

**ECONOMIC DEVELOPMENT OPPORTUNITIES  
FOR  
PORTLAND'S GREEN BUILDING INDUSTRY**

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**Prepared For**



**CITY OF PORTLAND  
OFFICE OF SUSTAINABLE DEVELOPMENT  
A BETTER FUTURE. A BETTER NOW.**

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## Executive Summary

The Portland Development Commission (PDC) and the Office of Sustainable Development (OSD) are collaborating on research and activities to expand the regional sustainable industries cluster. As part of that effort, this study is the first step in evaluating economic development opportunities within the green building industry, including opportunities for import substitution. Through interviews with leading local green building design teams, the project team identified opportunities for green building products, services and systems that could provide economic benefits for the City and state.

Portland has a vital and well-recognized green building industry, with the most LEED-registered green buildings per capita. This report, based on interviews with leading green building professionals, is designed to help stimulate discussion and shape an agenda to strengthen Portland's emerging green building industry.

The following eleven potential product and service focus areas are identified based on input from the design teams and on local economic activity and Oregon resources. They were the most commonly cited needs or opportunities.

- 1. Modular construction and prefabrication.** Many interviewees see great potential in building on Oregon's manufactured home and coach industries to develop prefabricated or modular building components for green buildings.
- 2. Photovoltaics and active solar power.** There is significant interest from green builders to integrate solar power into their buildings, though it is usually deemed cost prohibitive. New financial tools and policies may make solar power feasible for more local green buildings. With two new regional solar manufacturers, there appears to be an emerging solar cluster in Oregon.
- 3. Third-party certified wood and value-added wood products.** Many interviewees reported challenges with the cost, availability or quality of certified wood and wood products. Several also noted that it is difficult to source regionally grown certified wood. New to Oregon are producers of certified medium density fiberboard free of added urea-formaldehyde.
- 4. Integrated design services.** Expertise in integrated design is one reason Portland is regarded as a leader in green building. This service can be promoted and exported to other burgeoning green building markets.
- 5. Integrated manufactured building material units.** There is growing demand for manufactured building material units including structural insulated panels (SIPs) and insulated concrete forms (ICFs). Opportunities exist to develop similar products here, potentially using Oregon agricultural waste products.
- 6. Agrifiber composite panels.** Wheatboard is most cited by interviewees as a product for which there is significant demand and whose raw materials are abundant in Oregon.

Wheatboard could be used locally by existing cabinetry shops and could be combined with non-urea formaldehyde adhesives.

7. **Substitutions for Portland cement in concrete.** There is interest in reducing the use of Portland cement in concrete. Most design teams interviewed support recycling fly ash for use in concrete. Many concrete manufacturers are importing supplemental fly ash from Canada and China to meet demand. Slag, a byproduct of smelting ore, was also identified for use in place of Portland cement.
8. **Countertops with recycled content.** Multiple interviewees are interested in an affordable green alternative to plastic laminate for countertops. Recycled content found in countertop products are typically either agricultural waste/byproducts or post-consumer materials including paper, plastic and glass. Opportunities exist for similar products to be produced in Portland using local or regional agricultural byproducts or recycled materials.
9. **On-site water treatment.** There is a significant unmet demand for products that facilitate stormwater retention and reuse as well as grey and blackwater treatment and reuse. Economic development in this area will need to include regulatory changes which will allow new storage and filtration systems to be used.
10. **Building automation systems.** Building automation systems is a field where the green building and high technology industries can come together. Regional high technology skills may be applied to a variety of building system controls and waste and water management.
11. **Clay wall board.** Clay wall board is an alternative to gypsum drywall. Clay is an abundant regional natural resource that offers advantages over dry wall.

Each design team also discussed common challenges they face when developing a green building. These include costs, regulatory barriers, established policies and procedures, and project financing. Higher costs are frequently attributed to the first costs of energy efficient products or the additional premium on green products. Certified wood and solar energy are perceived as cost prohibitive for many projects. LEED certification is expensive and can be cost prohibitive for smaller-scaled projects. Code appeals are another source of added costs.

Many design teams face challenges implementing innovative or unconventional practices because they are inconsistent with the established building and zoning codes. The most often-cited regulatory barrier is linked to waste water treatment and reuse. This is an opportunity area for Portland that will require policy changes to be implemented.

Design teams also note that City policy and procedure can be inconsistent at different bureaus. This “silo effect” can inhibit the development of green, as well as conventional, buildings.

Green buildings have unique initial, operating and life cycle costs not easily accounted for by current financing methodology. The long-term cost savings and benefits of green buildings have

not yet been quantified extensively enough to be reflected in financing tools or insurance policies.

The design teams interviewed offered a variety of suggestions on ways to remove these barriers and strengthen the local green building industry. Several interviewees believe that although Portland is currently regarded as a leader in green building, it will need strong leadership and aggressive policies to maintain its position as a leader. Another common point is that, compared to other municipalities, green building in Portland relies more heavily on private-sector action rather than public policy. Many interviewees would like to see PDC and the City market Portland as a leader in green building and sustainability industries.

Interviewees recommend several specific ways in which the City could facilitate and support green building, including financial incentives, regulatory systems that facilitate green building and building regional economic development alliances (e.g., certified wood products). Many green building professionals also point out that Oregon's forest and agricultural industries could be strategically linked to green building in a mutually beneficial way. Certified, value-added wood products are a particularly strong opportunity.

Several interviewees suggest ways that waste recycling and reuse could be a strong industry, potentially including closed-loop material flows. Others support linking high technology and green building.

Another common theme was application of green building practices to a larger scale, such as neighborhood or urban renewal areas. Many energy and development solutions not feasible for individual buildings may become feasible at larger scales.

Many interviewees would like Portland to be home to a green building testing, research and demonstration center, potentially linked to the Oregon Bio-Economy and Sustainable Technology (BEST) Center.

There appear to be significant opportunities to support expansion of the green building industry in Portland, but further strategies are needed to:

1. link suppliers with green building professionals;
2. overcome barriers posed by tax, regulatory and purchasing policies; and
3. develop a broad strategy to support the evolution of the green building industry.

## Introduction

The City of Portland is popularly regarded as a national leader in urban sustainability and green building. This reputation is supported by multiple City policies and programs, including the City's Green Building Policy<sup>1</sup> and Portland Development Commission's (PDC) Green Building Policy<sup>2</sup> which require green building standards and/or certification for City-owned or PDC-funded projects. The City of Portland's Green Investment Fund (GIF)<sup>3</sup>, which has invested over \$1.5 million in green building practices since 2005, has also raised the City's profile in the green building industry.

PDC has supported economic development in the sustainable industries based on research completed in the environmental services and technologies cluster and the broad strategy defined in Portland Future Focus. In 2006, OSD and PDC partnered through a Memorandum of Understanding (MOU) to build upon the Sustainable Industries Target Industries Plan, which called for a study to help evaluate economic development opportunities within Portland's green building industry. This study is a result of that collaboration between PDC and OSD.

Cogan Owens Cogan, LLC conducted twelve group interviews with leading regional architecture, planning and design teams who predominantly produce commercial green building projects. Some interviews also included contractors, developers and building owners. (Appendix 1 lists the firms participating in the interviews and the interviewees; most interviews included representatives of multiple firms.)<sup>4</sup>

*This report is intended to stimulate discussion among green building and economic development professionals.*

The primary purpose of the interviews (see Appendix 2) is to identify import substitution opportunities<sup>5</sup> — products and services that might be provided locally and regionally in place of products and services that are currently imported from outside the region. Each team was asked to identify:

- major green building goals;
- products and services used to meet those goals;
- products that were not locally or regionally sourced;
- the biggest opportunity for green building industry products;
- City policies or actions that would support the industry.

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<sup>1</sup> <http://www.portlandonline.com/shared/cfm/image.cfm?id=112682>

<sup>2</sup> <http://www.portlandonline.com/shared/cfm/image.cfm?id=112680>

<sup>3</sup> <http://www.portlandonline.com/osd/index.cfm?c=ecbde>

<sup>4</sup> This analysis was produced by a team composed of Cogan Owens Cogan, LLC (COC) and SERA Architects. COC is responsible for overall project management, team interviews, analysis of the results and drafting this report. SERA team members were responsible for advising on project and interview strategy, key questions for the interviews, and product and service categorization and characterization. Because SERA is a competitor with other design teams they did not have access to the interview results attributable to any individual or team.

<sup>5</sup> For more information on import substitution and economic development concepts, see Appendix 4.

This report is based on the qualitative information from the interviews. The study does not provide specific product market research (e.g., how large is the market for manufactured housing?) or objective analysis of specific product substitution opportunities (e.g., whether wool fiber can be used for insulation). Instead, it highlights the product/service ideas that the design teams most often cited as potential candidates for import substitution. The report also includes a discussion of barriers to green development and concludes by highlighting key opportunities for strengthening and growing Portland's green building industry.

This report is intended to stimulate discussion among green building and economic development professionals about these and other opportunities for growing the local economy.

## **Part A: Green Building Product and Service Opportunities**

In each of our interviews, green building specialists discussed products and services they currently use, they would like to use but could not, or that they would use if such products or services existed. This “wish list” of products, services and systems represents a fraction of the demand generated by local green building activity but is illustrative of gaps in the market and some unmet needs. Interviewees also identified products that might be appropriate for production in Portland.

The following section discusses 11 potential opportunity areas for economic development in the Portland green building sector. These 11 items are the most common and/or most promising suggestions from the design team interviews. These are illustrative examples of areas in which economic development activity may be appropriate for Portland given existing business and industries and Oregon’s available natural resources. This section presents the need or demand for each product, service or system, its “green characteristics,” potential local market advantages and illustrative examples.

A compilation of all products and services cited in the interviews is included as Appendix 4. Products or product types are listed in the product opportunity/substitution matrix (Appendix 4). Examples are listed with their source location and other information. Products referenced in this study are not endorsed by Cogan Owens Cogan, SERA Architects, Office of Sustainable Development or Portland Development Commission. Nor is this intended to be a comprehensive listing of green products or services.

### **1. Modular construction and prefabrication**

Many of the design professionals interviewed see potential in linking Portland’s green building activity with Oregon’s manufactured home and coach industries. There is growing interest within the green building community in using prefabricated or modular building components, including value-added wood products.

Modular building and prefabrication are regarded as natural partners to green building. Construction occurs in climate-controlled factories which reduces problems with mold and other indoor environmental quality issues. Factory construction also reduces site impacts. Modular building minimizes waste and scrap materials; manufacturers can buy materials in bulk, driving down cost and waste. Factory construction is typically regarded as more energy efficient and relatively affordable. The building process is typically quicker and more efficient, reducing overall energy input.<sup>6</sup> Modular and pre-fabricated materials can be flat-packed for more efficient transportation and the carrier units themselves can sometimes be converted to building materials.

Interviewees reported that some manufactured home companies in other regions of the US are positioning themselves to create modular components for green buildings. Oregon has a strong

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<sup>6</sup> Western North Carolina Green Building Council; <http://www.wncgbc.org/>

manufactured home industry that could produce modular components for green buildings. A 2003 analysis of Oregon economic clusters identified 13 mobile home manufacturers and 22 companies creating prefabricated buildings and components.<sup>7</sup> In addition, there are several mobile home/coach companies in Oregon.

## 2. Solar photovoltaic (PV) and thermal (hot-water) systems

Many design teams are eager to include on-site renewable energy as an integrated component of their green buildings. However, interviewees were in general consensus that integrating solar power into green buildings is cost-prohibitive. Several interview teams reported studying the feasibility of solar on specific projects but not including it due to high costs and/or long payback periods. Some green building professionals feel that having access to photovoltaics in building-integrated products (such as PV shingles or PV glazing) may make them more feasible. Many felt that expanding the use of solar energy systems in the Portland region will require some combination of greater incentives, lower system costs and continued rising energy prices. These concerns may be mitigated somewhat by energy related bills passed in this year's state legislature, outlined in more detail below.

*The solar industry is potentially synergistic with the existing high technology industry in the region.*

Portland was recently named an inaugural Solar America City, which included a \$200,000 federal grant to help the City of Portland facilitate the widespread adoption of solar technology. These funds will be used to educate the public, build demand for solar technology and increase economic opportunity for solar manufacturers and installers.

With the location of SolarWorld and Solaicx in the region there appears to be an emerging solar cluster in Oregon. The solar PV industry seems to be synergistic with the existing high technology industry in the region (both are based on silicon technologies). Such an emerging cluster could develop by focusing attention on incubating, growing and attracting manufactures, suppliers, installers, maintenance and management, and financial firms.

The cost of installing solar equipment can be greatly reduced, in some cases up to 50%, because of federal and state tax incentives and Energy Trust of Oregon programs. Widespread use of solar installations in Portland requires creation and growth of solar development companies with the capacity to take advantage of tax breaks and sell the power related to distributed solar installations. Ideally, rooftops can be leased from building owners by the solar development companies. In exchange, the solar development company would install and own the facility. After the 10-15 years of tax credits and power sales, the solar development company could transfer ownership of the installation to a building owner for the remaining 25-35 years of life of the equipment.

The policies adopted during the 2007 Oregon legislative session addressing state renewable energy policy, include:

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<sup>7</sup> Based on SIC codes: Impresa, Inc 2003; <http://www.oregon4biz.com/p/Cluster.pdf>.

- a renewable portfolio standard requiring all utilities and electricity service suppliers serving Oregon to include in their portfolio of power sold to retail customers a percentage of electricity generated from qualifying renewable energy sources<sup>8</sup>;
- requirements that 1.5% of the budget for construction of state-funded new public buildings be used to include solar technology in the project;
- a change to net metering rules that allow renewable energy generators and commercial scale projects to be compensated to 2 megawatts. (The previous limit was 25 kilowatts.);
- the expansion of the Oregon Business and Energy Tax Credit from 35% to 50% for on-site renewable power equipment.

These legislative changes enable an innovative delivery model known as third party investment. This model, already in use in California and Minnesota, is most likely to be utilized in projects where the owner does not have tax liability (i.e. institutions, governments, non-profits, etc.). In these cases, a third party investment group capitalizes the renewable energy system; then extracts the cash incentives, tax credits and federally allowed accelerated depreciation over a 6 – 9 year period.

The investment group then has a number of different options including selling power back to the building over the long term, selling the system to the building owner for at its depreciated costs (a small fraction of its original cost), or a variety of leasing options. This investment model (and its many derivatives) could dramatically accelerate the uptake of solar and wind power systems in Oregon in the near term.

### **3. Third party certified wood and value-added wood products**

Third-party certified wood was a common topic in the design team interviews. Interviewees report a variety of barriers to using certified wood in green buildings and there is some disagreement on the value of, and potential for, the widespread use of certified wood.

The primary example of a third-party wood certification standard noted by Portland design teams is the program developed by the Forest Stewardship Council (FSC). Interviewees report a variety of issues with the use of FSC certified wood, particularly that both supply and demand is uncertain and unpredictable. Many green builders also believe that FSC certified wood is too costly to include in their project. The chain of custody requirements, which mandate each forest manager and fabricator of the wood be certified to ensure the product installed is generated from a well-managed forest, contribute to both of these challenges. The added time and expense due to the chain of custody requirements have made many design teams and contractors reluctant to seek out certified wood. Other teams feel that there are products or systems that provide higher ecological value than certified wood. For example, one firm reports they chose not to pursue

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<sup>8</sup>For more information, see: [http://www.puc.state.or.us/PUC/Senate\\_Bill\\_838.shtml](http://www.puc.state.or.us/PUC/Senate_Bill_838.shtml)

FSC wood in lieu of investing in a more efficient HVAC system. FSC is viewed as cost-prohibitive for affordable housing projects.

Many interviewees also point out that it is difficult to find certified wood that is from regional forests, while many certified woods are exotic tropical varieties from Asia, South America and the Baltic Region. This creates a trade-off for the builders between supporting certified forests and trying to source building products regionally.

Regionally harvested FSC certified wood is often shipped to other countries to be incorporated into building products. For example, at least one Oregon wood window manufacturer<sup>9</sup> allows the designer to specify that their window frames will be made using regionally harvested FSC certified Douglas Fir; but then this timber is sent to Manitoba, Canada for the manufacturing process. Oregon-grown Pepperwood and Madrone are crated to Guatemala to be manufactured as engineered wood flooring due to the absence of any significant hard wood industry on the West Coast and lack of mills to process these woods. Wood Floor Resource Group, a major manufacturer of a variety of engineered wood flooring, engages with these regional producers in order to create a value-added product and support the FSC industry in Oregon.

However, there are instances where FSC certified wood is harvested and manufactured in Oregon. Green Mountain Woodworks is a company based in Ashland that focuses on producing solid wood flooring that is FSC certified and northwestern native. Roseburg Forest Products and The Collins Companies are two manufacturers of FSC certified products including sheathing, plywood, siding and formwork.

There are mixed opinions on the actual quality of FSC wood. One design team reported purchasing 2-3 times the needed quantity of FSC wood to ensure they would have enough of the desired quality. This clearly creates a significant amount of waste, undermining overall sustainability goals. Other interviewees feel the quality issue has generally been resolved.

Certified wood can also be used in composite products made with non-urea formaldehyde adhesives. For example, Columbia Forest Products uses Purebond, a soy-based adhesive, in all of their hardwood plywood and particleboard products which range from *JayCore* and *KayCore*, its premium veneer substrates, to the more streamlined Purebond Particleboard. All of these products are made using 100% FSC certified fibers. *PureKor*, distributed by Panel Source International based in Alberta, Canada, is a medium density fiberboard (MDF) made from 100% FSC certified fibers without added urea-formaldehyde.

Several interviewees comment that it is difficult to source MDF made without added urea-formaldehyde. However, in addition to the internationally-sourced product referenced above, several regional manufacturers create MDF made from 100% post-industrial recycled content without using urea-formaldehyde. Sierra Pine in Medford, Oregon, has three such products: *Meditate II*, *Medex*, and *Arreis*. Roseburg Forest Products manufactures a similar product called *Skyblend*.

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<sup>9</sup> Loewen

#### **4. Integrated design services**

One of the primary reasons Portland is regarded as a leader in green building is the quantity and quality of its green building professionals who serve the region and west coast. One service for which Portland has developed leadership is integrated design.

Integrated design is a method involving professionals from multiple design-related disciplines to create higher-performing buildings at lower costs. Integrated design typically involves architects, mechanical engineers, lighting and electrical specialists, landscape architects, interior designers and other allied professionals.<sup>10</sup> Integrated design, through finding greater efficiencies at the building scale, has contributed to significant energy savings for many projects<sup>11</sup>. This is in part achieved with energy modeling, including computational fluid dynamics — a branch of fluid mechanics, to examine how air flows through a green building.

Many Portland-based consulting companies are working in other cities. As public awareness of environmental issues grows and green building becomes more common there is great potential to export Portland's expertise to new markets throughout the country. Promoting these services and building on the City's reputation for green building innovation can continue to strengthen Portland-based firms. PDX Lounge, a networking and promotion event which debuted at the 2006 GreenBuild conference in Denver, was an excellent example of innovative, cluster-focused marketing and a successful public-private partnership.

#### **5. Integrated manufactured building material units**

Many of the products Portland green building professionals cite as potential local opportunities are wall systems or building components, including "green" structural insulated panels (SIPs) and insulated concrete forms (ICFs).

SIPs are high-performance building panels used for walls, floors and roofs traditionally composed of polystyrene or polyurethane insulation sandwiched between two layers of oriented strand board (OSB). Interviewees identify a "green" SIPs product that has an agrifiber core in lieu of the petroleum-based foam insulation. The manufacturer, Agriboard Industries, is located in Kansas and uses wheat and rice straw sourced from North Texas. Several SIPs manufacturing facilities operate in the Pacific Northwest, such as Precision Panel, which has a number of fabrication facilities including one in Klamath Falls, Oregon, and Premier Building Systems located in Fife, Washington. Considering the availability of wheat and other agricultural crop waste in the Pacific Northwest, manufacturing a similar "green" SIPs product regionally is possible.

ICFs are modular wall blocks that serve as forms for poured concrete walls. ICFs are durable, insulative and provide acoustic barriers as well as backing for drywall or exterior siding. They

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<sup>10</sup> US Department of Energy: <http://www.eere.energy.gov/buildings/info/design/integratedbuilding/>.

<sup>11</sup> Additional information on integrated design can be found at <http://www.gvrd.bc.ca/Buildsmart/integrated-design.htm>

contribute to energy savings by reducing air flow through the concrete<sup>12</sup>. ICFs can be used in conjunction with ecologically-friendly insulation. For example, Durisol Building Systems, a company based in Canada and Europe, manufacture an ICF made predominantly from waste wood and Portland cement that is 100% recyclable. The Durisol ICF is also available as a “thermal wallform” which adds interstitial rockwool insulation. There are opportunities to recruit related firms to Portland or to develop similar products here.

## **6. Agrifiber composite panels**

Interviewees most often cite wheatboard as a product opportunity for which there is significant demand and whose raw materials are abundant in Oregon. Wheatboard is currently not readily available on the market since the only known mass producer (Dow Chemical) ceased production. Yet, wheat is grown in abundance in Eastern Oregon and other agricultural byproducts from processing straw, rice or barley may also be used to create a panelized substrate.

When it was available, wheatboard was primarily used as an alternative to MDF or particleboard. If produced in Oregon, wheatboard could be used locally by existing cabinetry shops and would meet national and possibly international demand. Non-urea formaldehyde adhesives, such as Columbia Forest Products’ *Pure Bond*, could be sourced from the greater Portland region in order to manufacture the product.

## **7. Substitutions for Portland cement in concrete**

There is interest in reducing the use of Portland cement in concrete as it is highly energy intensive and a significant generator of greenhouse gas emissions. Most design teams interviewed support recycling fly ash for use in concrete. Fly ash is a byproduct of coal-burning power plants, of which there are two in the Pacific Northwest (in Centralia, Washington and Boardman, Oregon). The quality of fly ash varies with the source of the coal burned and the emission standards set for the power plant. As noted by one major supplier<sup>13</sup> in the Pacific Northwest, the annual demand for Portland cement in Washington is approximately 3 million tons and in Oregon, an additional 1.5 million tons. The current amount of fly ash produced between the two regional power plants is about 450,000 tons annually. This correlates to only a ten percent substitution potential for Portland cement used in the region, and the amount of fly ash available will likely decrease over time as other energy sources come on-line. Yet, it is not unusual for projects using fly ash to specify Portland cement substitutions of 30% or more; LEED has a recognized innovation credit for 40% substitution. As a result, many concrete manufacturers are importing supplemental fly ash from Canada and China to meet the demand.

Slag, a byproduct of smelting ore, was also identified for use in place of Portland cement. This aspect of the steel industry is not present in the Pacific Northwest. Therefore, if used, slag is often imported from Japan by concrete manufacturers. The use of crop ash, a byproduct of the

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<sup>12</sup> [www.cement.org](http://www.cement.org)

<sup>13</sup> Glacier NW

agricultural industry, is strictly regulated by the US EPA and not allowed as a substitution due to the quantity of heavy metals in the ash.

## **8. Countertops with recycled content**

Multiple interviewees are interested in an affordable green alternative to plastic laminate for countertops. Several countertop products containing recycled content are on the market. However, several green building professionals interviewed cite products with recycled content and/or natural fibers as very expensive and either cost-prohibitive for some building types (e.g., affordable housing) or are eliminated during value engineering. Recycled content found in countertop products are typically either agricultural waste/byproducts or post-consumer materials including paper, plastic and glass.

Opportunities exist for similar products to be produced in Portland using local or regional agricultural byproducts or recycled materials. Potential source materials include Eastern Oregon wheat, Willamette Valley agricultural byproducts, or recycled paper, plastic or glass. The products outlined below provide more specific information on substitution opportunities.

Canopy is a company headquartered in Portland, Oregon. Among other products, they manufacture *Palouse* and *Dakota Burl Fusion*, two solid surface countertop options made from 70% agricultural byproducts and 30% acrylic resin. The products are manufactured in Oregon; however, the agricultural byproducts are sourced from the Mid-West. The main component of *Palouse* is wheat board; *Dakota Burl Fusion* is primarily composed of sunflower husk board.

*Paperstone Certified* is a regionally produced solid surface countertop made in Hoquiam, Washington, by Paneltech International LLC. It is primarily composed of 100% post-consumer recycled paper bonded together using a water-based and petroleum-free resin system. The paper is sourced locally to the manufacturer from the Grays Harbor Paper Company.

Squak Mountain Stone, based in Woodinville, Washington, manufactures a solid surface countertop made from 100% Washington sourced material, including post-consumer recycled paper, post-industrial recycled glass, coal fly-ash and Portland cement. The overall product is composed of over 50% recycled content.

Icestone, LLC manufactures a product of the same name in Brooklyn, New York. The solid surface countertop material is primarily composed of 100% recycled glass (a combination of post-industrial and post-consumer recycled material) and concrete; it does not contain any petroleum-derived materials.

*Durat* is a polyester solid surface countertop manufactured in Finland. Approximately 50% of the product is recycled plastic sourced from waste raw material from other industrial processes throughout Scandinavia.

*Fuez*, a new Portland firm, produces countertops with recycled glass and fly ash concrete.

## 9. On-site water treatment: rain/gray/black

Water conservation is a key goal of green building. This includes stormwater retention and reuse as well as grey and blackwater treatment and reuse. There are a variety of regulatory barriers to commercial water reuse (discussed in more detail in the following chapter) although Portland does have successful examples of water treatment systems at varying scales.

A number of homes in Portland have installed rainwater collection systems that are used for irrigation, while fewer also use it to flush their toilets. A few include a filtration system that treats water to potable standards.

There are few examples of wastewater re-use at larger scales. Two notable examples of successful projects are the Station Place Apartments owned by REACH and the OHSU Center for Health and Healing. Station Place is an affordable housing complex for seniors, which collects stormwater to augment toilet flushing. The OHSU building collects stormwater and uses a membrane bioreactor to treat blackwater for reuse as irrigation, toilet flushing and in its cooling tower.

There is a significant unmet demand for financially feasible and legal rain and waste water storage and treatment systems. Economic development in this area will need to include regulatory changes which will allow new storage and filtration systems to be used in the region and throughout the state. The local climate provides great opportunity for development of a variety of rain and waste water storage and treatment systems for many different building scales.

*There is unmet demand for financially feasible and legal wastewater treatment systems.*

## 10. Building automation systems

Building automation systems is a field where the green building and high technology industries can come together. Oregon has very strong capacity in semiconductors, control and measurement systems and open source software. In addition, Intel<sup>14</sup>, Microsoft, and Hewlett Packard have had significant initiatives such as “intelligent” buildings, “smart” buildings, connected homes and homes of the future. In general, these initiatives have focused on the use of high tech solutions in:

- computer and audio-visual connectivity (can be used for telecommuting);
- security systems;
- smoke control systems;
- lighting systems and window management;
- heating and cooling systems;
- energy production and distribution;

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<sup>14</sup> Intel connected home initiative  
[http://www.intel.com/pressroom/kits/connectedhome/connected\\_backgrounder.htm](http://www.intel.com/pressroom/kits/connectedhome/connected_backgrounder.htm)

- water use and reuse;
- waste management;
- healthcare and patient monitoring.

Some design teams report challenges with building automation systems, particularly for small to mid-scale buildings. One firm had difficulty fine-tuning their window operation system for optimal performance. There is a need for technology to coordinate multiple systems for a medium or large scale building.

It appears there has been limited dialogue between Portland's green building industry and regional high tech companies. This opportunity deserves further exploration.

## **11. Clay wall board**

Clay wall board is an alternative to gypsum drywall. Clay is an abundant regional natural resource which offers advantages over dry wall. Clay wall board regulates temperature, absorbs and diffuses water, and reduces noise levels. Clay wall boards may be entirely composed of natural materials.

*Claytec* clay board, which is manufactured in Germany, is a combination of clay, reed and hessian.

*American Clay*, based in New Mexico produces plasters made from natural clays and recycled and reclaimed aggregates that are used as an alternative to cement, gypsum, acrylic and lime plasters. Their plasters are non-dusting, mold and fade resistant, repairable and control moisture.

## **Part B – Major Green Building Challenges**

Each of our interviews included a discussion of the development team’s green building goals. These goals range from ethical and philosophical convictions to seeking a marketing advantage in the private market. We heard, however, that developing a green building with finite financial resources often involves trade-offs and concessions. By focusing on what the barriers to reaching these specific goals are, and what the general challenges of building green in Portland are, we can identify strategies for the City and PDC to better facilitate and encourage green building practices through financial support, policy changes or other actions.

The most commonly cited issues and challenges from the interviews are discussed below and include cost, regulation, City administration and project financing.

### **Cost**

Green building products often have a cost premium over their conventional counterparts. This may be attributed to a level of risk associated with innovation or because many new products have not reached an economy of scale. On the other hand, green building products may be more valuable in that they can be more durable and less costly to maintain. Several interviewees also discussed costs associated with LEED certification. Using products or services to qualify for a LEED credit can be more expensive than other approaches. In addition, the LEED certification process is itself an added project cost, which is particularly limiting for the small commercial and affordable housing markets.

*“Zero transportation cost is its own incentive.”*

Although opinions differ on how great the green building cost premium is, it is generally accepted that most green buildings have higher up-front costs but lower overall operating and life-cycle costs due to lower energy and water consumption. Teams with significant LEED experience are developing buildings with little or no additional direct costs. Research is needed that compares the initial, operating and life-cycle costs of green buildings and better quantifies their return on investment.

Several interviewees express a desire for pre-designed, packaged stormwater retention and treatment systems. Systems that capture, treat and reuse water on-site are often cost-prohibitive for green builders. The costs associated with these systems are two-fold:

- system infrastructure costs are substantial, particularly for large, on-site storage tanks;
- appealing code restrictions creates additional costs.

There are not yet clear established financial incentives for reducing water use and/or stormwater runoff. Some projects in Portland have recently negotiated System Development Charge (SDC) fee reductions in return for calculated water savings, but this is occurring on a project-by-project basis at the initiative of the building owner or developer, in partnership with the City.

Water, sewer and energy system delivery costs determine pricing of these services. Dramatic reductions in use of these services will require new funding models for public capitalization of infrastructure.

Likewise, many interviewees find vegetated roofs as stormwater solutions to be too expensive, both as a line-item cost and for their perceived ecological impact. Some City planning and zoning codes provide Floor Area Ratio (FAR) bonuses for vegetated roofs, but these are rarely used, since they are part of a package of available FAR bonuses within an absolute maximum. Most teams have found that they can achieve all the FAR bonuses possible without the addition of a vegetated roof, so this incentive is currently not being utilized.

Within the building industry, increased energy efficiency is regarded as the most cost effective way to reduce energy costs. Within the energy efficiency industry, the rule of thumb is that every dollar invested in efficiency equals about three dollars spent on electricity generation for the same amount of renewably-generated energy. Our interviewees echo this point and emphasized that energy efficiency and conservation should be a top local priority to reduce costs and avoid pollution and greenhouse gas production.

Oregon's Business Energy Tax Credit (BETC) is widely regarded as a highly effective financial incentive for energy conservation and accelerated adoption of LEED certified green buildings. Energy Trust of Oregon, Inc. (ETO) also offers several incentives for energy efficiency and the use of renewable energy for industrial, commercial and residential buildings. This set of financial incentives is widely used by the green building community and is a model for incentives in other areas.

*“Energy conservation will always be more efficient than renewable energy.”*

Several interviewees note that integrating solar power into a green building is still proving to be cost-prohibitive. There is consensus that without greater incentives, using solar power in the Portland region would not become financially feasible, barring dramatic increases in energy costs.

The Oregon Legislature recently passed legislation increasing the BETC tax credit for renewable energy from 35% to 50%. Taken together with federal tax and ETO incentives, this dramatically improves the cost effective outlook for solar and other renewable energy sources. It is worth noting that each applicant for the BETC Sustainable Buildings incentive is directed to calculate potential savings through the use of solar power, regardless of whether the applicant is planning on using solar energy or not, thus adding an educational component to this state incentive.

## **Regulation**

Many green building practitioners feel that the City's building and zoning codes are not flexible enough to allow products or processes that are unique to green buildings. A few interviewees note that the code does not allow for exceptions despite alignment with City policies and goals. An example is glazing requirements that worked counter to a project's energy-saving strategies for heating and cooling.

The most often-cited regulatory barrier to meeting green building goals is linked to wastewater and rainwater reuse. It is frequently noted that the water and plumbing codes are restrictive and decentralization of water management systems is not currently addressed in the codes.

At the present, rainwater may be used for toilet flushing and irrigation for 1 and 2 family homes without appeal. At the same scale, rainwater may be collected and filtered for potable uses by appeal. Rainwater use in commercial or mixed-use buildings is prohibited for any use without an appeal, and the commercial uses allowed by appeal are very limited and have been rare to date.

Greywater (wastewater generated from processes such as washing dishes, laundry and bathing) is also strictly regulated. The State plumbing code does not currently distinguish between greywater and blackwater (sewage). Any greywater use would have to be treated to potable standards as if it was blackwater which is very expensive. Additionally, the state Department of Environmental Quality (DEQ) mandates connecting to a sanitary sewer line if available within 300 feet, and paying the associated development fees. This erodes any incentive to disconnect from the water and/or sewer systems and to reuse wastewater. There have not yet been any successful appeals for greywater reuse in Portland.

Permitting stormwater and greywater treatment and reuse associated with specific system designs would remove a significant hurdle to meeting green building goals and LEED criteria associated with water conservation.

### **City Policy and Procedure**

A challenge that interviewees frequently cite is a perceived “silo effect” between and within City bureaus, which leads to inconsistent policies and requirements for green buildings (although the perceived silo effect is not limited to green buildings). This is more common when dealing with site issues. For example, one firm reports having to develop two bioswales so that water that fell on private property was treated separately from water that hit the street. OSD was identified as a good source of advocacy and promotion of inter-bureau cooperation.

### **Project Financing**

Conventional financing, investment, insurance and appraisal methods are not well suited to green buildings because of the different initial, operating and life-cycle costs and benefits inherent in green buildings. These buildings sometimes have higher up-front costs with lower operating and overall life-cycle costs. However, current financing methodology and tools often do not easily account for a green building’s efficiency improvements and payback periods.

Green building appraisal is difficult because there are few comparable projects that can help determine a project’s premium in the market place. In addition, productivity improvements within green buildings due to daylighting, healthy indoor air quality and non-toxic materials have yet to be quantified definitively in order to be reflected accurately in insurance policies<sup>15</sup>. Several

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<sup>15</sup> Some data is available from Heschong Mahone Group <http://www.h-m-g.com/projects/daylighting/projects-PIER.htm> and the Healthy Building Network [www.healthybuilding.net/](http://www.healthybuilding.net/).

interviewees also note the lack of good empirical data on green building life-cycle cost savings useful to brokers, appraisers and insurance companies.

The need for this quantitative data is an opportunity for the City to partner with academic institutions to develop credible and verifiable studies which explore and support the green building movement. With Portland being one of the nation's leaders in green building development we are well positioned to become a leader in the analysis of green building performance.

## **Part C – Green Building Industry Opportunities**

Because of the interest and creativity of the design team interviewees, several significant opportunities to strengthen the green building industry were identified. The identified opportunities are not attributed to any individual or project team.

Key green building opportunities include:

- strengthen green building leadership;
- focus economic development on the green building cluster;
- focus on incentives and regulations to stimulate new products and services;
- bridge urban and rural Oregon;
- foster green building education and develop partnerships;
- support green building/value-added wood products;
- support green building/materials recycling;
- support green building/high technology;
- expand the green building to large scale urban development;
- create a green building/research and demonstration center;
- develop carbon and other market mechanisms.

### **Strengthen Green Building Leadership**

Many interviewees felt that although Portland is recognized as a leader in green building, the City cannot maintain its leadership simply by continuing past and current practices and programs. It is frequently noted during interviews that other cities (e.g., Santa Monica, Chicago, Austin and New York) are adopting aggressive policies to promote sustainable practices and green building that rival or exceed Portland's current policies. Several of the interviewees would like all levels of the City, from elected officials to staff to embrace the success of the green building industry and seek to market, promote and take action — even difficult action — to grow the industry. Only by embracing existing success can Portland maintain its leadership and continue to move to the next level.

*“Portland took the lead in green building but now everyone is catching up.”*

The design teams exhibit interest in extending the green building policy beyond City buildings to all commercial buildings above a certain scale so that there could be a more comprehensive green building policy and widespread application of green building practices across all sectors of the building industry. Other American cities such as Boston and Washington, D.C., have already implemented similar policies.

Some interviewees also express interest in seeing the City push the envelope by supporting LEED Platinum as a target standard for all public and private buildings of major scale. There is also support for City endorsement of the new Cascadia Region Green Building Council's Living Building Challenge as the next frontier of green building. Many design teams support strong City procurement policies for green building, for example, requiring locally-sourced FSC wood for all City-sponsored or financed facilities to stimulate the FSC wood industry in the region.

## Define and Promote the Green Building Economic Cluster

Input from the interviews reinforces a conclusion that the Portland region already has an established critical mass of businesses operating in the green building sector. Some perspectives consider this sector to be an emerging cluster, which includes the vast array of products and services involved in planning, designing, engineering, constructing and managing buildings. The cluster can also be defined to include the civil engineering and ecosystem services of the entire built environment. Although the scope and scale of the industry can be debated, most of the teams interviewed would like to see the industry cluster as a whole defined and taken seriously as an economic development target.

The Portland Development Commission identifies Sustainable Industries as a target for economic development. PDC and OSD promote green building, recycling and renewable energy as economic development targets.

The interviewed teams widely support defining, in more detail, the green building cluster for future economic development attention.

*“Portland has to start thinking about its economic clusters and how they drive the city.”*

An industry cluster is a group of similar or interrelated firms that share common markets and technologies and draw on similar worker skills. In this environment, competitors, allies and their vendors form a critical mass of expertise, innovation, production capability, skilled labor and financing. Inventing and producing new products gives rise to new businesses, fosters the expansion of existing businesses, attracts firms from other locales and stimulates competition and collaboration among firms. Advantages of focusing on the green building cluster include:

- accumulation of skilled labor in places with a concentration of employers;
- opportunities for specialized supplier firms and strong buyer-supplier relationships;
- shared export markets and import substitution potential;
- spillovers of knowledge among firms;
- competition and collaboration among firms;
- stimulation of research and development, and technology transfer activities.

## Focus Economic Development on the Green Building Industry

Some interviewees believe that despite of Portland’s policy leadership position and private industry strengths, the Portland Development Commission does not place a strong enough emphasis on the green building industry or the overall sustainable target industry cluster. Several interviewees believe that the strengths we have should be expanded further in a number of areas including: branding<sup>16</sup> and marketing international trade, university research and development, regional trade, industrial recruitment, tourism, urban development and transportation investments. Such expansion will require strong political leadership, collaboration with the

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<sup>16</sup> Ideas were suggested such as “It’s Easy Being Green in Portland,” “Portland Naturally,” “Portland Green x Green.”

private sector and colleges and universities. Interviewees are uncertain whether current City leadership sees the amount of potential seen by industry partners. One interviewee commented, “this is who we are. Why can’t we just accept it?”

A powerful economic development strategy for the Portland region can potentially be built on the strengths of the City, private companies, academic institutions and non-profit organizations. However, our interviewees feel it will require stronger leadership by the City.

### **Focus on Incentives and Regulations to Stimulate New Products and Services**

There is a belief that the City has the opportunity to focus incentives and remove barriers to facilitate the development and use of new green building products, systems and services as discussed in Part C. In general, these changes should support:

- taxes and regulations that encourage what we value and penalize what we do not value;
- incentives and regulations that support strong local and regional economic development alliances (e.g., for green building and value-added wood products, recycling-reuse, and industrial ecology);
- incentives that encourage innovation and local green product and system use;
- regulatory systems that facilitate and speed up green development projects;
- advanced energy conservation standards, building commissioning and recommissioning;
- the American Society of Heating, Refrigerating and Air-Conditioning Engineers’ (ASHRAE) Proposed Standard 189, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings;<sup>17</sup>
- the Architecture 2030<sup>18</sup> and the application of the Natural Step Four System Conditions<sup>19</sup> into the green building industry;
- organizations that assist homeowners and small businesses to efficiently utilize existing and future incentives (e.g., photovoltaic installation using BETC, federal tax incentives, and Energy Trust incentives).

### **Bridge Urban and Rural Oregon**

Interviewees indicate that green building, especially with a focus on value-added wood products, manufactured housing and building components, presents the opportunity to strengthen the economic bridge between Portland and rural Oregon. The critical necessary step for this to occur is to have a constructive dialogue and agree on the use of FSC wood or other rigorous third-party certified systems for sustainably managing Oregon forests and production of forest products.

At this time, several design teams express frustration with the fact that certified wood is often not available locally or competitively priced so they specify certified wood for LEED projects that

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<sup>17</sup> See American Society of Heating Refrigeration and Air Conditioning Engineers, Inc. standard for high performance buildings — <http://spc189.ashrae.org/>

<sup>18</sup> Architecture 2030 supports: All new buildings, developments and major renovations designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 50% of the regional (or country) average for that building type and other related goals.

<sup>19</sup> See <http://www.ortns.org/framework.htm> for more information.

are imported from other parts of the world. They say this seems like the opposite of any of the basic economic development strategies – exports, import substitution, or preventing capital leakages from the region. Several interviewees believe major challenges must be overcome, including the lack of action in the Oregon Legislature on this subject and lack of a productive forum where the wood products and green building industries can intersect and collaborate.

Several interviewees suggest an opportunity exists for the Portland Development Commission, Sustainable Development Commission and Oregon Economic and Community Development Department to bring elements of the green building industry and the value-added wood products industry together to develop a common agenda. One partner in this effort should be the Healthy Forests, Healthy Communities Partnership (HFHC). HFHC is a network of regional businesses seeking to link sustainable foresters with producers of value-added wood. Its Wood Products Industry Cluster Development Project is intended to develop a wood products cluster that benefits three rural counties while supporting sustainable forest practices<sup>20</sup>.

Design team interviewees are also interested in an FSC wood distribution center in the Portland region to better connect the suppliers of certified wood and the large and growing green building industry in the Portland region.

### **Foster Green Building Education and Develop Partnerships**

Several interviewees support and have thrived in the environment in which the City promotes and supports private green building development. They would like to see the City focus additionally on a more comprehensive green building policy promoting green building for City agencies, public schools, institutions, colleges and universities, and other public building partners. They also believe there is an opportunity to expand and deepen green building in the community among smaller builders and construction companies for smaller projects.

Multiple potential partnerships were identified by interviewees. Several interviewees are interested in marketing green building to more traditional construction companies and remodeling companies. There is also interest in promoting collaboration in the green building products supply chain in the region and developing a one-stop database for local and regional suppliers. Another area of interest is in developing a stronger supply chain connection for FSC wood, where wood lot owners and other suppliers can be assured that if they take the steps to “go FSC,” they have a clear path to the market providing consistent, predictable demand.

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<sup>20</sup> <http://www.hfhcp.org/wpicdp/wpicdp.php>

## Support Green Building/Value-Added Wood Products

Portland can seize the opportunity to capitalize on this confluence of forces to create linkages between rural certified forests and wood products and Portland's leadership in green building. The potential elements of the strategy identified by interviewees include:

- global, national and regional green building demand as a driving force;
- substituting local products and services for imports as the key way to innovate in the local market while also serving global markets;
- collaborations between Portland's green building industry and Oregon's certified forests and the value-added wood products industry;
- focus on linking smaller forest land owners and manufactures and suppliers in rural Oregon (including HFHC members) with urban/metropolitan green building designers and specification writers;
- focus on the gaps between supply and demand identified during the interviews such as:
  - ✓ steady supply,
  - ✓ quality control,
  - ✓ processing capability to avoid shipping costs,
  - ✓ information on suppliers,
  - ✓ distribution capacity for smaller suppliers;
- focus on higher value-added processing for composites and building components.

Far and away the largest potential opportunity identified by interviewees is for development of integrated manufactured wall and building materials units. This strategy would need to link the green building, home building, wood processing, manufactured homes/mobile home and coach industries. Additional product opportunities include those using wheat straw or other agricultural and forest materials in building components.

## Support Green Building/Materials Recycling

Oregon is know globally for its Bottle Bill and the City of Portland and Metro have focused on encouraging home and commercial recycling as a means of conserving resources and energy. Strong progress has been made both in commercial and residential recycling. New targets, such as commercial and industrial and food waste, are now being considered. During the past 20 years, as recycling has increased, a large related industry has emerged supplying paper, fiber, metal, glass and other materials locally, regionally and internationally. Construction waste is being recycled effectively, especially for large commercial projects. Businesses such as the Rebuilding Center and on-line resources such as Metro's Boneyard NW have emerged.

*An opportunity exists to bring elements of the green building industry and the value-added wood products industry together to develop a common agenda.*

Several interviewees suggest the opportunity exists to define an economic development strategy to support a successful regional construction waste recycling and reuse industry. Some interviewees have a strong vision for this industry as an entirely closed-loop materials supply chain with a goal of completely eliminating waste from the supply chain. Suggestions for strengthening the industry and developing closed-loop material flows include:

- supporting the materials recycling, reuse, remanufacturing industry as a key economic development cluster;
- maximizing deconstruction and reuse of building materials;
- maximizing recycling of building materials;
- developing a closed loop supply chain for materials;
- developing advanced recycling processing techniques for use and export;
- developing unique products, technologies and services for the green building industry with high recycled and reuse content (e.g., glass composite countertops, wheat and/or straw boards, and clay wallboards and wall fabrication materials);
- conducting research and development on future products and processing opportunities.

*A strong vision for the recycling/waste industry is an entirely closed loop materials supply chain with a goal of completely eliminating waste from the supply chain.*

### **Support Green Building/High Technology**

Several interviewees mention product/service opportunities to integrate high technology components into green building design. Several specific opportunities are mentioned that are or can be integrated into the green building realm, including:

- advanced building controls;
- HVAC systems;
- building modeling software;
- district-wide energy production and distribution systems;
- solar photovoltaic power production;
- advanced lighting systems including passive lighting;
- packaged water management and waste-water treatment and reuse systems;
- telecommunications/home entertainment.

A green building/high technology strategy should be a future consideration for PDC and OSD as an important industry cluster for promotion. Focus on this cluster will provide an opportunity for constructive engagement of the high technology industry in the Northern Willamette Valley.

It must be noted that there is currently discussion and disagreement within the design industry over the usefulness of high technology solutions for green building. The tension exists, for example, between designing buildings that perform more like nature (e.g., “Living Buildings”) and supply their own needs, and buildings that are more like machines with technology integrated throughout (“smart buildings”).

Because of the strength of both the green building and high technology industries here in Oregon, there is an opportunity to define the kinds of technologies that will be needed in the future for residential, commercial, industrial and large scale development.

## Expand Green Building to Large Scale Urban Development

Interviewees suggest several urban development strategies that could be used to promote the green building industry in the City by focusing on larger portions of the City. They include:

*There is agreement that the next big opportunity for green building in Portland is at the scale of neighborhoods, green streets, campuses and urban renewal districts.*

- Neighborhood/district-level/URA projects. There is widespread agreement that the next big opportunity for green building in Portland is at the scale of neighborhoods, green streets, campuses and urban renewal districts. At this district scale, energy and development solutions, such as local renewable power or water reuse systems, are possible that would not make sense at the building scale.
- Decentralization (especially water and energy). Interviewees believe that advanced renewable energy and water installations are most viable at a district scale and may not be economically feasible at the building scale. Large, mid- and especially high-rise urban buildings and neighborhood developments can utilize water use and reuse systems as well as energy production technologies. A good and successful example of a “district” strategy is the creation of the

chiller district as part of the Brewery Blocks Project. An important immediate opportunity is promotion of solar energy integrated into major new developments and urban redevelopment projects. District-scale water treatment and renewable energy generation systems should be considered important and viable options in upcoming urban redevelopment projects.

- Industrial ecology/closed-loop systems. Several interviewees suggest that, because of the substantial industrial commerce in Portland, there is an opportunity to create eco-industrial zones where closed loop resource reuse systems take the waste or product from one company and use it as input for another. The eco-industrial concept is widely developed in Canada and Europe and could serve as a new industrial and economic development opportunity. This model might be especially useful in industrial urban renewal districts.

PDC has launched a pilot program, ResourceFull USE<sup>21</sup>, in the Columbia Corridor area. ResourceFull USE is a collaborative exchange to help businesses find cost-effective, environmentally-friendly ways to obtain and dispose of materials and other resources. The system will help match potential sources for raw material inputs and recipients of unwanted wastes by looking at the entire resource flow through each participating business.

## Create a Green Building/Research and Demonstration Center

Oregon’s University System is in the process of creating an Oregon Bio-Economy and Sustainable Technologies center (Oregon BEST center). Several interviewees suggest the need for, and opportunity to create, a Portland green building research, demonstration and testing center, possibly tied to the Oregon BEST center. Such a development would probably require private, federal, state, academic

*“Portland is running out of little ‘cottage’ success stories. We need a shift in scale.”*

<sup>21</sup> <http://resourcefulluse.org/index.php?page=home>

and foundation support – possibly via a combination of elements ranging from a national laboratory to a NSF research center, or as an accredited standards developer like the American National Standards Institute (ANSI) or the Underwriters Laboratory (UL). One suggestion is the City and region work with the US Green Building Council and others to create a research, demonstration and testing center in Portland.

### **Develop Climate and Other Market Mechanisms**

Some interviewees believe the markets in greenhouse gases will be expanding and it may be possible and desirable to link green building performance to incentives to reduce greenhouse gas production. The City of Portland and Climate Trust illustrated the potential for linking greenhouse gas reduction to green building through a carbon offset purchase agreement in 2002. As this market develops there may be much greater opportunities to link green building performance to other eco-system markets that may emerge for water use, energy use, air pollution and habitats.

Currently efforts by the Eco-trust, Earth Advantage, the Cascadia Region Green Building Council and others promote the “climate neutrality”<sup>22</sup> for the Western United States by 2025.

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<sup>22</sup> Climate neutrality entails reducing or offsetting greenhouse gases to achieve no net effect on global warming.

## **Appendices**

- 1. Participating Firms and Interviewees**
- 2. Interview Questions**
- 3. Economic Development Concepts and the Green Building Industry**
- 4. Green Products and Services Matrix**

## **Appendix 1. Participating Firms and Interviewees**

***Brightworks:*** Chris Forney, Nicole Wolters

***Community Partners for Affordable Housing:*** Sheila Fink

***Lease Crutcher Lewis:*** Mike Levesque

***DCI Engineers:*** Harry Jones

***DMS Architects:*** Kathy Bash

***GBD Architects:*** Phillip Beyl, David Posada

***Gerding Edlen Development:*** Dennis Wilde, Renee Worme

***Gray Purcell:*** Alan Fong, Michael Purcell

***Green Building Services:*** Jay Coalson, Richard Manning, Terry Miller

***Housing Development Center:*** Craig Kelley

***Henry V Events:*** Patrick Eckford

***Hoffman Construction Company:*** Stephanie Coyle

***Interface Engineering:*** Mark Heizer, Omid Nabipoor

***Mahlum Architects:*** Kurt Haapala

***Opsis Architecture:*** Randall Heeb, James Meyer, Alec Holser

***Precision Construction:*** Mike Sullivan

***Renewal Associates:*** R. Peter Wilcox

***Reworks:*** Aaron Blake

***Sakura Urban Concepts:*** Eli Hayworth

***SERA Architects:*** Eden Brukman, Clark Brockman, Bonnie Bruce, Lisa Petterson

***simpL Landscape Architecture:*** Jeff Simpson

***Thomas Hacker Associates:*** Jonah Cohen, Alexander Lungershausen

***Walsh Construction:*** Chuck Hallian, Dave Riedel

***Waterleaf Architecture:*** Stephen Lapp, Mark Mikolavich

***William Wilson Architects:*** Scott Crosby, William Wilson

***Zimmer Gunsul Frasca Architects:*** John Breshears, Joanna Brickman, Craig Briscoe, Naomi Cole, James McGrath, Peter van der Meulen

## **Appendix 2. Interview Questions**

1. What were your green building goals for this project? (*Interviewer prompt: What drove your decision-making?*)
2. What were the most important products and services you used to meet those goals?
3. Would you use these again? Why or why not? (*optional*)
4. During the design process, were there products you used or wanted to use that were not locally produced? Why not? (*Prompt: availability, cost, regulations?*)
5. What do you see as the (5) biggest opportunities in the green building industry products and services in the future? (*Prompt: products and services, action items for ODS and PDC*). Who should champion these ideas?
6. What can/should the City of Portland do to support development of local products and services currently imported?
7. What is your biggest dream for the future of green building in the Portland area?
8. Anything else you'd like to add (*as time allows*)?

### **Appendix 3. Economic Development Concepts and the Green Building Industry**

The following appendix addresses a few key economic development concepts discussed in this report.

#### **The Traded Sector and Import Substitution**

Economic development is often concerned with promoting what is called the “traded-sector.” The Oregon Business Plan, for example, is focused on “the primary sources of Oregon’s prosperity — our traded-sector industries. Businesses in these industries sell their goods and services primarily outside the state, creating jobs and bringing in new dollars that benefit local communities.”<sup>23</sup>

Related, but a less utilized concept of economic development is import substitution<sup>24</sup> — substituting local for imported products and services. Both of these strategies — exports and import substitution — focus on regional capital accumulation. One definition of import substitution is “the replacement of goods and services purchased outside a region with goods and services produced within the region.”<sup>25</sup> In this sense, import substitution creates “growth from within,” as local businesses receive supply contracts and local residents earn wages and income. Three main types of import substitution programs are being used in the United States:

- Information Sharing and Networking — matching local producers with local suppliers;
- Buy Local Programs — encouraging firms and consumers to purchase local products rather than imports;
- Industry Targeting — attracting firms and businesses that will engage in or enable import substitution.

Export and import substitution strategies result in increased capital that can be circulated within the Portland regional economy and stimulate more related economic activity. In the green building economy there are significant opportunities, detailed in the report, to substitute locally made building products and components for those currently imported to the region.

In the case of green building exports, strategies would focus on economic activities such as producing value added wood products, finished goods such as doors and windows, and exporting them to North America and internationally. Import substitution strategies will focus on economic activities such as utilizing locally manufactured wood product and finished goods instead of shipping wood overseas and re-importing the finished goods.

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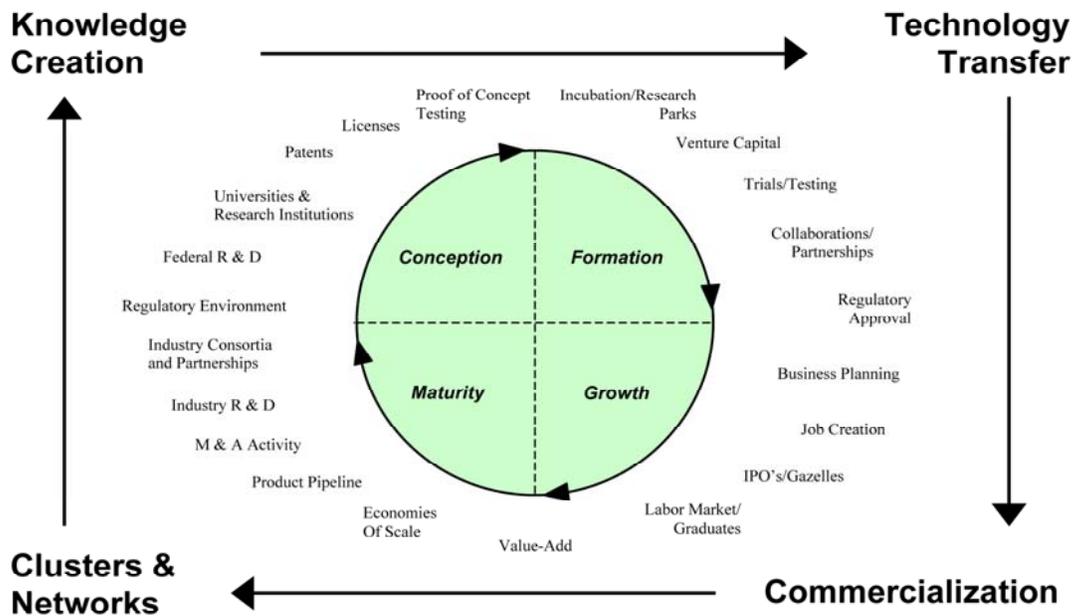
<sup>23</sup> *The Oregon Business Plan*, 2003, [http://www.oregonbusinessplan.org/plan\\_framework.html](http://www.oregonbusinessplan.org/plan_framework.html), Accessed April 17, 2007

<sup>25</sup> <http://www.planning.unc.edu/courses/261/drucker/index.html>

## Product Innovation Lifecycles

Each green building product and service has its own innovation lifecycle, summarized in Figure 1 below. This figure illustrates an integrated view of the product development and production process over time.

**Figure 1: Product Innovation Lifecycle**



Source: Cogan Owens Cogan

For example, government-funded university research and development creates new knowledge and attracts additional funding for further research and development. Additional funding increases collaboration between industry and universities and results in creation of knowledge. New scientific findings and technologies developed in laboratories are then tested and produced as products by new start-up enterprises or existing companies of various sizes. These new products generate more employment and are conducive to new businesses, adding to the industry cluster. Major manufacturing companies emerge with global product supply chains and sales networks.

The product lifecycle for a green building product is illustrated by the work of Oregon State University. Dr. Kaichang Li of OSU's College of Forestry developed a new non-toxic organic adhesive, based on research on mussels from the Oregon Coast, to replace existing urea-formaldehyde resin, adhesives.<sup>26</sup> Following patents, the technology is licensed to Columbia Forest Products and is now used extensively as Pure Bond, in plywood and other veneers. As demand grows, expansion of production capacity will expand. The adhesive can be licensed to

<sup>26</sup>Oregon State University, EurekAlert, *Nature Provides Inspiration for Important New Adhesive*, April 11, 2005 [http://www.eurekalert.org/pub\\_releases/2005-04/osu-nii040805.php](http://www.eurekalert.org/pub_releases/2005-04/osu-nii040805.php), Accessed April 17, 2007

other uses where non-toxic chemistry is needed, possibly in automobiles and airplanes. Eventually competition will emerge and a better or less expensive adhesive will be developed.

**Appendix 4: Green Products and Services Matrix**\*Products referenced in this study are not necessarily endorsed by Cogan Owens Cogan, SERA Architects, Office of Sustainable Development and Portland Development Commission. The items below are the products or services identified by interviewees in the design team interviews. This is in no way intended as a comprehensive listing of green products or services.

PRODUCT	CATEGORY	SECONDARY CATEGORY	EXAMPLE	CURRENT MNFR LOCATION(S)	GREEN ATTRIBUTES	COMMENTS
Radiant heat systems	Energy	Env. Quality	Warmboard/Pacific Hydronics	Willits,CA (plywood: Medford, OR)	Energy Conservation	Raises finished floor level
Chilled slab	Energy	Env. Quality	NA		Energy Conservation	Often coupled with passive water cooling (space constraint)
LEDs	Energy		Sistemalux	Montreal, Canada	Energy Conservation	Mixed opinions on quality of light
Light-shelves	Energy	Env. Quality	None known		Energy Conservation	Usually custom fabrication for particular space
Triple Glazed Windows	Energy	Env. Quality	Loewen HeatSmart	Manitoba, Canada (Doug fir: Pacific NW)	Energy Conservation	FSC wood regionally sourced - high performance rating (U-value)
Daylight sensors	Energy	Env. Quality	Honeywell			Expensive at small scale
High-performance glazing	Energy	Env. Quality	Cardinal Low E-366	Tumwater, WA	Energy Conservation	Can be local, but very expensive
Parapet wind turbines	Energy		Architectural Wind	CA	Renewable Energy	May not fit small-medium scale buildings
Ground source heat pump systems	Energy		Econar	Appleton, Minnesota	Renewable Energy	Space requirements, have been misused in the past
Energy sharing systems	Energy		CitiMulti by Mitshubishi	Japan	Energy Conservation	Major added expense
Heat recovery ventilation system	Energy		Lifebreath	Ontario, Canada	Energy Conservation	
Pellet stoves/wood burners	Energy		Napoleon	Ontario, Canada	Renewable Resources	
Computational fluid dynamics/energy modeling	Energy		Green Building Services	Portland, OR	Energy Conservation	Prevalent in Portland
Insulating paint	Energy		Hytech	Melbourne, FL	Energy Conservation	
Multi-function micro-processor control relay (MCR)	Energy		None known		Energy Conservation	
Photovoltaics	Energy		Sharp / Kyocera / Sunny Boy	International	Energy Conservation	Cost prohibitive
Solar Thermal systems	Energy		Mr. Sun	Portland	Energy Conservation	
Cold climate heat pump	Energy		Nyletherm	Maine	Energy Conservation	
Solar water heaters	Energy		Sol-Reliant		Energy Conservation	
Insulation	Energy	Env. Quality	Thermafiber	Indiana	Energy Conservation	
Floor insulation	Energy		THERMAX	Dow	Energy Conservation	
Chilled beam cooling system	Energy		NA	Portland, others	Energy Conservation	Beams from Europe
Trickle vent windows	Env. Quality		None known		Air Quality	A component of a glazing unit - available in a number of products from many manufacturers

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PRODUCT	CATEGORY	SECONDARY CATEGORY	EXAMPLE	CURRENT MNFR LOCATION(S)	GREEN ATTRIBUTES	COMMENTS
Carpets-natural fiber/wool	Env. Quality	Material	Shaw / Interface / Unique Carpets	Dalton,GA / Atlanta,GA / Riverside,CA	Renewable Resources	Local wool expensive
Carpet made from recycled plastic/low VOC system	Env. Quality	Material	Shaw / Interface / Unique Carpets	Dalton,GA / Atlanta,GA / Riverside,CA	Recycled Content	
Alcohol gel fireplace system	Env. Quality		Blomus	Germany		Retail cost starts at approx. \$1,400. Best where shaft space is limited.
Non-PVC flooring	Env. Quality	Material	Forbo Marmoleum		Air Quality	
Low VOC paint	Env. Quality		Miller / Rod / YoLo	Portland,OR	Air Quality	Successful local industry
Photosensors	Env. Quality		Watt Stoppers	California	Energy Conservation	
Sealants (Timber / Concrete)	Env. Quality		TimberPro UV / Euco AquaCure	Portland,OR / Cleveland,OH		
PVC / CPVC / ABS Welding Cement	Env. Quality		IPS Weld-On	Compton,CA		
Recycled rubber flooring	Material		Expanko	Coatesville,PA	Recycled Content	Also manufacture combination cork-rubber flooring product (material sources are rapidly renewable)
Agricultural-based solid surface counter tops	Material		Palouse and Dakota Burl Fusion	Oregon (ag. material: Midwest	Renewable Resources	
Non-urea formaldehyde particle board FSC	Material	Env. Quality	Columbia Forest Products	Canada	FSC wood	
Formaldehyde-free MDF	Material	Env. Quality	Sierra Pine: Medex, Medite II, Arreis / Roseburg: Skyblend	Medford,OR / Roseburg,OR	FSC wood	Some composite products not fire-rated
Formaldehyde-free MDF - FSC	Material	Env. Quality	PureKor	N. Korea/New Zealand	Air Quality	
Non-urea formaldehyde plywood	Material	Env. Quality	Collinswood, Roseburg	Oregon	Air Quality	Plywood typically uses phenyl-formaldehyde instead of urea formaldehyde in production
Wheatboard (no added urea formaldehyde)	Material		Environ Biocomposites	Mankato,MN	Renewable Resources	Perceived issues with product strength/quality
Wheatboard cabinetry	Material		Humabilt	Ashland,OR	Renewable Resources	
Fiberboard	Material		Georgia-Pacific/Int'l Bildrite/Temple	GA/MN/TX/Canada	Renewable Resources	Added materials to "improve" product not known
Terra cotta rain screen	Material		James and Taylor	England	Renewable Resources	
Clay wallboard	Material		Claytec	Germany	Abundant Resource	
Drywall with higher recycled content/gypsum board	Material		Georgia-Pacific	Tacoma,WA	Recycled Content	Uses synthetic gypsum by-product of Centrailia power plant
Green SIPS	Material	Energy	Agriboard	Wichita,KS (ag. Material: N Texas)	Renewable Resources	Uses agricultural waste instead of polystyrene foam
Heat reflective roof materials	Material	Energy	Fabral	PA	Energy Conservation	

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PRODUCT	CATEGORY	SECONDARY CATEGORY	EXAMPLE	CURRENT MNFR LOCATION(S)	GREEN ATTRIBUTES	COMMENTS
Fiber Cement Siding	Material		Certainteed	White City,OR	Recycled Content	30% fly ash
Pre-plumbed walls	Material		None known			
Countertops with recycled content/natural fibers	Material		Durat / Fuez	Finland / Portland,OR	Recycled Content	Very expensive
Foam spray insulation	Material	Energy	Bio-based / Demilec / Isonene / Dura-fill	Rogers,AR / Arlington,TX / Plymouth,WI	Renewable Resources	Replaces up to 10% of total product petroleum with soy
Panelized brick	Material		None known		Abundant Resource	
Curtain Wall	Material		Centria / Sapa / Benson	AR / KY / PN (framing: Pacific NW)	Energy Conservation	100% domestic, and cradle to cradle certified. Fabricated overseas.
Insulated concrete forms (ICFs)	Material	Energy	Durisol	Canada	Energy Conservation	
FSC casework	Material		Neil Kelly	Portland,OR	FSC wood	Chain of custody is the issue; need more certified shops; more competition to bring cost down
Concrete masonry units (CMUs)	Material		Mutual Materials	Clackamas,OR	Energy Conservation	3% fly ash, produced/sourced regionally
Fly Ash Concrete	Material		Glacier	Portland, OR	Recycled Content	Fly ash is byproduct of coal - limited supply. No "new" ash source for added /substitution (EPA regulations)
Styrofoam insulation/thermal mass composites	Material	Energy	Dow T Mass		Energy Conservation	
Recycled FSC flooring	Material		Worthwood-Oregon Lumber	Portland	Recycled Content	Uses residual Oregon FSC doug fir from door/window manufacturing process
Eco-roof	Site	Water	Hydrotech	Chicago, IL	Water Conservation	
Xeriscaping	Site	Water	NA		Water Conservation	Design application using native plant species
Pervious concrete	Site		Turfstone/ SF Rima-Willamette Graystone	Virginia / Salem,OR	Water Conservation	
Rainwater harvest system	Water		Lando Concentric	Portland,OR	Water Conservation	Regulation
Water Treatment + Wastewater Recycling System	Water	Site	Eqauris / Orenco	Minnesota / Sutherlin,OR	Water Conservation	Not approved by State, cost premium
Night sky sprinkler system	Water		None known		Energy Conservation	
Composting toilets	Water		Phoenix	Whitefish,MT	Water Conservation	Education of users, additional space requirements, cost premium
Bio-reactor	Water	Site	NA		Water Conservation	
Dual Flush Toilets	Water		Caroma / Toto / Kohler	International	Water Conservation	Education of users, cost premium
Low-flow urinals	Water		Caroma / Toto / Kohler	International	Water Conservation	
Waterless Urinal	Water		Kohler / Caroma / Sloan / Falcon / Zurn	International	Water Conservation	Cartridges require regular replacement, are composed of plastic

