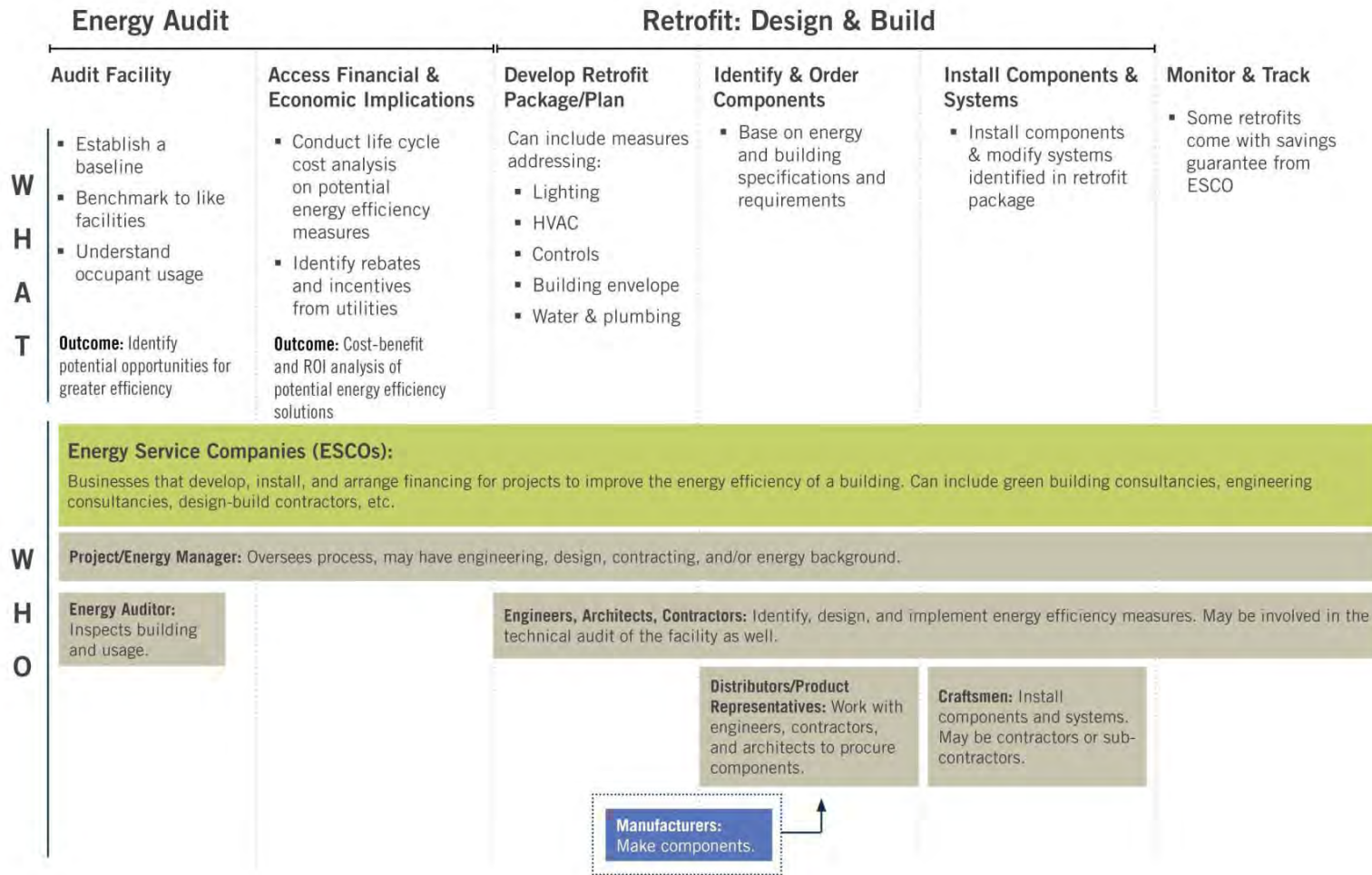
- **Northwest climate and energy costs.** The Northwest’s low energy costs and a moderate climate lessen the potential demand for building retrofits in this region. Building retrofits can produce a larger magnitude of energy cost savings in other U.S. regions where costs are higher.
- **Northwest leadership in building energy efficiency.** The Northwest region of the U.S. and the Puget Sound region in particular are at the forefront of energy efficiency services. The region is home to a number of energy service companies (ESCOs) — companies that develop, install, and arrange financing for building energy efficiency projects — including industry leaders such as McKinstry. This concentration of ESCOs greatly contributes to the region’s expertise in building energy efficiencies.

LEED is voluntary certification program that can be applied to any building type during any phase of a building’s lifecycle. Certification aims to improve building performance in the areas of: energy savings, water efficiency, CO2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

Energy Efficiency Retrofit Projects: Process and Players

An energy efficiency retrofit is a multi-step process and involves many players, as presented in Exhibit 1 and described on the following pages.

Exhibit 1: Retrofit Process



Source: BERK 2010.

Energy Audit. The first step in a building retrofit is an assessment of a building's current operating performance to identify all potential measures to increase the building's energy efficiency. This process is usually conducted by an energy auditor and includes: establishing a building baseline, benchmarking the building against other like facilities, and understanding how occupants use the building.

After the preliminary technical assessment, a financial assessment is also conducted to identify the efficiency measures with the greatest potential return on investment. Relevant rebates and other financial incentives from local utilities are examined and a lifecycle cost analysis is conducted to develop a retrofit package that enhances energy efficiency and is financially feasible.

Retrofit: Design and Build. Engineers, architects, and/or contractors then work to design and implement the energy efficiency measures identified in the retrofit package. Most manufactured components are procured through a product representative, and these parts are ordered according to building specifications and energy requirements. Subcontractors and craftsmen install components and systems in the building. In some cases, ESCOs may offer a savings guarantee for the retrofit, in which case the building is monitored for performance.

Key Takeaways

The focus of this study is the manufacturing of component parts that are installed during a commercial building retrofit. With this focus, there are some key takeaways to be gleaned from the retrofit process description:

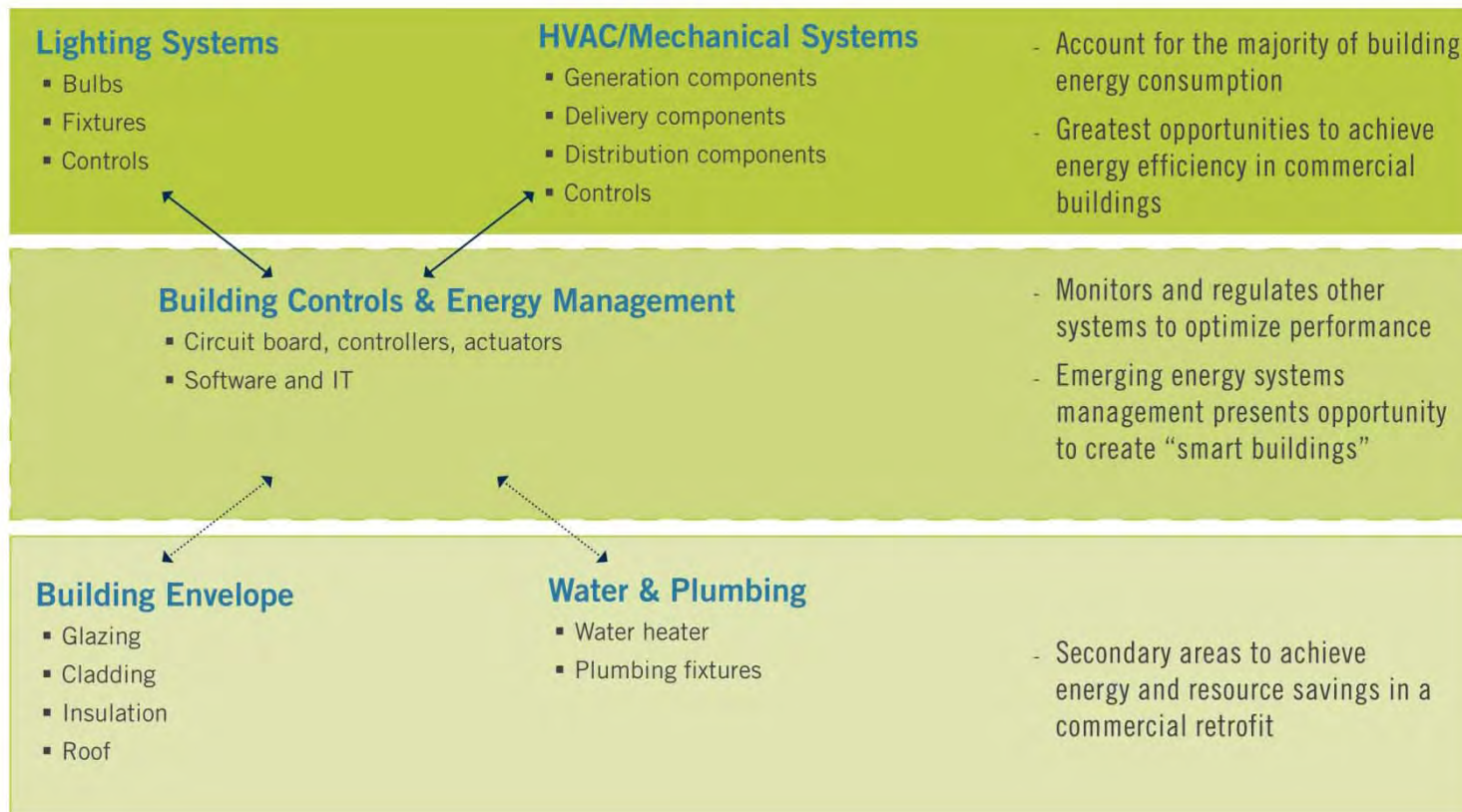
- Manufacturers are one of many players involved in a retrofit process. While manufacturers are the focus of this study, it is important to acknowledge the diversity of jobs and skill sets involved in building retrofits, including engineering and building trades.
- ESCOs are a diverse set of companies that are involved in all phases of a retrofit. Given the region's relative concentration of ESCOs, this study will look towards how this expertise can be leveraged to enhance local firms' participation in the retrofit process.

Key Building Components and Systems

In a commercial building, there are five main areas of a building that may be modified to achieve energy efficiencies. Exhibit 2 organizes these systems in three categories, with more description on the following two pages:

- **Greatest potential for efficiency gains:** lighting and HVAC are presented first as they offer the greatest potential efficiency gains in a commercial building;
- **System integration and optimization:** building controls and energy management has the potential to integrate and control different building systems to optimize performance;
- **Secondary efficiency gains:** Building envelope and water and plumbing systems also offer opportunities for efficiency gains, but in general, these gains tend to be relatively smaller than other retrofit measures in commercial buildings.

Exhibit 2: Building Systems and Components



Source: BERK 2010.

Lighting. Lighting is the single largest operating cost of commercial buildings in the U.S., constituting approximately 30% to 50% of total annual electrical energy consumption in U.S. office buildings¹. A building's design and, in particular, its use of day-lighting, affects the efficiency of a lighting system. In a retrofit, where the building's design is mostly a given, a lighting system's component parts are examined to identify areas for increased efficiency. These main components are:

- Bulbs;
- Fixtures, which include a reflector system, or encasement, around the bulb and may include transformers or ballasts; and
- Controls, which include sensors and control panels, which can automate turning the lights on and off.

Components may be upgraded to higher efficiency models, and enhanced control systems can be used to automate lighting functions.

HVAC. The HVAC system, which maintains the temperature of the indoor environment, is another major consumer of energy in a commercial building. In small-scale commercial buildings, HVAC systems may be comprised of a packaged unit or split units. In larger-scale buildings, however, the main components of HVAC are:

- Generation components, which include chillers, boilers, heat pumps, and cooling towers;
- Delivery components, which include air handling units, chilled beams, radiators, and variable air volume (VAV) boxes;
- Control components, which include variable frequency drives, control valves, and control dampeners; and
- Distribution components, which include ducts and pipes.

Components may be upgraded to higher efficiency models, or more sophisticated controls can be applied to components to enhance energy efficiency or regulate usage.

Building controls and energy management. Building controls monitor and regulate other systems to optimize performance. Traditional building control systems include circuit board/digital controls, temperature controls and sensors, and actuators. Emerging technology and systems are currently being developed to take building controls to a more sophisticated level of performance and energy management through more sophisticated software and IT. The idea is to create a "smart building," in which individual components are performing at the optimal level, building systems are working together, and building occupants can monitor, track, and manage the building's energy usage and performance.

¹ Los Alamos National Laboratory Sustainable Design Guide

Building envelope. A building's envelope consists of all materials and components that enclose the interior environment from the exterior environment. The building envelope and the materials used are heavily influenced by the building's architectural design and aesthetic. Key components include:

- Glazing, which includes transparent walls made of glass and plastic, and Onsite energy generation and storage, such as the installation windows;
- Cladding, which includes all materials used to enclose the building, from metal or concrete products that provide an exterior covering;
- Insulation; and
- Roof.

Onsite energy generation and storage, such as the installation of solar panels on a building roof, presents a host of other opportunities to make a building "more green," but was not included in the scope of this study.

Components may be upgraded to better regulate light and heat between the indoor and outdoor environments.

Water and plumbing. Water heaters and plumbing fixtures, such as faucets, toilets, urinals, and showers comprise a building's water and plumbing systems. Components can be upgraded to be more energy and water efficient.

SUPPLY CHAIN ASSESSMENT: COMPONENT MANUFACTURERS

This section builds from our description of the retrofit process by describing the manufacturing landscape of key component systems involved in commercial retrofits. First, we identify major manufacturers of the five commercial building systems described in the previous section and locations of their manufacturing facilities. Second, we look within the State of Washington and identify local manufacturers involved in the retrofit supply chain.

Manufacturing Market for Key Retrofit Components

A building retrofit can touch upon several different building systems and a number of component parts. Exhibit 3 presents the following aspects of the supply chain assessment:

- **Major manufacturers and fabricators:** This sample of manufacturers is based on interviews with industry experts. Manufacturers listed include the major players in the industry and in some cases, firms that occupy particular market niches. While this is not a comprehensive inventory, the sample enables broad assessment of market conditions and maturity for each building area.
- **Manufacturing and fabrication locations:** Geographic locations of manufacturing and fabricating locations were obtained through online research and phone calls to key manufacturers listed. This location list is a sample based on available information, not a comprehensive list of all manufacturing locations of the manufacturers listed. Of the major manufacturers contacted, most had a number of manufacturing locations worldwide. Companies with a known presence in Washington are italicized and bolded.

Key Takeaways

Most components involved in a commercial building retrofit are not manufactured in the Puget Sound region or in Washington State. Most manufacturers are large, well-established corporations in their respective industries and have dominant market share. Manufacturing locations are concentrated in the Midwest, South, and East regions of the U.S. and outside of the U.S. More detailed descriptions regarding the supply chain of each building area are presented below.

**Exhibit 3: Commercial Retrofit Supply Chain: Manufacturers and Manufacturing Locations Sample of Major Manufacturers/Fabricators
Sample of Manufacturing/Fabrication of Systems and Components Locations**

	Sample of Major Manufacturers/Fabricators of Systems and Components	Sample of Manufacturing/Fabrication Locations
Lighting	<ul style="list-style-type: none"> • Cooper Lighting • GE • Lithonia • Lutron • Sylvania • Philips • Vantage Controls 	<ul style="list-style-type: none"> • Mexico • China • Midwest (OH, WI, IN, KS) • South (GA, KY, TX, VA) • East (NY, PA, MA) • West (UT)
HVAC	<ul style="list-style-type: none"> • AAON • Carrier • Cerus Industrial • <i>Haakon</i> • Johnson Controls • Lennox • McQuay • Metal Aire • Multistack • Nailor • Price • Smardt • Titus • Trane • York 	<ul style="list-style-type: none"> • Canada • Mexico • China • Midwest (WI, MN, IN, IA) • South (SC, KY, TX, OK, NC) • East (NY) • West (AZ, NV, OR, WA)
Building Controls & Energy Management	<ul style="list-style-type: none"> • Alerton (Honeywell) • Automated Logic Systems (ALC) • American Auto-Matrix • Belimo • Johnson Controls 	<ul style="list-style-type: none"> • International (Canada, Mexico, France) • Midwest (OH, IA, NE, IN, MO) • South (SC, TN, KY, TX, GA) • East (PA, CT)

Building Envelope (Focus on Glazing)

<ul style="list-style-type: none"> • KMC Controls • Siemens • Schneider Electric 	
<ul style="list-style-type: none"> • Anderson • Hartung Glass • Marvin • Milgard • Northwestern Industries • Old Castle • Pella • Viracon 	<ul style="list-style-type: none"> • British Columbia, Canada • Northwest (WA, OR) • West (UT, CA, CO, AZ) • Midwest (MN, MI, IL, IA) • South (GA, TX, VA) • East (NY)
<p>Water & Plumbing</p> <ul style="list-style-type: none"> • AO Smith • Aerco • American Standard • Bradford White • Kohler • Zurn 	<ul style="list-style-type: none"> • International (Mexico, China, India, Canada, Brazil, Guatemala) • South (SC, TN, AR, NC, TX, KY) • Midwest (WI, OH, MI) • East (NJ, NY) • West (1 manufacturing plant in WA)

Source: BERK 2010.

Lighting. Stakeholders noted that lighting manufacturing is a mature market, dominated by large, multi-national companies. Within lighting, large companies have market dominance in the manufacturing of bulbs/lamps, ballasts, and transformers. There is greater market fragmentation in the manufacturing of fixtures, where smaller, niche firms compete with larger companies. Fixture manufacturers tend to also be active in the manufacturing of lighting controls.

HVAC. Stakeholders noted segmentation in the market between standard and custom HVAC units and parts. The standard HVAC market is a well-established and dominated by major companies, including Carrier, Lennox, Trane, and York. The custom market is comprised of relatively smaller firms and tends to focus on particular customer or use types. In addition, given the complexity of larger HVAC systems, there are additional manufacturers of particular component parts.

Building Controls & Energy Management. This is a dynamic market, currently in flux. There are traditional building controls manufacturers listed above, which include large companies and some relatively smaller companies that focus on particular temperature controls and sensors. However, in addition to manufacturers, IT companies, such as Cisco and IBM, and software-based application vendors, such as Archibus, Converge, and EnergNOC, are entering the energy management market².

Building Envelope: Focus on Glazing. As described in Section 3.0, the building envelope consists of a number of materials used to enclose the building. Given the response rate of potential stakeholders in this area, this section focuses on glazing. This is also an area that is particularly well-suited for retrofits, as it is less disruptive than the replacement of other building envelope components.

Float glass, or glass sheets, are typically made by a few large companies, including PPG Industries, Pilkington, and Guardian Industries. Exhibit 3 above focuses on glass fabricators, or companies which cut, shape, coat, and assemble the insulated glass units ready for installation. In the fabrication market, companies are segmented by customer and building type, including high end commercial, light commercial and residential. Stakeholders noted that commercial glass fabrication is dominated by key large companies with regional fabrication hubs. Large companies set up regional fabrication factories, given the cost of shipping insulated glass units. In addition, stakeholders noted that there are smaller independent fabricators that serve a local market area, usually spanning 100 to 300 miles from their fabrication plant.

Water & Plumbing. This is a mature market with well-established companies. It should be noted that AO Smith, a water heating manufacturer, has one plant located in Renton, Washington. This facility specializes in custom, special-order water heaters, which are then shipped worldwide. In an interview with the facility's head of manufacturing engineering, it was noted that the facility was located decades ago and that today the cost of labor is significantly higher compared to other company plants.

² "Commercial Energy management Systems Market to Surpass \$6B by 2014," Sustainable Business.com, June 29, 2010.

Washington Firms in Component Manufacturing

As described in the previous section, most major components involved in commercial building retrofits are not manufactured in the Puget Sound region or in Washington State. However, there are a handful of firms in the region that were identified and are manufacturing, fabricating, or installing key components in the commercial building retrofit market.

While not a large number, these companies demonstrate that local firms can be competitive in these markets, despite the market landscape described in the previous supply chain description. These firms have been able to carve out smaller, more specialized market niches for their goods and services. Beyond, this, there are a few common features of these markets that these firms have been able to take advantage of:

- Markets oriented around service to regional and local markets;
- Markets with fewer competitors; and
- Emerging markets.

Exhibit 4 lists some summary characteristics of a sample of firms located in Washington State.

Exhibit 4: Sample of Firms in Washington State

	Optimum Energy	Evluma	Robinson Solutions (formerly Energy Savings Management Systems)
Location	Seattle, WA	Seattle, WA	Mukilteo, WA
Founded	2005	2008	1998
Employees	50	~15	16
Primary Customers	Commercial Building Owners and Engineering Firms	Utilities, Co-ops, and Municipalities	Fast food restaurants
Description	Energy-saving HVAC building	Energy-saving solid state illumination (LED) lighting products.	Advanced small building automation and energy management systems

Source: BERK 2010.

Optimum Energy is an example of a local firm that has successfully developed a market in HVAC control systems. By developing a software and hardware product that allows an existing HVAC system to run more efficiently, they have created a specialized area for their product. Also, since they make such a unique product, there are no existing competitors in their field. While much of their market is outside of the Washington, this lack of competitive pressure allows Optimum to remain headquartered in Seattle – the home town of the company’s founder and a reflection of this region’s quality of life.

Haakon, a custom HVAC manufacturer does its West Coast manufacturing in Cheney, Washington, and is an example of firm that is located in the region in order to serve a larger regional demand (East Coast market is served by production in Ontario, Canada). Additionally, Haakon is the only provider of large custom HVAC systems in the nation. Additionally, this is a common strategy among glazers as well, most of whom serve local demand, with most customers coming from a 100 - 300 mile area.

Robinson Solutions³ is a 14 year old company specializing in energy management systems for commercial restaurants, primarily quick service restaurants. Their customers also include, to a lesser extent, supermarkets and gas stations. They assemble “complete solution” management systems which monitor and control how energy is expended in various ways in these businesses. While there is strong competition in energy management systems, Robinson Solutions have been able to offer a strong product in a segmented market oriented towards quick service restaurants.

Evluma manufactures solid state illumination (LED) products. LED lighting in is an emerging market since there are both advantages and disadvantages to its use. However, since the technology has not gained widespread acceptance in the marketplace, there are no clear market leaders, and Evluma has been able to carve out a niche oriented around outdoor lighting.

³ Energy Savings Management Systems (ESMS) was purchased by Robinson Solutions in July 2010 during the scope of this study. While ESMS was a locally based company, Robinson Solutions is based outside of Washington with multiple national offices.

ECONOMIC DEVELOPMENT OPPORTUNITIES AND WORKFORCE IMPLICATIONS

While our current manufacturing for energy efficiency is very modest, this section looks forward to the future of the industry and explores some reasons to be more optimistic given targeted regional economic development efforts in clean energy.

Market Outlook for Commercial Building Retrofits

The energy efficiency commercial building retrofit market will be driven by federal energy policy, utility companies, rising energy prices, and increasing social responsibility. The drivers are likely to be robust and will move the market forward. An American Council for Energy Efficient Economy report has estimated US spending on energy efficient technologies and infrastructure will grow from \$300 billion in 2004 to \$700 billion in 2030⁴.

The best-funded opportunities for energy retrofits today are major upgrades in institutional buildings, especially in public buildings. This market, already strong because of federal and state policy mandates, received a boost from ARRA with spending in 2009, 2010, and 2011. Local allocated spending from ARRA on retrofits approaches \$118 million. The current market is small compared to its potential, due to an assortment of barriers within various industry segments. These public institutional buildings comprise a small percentage of existing commercial space, where the potential is for energy retrofits in private commercial buildings. It is estimated that there is currently a \$36.5 million market in commercial buildings retrofits for private sector properties in downtown Seattle core⁵.

Performance verification refers to the lack of certainty on the return on investment of building efficiency investments due to “real world” challenges such as climate, building condition, and human factors.

Technology integration speaks to the systems level integration needed to operate complex energy systems in the building.

Regional Economic Development Opportunities

Regional opportunities will be driven by growth in the energy efficiency market and how competitive the Puget Sound region will be in capturing market share of that growth. Given that most components used in an energy efficiency retrofit are not manufactured in the Puget Sound region, there appears to be limited opportunity for local entry into the major component market for commercial building retrofits. However, the presence of local firms in the energy efficiency retrofit market has demonstrated that the region can be competitive in specialized, emerging markets, particularly in support of the region’s expertise in energy efficiency services.

⁴ Ehrhardt-Martinez, Karen, John “Skip” Laitner, “The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture” (American Council for an Energy Efficient Economy (ACEEE), 2008)

⁵ Personal communication, Perry England, MacDonald Miller, 2010.

While the industry faces many challenges, the Puget Sound Prosperity Partnership established a priority focus to address performance verification and technology integration as part of its recently completed Metropolitan Business Plan conducted to grow the region's energy efficiency cluster. Most industry experts felt that the economic development focus for the region should be placed on areas where we are likely to be competitive given our regional strengths and where the market is likely to grow. A list of strengths highlighted by interviewees is shown in the sidebar.

Leveraging the region's unique competitive assets against likely market opportunities, the Puget Sound's region's best economic development prospects are likely to be in three different areas:

- Capturing a greater share of the local market in building envelope manufacturing/fabrication;
- Creating goods and services in the optimization of building components and systems; and
- Creating goods and services in building system integration and building efficiency performance.

These three areas are described in greater detail below.

Opportunity: Capture greater share of local market in building envelope manufacturing

The opportunity in this area primarily revolves around building cladding products. Given the relative bulk and high transportation costs involved in delivering these products, firms typically serve a smaller regional market. As demand matures for commercial building retrofits, there is an opportunity to support a larger amount of local manufacture of components in cladding products to support retrofits throughout the greater region (Vancouver, British Columbia in the north and Portland, Oregon in the south). By out-competing other firms in this region, local firms may capture a greater share of the market.

Puget Sound's Major Competitive Assets

- **Utilities** will continue to play a key role in energy policy and the promotion of new efficiency measures
- Local **ESCOs** represent knowledge and skill base in energy efficiency know-how
- **IT/Software** clusters are increasingly core competencies in energy efficiency work. As buildings get "smarter", they need more complex and integrated control systems
- **Energy-oriented research centers** will be involved in innovation and commercialization
- **Quality of life**, our region ranks high as a place to live and work
- The Northwest's **moderate climate** is prime testing ground for building efficiency design and performance monitoring.

For the few local firms that manufacture or fabricate components in the region, they did not cite a shortage of manufacturing/fabrication skills as a constraint on business expansion. Generally, interviewees pointed out that they hire employees with traditional manufacturing skills and use on-the-job training to pass on any custom or specialized skills related to manufacturing or fabrication. The current slack in the economy has produced a glut of available manufacturing labor that firms are able to draw from when they do hire. Due to the prevalent practice of using on-the-job training to transfer specialized manufacturing skills, there does not appear to be a particular need for adding workforce training programs for these skill sets.

Opportunity: Optimization of building components and systems

This opportunity mirrors the demonstrated success of a few local firms in the commercial building retrofit market. It entails improving energy efficiency of existing building components through customization and better optimization of the component control systems. A feature of this market is that it has an engineering, software, hardware manufacture, and installation dimension to it. In other words, firms are using a mixture of in-house developed software and the fabrication of custom components to enable existing building energy systems to function at higher efficiency.

This is a dynamic and young market, and much of it remains unsettled. While some of the market has traditional building controls manufacturers, there are also some relatively smaller companies that focus on particular systems in an effort to specialize. Companies like Optimum and Robinson Solutions use their expertise in their field to develop more specialized products, allowing them to reach a broader market while avoiding competition with larger multi-national firms.

Several interviewees of industry players cited a need for employees with more integrated skills to support these industry niches. They frequently cited need for employees with mechanical skills plus other specialized skills (e.g. needing someone who knows HVAC and software). An interviewee suggested local job training programs had addressed these integrated skills in times past, but are not currently being addressed by the traditional education and training system. The difficulty in finding employees with integrated skills has led firms turning to either 1) recruitment outside the region, or 2) spending significant resources to train experts in a traditional field with specialized skills of a different (or emerging) field.

Opportunity: Building system integration and building efficiency performance

This opportunity addresses a key supply-side constraint identified earlier in this report: that the vast majority of the market for commercial retrofits is in private buildings, and that this market is not growing above the replacement rate for energy efficient components because vendors are not able to guarantee a level of building efficiency and cost savings.

BETI proposed in the Prosperity Partnership's Metropolitan Business Plan, would serve as a critical tool to expand the Central Puget Sound Region's energy efficiency industry cluster. BETI is designed to support the creation of products and firms that allow for more efficient buildings through real-time energy management using information and communications technologies that integrate multiple buildings systems. This opportunity represents matching the regions energy efficiency intellectual capital with its software development and specialized hardware manufacture/fabrication assets.

The Prosperity Partnership is addressing this challenge through the proposed creation of the Building Energy-efficiency Testing and Integration Center (BETI) as part of their Metropolitan Business Planning process. BETI is designed to catalyze innovation in the system integration area by providing an arena for the testing and efficiency demonstration of new products so they can be introduced to the marketplace.

The BETI is designed to work in tandem with other local efforts like the McKinstry Innovation Center to develop and grow local firms in the energy efficiency industry. While competition will be intense in this industry, there is reason to believe that the Puget Sound region could emerge as a market leader since:

- Much of the competitive landscape is unsettled;
- There are relatively few barriers to entry into the market, unlike those that exist in the traditional manufacture of energy efficient component;
- There is a good match of the region's competitive assets and the productive inputs needed for this emerging market.

If these efforts prove to be successful, the region could see a growth in products/services specializing in building system integration and building efficiency performance. It would likely create jobs in both the technical and manufacturing fields since the products would like have both a software and hardware component, and would need installation and maintenance services. In terms of the job impacts in this area, it is estimated that the building controls market could reach \$7 billion in 2020⁶, leading to the creation of anywhere from 25,000 to 50,000 jobs in this industry⁷. Depending on the success of efforts like BETI and the McKinstry Innovation Center, the Puget Sound could be poised to capture a significant portion of this growth.

While it is uncertain what type of companies the nature of the jobs that may emerge from these economic development efforts, many of the industry experts interviewed thought that this segment of the energy efficiency industry would need general skills in:

- Engineering,
- Software and programming,

McKinstry Innovation Center

The McKinstry Innovation Center, located on the McKinstry campus, is an energy efficiency development and commercialization center, with 26,000 square feet of flexible office space. It is designed to stimulate entrepreneurial collaboration between companies in the energy efficiency and renewable energy market, particularly those developing new technologies, products and services and to eliminate waste and create efficiencies in the built environment. There are currently 6 companies renting space at the center, with a potential capacity of 20-30 companies.

⁶ Webber, Alan, "Energy Management Systems for Commercial Buildings: Energy Efficiency, Demand Response, and Advanced Building Management Systems" (Pike Research, 2009)

⁷ Jobs estimates developed from a range of job multipliers commonly found in the energy efficiency industry (BERK, 2010)

- Building design,
- Energy auditing;
- More specialized skills in the installation building controls and component system optimization, and,
- Technical expertise to support product operation.

It is important to note that the immediate job impacts stemming from this economic development effort will likely come from firms working directly in the innovations to the systems integration/building performance area. However, it will also have indirect impact on other firms in the energy efficiency industry cluster, such as ESCOs and the local firms profiled in this study. It also worth acknowledging that these building solution oriented innovations will ultimately drive demand in retrofit construction projects where trades such as plumbers, electricians, metal workers, etc are involved and employed.

Appendix A**Industry Experts and Stakeholders Interviewed**

BERK conducted 30 stakeholder interviews to inform the description of energy efficient retrofits, manufacturing of retrofit components, and opportunity assessment sections of this report.

Industry Participants

Sherry Ambrose, Associate Economic Policy Analyst, Puget Sound Regional Council/Prosperity Partnership

Joseph Hauth, Director of the Puget Sound Industrial Excellence Center

David Landers, Director of Business Management, Puget Sound Energy

Thomas McLaughlin, Executive Director, Center for Advanced Manufacturing Puget Sound

Stan Price, Director, Northwest Energy Efficiency Council

Eric Schinfield, Economic Development Program Manager, Puget Sound Regional Council/Prosperity Partnership

Retrofit Contractors and Component Distributors

Darrel Aldrich, Vice President, Northwest Industries

Dan Barrett, Vice President, Sellen Construction

Rand Conger, Design Engineer, Johnson-Barrow Inc.

Perry England, Vice President, MacDonald-Miller Facility Solutions

Rick Fellows, Sales/Marketing, Control Contractors

Andy Gerde, Lighting Specialist, Trade Ally Network

John Gundlach, Energy Services Manager, Hermanson Company LLC

Dan Hering, Business Development Manager, PSF Mechanical

Bill Konrady, Owner of Custom Mechanical Solutions

Mark Larson, Sector FEA Manager, Portland Energy Conservation Inc.

Curtis Longan, Distributor, Contractor Sales Representative, Pacific Lighting Systems

Steve Mangold, Vice President in Engineering, Benson Construction

Steve Nelson, Vice President, Cardinal Glass

Jerry Owens, Vice President, Industrial Air Systems

Rae Anne Rushing, Co-founder and President, Rushing Company Jim Sinclair, President of Air Commodities Manufacturing

Scott Sherman, Project Engineer, Affiliated Engineers

Eric Strandberg, Senior Lighting Specialist, Lighting Design Lab

Local Firms in the Retrofit Supply Chain

Karli Barich, Energy Directive Manager, Robinson Solutions (formerly Energy Efficiency Management Systems)

Art Barnes, Head of Manufacturing Engineering, AO

Smith Renton Wade Bodlovic, CEO of Greenfoot Technologies

Rick Collins, President and Founder, Green Efficiency Group

Tedd Fillips, Vice President of Service Sales and Operations, ATS Automation

Nathan Rothman, Founder and CEO, Optimum Energy



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120 Lakeside Avenue
Suite 200
Seattle, Washington 98122
P (206) 324-8760
www.berkandassociates.com

Principals Bonnie Berk and Michael Hodgins
Project Manager Morgan Shook
Analysts Julia Bosch and Gary Simonson