Green Building: Saving Salmon, the Environment, and Money on the Path to Sustainability

Opportunities for the Pacific Northwest

Prepared by

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September 2000

READERS' GUIDE

Why Was This Report Prepared?

The citizens of Washington and Oregon face a number of important environmental challenges. For example, they know that a majority of streams fail to meet water quality standards and that many salmon stocks are listed as threatened or endangered regionwide. In addition, the recently published Oregon State of the Environment Report identified a number of areas where Oregonians can expect continued problems under current policies and programs including: poor water quality, especially in urban and agricultural areas, inadequate water supplies, loss of wetlands, degraded riparian areas, depleted fish stocks, invasion of exotic species, diminished biodiversity, and increased waste and toxic releases.

These environmental issues threaten to constrain the economy and communities of the Pacific Northwest. The public and decision makers want to take appropriate steps to resolve these problems, but often hesitate because they fear the economic consequences will be too severe.

In the spring of 1999, The Center for Watershed and Community Health (CWCH), a non-profit research institute affiliated with the Mark O. Hatfield School of Government at Portland State University, initiated a project to help decision makers throughout the region better understand the economic issues and facts associated with developing a more environmentally sustainable economy. The CWCH's aim is to provide accurate, objective, and easy-to-understand information about the potential costs and benefits associated with adopting practices and policies that can resolve pressing problems such as endangered salmon and lead to a more sustainable economy. The CWCH provides grants to a number of leading economists throughout the region, and completes its own research, to accomplish this goal. This assessment is one in a series of reports to be produced as a result of this effort. The project is an integral part of CWCH's focus on developing new, more effective and efficient approaches to environmental governance.

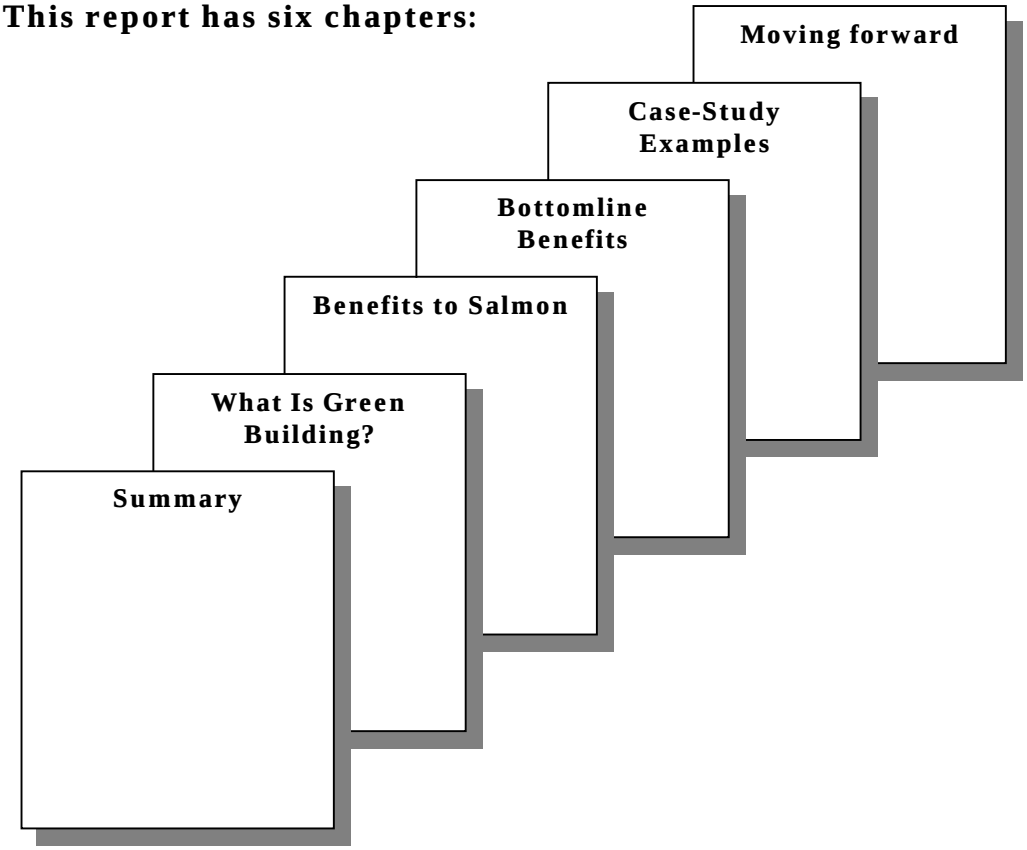
Who Prepared this Report?

This report was produced by Jim Ebenhoh, Ernie Niemi, John Tapogna, and Ed Whitelaw, economists with ECONorthwest, under a grant from The Portland State University, Center For Watershed and Community Health. The authors gratefully acknowledge comments by Robert Doppelt (CWCH), Robert Harrison (Robert Harrison Architects), Lucia Athens (Seattle Public Utilities), Rob Bennett (City of Portland Energy Office), Dennis Wilde (Gerding/Edlen Development Company), Logan Cravens (Zimmer Gunsul Frasca Partnership) and Alan Scott (Portland General Electric). The authors are solely responsible for the content of the report.

Acknowledgements

The CWCH gratefully acknowledges the financial support of the Ford Foundation, Brainerd Foundation, Lazar Foundation, and Harder Foundation for this project. The authors are solely responsible for the content.

This report has six chapters:



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Check out related studies. Check the CWCH website: www.upa.pdx.edu/CWCH/, or the Salmon and the Economy website: www.SalmonAndEconomy.org.

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SUMMARY

Green building: "innovative building and site design techniques that improve the quality and performance of buildings while simultaneously reducing stress on the environment."
—City of Portland Green Building Initiative

The Pacific Northwest faces a number of growing environmental challenges. For example, at least 19 wild salmon populations in Washington and Oregon are extinct and the remainder are in trouble. More than 70 percent of Washington and one-half of Oregon are covered by "endangered" or "threatened" listings of salmon under the Endangered Species Act. Conserving the environment, including water quality and salmon habitat requires widespread changes in how homes, offices, and shopping areas are built, landscaped, and operated.

Some builders prove every day that conserving the environment and saving salmon does not have to hurt the bottom line. **They have shown that using green-building practices for design, construction, and landscaping can help conserve the environment and save salmon** …

- Directly by reducing building-related damage to salmon habitat and pollution.
- Indirectly by reducing the demand for water, hydropower, forest products, and other goods, the production of which is often harmful to salmon.

… **and save money. By incorporating green-building practices, Washingtonians and Oregonians could save more than $90 million each year in energy, water, and construction-related costs. Who benefits?**

- Builders: Green homes and buildings are often more marketable, and, because green buildings promise lower future utility bills, buyers can spend more on the structure. Also, firms with a reputation for harming salmon risk consumer backlash
- Homeowners: Green homes use less electricity, water, and sewer capacity, saving a typical homeowner about $500 each year. Preferential mortgage rates may become available for green-built homes.
- Businesses: Commercial tenants of green buildings pay up to 35 percent less for lighting, heating-cooling, water, and sewer. Their workers often are more productive because they are exposed to fewer toxic building materials and work in natural light.
- Taxpayers and ratepayers: Conserving electricity and water lowers the need for expensive new dams and power plants. Also, preventing pollution and damage to salmon habitat usually is cheaper than cleaning up after the damage is done. Reducing sediment from building sites prevents clogged channels and reduces risk of flood damage downstream.

Wider application of green building practices makes good economic sense and would occur, even if there were no salmon crisis. Through common-sense actions, they stop wasteful uses of electricity and water that are expensive to produce; reduce the emission of pollutants that are a waste of resources and expensive to clean up; recycle building materials that are too valuable to throw away; and avoid creating compacted soils and other impervious surfaces that are expensive to manage, accelerate rainwater runoff, and increase the risk of flooding.

Saving Salmon, the Environment, and Money

Green building practices reduce building-related degradation to the environment, including habitats salmon need to survive. By incorporating these techniques into new construction and remodeling projects, residents and businesses in Washington and Oregon could save over $90 million each year.

- **Electricity conservation:** Widespread adoption of common-sense practices to conserve electricity would save about 800 megawatts[1] and lessen the region's reliance on dams harmful to salmon. The potential conservation equals the amount of power generated by the four, controversial, federal dams on the Lower Snake River. At the average retail rate, this conservation would save residential and commercial consumers $77 million per year.
- **Water conservation:** Residential, commercial, and public-agency water users account for two-thirds of all non-farm water diverted from the region's streams[2]. Leaving more water in streams would help salmon and reduce costs. If simple conservation measures were adopted throughout Washington and Oregon, region-wide water consumption would fall by 14.9 billion gallons each year, and water customers would have a net savings of $12 million annually on their water bills.[3]
- **Erosion control:** Sediment from construction sites—typically 59,670 pounds per acre per year, vs. 27-44 pounds from general urban activities—chokes streams and destroys salmon habitat.[4] The excess from each acre also imposes about $110 in costs on others by clogging stream channels, raising the risk of flood damage, and increasing filtration costs for water users. Each year, construction occurs on 15,500 acres in Washington and Oregon. Eliminating excess sediment would save taxpayers $1.7 million annually.

The Case Studies chapter shows how individual projects have saved money through green building.

- **Toxic pollution:** Landscaping designs greatly influence the amount of pollution harmful to fish. For example, urban use of pesticides in the Puget Sound area—about 1.1 million pounds per year—is more than three times agricultural use and costs about $760,000.[5] Reducing usage to agricultural levels would save about $500,000. With similar reductions throughout the region the total savings would be $900,000 in Washington and $780,000 in Oregon.[6]
- **Stormwater runoff and forest conservation:** Green building practices can reduce impervious surfaces, which speed rainfall runoff, increasing floods and carrying pollutants into streams,[7] by at least 50%.[8] Green building practices also protect salmon by using less timber, allowing for valuable streamside shading in forest regions.

Green Building Practices Will Make Even More Sense in the Future

The monetary savings from using green building practices to help the environment and salmon should increase in the future, as these and other forces increase the demand for green building practices:

- **Consumer preferences.** Just as shoppers increasingly prefer "organic" foods, they are likely to prefer to shop in innovative, green buildings.
- **Green building supplies.** Home Depot and other building suppliers have made commitments to supply green-certified building materials. Builders that buck the trend face market sanctions.
- **International markets.** Local manufacturers increasingly will have to occupy green factories to have access to European and other markets where green standards are high.
- **The free lunch is over.** When builders use environmentally harmful materials and practices, somebody eventually has to pick up the tab. As the tab gets larger, society will press for greater use of green building practices.

In short, Green Building will help the region adopt more environmentally and economically sustainable paths. In doing so, the economy, communities and environment will all benefit.

WHAT IS GREEN BUILDING?

The Portland, Oregon, Green Building Initiative, a city-run program to encourage green building in the Portland area, defines green building as "innovative building and site design techniques that improve the quality and performance of buildings while simultaneously reducing stress on the environment." Though there are many other possible definitions, this one encompasses what is valuable about green building—its ability to enhance the bottom line as well as the environment.

Green building has its roots in the energy-conservation movement of the 1970s and 1980s, and has matured to embrace a wide set of design standards and building techniques. The techniques involved in green building are manifold, and are listed in several manuals and guides. Not all the practices deal with the structure of buildings; some deal with large interior appliances and systems that are installed when a building is initially constructed, and others deal with landscaping, site design, and other exterior issues.

Green Building Practices

Green building practices fall into six basic categories, and directly benefit builders, businesses, homeowners, and salmon.

Energy-saving practices reduce the amount of electricity, natural gas, and oil used for space heating, water heating, and lighting of homes and offices. Particularly innovative techniques include furnaces equipped with clock thermostats, skylights for closets and dark hallways, office occupancy sensors, and triple-glazed windows. Additional savings are achieved through energy-efficient appliances.

Water-saving practices cut down on water use both indoors and outdoors. To manage water consumption, a green building incorporates low-flow showerheads, aerating faucets, low-flow toilets, and high-efficiency washers. Outside of the home, water systems reuse household grey water in the lawn and garden.

Erosion-control practices use natural vegetation and other measures to reduce the amount of harmful silt and sediment that enters waterways.

Pollution-reducing practices limit the use of toxic building materials, such as particleboard and cabinetry made with formaldehyde glues. Cutting down on pollutants is also important outside of the home or office. Green builders substitute native plants for exotic plants in landscape designs, which decreases the need for environmentally harmful (and expensive) fertilizers and pesticides.

Stormwater runoff-reducing practices limit the amount of stormwater that surges into streams during rains, primarily by retaining stormwater on-site and reducing the amount of impervious surface on the property. Techniques include on-site drainage ponds,

rainwater catchments and the use of pervious materials, such as gravel or crushed stone, rather than asphalt or concrete.

Forest-conserving practices are based on the three "Rs"—Reduce, Reuse, and Recycle—and these practices lower the demand for new timber and other natural resources. They include advanced framing systems that use less timber, salvage reused timber, and use timber from sustainably harvested and certified forests.

Green Building Practitioners

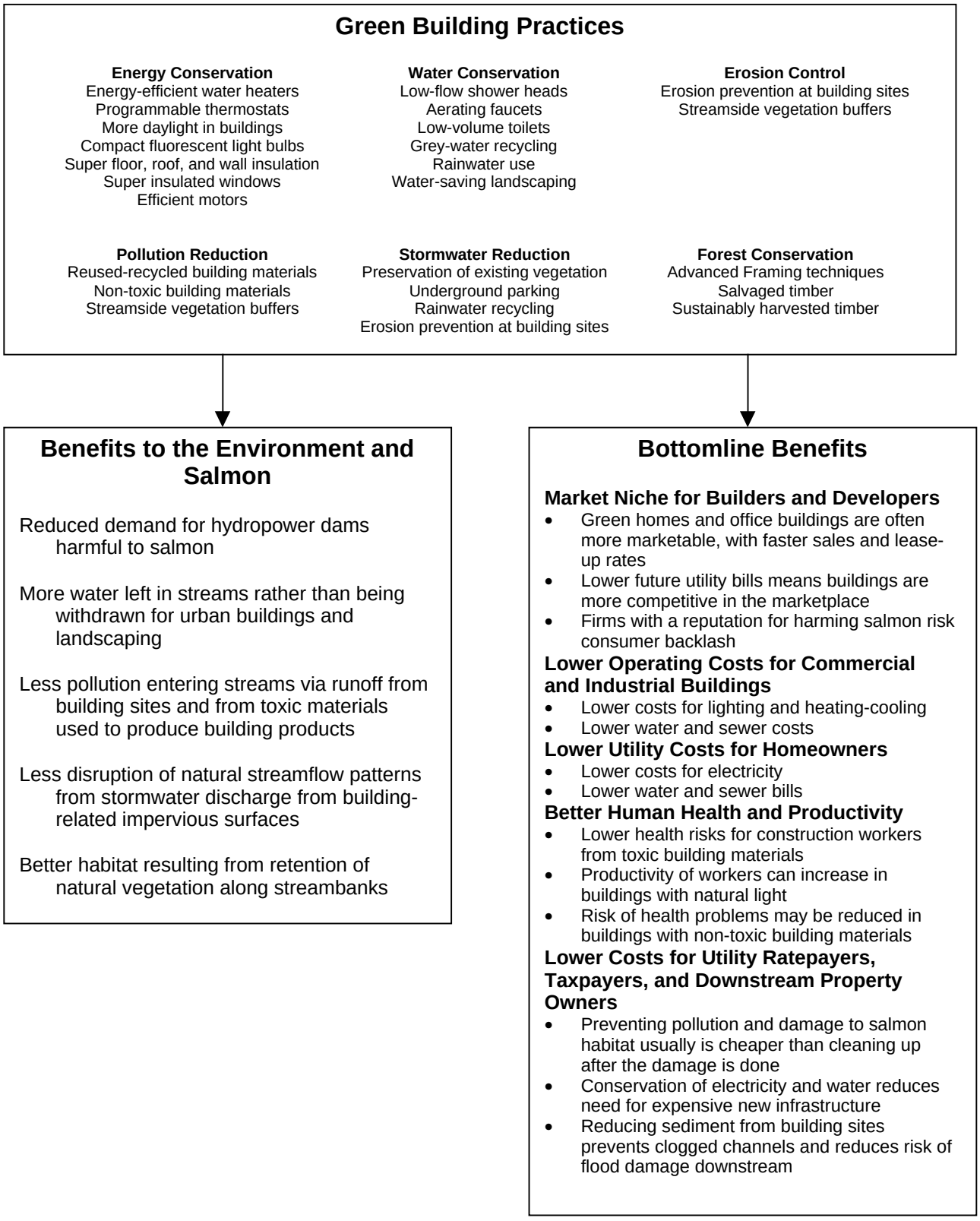
The number of people and businesses involved in green building has grown rapidly in recent years. The Northwest EcoBuilding Guild's 1999-2000 *Green Pages*[9] lists 318 businesses and organizations involved in green building. Of these, 53 are architecture firms, 64 are general contractors, 24 are building material and supply firms, and 12 are remodeling firms. In addition, about 60 members of the US Green Building Council, which covers commercial-sector construction, have offices in Washington and Oregon.

Two active local figures are Robert Harrison in Seattle and Dave Heslam in Portland. As executive editor of the *Green Pages* and the head of Robert Harrison Architects in Seattle, Harrison has completed more than 30 projects over the past seven years that demonstrate the benefits of resource conservation, energy conservation and healthier building. Dave Heslam is a Portland contractor who runs Coho Construction Services Inc. and is president of the Oregon chapter of the NW EcoBuilding Guild. Other popular businesses such as Neil Kelly Inc., Ashford Pacific, Gerding/Edlen Development, and the Zimmer Gunsul Frasca Partnership in Portland are raising the profile of green building in the Northwest. If the average firm has 3 employees,[10] just those firms listed in the Green Pages employ nearly 1600 Oregon and Washington workers in the green building trade. The number of people and businesses involved in green building has grown rapidly in recent years.

What Are the Benefits?

As Figure One on the next page shows, green building practices benefit salmon and the bottom-line. The following chapters describe these benefits in greater detail.

Figure 1: Greater Adoption of Green Building Practices Can Help Save Salmon and Save Money and the Environment for Nearly Everyone in the Pacific Northwest



BENEFITS TO THE ENVIRONMENT AND SALMON

Inappropriate urban development is a key factor in degradation to the environment and one of the primary causes of the decline in salmon populations. Smarter urban development incorporating proven green building practices can help turn the tide so that both existing urban areas and new developments are less harmful to the environment and salmon.[11] Green building practices help the environment and salmon directly by reducing building-related pollution and damage to salmon habitat; and indirectly, by reducing the demand for goods and services—especially water, hydropower, and timber products— that often are produced in ways harmful to salmon.

Less Damage by Hydroelectric Dams

There are 255 hydroelectric dams in the region[12] that harm salmon by blocking their access to stream habitat, altering habitat both in the reservoirs behind the dams and in the streams below them, making juvenile salmon vulnerable to predators, and killing fish forced through turbines.[13] With electricity rates in the Pacific Northwest well below national levels, builders and building owners have had little incentive to rein-in electricity waste. By reducing the waste, the region can maintain its standard of living, lessen its reliance on hydroelectric power, and more easily consider modifying the dams most harmful to salmon populations.

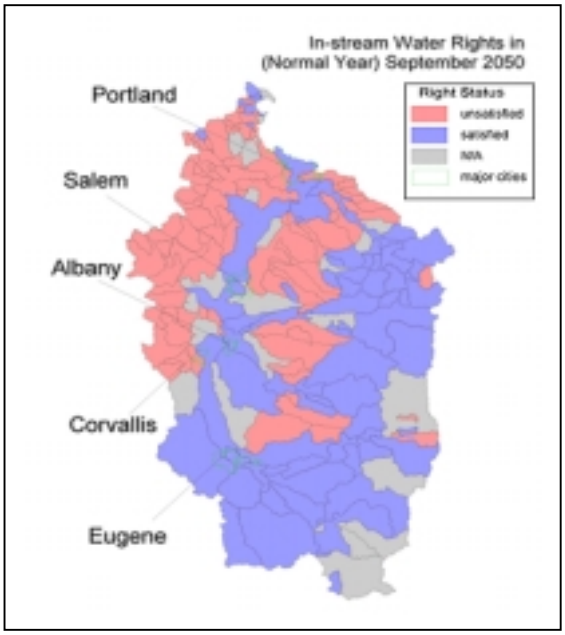
Ninety percent of the electricity consumed in the region comes from dams. Consumption is split almost equally between residential, commercial, and industrial users. Dams that allow fish passage kill up to 15 percent of juveniles that attempt to pass[14], while those that block passage totally eliminate salmon populations upstream. Reductions in building-related consumption in the Northwest directly lessen the demands on the dams and indirectly benefit salmon. For example, the Northwest Power Planning Council estimates that common-sense conservation measures in residential and commercial buildings (see the next chapter for details) could reduce electricity use by almost 1,000 megawatts. Such a reduction is equivalent to the entire output of power from four controversial dams on the lower Snake River.[15] Conserving electricity could make tremendous contributions to saving salmon.

Adequate water flow

In many streams, and during many months streamflows are insufficient to support abundant salmon populations. The map of the Willamette Valley, in Figure 2, illustrates the problem. For much of the valley, streamflows are insufficient, even during a year with normal precipitation, to satisfy in-stream water rights representing the minimum flows

needed for healthy fish populations. Conditions are worse in drier parts of the region and during years when precipitation is below average.

Figure 2: Water Withdrawals Often Leave Streamflows Too Low to Protect Fish



Low streamflows result when water is withdrawn from streams. Irrigation accounts for the highest percentage of withdrawals, but withdrawals by public water providers, and self-supplied commercial and industrial users are also important, as shown in Table 1.

Table 1: Surface-Water Withdrawals by Water-Use Category in Oregon and Washington, 1995 (values in millions of gallons per day)

	Public Supply	Domestic	Commercial	Industrial	Irrigation, Livestock, Mining	Total Withdrawals
Oregon	395	5	550	352	924	2,226
Washington	505	0	0	330	144	979
Region	900	5	550	682	1,068	3,205
Category as % of Total Withdrawals	28.1%	0.2%	17.2%	21.3%	33.3%	100.0%

Source: US Geological Survey

Recognizing the importance of increasing streamflows, both Oregon and Washington have issued statewide salmon-recovery strategies that target water conservation as a key objective.[16] This salmon-related pressure to conserve water occurs, however, against nationwide conservation efforts. New water-efficiency standards, for example, will change the supply of clothes washers available on the market, reducing the amount of water per wash by more than 35 percent, and saving each household $100 a year in water rates, on average.[17] Efforts within the region further prove the potential for conservation. A recent study by Seattle Public Utilities indicated that more than 31 million gallons of water could be conserved each day during the high-use summer months if consumers implemented cost-effective technologies like low-flow toilets, efficient showerheads, and efficient clothes

washers.[18] If similar conservation measures were adopted throughout Washington and Oregon, region-wide water consumption would fall by 14.9 billion gallons each year. At current retail rates, water customers would save about $32 million annually on their water bills, which would more than offset the $20 million annual cost of implementing the cost-effective techniques.[19] Water conservation would increase streamflows and improve salmon habitat.

Urban Development Has Been Hard on Salmon Habitat

"When Portland was first settled, there were some 200 streams; now all but six have been piped or "culverted" and paved over, obstructing fish passage and, in some cases, entirely eliminating aquatic and riparian habitat. Over 300 miles of stream banks have been paved over."

Portland City Club. 1999. *Endangered Fish Species in Portland*.

Projected increases in water prices, to cover new infrastructure and the rising costs of ensuring that delivered water is safe to drink, should induce even more conservation. In 1996, before salmon conservation became a serious concern, the water providers in the Portland region concluded that possible conservation programs could save 10.7% percent of peak season water demand by 2020.[20] Water-conservation measures prompted by efforts to save salmon will reinforce such changes taking place for other reasons.

Urban Water Quality and Streamflows

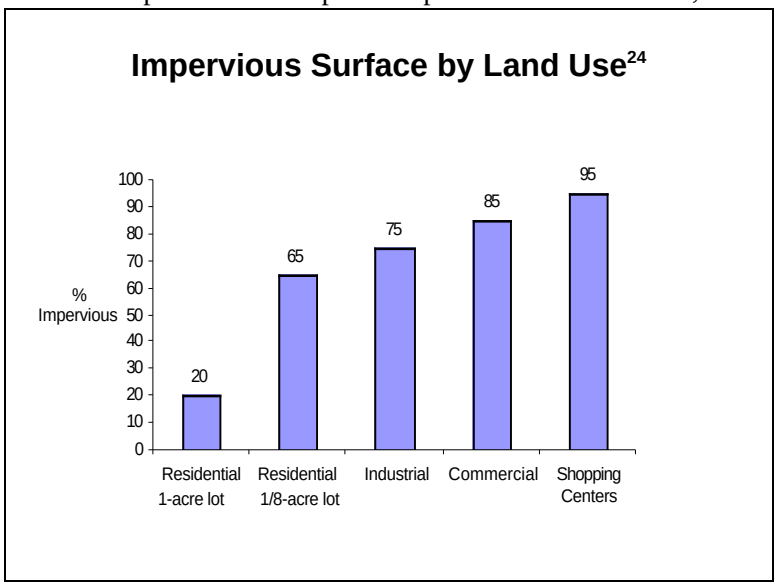
Salmon need cool, clean water in streams with a complex range of microhabitats. To meet these needs, the water in streams must be unpolluted, exhibit patterns of streamflows that rise and fall corresponding to the needs of salmon's life cycle, and flow through corridors of naturally occurring riparian (streamside) vegetation. Past development patterns and practices have interfered with each of these requirements, by removing streamside vegetation, increasing impervious surface and stormwater runoff, and introducing pesticides and other toxins into watersheds. By limiting runoff, green building practices minimize development's effect on stream temperatures, streamflow patterns, and water quality.

Temperatures Maximum stream temperatures in 70 percent of the streams west of the Cascades exceed a level deemed "potentially stressful" for salmon, and exceed a level deemed "potentially lethal" in 20 percent of the streams.[21] Recent surveys show that 282 water bodies in Washington and 940 in Oregon fail to meet temperature criteria for healthy streams.[22] Higher temperatures often occur where urban development has destroyed streamside vegetation that would provide shade for streams. They also occur where logging has eliminated streamside trees. Urban development that preserves streamside vegetation can help maintain proper stream temperatures. Advanced framing techniques and the use of salvaged or recycled timber also indirectly allow streams to be shaded by reducing the demand for timber. In addition, timber certified as "sustainably harvested" is likely to have been taken from forests that preserve streamside habitat and reduce erosion.

Impervious surfaces and streamflow patterns. Impervious surfaces—compacted soils, pavement, roads, roofs, and other barriers that water cannot penetrate—can dramatically alter streamflow patterns by causing rainwater to runoff quickly rather than soak into the ground. The resulting high streamflows can sweep away spawning beds as well as sweep away large pieces of wood and other features of streams that provide fish shelter, accelerate

storm runoff, and increase the flow of pollutants into streams. Precipitation that enters streams as surface runoff also can be warmer than that which seeps into the ground and is later released to streams. Hence, the greater the amount of impervious surfaces in a watershed, the lower the health of its streams.[23]

Studies near Puget Sound show that, in natural forests, less than one percent of rainfall becomes surface runoff, 33 percent becomes groundwater, and 46 percent returns to the atmosphere via evapotranspiration. In contrast, on impervious surfaces 84 percent of the rainfall becomes surface runoff, none becomes groundwater, and 16 percent is evapotranspirated.[25] Almost all of the pollution deposited on impervious surfaces that is not removed by street cleaning, wind, or decay will end up in surface waters.[26]



Covering as little as 10 percent of a watershed's surface with impervious surface can exhaust a stream's capacity to maintain salmon[27]. The amount of impervious surfaces varies with land use. Although low-density residential subdivisions have the lowest impervious surface per lot, their longer roads, driveways, and sidewalks generally create more overall impervious surface than cluster-style housing.[28] High-density development, avoiding an oversupply of parking lots, and the preservation of natural vegetation can together decrease impervious surfaces to very low levels.

Sediment and other pollutants. Urban lands generate lots of pollution harmful to salmon. Studies in the Willamette Basin show that, per acre, urban sites deliver the greatest amount of suspended sediment to streams.[29] Construction activities are especially harmful, generating 59,670 pounds of sediment per acre per year while general urban activities produce 27-44 pounds per acre.[30] Erosion control measures at construction sites, and the retention of streamside vegetation, can control muddy runoff and sediment deposit.

In the Puget Sound Basin, more types of pesticides were detected in urban streams than in agricultural areas. Urban use of pesticides, about 1.1 million pounds per year, is more than three times greater than agricultural use in the Puget Sound area.[31] Pesticides used on lawns and gardens often end up in streams, where concentrations frequently exceed water-quality standard.[32] Green landscaping avoids pesticides altogether where possible and uses limited amounts where needed.

BOTTOM-LINE BENEFITS

Salmon and the environment are not the only beneficiaries of green building practices. These common-sense actions also put more money in the pockets of builders, homeowners, and the owners and occupants of commercial and industrial buildings. They also save money for taxpayers and utility-rate payers.

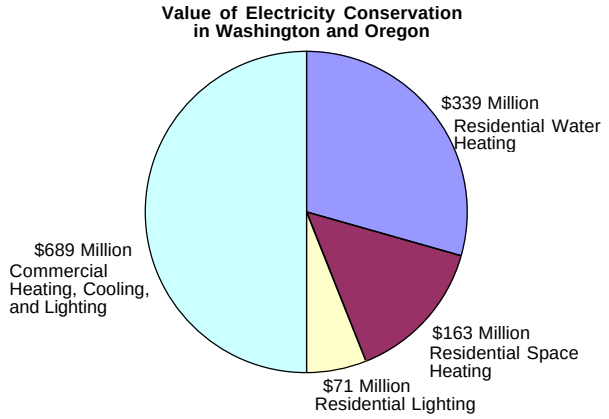
In some cases, these financial benefits come about at little or no cost: adjusting thermostats, for example, or using comparably priced non-toxic building materials instead of toxic ones, or landscaping a yard with plants that have low water requirements in summer months. Others require an initial cost, but then generate savings, usually spread out over the useful lifetime of a building or a landscape. The green building practices that yield the greatest savings pay for themselves in a very short amount of time. Others take longer, but are still financially worthwhile.

Below we illustrate how green building can strengthen the bottom line at home and work.

Electricity conservation is worth $1.1 billion in Washington and Oregon

Economists at the Northwest Power Planning Council (NWPPC) recently identified the electricity conservation potential that exists in Washington and Oregon. Using the most likely forecasts of population, economic growth, and energy cost, economists estimate that electricity customers could cost-effectively reduce their electricity use by 800 average megawatts over the next 20 years. In monetary terms, ECONorthwest calculates the conservation resource—within the residential and commercial sectors—has a present value of $1.1 billion. That amount represents the *net benefit* of conservation after having subtracted the initial cost of implementing the electricity-saving techniques.

Because NWPPC believes most of the potential lay in new homes and offices, green builders will play a critical role in tapping these savings.



Lower utility costs and easier financing for homeowners

Homeowners (and renters) benefit by paying less for electricity, natural gas, water, and other services they pay for on a per-unit basis.

Looking across all homes, we estimate that Northwest residents could save $23 million each year by efficiently heating the water in their homes; another $11 million a year could be saved through efficient space heating.[33]

Because the economic benefits of green building are not limited to the timespan of one owner, homeowners benefit not only from their cost savings, but also from the increased re-sale value of their home or building. Between 70 percent and 90 percent of many energy-saving improvements translate into increased home equity.[34] Homebuyers need not wait to enjoy these savings. So-called energy-efficient mortgages allow homebuyers to document energy savings while buying their house. The dollars that are liberated from the family's utility budget can be applied to the overall loan amount and make a family eligible for a larger loan.

The Green Payback

A package of green-building techniques—which includes improved insulation, advanced windows, low-flow toilets, tightly-sealed ducts, and a high-efficiency heating system—will add about $3,000 to the cost of a $160,000 home. However, the homebuyer saves a little more than $500 each year in energy costs.[1] Evaluated in financial terms over ten years, the $3,000 green investment generates an 11-percent internal rate of return.

Lower operating costs and higher profits for commercial buildings

Green building practices decrease the use of electricity, natural gas, fuel oil, and other services that commercial ratepayers pay for on a per-unit basis. Take, for example, an engineering firm operating out of a 50,000 square foot building and spending $125,000 per year on energy. By making two environmentally sound investments, the company can cut its energy costs and bolster its bottom line. Replacing wasteful T-12 fluorescent lamps with energy-efficient T-8s or T-5s would cost $17,000 up front but saves the firm $4,300 each year over the next ten years. Similarly, an inspection and tune up of the heating, cooling, and ventilation system would cost about $15,000 and generate annual energy savings of $4,200 thereafter. Taken together, these two steps cost $32,000 and yield yearly savings of $8,500. The measures pay for themselves in a little less than four years.[35]

Although in this simple example the firm's energy bill drops by 7 percent, far greater savings are obtainable. The U.S. Environmental Protection Agency estimates that—by incorporating a full complement of green building techniques—some businesses could lower their energy costs by up to one-third.[36] Locally, we estimate that commercial businesses in the Northwest could save more than $38 million annually by updating their heating, cooling, and ventilation systems; installing occupancy sensors; and using compact florescent lighting.[37]

Higher profits for builders and developers

Buildings designed with green-building principles and constructed with green-building techniques can be more marketable than conventional buildings and, hence, enable developers and builders to earn higher profits. These benefits come about through several, related mechanisms:

- Market segmentation. Many potential buyers or tenants will pay more for the cachet of being in a building that can readily be identified as complying with the principles of

green construction. In contrast, firms with a reputation for harming salmon risk consumer backlash.

- Capitalization of operating savings. Lower future utility bills mean buyers can spend more on the structure.

- Capitalization of higher productivity and amenities.

More and more builders and developers will have the potential to profit from green building as market demand increases. A recent Executive Order by Oregon's Governor Kitzhaber requires sustainability purchasing benchmarks for state building construction, providing an example of future increased demand as public policy reinforces market trends. Related market forces, evidenced by Home Depot's shift towards green building materials, reinforces such actions by state and local governments.

Increased human health and productivity

Green buildings are healthier and more pleasurable places to work. Efficient lighting helps people see better, which reduces mistakes, increases work quality, and boosts production. The elimination of toxic building materials improves worker health. Optimal heating and cooling system increase worker comfort and output.

In two model sites, the US Green Building Council estimates that green features increased worker productivity by between 6 percent and 16 percent.[1] Even small productivity gains can justify an investment in green techniques. For example, consider a 10,000-square-foot office space renting for $20 per square foot including energy costs of $1.80 per square foot. If 25 workers occupy the office, and each earns an average annual salary of $50,000, the workers cost $125 per square foot—or 70 times more than energy. In this example, a 1-percent increase in worker productivity would pay for the company's entire energy bill for eight months.[38]

Productivity Increases

In two model sites, the US Green Building Council estimates that green features increased worker productivity by between 6 percent and 16 percent.

Lower costs for utility ratepayers, taxpayers, and downstream property owners

All ratepayers benefit from the decreased marginal costs of producing electricity, water, gas, and other natural resources. In general, it becomes more costly to extract resources as the level demanded increases, and costly new infrastructure is required. Taxpayers also benefit by preventing pollution and damage to salmon habitat at the outset, when the cost of clean up is cheaper, rather than after the damage is done.

Taxpayers can also benefit through green building as public buildings that use these techniques achieve capital and operational savings that can be passed on to all taxpayers. For example, new Seattle public schools incorporate sustainable design features—such as occupancy sensors for lighting—and have saved taxpayers more than $1.3 million in electric and water bills each year. In Portland, the installation of energy efficient lighting, extra

insulation, and atrium skylights into the City Hall has reduced electricity use by 24 percent, saving $15,000 each year.

Healthier housing and lower utility bills for low-income families

Low-income families are more likely to notice and appreciate the utility savings associated with green building given that utility bills comprise a larger share of their total expenses[39]. Recognizing this fact, several builders of affordable housing in the Pacific Northwest have incorporated green-building techniques into their designs. St. Vincent de Paul, which owns and operates 500 affordable-housing units throughout Oregon's Willamette Valley, has developed its own green-building manual[40]. Whenever financially possible, the non-profit organization incorporates energy-saving measures into its units, such as compact fluorescent lights, solar-hot-water systems, and low-E-gas-filled windows. The organization will experiment with foam-core-panelized housing that greatly reduces the use of lumber. St. Vincent de Paul also operates several recycling and waste-based business ventures including the creation of the St. Vincent de Paul Woodshop, Mattress Factory, Appliance Shop, and Aurora Glass. Through these ventures, the organization diverts more than 12 tons of waste each day from area landfills and creates jobs for low-income people.

Adding it up: Green Building's Bottom Line

In short, Green Building practices are just plain good business. They benefit the economy, salmon, and the environment. By incorporating these practices into new construction and remodeling projects, residents and businesses in Washington and Oregon could save more than $90 million each year. Green building is a key element in helping the region move towards more environmentally and economically sustainable paths.

- **Electricity conservation:** Widespread adoption of common-sense practices to conserve electricity would save about 800 megawatts. At the average retail rate, this conservation would save residential and commercial consumers $77 million per year.

- **Water conservation:** If simple conservation measures were adopted throughout Washington and Oregon, region-wide water consumption would fall by 14.9 billion gallons each year, and water customers would have a net savings of $12 million annually on their water bills.

- **Erosion:** Excess runoff from each acre also imposes about $110 in costs on others by clogging stream channels, raising the risk of flood damage, and increasing filtration costs for water users. Each year, construction occurs on 15,500 acres in Washington and Oregon. Eliminating excess sediment would save taxpayers $1.7 million annually.

- **Toxic pollution:** Landscaping designs greatly influence the amount of pollution harmful to fish. For example, urban use of pesticides in the Puget Sound area—about 1.1 million pounds per year—is more than three times agricultural use and costs about $760,000.[41] Reducing usage to agricultural levels would save about $500,000. With similar reductions throughout the region the total savings would be $900,000 in Washington and $780,000 in Oregon.[42]

CASE STUDIES: SUCCESSFUL GREEN BUILDING PROJECTS

Any one of the green building techniques described above can benefit salmon and the bottom line. Incorporating a host of these techniques can increase the benefits further. This chapter describes some of the successful building projects and practitioners from the Northwest and neighboring states that use innovative green building techniques to save salmon and dollars.

Commercial Projects

Tolman Creek Shopping Center, Ashland, Oregon. Completed in 1991 by Watson and Associates, this 94,500 square-foot retail development incorporates a number of green building features, from site design to energy efficient building systems. The development preserved an existing stand of oak trees and a stream. In addition, it utilized natural lighting, high levels of insulation, a heat recovery system for the grocery store refrigerators, and occupancy sensors to control lighting and heating. The development also minimized the size of the parking lot and thereby decreased the impervious surface to improve storm drainage. As a result of these green measures, the energy performance of the development is beyond the City of Ashland's model energy code. The grocery store saves $40,000 annually in energy costs. The development received the Bonneville Power Administration's Energy Smart Award.[43]

Wieden & Kennedy Headquarters, Portland, Oregon. This five-story building, which formally operated as a cold storage facility in Portland's Pearl District, serves as Weiden and Kennedy advertising firm's new headquarters. The building continues to receive local and national attention for its unique one-of-a-kind design and incorporates recycled structural timbers, daylighting, and an under-floor air distribution system. The project was awarded tax credits under the State of Oregon's Business Energy Tax Credit (BETC) program and was the recipient of a BEST Business Award for Energy Efficiency by the Oregon Office of Energy.

Portland General Electric Gas Transmission Headquarters. A model of sustainable design and construction, the building was awarded the Design Award for Energy Efficiency by the Architecture and Energy Steering Committee of the AIA/Portland Chapter. The 180,000 square foot, six-floor building incorporates occupancy sensors, high-efficiency glazing on building walls, and daylighting among other green building techniques.

Norm Thompson Outfitters, Hillsboro, Oregon. This 55,000-square-foot building was completed in 1996 and features advanced lighting systems, recycled building material, and a bioswale to filter stormwater. Though the environmental improvements initially cost an additional $4 per square foot, or $220,000, the company expects the savings to pay back the

initial cost in just over 4 years, with annual energy savings of up to $22,000 after the fifth year.[44]

King Street Center, Seattle, Washington. Opening in October 1999, this eight-story 327,000 square-foot office building is Seattle's "greenest" building to date, and includes the largest installation of renewed carpet in North America. Carpet renewal, consisting of super-cleaning, re-texturing and restyling used carpet tiles, saves about half the cost of new carpet and decreases landfill waste. The sensor-controlled lighting in the building is the most energy-efficient to date in Seattle, using 28 percent of the energy allowed by existing energy codes. An on-site rainwater reclamation system will supply 60 percent to 80 percent of water used for flushing toilets in the building.[45]

Town and Country, Seattle, Washington. This 69,000 square-foot retail grocery store development, completed in 1995, incorporates recycled building materials and a number of energy efficiency measures.[46]

Seventh Generation Systems Sustainable Technology Center, Friday Harbor, San Juan Island, Washington. This 17,000 square foot commercial/office development, completed in 1995, targets high-technology firms and uses state-of-the-art green building technology. Some of its features include high performance windows, solar space and water heating, a super-insulated building envelope, onsite wastewater treatment, reclaimed water reuse, and recycled building materials. As a result, this development saves $32,000 a year--the equivalent of two months' free rent for all its tenants. Electricity costs were reduced 83 percent, and sewer and water costs were reduced 69 percent.[47]

Double Tree Inns, Portland Oregon. Hotels were retrofitted with efficient plumbing fixtures and established a conservation education program. Double Tree replaced single-pass laundry washing systems with filtration and reuse systems. Hotel retrofits saved 12 million gallons per year (36 percent). The laundry project saved 6 million gallons of water per year (an additional 30 percent).

Residential Projects

Build a Better Kitsap Home, Hansville, Washington. The Build a Better Kitsap program is run by the Home Builders Association of Kitsap County. There is also a program in Clark County, Washington. This 2400 square-foot home meets the programs highest "3-Star" criteria and is expected to save $750/year in heating costs.[48]

Affordable Housing, Buckman Heights Apartments, Portland, Oregon. This 144-unit affordable housing complex in northeast Portland incorporated recycled sheet rock and insulation, water-based adhesives, green-label carpeting, bioswales and planters that eliminate stormwater discharge, and continuous indoor ventilation. The cost was only $62 per square foot, and the apartments were full six months after opening.[49]

Cascadia Home, University of Oregon. This home design was developed by the Energy Studies in Buildings Laboratory at the University of Oregon's Department of Architecture. It uses 20 percent less energy per year than a comparable size house built to Oregon code. It is eligible for $1500 in rebates for energy efficiency, $1273 in Oregon income tax credits,

and an Energy Efficient Mortgage. It is currently being built by the Springfield/Eugene Habitat for Humanity.[50]

Wolf-Meyer House, Wallingford, Seattle, Washington. Renovated by architect Rob Harrison, this 92-year-old home uses compostible linoleum and cork floors, non-toxic building materials, a circulating hot water pump that provides instant hot water, and a heat exchanger that heats water with water drained from the bathtub/shower.[51]

An Urban Retreat, Queen Anne, Seattle, Washington. This renovation of a 1930's house incorporated double-glazed, argon filled windows; CFC-free, recycled insulation; advanced framing; salvaged timber and doors; bathroom tiles made of recycled glass bottles; water-based finish; a countertop water filter; light dimmers; a front-loading clothes washer; and a water-permeable parking spot.[52] These features will provide operational savings for years to come, as well as being easy on the environment.

Village Homes, Davis, California. Considered to be the "grandaddy of green development," this 70 acre, 240-unit residential development was completed in 1981 by Michael and Judy Corbett. All homes are solar heated, as is the development's swimming pool. Narrow streets of 24-26 feet are used to cut down on stormwater runoff, to lower ambient air temperatures, and to improve pedestrian safety. Natural surface drainage swales provide for on-site stormwater control. This project has been a resounding financial success. The project's original investors made a profit of 30 percent annually. In 1995, the homes in the development sold for $10-$25 more per square foot than standard homes in the area. Surface drainage measures alone saved $800 per lot.[53]

ACT^2 House, Davis, California. This 1672 square-foot demonstration house used advanced framing techniques to cut wood consumption by 50 percent. Green heating and cooling features allowed for the elimination of a furnace and air-conditioning. Energy costs were cut by 75 percent, and construction costs were $1800 less than comparable non-green houses.[54]

MOVING FORWARD

Green building is not only good business; it is sound economic policy. As businesses and homeowners spend less on utilities and construction—without sacrifice in service or comfort—productivity increases, the economy grows, and salmon habitat improves. With benefits of more than $90 million each year, the market should be quick to embrace these commonsense practices. Yet—as with any new idea—tapping green building's full potential will require education. Below are some key steps that will expedite the education process.

Enhance the visibility of green techniques. Customers don't value what they can't see, which puts important techniques—like insulation—at a disadvantage. To get around this, builders might spend more time touring half-built homes with potential buyers when walls are exposed and crawl spaces are accessible. Demonstration homes, with exposed wall and floor space, also serve as important selling tools.

Improve information. Homebuyers may not be aware of the savings associated with green building and may perceive initial investments as simply an uncompensated cost. Many states have promoted Home Energy Rating Systems (HERS) to provide information on energy costs and specific systems. To draw attention to energy-saving features, one homebuilder has even offered a money-back guarantee. Bigelow Homes of Chicago guarantees that seasonal heating bills will be less than $200 or the homebuilder will pay the difference (RMI, 1998). The builder has had to make good on the guarantee only twice.

Work energy savings into financial vehicles. In this credit-card culture with households willing to pay up to 18 percent interest on their current purchases, we have ample evidence that some people simply won't value energy savings unless they are immediate. Energy-efficient mortgages are one solution to this dilemma. They have been around since the early 1980s, and the notion is simple. The less you're expected to pay for electricity, gas, or water over time; the more you have left to spend on the physical house. These lending vehicles allow you to capture those long-run energy savings in the initial mortgage effectively raising the price ceiling for a home purchase.

Making the Case

Market surveys show that—if utility savings are well documented—buyers will pay a premium for green amenities. Green developers should start with most cost-effective features first and get them on the ground, proving to bankers and other members of the development community that these techniques make financial success.

Get green comparables into the marketplace. Most builders and developers are also not aware of the latent demand for green buildings, and the extent to which their green product could be a big moneymaker. Promoting the cost savings and financial benefits of green building will generate even further demand.

Speak to bankers in their own language. Lenders are, by the nature of their business, conservative and unwilling to lend money for projects that they see as unusual or untested. What might be mainstream in one neighborhood of residents might be seen as "risky" by financial institutions. Until lenders are presented with more information showing how green construction is a good investment, they will

continue to be a barrier. Sustainability, bio-diversity, and ecology have little currency in the financial world. If green building techniques are going to thrive in the marketplace, it will be because all participants in urban development understand that they make economic sense.

Leverage the free press. Green building is innovative and newsworthy. Developers should incorporate free media coverage into their marketing strategies—for example sending press releases and inviting writers to building or home openings.

Study and quantify savings for the newest techniques. Ideas that are still in their infancy—like building commissioning—lack solid statistical data on the costs and benefits. Rigorous studies that follow a consistent format should be conducted to demonstrate the energy and non-energy benefits of the measures.

Standardize green building measures. The U.S. Green Building Council has designed a "Leadership in Energy and Environmental Design" or "LEED" system for rating green buildings, and it is proving to be an industry benchmark for green building, particularly for commercial buildings. The LEED Green Building Rating System evaluates environmental performance from a “whole building” perspective, providing a definitive standard for what constitutes a green building. The feature-oriented system rates new and existing commercial, institutional, and high-rise residential buildings.

The City of Seattle recently adopted the LEED system as a benchmark for its new municipal buildings. The LEED system is also referenced in Oregon Governor Kitzhaber's recent Executive Order as a benchmark for state buildings.

Enact enhanced appliance standards through Congress and the US Department of Energy. For certain techniques—particularly appliances like refrigerators, freezers, water heaters, clothes washers—the most effective way to spur widespread use of the technique would be through the legislative and regulatory processes. Public interest groups, utilities, manufacturers, and state energy offices will need to supply policymakers with information from relevant pilot projects like Super Efficient Refrigerator Project.

APPENDIX A: USEFUL REFERENCES

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