EARTH ECONOMICS

The Economics of Change

Catalyzing the Investment Shift Toward a Restorative Built Environment

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Abstract:
The Economics of Change: Catalyzing the Investment Shift Toward a Restorative Built Environment provides effective alternatives to the current financial model and policy framework that drive investment decisions in real estate. These alternatives will help shift limited investment capital towards a restorative built environment by integrating social and environment benefits into investment models appraiser methodologies, and supporting policies.

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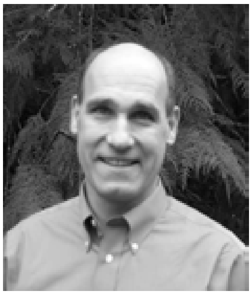
Jason Twill

Currently managing sustainability initiatives at Vulcan Inc., Jason has over 13 years of experience in the areas of construction management, architecture, urban planning and real estate development. His work includes research and implementation of portfolio-wide resource conservation program, creating investment strategies for alternative energy and water systems, and advocacy work for policies that support environmentally and socially conscious design. Jason earned a masters degree in real estate finance and development from New York University and is a trained climate change communicator for both the city of Seattle and The Climate Project. Jason is a member of the Garrison Institute's Climate, Mind & Behavior Project and serves on the boards of the International Living Future Institute, BioRegional North America and is a founding board member of the Green Sports Alliance. He was the recipient of the 2011 Better Bricks Emerging Leader Award and was selected as a 2011/2012 Affiliate Fellow to the Runstad Center for Real Estate Studies at the University of Washington's College of Built Environments.

David Batker



Founder and Executive Director of Earth Economics since 1998, David Batker has completed over a dozen path breaking ecological economics studies that have changed policy at the international and local levels. Mr. Batker completed his graduate training in economics under Herman Daly, one of the world's foremost ecological economists and brings over 20 years of experience working on environmental and economic issues specializing in ecosystem service valuation, trade and international finance. His work has directly contributed to shifting lending at the World Bank, IDB, ADB, ECAs and private banks, and an exception to the US Army Corps of Engineers' Principles and Guidelines to include the value of wetlands for storm protection in Benefit Cost Analysis in Louisiana. Mr. Batker is also working the US Federal Emergency Management Agency to include ecosystem service values in their Benefit Cost Analysis tools.

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Stuart has 15 years of experience in designing, planning, and financing sustainability projects in ecological design, renewable energy, and biocultural restoration. He was a founding member of Portland Family Funds, a sustainable community bank. Together with its national affiliate, United Fund Advisors, PFF has structured transactions totaling $2 billion, creating 16,000 jobs. While at Ecotrust, he led the development of the Reliable Prosperity framework for a carbon neutral bioregion. He is the co-author with Sim Van der Ryn of Ecological Design, an overview of the integration of ecology, architecture, land use planning, and product design that has been translated into three languages. He is the co-founder of Autopoiesis LLC, which uses self-organizing living systems to collaboratively create value and mobilize capital for biological + cultural resilience. He received his doctorate in Complex Systems from U.C. Berkeley.

Theddi Wright Chappell

In collaboration with the Northwest Energy Efficiency Alliance (NEEA) and Cushman & Wakefield's Research Group, Theddi developed the Green Building Opportunity Index, the first office market assessment tool to provide weighted comparisons of top U.S. office markets on the basis of both real estate fundamentals and green development considerations. She is a national speaker and educator on the implications of green strategies on asset value and serves as the Ambassador of Sustainable Initiatives for the Appraisal Institute. She is a Director of the Green Building Finance Consortium and was an organizer of and presenter at the international Vancouver Valuation Summits I and II in Vancouver, BC. Prior to joining C&W, she served as the CEO of Sustainable Values, Inc. in Portland, Oregon, where she specialized in market, feasibility and investment analysis, particularly related to valuation and financing of new, existing, and urban redevelopment projects, and the identification and quantification of the benefits of sustainable development.

Executive Summary

A new policy framework implemented in the Northwest, coupled with an enhanced real estate investment model has the potential to drive billions of dollars towards a truly sustainable built environment, with exceptional benefits for our local economies and ecosystems. This investment shift has the potential to completely transform the built landscape in the coming decades.

Through a unique collaborative effort that unites the theoretical approaches of ecological economics and the practical techniques of real estate appraisal and valuation this study expands the methodologies used to evaluate the multiple benefits of high performance green buildings and infrastructure. In contrast to the handful of traditional industry metrics currently considered, this broader framework for appraisal and valuation of the built environment includes social and ecological costs and benefits. A deeper understanding of these costs and benefits has the potential to incentivize environmentally and socially responsible real estate investment and bring restorative buildings and communities to scale in the Pacific Northwest Region and beyond.

The overarching goal of this study is to catalyze a shift in mainstream real estate practices to support a restorative built environment that is compatible with and supportive of healthy natural environments. This study seeks to provide evidence of monetized environmental and social benefits that are currently not considered in a conventional real estate investment model. By enhancing the underlying real estate investment model, which includes appraisal, risk assessment, finance, and lending, a high performance built environment appropriate for the 21st century can be achieved.

The built environment, and the building sector in particular, have a massive impact on climate change, biodiversity loss, diminished connection to nature, and many other environmental and social issues. Traditional real estate valuation and investment strategies fail to capture the full suite of benefits produced by high performance buildings – and, conversely, the full environmental and social costs of conventional buildings. As the building design and construction industries continue to make step-leap efforts in leveraging processes and technologies to achieve highly sustainable buildings, time is of the essence to institute a new investment model and a strategic redirection of policy incentives that support this industry transformation.

Introduction

In the past decade, hardly a day has passed without the news headlines, magazines, or TV reporting on some form of adverse environmental or social issues occurring in the world.   Media outlets in nearly every nation are consistently relaying the story of a world that is getting more divided, more dangerous, and more complex to live in. Climate Change is causing the earth's glaciers to melt causing sea level rise; the chemical soup generated by human industries is causing infants to be born with unprecedented levels of toxins in their bodies; and millions of people are dying of avoidable poverty-related illnesses each year. As of 2011, the global economy continues to teeter on the edge of further losses. All of our global ecosystems are either under stress or in active decline.[1]

According to the World Wildlife Foundation's Living Planet Index, an indicator designed to monitor the state of the world's biodiversity, the planet's major ecosystems have been in steady decline since the mid 1980s. Numerous reports by thousands of respected researchers and organizations from around the globe reveal that human activities are putting such a strain on the environment that the planetary systems required to sustain life on earth (e.g. clean air & water) can no longer be taken for granted.

The consequences of our activities are already being witnessed around the world: the collapse of ocean fisheries is threatening lives and livelihoods of many cultures; topsoil depletion and the loss of workable farmland is contributing to severe food shortages; and dwindling quantities of clean water are putting many populations at risk of contracting preventable water-borne diseases such as cholera. In particular, human induced global warming has emerged as a defining challenge of the 21st century.

The paradox of our modern age is that at the same time natural resources are disappearing, our demand for them is increasing. According to the Global Footprint Network, the Ecological Footprint

has emerged as the world's premier measure of humanity's demand on natural resources. The Ecological Footprint calculates how much of the planet's natural resources are needed to not only produce the goods and services we use, but to absorb the waste streams created through our consumption of these resources. Historical trend analysis of this metric shows that our global demand for resources and ecosystem services has been rising steadily since the 1970's. These analyses demonstrate that demand on the planet's natural resources has already surpassed by more than 30% the earth's capacity to regenerate those same resources.[2] More simply stated, it would take 1.3 planets worth of resources to meet our current demand. If everyone consumed at levels of U.S. citizens, it would take nearly eight planets' worth of resources. As of 2007, the United States had the fifth largest ecological footprint per capita of all nations only behind those of Belgium, Denmark, Qatar and the United Arab Emirates.

The consequence of living beyond the planet's means is that ecosystems are being run down, resources are disappearing and waste is accumulating in the air, land and water. The resulting impacts – such as clean water shortages and climate change – are putting the well-being and development of all nations at risk.[3] The built environment is a huge contributor to the ecological footprint of all nations.   Yet as we enter into this new age of sustainability, we may begin to shift our understanding of the built environment as something that the natural world has to be protected from, to a seeing it as humanities greatest tool by which to restore the world.

Transforming the built environment from a source of environmental and social stress into a restorative fabric that can support a more resilient world will require new approaches. Progressive policies and a shift in current appraisal, lending, financing and risk assessment methodologies are required to change the financing, profitability, and value determination of high performance green buildings. At a national level, fundamental economic and market incentives can direct trillions of dollars of real estate investment toward sustainable building investments.
By integrating complex systems analysis, ecological economics and practical market experience, we are proposing new methodologies to assess, monetize and demonstrate the value of social and environmental benefits inherent in green buildings and infrastructure. The value captured by these benefits is identified by avoided externalities (e.g. zero impact on watershed) and positive externalities created through the restorative design principles of a Living Building (e.g. habitat/soil regeneration, elimination of toxics in material supply chain, beauty, water conservation, etc.). The Living Building Challenge certification program administered by the International Living Future Institute[4] is a program which seeks to move beyond LEED but is deeply rooted in practical applications of current technologies and design principles.

During April to October of 2011, Earth Economics partnered with Cushman and Wakefield, and Autopoiesis LLC to conduct Phase I of a research study to identify and investigate leverage points which will catalyze a large-scale shift in current real estate investment practices. The team developed a framework, scope, strategy for evaluating environmental and social benefits inherent in high performance green buildings and specifically how these benefits may be monetized. The team created a prototype modeling tool for the purpose of demonstrating how the incorporation of these additional monetized benefits into a real estate proforma may begin to positively alter investment decisions in the built environment.

Phase II of the study will include further development, refinement and peer review of the new investment model and identification of key policy reforms needed to support it. In addition, the investment model will be applied to three case study projects in the United States region: The Bullitt Center in Seattle, WA and the Oregon Sustainability Center in Portland, OR and One Bryant Park (Bank of America Headquarters building) in New York City. The tool will be tested with early adopters in the finance community with the goal of creating innovative methods most likely to be accepted by the mainstream real estate community.

Phase III will involve large-scale implementation, beginning with key early adopters identified in Phase II, including state level regulatory and legislative bodies, local municipalities, lending institutions, valuation experts, and regional utilities.

This document summarizes the team's work in Phase I, consisting of initial research, development of the prototype investment tool, and a planning effort to define a strategic approach.

The primary outputs of Phase I include the following:

1. A prototype of an integrated real estate investment model that explicitly links a recognizable conventional real estate financial model to ecological and social costs and benefits. This provides a method to test the impact on financial returns of internalizing, building markets in, generating revenue streams for, or otherwise accounting for ecological and social factors typically valued at zero;
2. Identification of new areas of value creation for environmental and social benefits derived from green building strategies; and
3. Identification of positive externalities as well as avoided negative externalities of high performance green buildings.

This report is organized in the following sections:

- **An Overview of Ecosystem Services**, including a discussion of natural capital and why it is important to account for it;
- **Ecosystem Services and the Built Environment** applies ecosystem service concepts to the built environment using a living building example;
- **Defining the "Value" of Sustainable Benefits** discusses current and future real estate appraisal analyses and including the challenges and opportunities for guiding the appraisal industry toward integrated valuation techniques;
- **The Integrated Real Estate Investment Modeling Tool** describes our prototype Pro Forma model including worksheet descriptions and assumptions;
- **Accounting for Cost Avoidance** identifies key issues in assessing the true contribution of reduced environmental demands from the built environment using case study examples;
- **Social Benefits of Green Buildings** describes the benefits of health and productivity gains, increased comfort, a sense of place, and enhanced transportation accessibility;
- **Towards 21st Century Economic Development,** articulates a vision mapping connections between new models of a restorative built environment and setting the stage for future sustainability investment and;
- **Conclusion** of our Phase I project and outline of our program for Phase II of this project.

An Overview of Ecosystem Services

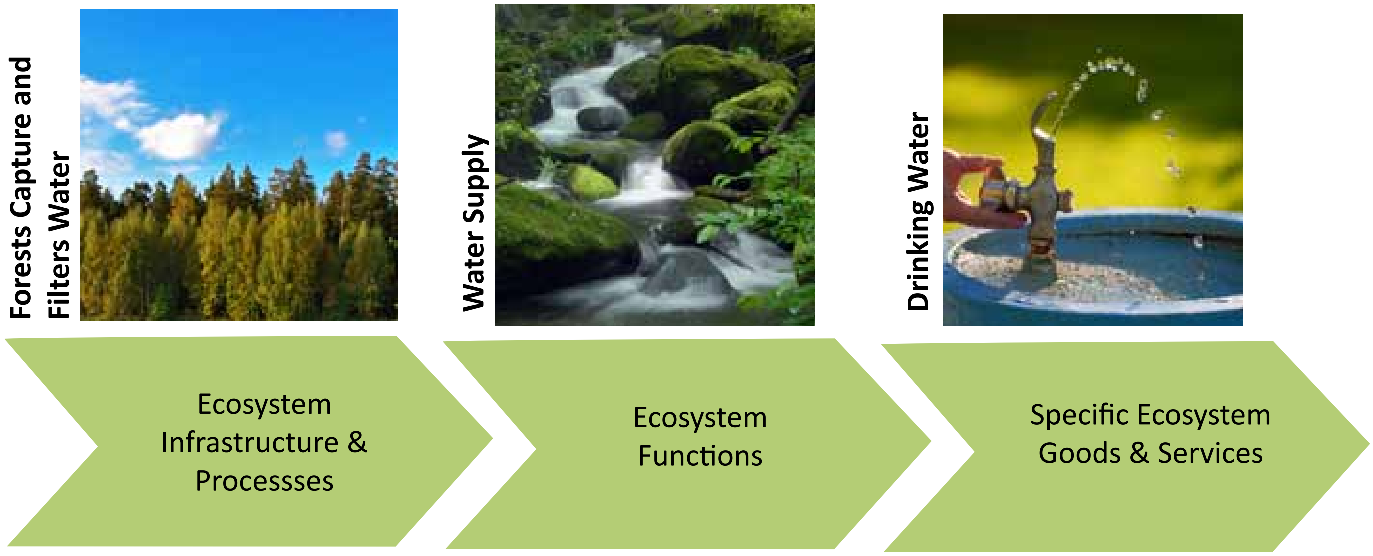
Our natural environment provides many of the things we need to survive – breathable air, drinkable water, food for nourishment, and stable atmospheric conditions – to name a few. These are what we refer to as "ecosystem goods and services." Ecosystem goods and services are those derived from natural systems that provide benefit to humans and all living things. Every ecosystem produces a "suite" of ecosystem services. Ecosystems perform many functions, but only functions that provide human benefits are considered ecosystem goods or services.

Healthy, resilient, natural infrastructure, referred to as "natural capital", is critical to the production of ecosystem goods and services. The natural capital of an ecosystem consists of its individual structural components (trees, forests, soil, hill slopes, etc.). These structural components work to produce dynamic processes (water flows, nutrient cycling, animal life cycles, etc.) that, in turn, create functions (water catchment, soil accumulation, habitat creation, etc.) and generate ecological goods and services (salmon, timber, flood protection, recreation, etc.). Figure 1 illustrates the relationship between ecosystem service process, function and goods and services.

This relationship can be likened to the production of cars in a factory: to build a car (a "built" good) requires high quality built capital (e.g. the factory, machines and connection to a power plant), natural capital (e.g. the extracted metal, rubber, food for the workers), human capital (the workers), financial capital (equity to buy the raw materials) and social capital (labor laws and agreements etc.).

When an ecosystem service is lost, a tax district is often created to raise money for the municipality to import or install the built capital required to provide the specific service that was lost. Ecosystem services provide economic value to our measured economy. When the positive values of ecosystem services are not counted, financial analysis disregards their loss. That loss is usually felt economically. When we damage or destroy a part of an ecosystem, critical ecosystem services may be damaged or lost, and must then be replaced by more costly built alternatives, often at taxpayer expense. If ecosystems are valued as assets, however, the most valuable and cost effective services will be preserved. Once lost, ecosystem goods and services are expensive to recover or may not be recoverable at all. Buildings are considered durable goods or assets, but in many ways they are more similar to ecosystems. Like an ecosystem, a building provides a suite of goods and services including space, warmth, water, storage, protection from the elements, and if designed and built right, healthy air supply.

Figure 1: Relationship between ecosystem process, function and goods and services



Ecosystem Goods

Ecosystem goods are typically tangible, quantifiable items or flows, such as drinking water, lumber from trees, fish, and food. Most goods are excludable, which means that if one individual owns or uses a particular good, that individual can exclude others from owning or using the same good. For example, if one person eats an apple, another person cannot eat that same apple. Excludable goods can be traded and valued in markets. The quantity of water produced per second or the amount of timber board feet in a 40-year rotation can be measured by the physical quantity an ecosystem produces over time. The current production of goods can be valued relatively easily, by multiplying the quantity produced by the current market price. Similarly, buildings are often valued based on their "excludable" economic aspects. Yet, buildings have the potential to provide many non-excludable services as well.

Ecosystem Services

Ecosystem services are "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life".[5] Unlike ecosystem goods, ecosystem services are generally not tangible items that one can see or hold. Flood risk mitigation and prevention, recreational value, aesthetic value, and ground water recharge are a few of the services that ecosystems provide. Though they are often more difficult to value monetarily because market values rarely exist, ecosystem services have tremendous economic value and are critical both for our quality of life and for economic production.[5; 6]

One reason these services seldom have defined economic values is that, for the most part, ecosystem services are non-excludable. For example, when one person enjoys a view of the Mt. Rainier National Park, another person is not prevented from enjoying the same view. Similarly, many non-paying downstream residents may benefit from the flood protection provided by upstream forest lands. Because of the challenge associated with measuring and valuing ecosystem services, they have often been ignored or entirely excluded from modern economic models. Often the positive aesthetic value of a building may provide additional value to neighboring buildings by creating a certain quality of place. This aspect of a building's value is not excludable and has a positive impact beyond the building's property line. Similarly, the blight value of a neglected or poorly designed building may drag down neighboring property values.

Ecosystem Services and the Built Environment

Significant benefits to people and other species come through the combination of natural resources (natural capital) and the built environment (built capital). The pipes of a water system (built capital) deliver the vital natural resource of clean water (natural capital) to our homes and businesses. The built environment and natural environment are completely interdependent. Buildings and the infrastructure that supports them are embedded within the natural environment and serve as a conduit and provider of certain benefits to people. Yet, an ecosystem good (e.g. fresh water supply) or service (e.g. fresh water storage) are different from the traditional economic benefits provided by labor and monetary capital that modern economies have historically valued.

The built environment, if conceived and implemented to support both human and natural systems in a restorative manner, can provide similar, if not identical, benefits as ecosystem services within the urban context. The real estate development paradigm that took hold over the 20th century and continues to this day often completely undermines ecosystems services and has historically worked to degrade them to the detriment of people's health and well being. Oddly, it is often the rules set forth by government and regulatory agencies that seek to protect people's health and well being that have permitted this degradation to occur.   Even as we were drafting this paper, the United States Congress was attempting to limit the U.S. Environmental Protection Agencies' rights to regulate air pollution through the Clean Air Act. Clean Air ... one of the primary inputs to maintain life on earth!

While a building may be designed and built to allow rainfall to recharge groundwater supply and avoid costly storm water charges for the owner through integration of permeable surfaces or bio-filtration swales, a conventional building will both deplete groundwater and create unwanted storm water flows that pollute our water bodies. The infrastructure typically mandated by law and building codes to convey storm and waste water is enormously expensive to build and maintain over time. This built capital solution devised over the 19th and 20th century is outdated and depreciates both physically and monetarily with time. Taking cues from nature, one sees that a natural capital solution such as a forest's ability to recharge groundwater has very low maintenance and operating costs and little, if any, capital costs. Similarly, a building designed to maximize groundwater recharge will usually not have costly pipes to install and maintain, thus requiring less maintenance and operating costs over time than one built with a full-blown storm water conveyance system typically required in conventional buildings.

Typically only the construction, or hard, costs reflected in real estate investment models are the built capital portions, not the costs of the infrastructure required to provide the natural capital goods and services to the site. For example, built and natural capital work complimentarily to one another in providing water to our homes, schools and businesses. Pipes (built capital) are required, but are useless if there is no water (natural capital) to fill them. Current industry practice only accounts for built capital costs included in the plumbing system of a newly constructed building (built capital - pipes, pumps, drains, etc..), whereas the value of water (natural capital), water savings, and the capital costs for providing water to the building are not adequately included.

In addition to natural capital, human capital and social capital are also either supported or degraded by the built environment. Few social benefits and/or costs are included in the accounting and valuation methodologies for real estate assets. Yet these benefits also hold tremendous potential for improving quality of life and sustainability of our natural resources.

Human well-being and economic expansion have always been tied to a healthy supply of nature's goods and services. Early economic models were created in a time of abundant natural resources. In that context, only built, financial and human capital were identified as constraining factors in the production process. Today's context is very different. Our planet has become "full" of built capital, and natural capital is now scarce, limiting production. Ecological economics extends basic economic concepts and reflects today's economy more completely. The "ecosystem services" framework is an operational way of including natural capital in economic analysis and is important to understanding and embracing an integrated approach to managing a watershed economy.

Ecosystems, and a vision of buildings serving as ecosystems, require a new, more complete view of economic and market determined value in order to maximize the full suite of benefits provided to building owners, occupants and their communities. For example, a standing forest may be cut down once every few decades to provide an ecosystem good (timber) with revenue generated from the harvest and sales of the wood. However, the same forest, if left standing, might purify the drinking water for a nearby city for centuries, saving the cost of constructing a filtration plant and the additional costs of maintaining the plant each year as it begins to degrade. Additionally, the forest also provides a host of many other services such as flood protection, soil erosion control, and many others.

As an emerging trans-disciplinary field, ecological economics aims to address the interdependence of human economies and natural ecosystems over time. Economists who work within this field have developed an approach to identify, value, map and model three elements of an ecosystem:

1. the provisioning area of ecosystem services;
2. the beneficiaries of those services; and
3. the impairments and impairers of that system.

This is good economics because certain externalities can be eliminated while markets and economic incentives become more efficient. In economics, externalities are costs or benefits, not transmitted through prices that are incurred by a party who did not agree to the action causing the cost or benefit. A benefit in this case is called a positive externality or external benefit, while a cost is called a negative externality or external cost. For example, manufacturing that causes air pollution imposes costs on the whole of society, while fire-proofing a home improves the fire safety of a neighborhood overall. This might correlate to an example within the built environment: if every building was credited in the marketplace for provisioning benefits such as groundwater recharge and storm water management, while buildings that impair services, such as causing storm water run-off and contributing to flooding, would be charged for the damage. Under this scenario, property owners would be rewarded for creating positive externalities and penalized for generating negative ones. Rewards may take the form of tax abatements, elimination of connection charges, or simply a rebate to help offset additional capital costs needed to provide such a service on site.

Penalties may take the form of increased impact fees for poorly designed sites. These rewards and penalties would drive investment decisions toward better site and building design that incorporate proper treatment and use of storm water. By leveraging the dollars collected from impact fees to fund the reward programs for proper design, a municipality may create a feebate program for water management akin to the cap and trade programs devised for carbon markets. A mechanism such as this utilized at scale could drastically reduce the cost burden on municipalities to install and maintain expensive and usually unnecessary infrastructure.

Ecosystem Services of Living Buildings

To further understand how the built environment may mimic and provide ecosystem services within our communities we have attempted to document and define examples of such services inherent within a restorative building typology. This report considered ecosystem services relevant to "Living Building." A Living Building as defined by the International Living Future Institute, the organization which oversees and administers the Living Building Challenge certification program, is a building which "generates all needed energy using clean, renewable resources; captures and treats water through ecologically sound techniques; incorporates nontoxic, appropriate materials; and operates efficiently and for maximum beauty." Table 1 below provides a breakdown and description of various ecosystem services intrinsic to Living Buildings that were identified as part of this study.

Table 1: Ecosystem Services Related to Living Buildings

Ecosystem Service	Definition	Living Building Examples
	Provisioning Services	
Food	Biomass for human consumption, provided by a web of organisms and a functioning ecosystem (see biodiversity definition below).	Food produced on a rooftop garden or elsewhere.
Water	Water supply	Water catchment (cistern or otherwise) that contributes to water supply. Reuse of grey water, or conservation that reduces water consumption per sq foot or per occupant.
Materials	Biological materials used for medicines, fuel, art and building. Geological materials used for construction or other purposes.	Fiber or other material production from the building such as a green roof or living wall. Elimination of toxic chemicals in the building materials provides enhanced air quality for both the workers producing the goods and occupants residing within the building.
Energy	Fossil fuel, electricity, heating energy production or cooling value.	Onsite energy production (solar, geothermal, wind, etc.) or energy consumption reduction values from improved building efficiency.
Biodiversity	The number and types of species and the ecosystems they comprise. Measured at gene, population, species, ecosystem, and regional levels. Biodiversity provides resilience to ecosystems and economies. Biodiversity is the infrastructure provisioning other ecosystem services.	Biodiversity support in an area around a building, or rural acquisition land related to the building. Contribution to salmon restoration or other habitat benefits with storm water recharging of groundwater on site, wastewater treatment or other actions that have biodiversity implications.

Ecosystem Service	Definition	Living Building Examples
Regulating Services		
Shoreline Stabilization	Keeping shorelines in a state of equilibrium with ocean waters, especially in the face of rising sea levels.	Value of natural shoreline protection or stabilization through construction. Conservation of sea grass area or natural beach is an example.
Storm Protection	Mitigation or attenuation of the effects of wind, waves, and flood waters on coastal land and communities.	Onsite collection and reuse of storm water. Reduction or elimination of waters flowing into municipal storm water systems.
Wind reduction values.	Biological materials used for medicines, fuel, art and building. Geological materials used for construction or other purposes.	Fiber or other material production from the building such as a green roof or living wall. Elimination of toxic chemicals in the building materials provides enhanced air quality for both the workers producing the goods and occupants residing within the building.
Flood Protection and Water Flow Regulation	Retention and storage of fresh water, recharge of groundwater.	Reduction of floodwaters downstream (down street) and recharge of groundwater. Water redirection to increase low-flow waters and reduce high flow waters.
Human Disease Control	Undisturbed ecosystems keep in check organisms which can cause disease in humans.	Air quality: contribution to indoor and outdoor air quality through operable windows and nontoxic materials use.
Waste Processing	Detoxification or absorption of natural or human-made contaminants.	Water quality improved through handling and removal of human-made contamination, such as composting toilets: building and site impact on water quality measurably reduced. Soil quality: impact on overall soil quality. Waste recycling, nutrient removal, waste disposal.
Climate Stability and Carbon Sequestration	Maintaining a climate within a stable range. This is facilitated by the capture and long-term storage of carbon as a part of the global carbon cycle. Oceans also play a crucial in role climate stabilization.	Building carbon budget. Relation to off-site carbon sequestration area. Avoided carbon emissions such as no parking garage to encourage non-auto modes of transportation.
Temperature Regulation	Moderating the local heat-island effect.	Reduction in heat-island effect due to building structure through preservation of trees onsite, high-Albedo roof coatings, solar, vegetative façade or roof.
Supporting Services		
Nutrient Regulation and Cycling	Transfer of nutrients from one place to another; transformation of critical nutrients from unusable to usable forms.	Nutrient movements and loads outside wastes discussed above.
Habitat	Providing for the life history needs of plants and animals.	Habitat contribution: On-site habitat features and allowances, use of snags and native vegetation landscaping, connectivity of wildlife corridors, wildlife friendly water features. Habitat contribution: Off-site mitigation.

Cultural Services		
Spiritual	The roles which ecosystems and their components play in the spiritual beliefs of people. This is especially important for indigenous cultures. These values do not lend themselves well to economic quantification.	Building contribution to spiritual values, design attention to natural surroundings, feng shui principles, quiet and meditative spaces.
Scientific and Educational	Ecosystems are the subject of much scientific study for both basic knowledge and for understanding the contribution of functioning ecosystems to human well-being.	Building contribution to scientific understanding of the connection between ecosystem services and the natural environment. Educational value for connecting ecosystem services and the built environment through day lighting systems, "visible green" truth walls and signage.
Tourism	The explicit role in attracting people to areas for vacationing.	Value as a destination for tourists.
Aesthetic	The role which natural beauty plays in attracting people to live, work and recreate in an area.	Building contributions to a net aesthetic improvement to the community: Does it raise property values in the area? Does it have a view of natural assets like the Cascade Mountains or Puget Sound? Or is the building a blight to neighboring residents? (Living Buildings have to meet the criteria of "beauty." Architectural design that is pleasing to the eye, the inclusion of art and open space, green infrastructure can be beautiful.)
Recreation	The contribution of ecosystem features like biological diversity and clean water in attracting people to engage in recreational activities.	Recreational and health benefits of green buildings and the interactions with the landscape through water features, bio swales, vegetated walls, gardens and food growth.

The field of ecological economics has greatly advanced the identification, valuation and mapping of ecosystem services, which in many circumstances has enabled new funding mechanisms such as payments for ecosystem services, ecosystem service markets and ecosystem service management incentives. Fundamentally, problems of sustainability are related to physical stocks and flows of natural and human-produced resources (water, toxics, materials, energy). However, the way society allocates resources within our modern economic system is based upon financial stocks and flows (capital assets, expected rate of return, actual rate of return). Sustainability can only be attained when these two realms are brought into alignment so that financial incentives based on physical sustainability goals help drive decision making and investment into sustainable endeavors while sharply discouraging unsustainable ones. Physical stocks and flows are measured in physical units. Ecosystem service analysis has been developed to achieve this alignment in the realm of natural systems. There is no reason why this same approach cannot be applied to the built environment by strengthening policy and better informing real estate investment decisions for both the public and private sectors.

The valuation of ecosystem services measures the benefits or costs to people of changes in physical stocks and flows of natural and human-produced resources and brings that into the realm of economic policy and investment consideration.

Economic Valuation of Ecosystem Goods and Services

Market goods and services are often valued via market transactions. However, many valuable ecosystem services may not be traded in markets, such as flood protection or water filtration value. Though these goods and services are not traded in markets, they have abundant benefits to society and tremendous economic value. Thus over the last 40 years, economic methods have been developed to value these non-market economic benefits. These economic methods for valuing ecosystem services include eight methodologies accepted in peer reviewed academic journals for valuing ecosystem goods and services.

Just as these services have not been valued in natural systems, they have not been considered or valued by the conventional real estate industry. However, these services are tangible, valuable attributes of high performance sustainable buildings and the benefits these services provide should be reflected in building valuation methodologies and investment models.

Table 2 provides a list of the eight ecosystem service valuation methodologies currently accepted in peer reviewed academic literature. Indeed, many of these methodologies are standard in establishing dollar estimates of value for appraisals and accounting values.

Table 2: Valuation Methodologies.

Avoided Cost (AC): services allow society to avoid costs that would have been incurred in the absence of those services; storm protection provided by barrier islands avoids property damages along the coast.	**Factor Income (FI):** services provide for the enhancement of incomes; water quality improvements increase commercial fisheries catch and the incomes of commercial fishermen.	**Hedonic Pricing (HP):** service demand may be reflected in the prices people will pay for associated goods, for example housing prices along the coastline tend to exceed the prices of inland homes.	**Contingent Valuation (CV):** service demand may be elicited by posing hypothetical scenarios that involve some valuation of alternatives; for instance, people generally state that they are willing to pay for increased preservation of beaches and shoreline.
Replacement Cost (RC): services can be replaced with human-made systems; nutrient cycling waste treatment provided by wetlands can be replaced with costly treatment systems.	**Travel Cost (TC):** service demand may require travel, which have costs that can reflect the implied value of the service; recreation areas can be valued at least by what visitors are willing to pay to travel to it, including the imputed value of their time.	**Marginal Product Estimation (MP):** service demand is generated in a dynamic modeling environment using a production function (Cobb-Douglas) to estimate the change in the value of outputs in response to a change in material inputs.	**Group Valuation (GV):** this approach is based on principles of deliberative democracy and the assumption that public decision making should result, not from the aggregation of separately measured individual preferences, but from open *public debate.*

Adapted from Farber et al, 2006[7]

Physically Measurable Ecosystem Services for the Built Environment

Many ecosystem services can be physically measured. A subset of these services can also be monetized. Policies, appraisals, accounting and investment standards can be adjusted to enable current financial models to incorporate the monetized value of relevant ecosystem services created through a progressively "green" real estate development project. Table 3 lists ten potentially measurable ecosystem services for green buildings.

Table 3: Ten potentially measurable ecosystem services for green buildings.

1.	Carbon sequestration
2.	Air quality
3.	Flood protection
4.	Water storage
5.	Water filtration
6.	Energy consumption or generation
7.	Storm water conveyance
8.	Biodiversity
9.	Temperature (heat island effect)
10.	Materials life-cycle

Earth Economics maintains a comprehensive database of ecosystem service valuation studies, which can be utilized to establish the values of ecosystem services under an appraisal approach. Studies demonstrating a valuation approach for a watershed have been provided primarily within the Northwest region, but also in other parts of the US, Latin America, Asia and Europe.

Defining the "Value" of Sustainable Benefits

Perception of Value

One of the main challenges facing early adopters and proponents of more sustainable real estate development (for example, architects and engineers) has been, and remains, their ability to convey the "value" of the additional benefits provided by high performing buildings/construction to the private sector investment community. Professing greater tenant satisfaction, comfort, and worker productivity as the some of the benefits of investing in green strategies (for both initial construction and retrofits), these proponents have been frustrated by the slow level of uptake by the private sector, particularly in the United States.

While more investors in the US, particularly those who invest for institutions, pension funds and internationally, are adopting sustainability mandates, the US still lags other countries in the level of uptake of green investment. Why? To a great degree, this is a factor of the bases upon which the investment, lending/underwriting, and valuation communities in the US assess "value". Investors in the US invest in real estate with a variety of goals, but the main driver is almost always their return on investment (ROI). This factor is driven primarily by the income to the property (net operating income/NOI), which is a function of numerous factors – almost all of which are specific, quantifiable and fairly easily measured. Therefore, to establish the "value" of additional, and in some cases less 'tangible' benefits, our challenge is to identify, quantify and consistently measure such benefits, as well as be able to translate them into the vernacular that investors, lenders, underwriters, valuers and other commercial market participants can analyze and evaluate efficiently.

Basis of Traditional Lending and Institutional Investing

With few exceptions, the basis upon which most investments in the US are analyzed is "Market Value". Understanding this concept and its application is critical to providing information and analyses to better quantify the benefits of high performing buildings and assess the potential "value add" of green strategies. The goal of this project is to identify and quantify these benefits and how they can be monetized so that their additional value, if any, can be accurately and objectively assessed and accounted for in a real estate investment pro forma.

To that end, the definition of Market Value, per Uniform Standards of Professional Appraisal Practice (USPAP) standards, as it is described in the 13th edition of The Appraisal of Real Estate, produced by the Appraisal Institute, is as follows:

> *Market value is described in the Uniform Standards of Professional Appraisal Practice (USPAP) as follows:*
>
> *A type of value, stated as an opinion, that presumes the transfer of a property (e.g., a right of ownership or a bundle of such rights), as of a certain date, under specific conditions set forth in the definition of the term identified by the appraiser as applicable in an appraisal. (USPAP, 2010-2011 ed.) USPAP also requires that certain items be included in every appraisal report. Among these items, the following are directly related to the definition of market value:*
>
> - *Identification of the specific property rights to be appraised.*

- *Statement of the effective date of the value opinion.*
- *Specification as to whether cash, terms equivalent to cash, or other precisely described financing terms are assumed as the basis of the appraisal.*
- *If the appraisal is conditioned upon financing or other terms, specification as to whether the financing or terms are at, below, or above market interest rates and/or contain unusual conditions or incentives. The terms of above- or below-market interest rates and/or other special incentives must be clearly set forth; their contribution to, or negative influence on, value must be described and estimated; and the market data supporting the opinion of value must be described and explained.*

In addition, Market Value is predicated upon the determination of a property's 'Highest and Best Use'. From the Appraisal Institute's General Appraiser Market Analysis and Highest and Best Use course:

Goal of a Highest and Best Use Analysis

> *The appraiser undertakes a highest and best use analysis to identify three characteristics of a property that is the subject of a market value appraisal:*
> *1. The physical use*
> *2. The timing of the use*
> *3. The market participants associated with the use—the users and most probable buyers*[8]

In laymen's terms and with some constraints, these definitions and comments imply that "Market Value" is what 'the market' values, with 'the market' inherently characterized as being the 'most probable buyer'. Hence, the activities and investment preferences of market participants who would fit this characterization are evaluated by appraisers/valuers in the context of specific investments and assumptions. It is these analyses upon which an estimate of Market Value is then made.

These assumptions, while both qualitative and quantitative, are in some fashion translated into terms that are monetized in order to estimate Market Value. Hence, any assumptions about additional benefits or value deriving from the incorporation of green strategies must, therefore, also be "monetized" in order to capture their value in traditional valuation methodology.

Traditional Valuation Methodology: Necessary Components

Traditional concepts of Market Value and the methodology upon which an estimate of such value is derived rely primarily upon the "quantity and quality" of the income stream associated with the property – hence, economic characteristics. Historically, considerations of the physical aspects of an income-producing property have been secondary to its income characteristics. However, given the physical attributes of a high performing building could potentially impact that building's overall performance, including its financial performance, it is logical that more consideration should be given to the green strategies employed as well as any additional benefits these strategies create.

"Performance" of 'High Performance' Buildings Goes Beyond NOI

Based on such factors as the exponential increase in signatories to the UN's Principles of Responsible Investment, the growing number of institutional investors adopting sustainability mandates in their investment criteria (RREEF, Principal, Bentall Kennedy, Vulcan Real Estate, PruPrim, Boston Properties, Lend Lease, and others), as well as the number of government agencies incorporating green standards (LEED and Green Globes) into their real estate policies, it is apparent that a growing number of 'market participants', hence 'probable buyers', are incorporating sustainable criteria into their investment considerations.

It follows that the appraisal community should also be integrating these factors into their evaluations and estimates of Market Value. (What 'the market' values equals Market Value.) In order to do so, additional factors, including both environmental and social (tenant) benefits, should be evaluated. If such benefits can be monetized and accrue to the owner/investor, then it is possible they can and should be incorporated into the Market Value estimate.

Market and Data Challenges

The research and analyses required to reach an accurate estimate of Market Value rely heavily upon market data. One of the greatest barriers to the proper valuation of high performing buildings is the current dearth of information on both the transactions and operational performance of these properties. Without these data, it is extremely difficult to reach realistic and defensible estimates of Market Value for high performing buildings.

This lack of data is attributable to several factors, the main one being that recognition of these benefits has only been relatively recently introduced into the commercial investing community. LEED, for example, has been around for just over a decade, providing an insufficient time parameter against which a number of buildings cycles or transactions can be compared. While there were a number of early adopters and proponents in the United States of more sustainable development (for example, Amory Lovins and Rocky Mountain Institute), their focus was primarily on environmental, as opposed to financial, characteristics. As a result, the type of data that is required for financial assessment was not initially gathered or analyzed.

Therefore, investors (particularly in the US) looking for financial validation for investing in high performing buildings and/or green strategies, are finding the available data inadequate. Despite numerous attempts to gather performance data, issues of confidentiality and competition have proven difficult barriers to these efforts. Disparate attempts to build data bases for the investment community have often fallen short of the level of due diligence that the investment community requires, or that the valuation or underwriting communities will accept. At the time of this writing, no single repository of validated performance data on high performing buildings exists in the US. If one does exist, it is not readily accessible to the market in general, or to its participants, including appraisers. This situation leads to confusion and inconsistency in attempts to analyze the financial benefits of investing in high performing real estate by investors, underwriters and the valuation community overall.

Examples: Claims and Accessible Data

One of the most common claims of proponents of high performing buildings is “greater tenant satisfaction”. How can that claim be validated and be quantified for use in an investment or appraisal analysis? Owners and analysts can track the following factors:

1. Absorption (lease up and sales) – Was it quicker for a high performance building than for its conventionally-constructed peers in a given market? If so, by how much? If not, is there really a benefit evidenced by more sustainable construction in this instance?
2. Renewal probability – Are the tenants in a high performing building more likely to renew their leases than those in their non-green competition; that is, is there a higher likelihood they will renew than is evidenced in the rest of the market? If so, this factor positively influences the bottom line, and hence, Market Value.

Another claim is that high performing buildings are less costly to own/operate. What factors can be analyzed to help determine the validity of this assumption?

1. Is the high performing building more adaptable/flexible than its competition? For example, does it utilize demountable walls? This strategy could decrease deconstruction time and costs, as well as the associated risk.
2. Are the systems at the high performing building more “efficient”? If so, how and what performance results are expected because of these differentials? How can these projected results be confirmed and/or documented? (For example, via energy modeling by an independent, experienced expert).

Solutions: Addressing the Challenges

These solutions will require greater collaboration between various real estate participants and sectors including: architects, designers, engineers, owners, investors, appraisers, governmental agencies and policy makers, with the goal being to defensibly identify and financially quantify the potential economic, environmental and social benefits of high performance buildings. Our project seeks to create a basis upon which these goals can be achieved.

The Integrated Real Estate Investment Modeling Tool

Our approach to redefining and developing a more complete investment model for the real estate industry begins with the application of rigorous techniques from the emerging field of ecological economics. This approach identifies, measures, and values specific streams of environmental and social value created by attributes of the built environment. These streams of value – ranging from storm water purification to aesthetics and sense of place – have yet to be systematically identified. Here our research aims to provide a taxonomy of value that avoids double counting of valuation metrics and favors simplicity. Our analysis incorporates additional benefits identified in buildings utilizing LEED and Living Building Challenge certification program guidelines and more specifically focuses on the strong correlation between these attributes and those of recognizable ecosystem services. Each value category will include standard building attributes that generate or, conversely, impair value. Additional attributes will provide options for "innovation" in which buildings generate value in novel, measurable ways.

Figure 2: From New Models to Shifting Real Estate Investment

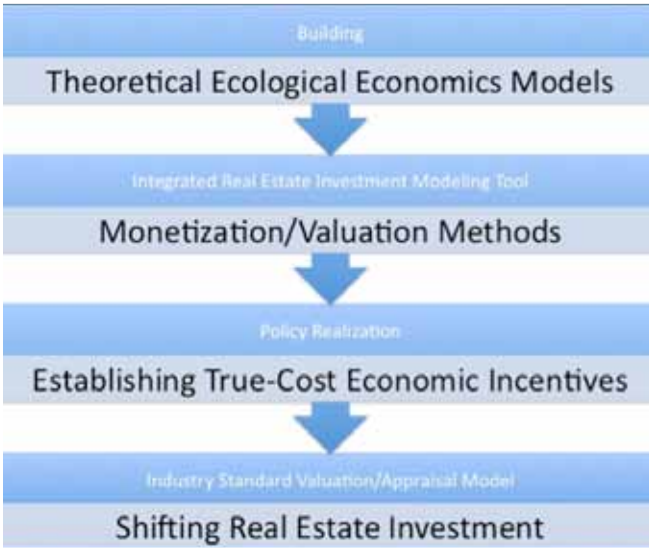


Figure 2 illustrates the approach that we are we are taking. The characteristics of a building (e.g. footprint, energy use, site context, natural light), community, city, or region can be used to generate a model of environmental and social costs and benefits using the theoretical framework of ecological economics. This model can then be "imported" into a traditional real estate investment pro forma, taking the form of additional data layers (EXCEL worksheets) and calculations (new and existing cells with EXCEL formulas). This results in an "Integrated Real Estate Modeling Tool" – an extension of conventional real estate pro formas that explicitly takes into account environmental and social costs and benefits using accepted valuation methodologies like those discussed in Table 2.

In a world of fully functioning capital markets, streams of environmental and social benefits would be directly and accurately monetized and reflected in the Integrated Real Estate Modeling Tool in various ways (e.g. incentive payments from government agencies, enhanced rents, carbon credit sales, etc.) and directly influence measures of NOI, ROI, and ultimately the gold standard of "Market Value" as discussed above. In practice however, the majority of benefits are valued at zero. This indicates a broken market link between genuine value creation and financial value. To repair this link, we must identify policy interventions and additional funding mechanisms (labeled "Policy Realization" in Figure 2 above) that seek to restore functioning markets. These policies ensure that real estate valuations provide an understanding of the environmental and social value created by buildings. Different policy prescriptions can be tested within the Integrated Real Estate Investment Modeling Tool to ensure the greatest leverage (i.e. greatest shift in investment decisions towards green and social benefits per dollar of incentive).

Once policies have been adopted (or existing incentives or programs properly harnessed), these true-cost economic incentives can then be used to inform a new generation of industry standard valuation/appraisal models. With accurate incentives flowing through a comprehensive model of environmental and social benefits to drive actual building financial performance, all that remains is to make sure this model has supporting standards (e.g. NIST), protocols, training programs, etc. This model will then shift real estate investment towards enhanced environmental and social value creation as capital is allocated in line with this next generation of appraisal and valuation methodologies.

To demonstrate how additional benefits may be accounted for in a real estate pro forma analysis, the project team conceived and built a prototype "Integrated Real Estate Investment Modeling Tool" (see Appendix A). The "Integrated Real Estate Investment Modeling Tool" is an extensive cash flow model prototype that attempts to incorporate the estimated values of environmental and social benefits. The Tool is a simplified version of a conventional real estate investment pro forma, in this case for the development of a mixed-use building.

This prototype attempts to capture the underlying logic and structure linking the ecological economics of the built environment to more traditional real estate investment and appraisal models (e.g. Argus) (Table 4 lists the associated worksheets in the EXCEL model). The model worksheets classify the generation of environmental and social value by type, and link to specific building features/attributes, in each case providing methodologies to measure outcomes. A variety of valuation methodologies (e.g. Travel Cost per Table 2 of "green building ecotourism" activity generated by a building) can then be applied to generate a corresponding stream of monetary benefits over time. It is beyond the scope of this report to provide detailed quantitative calculations for this diverse range of environmental and social values, but Phase II will include a peer review process to generate appropriate calculation methodologies.

Table 4: Worksheets in the Integrated Real Estate Investment Modeling Tool prototype

1.	Project Overview
2.	Environmental Benefits
3.	Social Benefits
4.	Cash Flow Projected
5.	Investor Returns
6.	Office Tenant Costs
7.	Retail Tenant Costs
8.	Schedule of Development Costs
9.	Operating Income
10.	Energy Incentives
11.	Water and Wastewater Incentives
12.	Green Building Incentives
13.	Loans and Tax Deductions
14.	Construction Period Interest
15.	Loan Amortization Schedule

Prototype Assumptions

The modeling tool included as an EXCEL file in Appendix A to this report contains a prototype version of an Integrated Real Estate Investment Model. It is intended to show the structure of such a tool, but does not yet include detailed calculations and metadata. The tool contains numerous linked worksheets showing projected investment returns for a hypothetical, though realistic, development project. Assumptions can be modified and key financial metrics recalculated accordingly (e.g. 1-year, 5-year, and 10-year internal rates of return).

To provide some context for this model, key assumptions used for each worksheet in the model are explained below. Many of these assumptions can be easily changed in the model to understand how they affect critical outputs like ROI.

Project Overview Worksheet

Square footages by investment type (office, retail, multi-family residential and industrial) are specified here. The project considered for this analysis assumes a pre-qualified loan-to-cost ratio of 80% for commercial debt, with the remaining 20% of project cost being provided through owner equity. The baseline version of the tool includes a 160,000 square foot Living Building with 150,000 square feet of office space and 10,000 square feet of retail space on a 40,000 square foot lot (4:1 floor area ratio).

Environmental Benefits Worksheet

This worksheet allows a wide range of environmental benefits produced by the building to be specified in detail. Each benefit is broken down by:

1. Type;
2. Definition;
3. Pathway to value specific to the built environment (how this benefit is produced by the building);
4. Quantity/quality of beneficial impact;
5. Estimated total value;
6. Valuation methodology;
7. Metadata;
8. Monetization methods and application in the model;
9. Value actually realized in the model;
10. Value realized by the public; and
11. Value realized by neighbors/adjacent buildings.

The classification of environmental benefit types closely follows Table 1, including a wide range of Provisioning Ecosystem Services, Regulating Ecosystem Services, and Supporting Ecosystem Services.

Social Benefits Worksheet

This worksheet allows a wide range of social benefits produced by the building to be specified in detail. Each benefit is broken down in the 11 categories listed above for the Environmental Benefits Worksheet. The Social Benefits discussed include:

1. Human Health;
2. Worker Productivity;
3. Comfort;
4. Satisfaction;
5. Well-Being;
6. Transportation Options;
7. Placemaking;
8. Biophilia;
9. Ecosystem Services – Aesthetic Values;
10. Ecosystem Services – Spiritual Values;
11. Ecosystem Services – Recreational Values;
12. Ecosystem Services – Scientific and Educational Values; and
13. Ecosystem Services – Ecotourism Opportunities.

Cash Flow Projected Worksheet

For simplicity, this worksheet in the prototype assumes design and construction occurring in years 2012 and 2013, with first year of stabilized occupancy in 2014. Construction occurs over a 20-month period concluding in December of 2013. The revenue portion includes:

1. Owner equity (drawn in 2012);
2. Construction loan (drawn periodically during construction phase in 2012 and 2013);
3. A wide range of potential environmental and social benefits accruing over the life of the building;
4. Gross operating expenses; and
5. Operating expenses charged (passed-through) to tenants.

Expenses include construction costs, land cost, draws against owner equity, and operating expenses. The standard after-tax earnings are then calculated including impacts of any tax deductions or tax credits relating to high performance building features. A tax rate of 35% is assumed.

In addition to these conventional investment pro forma considerations, the model includes rows to explicitly account for streams of cash incentives over the investment horizon accruing from the following environmental and social benefits.

Table 5: Environmental Benefits for Pro Forma Consideration

1.	Energy Incentives
2.	Transportation Demand Reduction Incentives
3.	Materials Provision (Value)
4.	Food Provision (Value)
5.	Carbon Credits
6.	Water Regulation Incentives
7.	Stormwater Regulation Incentives
8.	Waste Absorption and Breakdown Incentives
9.	Biodiversity and Habitat Incentives
10.	Soil and Nutrient Incentives
11.	Additional Environmental Benefit 1
12.	Additional Environmental Benefit 2

Table 6: Social Benefits for Pro Forma Consideration

1.	Indoor Air Quality Incentives
2.	Healthy Materials Incentives
3.	Worker Productivity Incentives
4.	Comfort Incentives
5.	Satisfaction Incentives
6.	Well-Being Incentives
7.	Transportation Options Social Incentives
8.	Placemaking Incentives
9.	Biophilia Incentives
10.	Aesthetic Values - Incentives
11.	Spiritual Values - Incentives
12.	Recreational Values - Incentives
13.	Scientific and Educational Values - Incentives
14.	Ecotourism Opportunities Incentives
15.	Additional Social Benefit 1
16.	Additional Social Benefit 2

Investor Returns Worksheet

This worksheet calculates one-year, five-year, and ten-year after tax investment returns. Equity is assumed to be invested in the first year of design and construction (DC1, or 2012). Hypothetical sales events in years one, five, or ten are based on a terminal cap rate of 8.5%, sales costs of 5% and an investor tax rate of 35%.

Office Tenant Costs Worksheet

This component assumes a base rent of $35 per rentable square foot (sq ft) escalating at 3% per year, utilities cost of $1.80 per sq ft escalating at 3% per year, and other operating expenses (insurance, property taxes, etc…) of $6.20 per sq ft escalating at 3% per year. This component also assumes a unique "green" payment factor equal to the modeled utility cost savings during first year of stabilized building occupation. This green payment is held fixed over lifetime of tenant's lease to allow predictability and increasing cost savings over time. This concept known as a "green triple net lease" provides a way to negotiate equitable sharing of operational and utility cost savings between a building owner and tenant. When the green payment is zero, much of the owner's financial incentive to undertake a green building disappears. Green payments fixed at first year's utility cost savings makes the first year payment cost neutral for a tenant and succeeding years increasingly cost favorable as savings grow due to utility and maintenance cost escalations. Green payments can also be set somewhere between zero and first year's utility savings. The office tenant's total costs over lifetime of lease (assumed 10 years) are calculated with a 10% discount rate.

The green triple net lease example is worked out in some detail in this worksheet as an alternative to standard triple net leases which create a well-known split incentive issue. In a conventional triple net lease, building owners cannot realize any of the utility savings from high performance green buildings because these savings are simply passed directly through to the tenant. The green triple net lease structure provides a way to test current and emerging Appraisal practice regarding the Market Value of buildings with below conventional operating costs.

Retail Tenant Costs Worksheet
For simplicity, this worksheet assumes the same base rent, utility costs, escalation rates, and other operating expenses as the office tenant. Of course, detailed cost allocation calculations can also be applied to give different costs per sq ft for office and retail space.

Schedule of Development Costs Worksheet
This output lists costs as indicated, including a line item for incremental green construction cost premiums if any. Construction period interest is drawn from a later worksheet.

Operating Income Worksheet
This worksheet assumes a 15% loss factor (85% rentable space efficiency) on 150,000 sq ft of gross office space with initial base rent of $35.00 per sq ft, green payments, and a 0% vacancy rate due to long-term lease. For the retail portion, a loss factor of 15% is assumed for 10,000 sq ft of gross retail space with an initial base rent of $35.00 per sq ft, green payments, and a 5% vacancy loss. Base rents are assumed to escalate at 3% per annum while green payments remain constant.

Energy Incentives Worksheet
This worksheet assumes a mixed-use office building that is a Living Building with no (net) energy costs. For illustrative purposes, utility cost calculations were derived using information from the utilities that provide electrical, natural gas and water (both supply and waste treatment) services to the City of Seattle in Washington State. Utility resource consumption was derived using national averages of historical usage for similar building types. Electrical costs are based on Seattle City Light's Large Network General Services Schedule per kilowatt hour (kWh) charges and peak demand charges. Natural gas costs are based on Puget Sound Energy's Schedule 31 Commercial and Industrial General Service. The Energy Incentives Calculation allows detailed calculation of standard financial incentives and rebates offered by the local utilities. The alternative "Generic Incentives Calculation" assumes a typical incentive rate per kWh of energy saved in first year. The federal tax deduction for high performance buildings is valued at $1.80 per sq ft for a building with energy performance 50% beyond code.

Water and Wastewater Incentives Worksheet
This worksheet also assumes a Living Building with zero (net) water usage based on LEED-NC 2.2 Water Efficiency Credit 3 Calculation Template provided by U.S. Green Building Council. Water costs for both supply and waste treatment are based on Seattle Public Utilities' commercial rates per 100 cubic feet (cu ft). Wastewater costs are also inclusive of basic service charges tied to estimate usage and pipe size. King County's capacity charge is based on the fixture count and residential equivalency calculation table provided. Water efficiency incentives are based on standard Seattle Public Utilities incentives.

Green Building Incentives Worksheet
This component provides summary of cash, tax credit, and tax deduction incentives available to the project from various sources.

Loans and Tax Deductions Worksheet
This worksheet provides a calculation of maximum loan available based on the minimum of 80% loan-to-cost and 75% loan-to-value. Permanent loan assumes an interest rate of 7.5% for 30-year loan period. The short term construction loan assumes an interest rate of 7.25%. The Federal tax credit for high performance buildings is based on $1.80 per sq ft at a minimum efficiency level of 50%.

Construction Period Interest Worksheet
This tool provides a calculation of accrued construction period interest charges based on a 20-month construction schedule and typical monthly expenditure curve.

Loan Amortization Schedule
This worksheet demonstrates calculation of annual debt service which includes both interest and principal payments over the 30-year permanent loan.

Accounting for Cost Avoidance

Often, the avoidance of costs associated with transportation, carbon, water, storm water, sewer, electricity, gas, heat and other attributes of green buildings are undervalued in the market and not considered by current appraisal and accounting practices. Why is this so?

Modern accounting principles are based primarily on measuring a firm or entity's ability to meet liabilities and obligations. Through the lens of ecological economics, once an ecosystem service is lost, for instance water supply, a liability is created and a problem can be detected using modern accounting methods. Alternatively, once the ability to avoid paying the cost of that service is lost, then accounting can detect the problem. This issue of cost avoidance is not easily detected by modern accounting or economics. If a building or natural system is providing benefits beyond its site boundary, such as watershed protection or groundwater recharging, these attributes do not directly contribute to reducing liabilities or meeting financial obligations. The following example from Seattle Public Utilities provides some clarity as to how estimation of avoided cost burdens can lead to recommended changes to current accounting rules, eventually "changing the investment playing field" by allowing avoided costs to be included in legal accounting requirements for natural systems and real estate.

Case Study: Seattle Public Utilities

Seattle's population quadrupled between 1880 and 1889. The city had no water or sewer systems. Four unregulated private water companies drew water from local lakes, into which sewage also flowed. Cholera and typhoid epidemics earned Seattle a reputation as one of the unhealthiest cities in the United States.[9] Citizens perished from contaminated water every year. Yet what sparked change was the water-related loss of the city's built capital. A catastrophic fire in 1889 burned down 65 acres of Seattle's downtown for lack of water to put it out. Citizens had had enough and they made the decision to invest in re-building the infrastructure required to secure a safe, healthy and abundant supply of clean water.

Photograph taken after the 1889 fire in Seattle

That year Seattle's citizens voted (93% "yes") to establish Seattle Public Utilities (SPU) as the agency responsible for providing water to the city. SPU took the initial and wise step of purchasing a majority of the upper Cedar River Watershed in 1899 to secure a safe water supply on a scale dwarfing the city's needs. Had the Seattle City Council required a quick return on the investment, the purchase would likely have been rejected. However, the goal was not to maximize "net present value," but to provide a safe, reliable and sufficient drinking water supply for the people of Seattle in perpetuity. By 1901, clean water was flowing. Cholera and typhoid were banished.[10] Citizens were healthier and more productive. Kids missed less school. Reconstruction of the downtown proceeded at a break-neck pace. By 1909, Seattle was considered one of the healthiest cities in the United States.

It was a sound investment by any measure. Today, SPU would have to pay $200 million to build a filtration plant to do what the Cedar River Watershed does for free. Filtration plants, like all built capital, depreciate and fall apart with wear and tear over time. The forest in the watershed did not depreciate or fall apart. On the contrary, the natural capital of the forest actually appreciated and grew over time. Relative to the size of the asset, a forest also requires very little maintenance. The watershed now provides far more water and far more dollar value than ever imagined by most citizens in 1899. Today, Seattle's tap water is also among the cleanest in the world. Better than bottled water, it has no endocrine disruptors or pharmaceuticals because no one is flushing anything into the watershed above the supply source.
Public utilities in the U.S. have played a crucial role in the development of the nation. The world and our understanding of biological systems have changed significantly over the past century. Access to clean drinkable water is rapidly becoming one of the primary resource constraint issues of the 21st century. Though many water supplies appeared to be unlimited at the dawn of the industrial age, we now know water supplies are severely limited and water withdrawn from natural systems has other negative tangential impacts such as reduced salmon productivity and loss of species abundance and diversity.

Today, Seattle and five other large U.S. utilities, including New York and San Francisco realize that both accounting practices and what is counted as infrastructure must change to secure water supplies. Though the Cedar River watershed provides water for Seattle, it is not valued on the asset sheet of the utility for anything more than timber and bare land value. Only the pipes that deliver water count as assets. The watershed, which filters and provides clean fresh water, does not. Seattle, among other utilities, seeks to change this accounting rule.

Why is this important? Accounting rules set forth by the Governmental Accounting Standards Board for public utilities will change. If a watershed that provides water can finally be counted and valued as an asset for providing and filtering water, then a system which captures and filters rain water for potable uses within a building should also be recognized as a capital asset and valued as such within standard accounting and valuation methodologies.

The Connection between Natural Capital Accounting, Built Infrastructure and Appraisal

Required changes to current appraisal and accounting practices for real estate are key factors in catalyzing an investment shift toward more progressive and higher performing built infrastructure. These changes, if accepted and implemented correctly, would in turn positively affect building valuation models. Valuation determines the cost recovery funding mechanisms for utilities which include charges, rate structures and investments. One of the great barriers to green building includes current utility rate structures that penalize avoided consumption and cost.

In the 20th century, a utility's infrastructure was fully held by the utility. Today, utilities pay some landowners for actions, which result in higher water quality standards as well as larger available supplies. If a building provides services such as storm water treatment and retention, or water collection and re-use, why should these systems not be considered part of the full infrastructure for the city? Furthermore, why couldn't the owners of these properties receive a payment from either damagers or beneficiaries of that system to offset the initial cost of the system that provides such a service?

Water, electricity, telecommunications, rail, sewer, storm water, flood control, irrigation, garbage, ports and more could and should be included.
Consider a few spatial aspects of the physical infrastructure, which could amplify or muffle the effectiveness of market incentives.

Living Buildings, if scattered throughout a city or region, will provide no relief from the need for full utility infrastructure. However if Living Building design guidelines were implemented on a district or community scale, then a significant portion of existing infrastructure could be abandoned or re-purposed to service future growth needs. For example, if every other building within a community was a Living Building with on-site storm water infiltration and re-use, the city would still be required to maintain a full storm water system. Whereas, if there is a district of buildings for which all storm water is handled on-site and re-used, then the traditional storm water pipes can be abandoned or maintained only for heavy overflow. The greatest cost of a utility is the capital cost of initial construction. Adding another gallon of water or sewerage to the system costs very little.

This is an important point as utilities, such as water, electricity, sewer and storm water have very large capital costs. Once the system is in place, the cost of handling a marginal increase in water, storm water, sewerage or power is very low. Thus, the largest capacity for financial incentives for green building resides in relieving utilities of the capital costs of construction and maintenance, not the small marginal costs of a few less gallons of water provided to a single site while requiring the full capital, maintenance and operations costs to provide the infrastructure for neighbors.

A policy implication of this could be that utilities shift toward more steeply tiered utility rate structure including a higher premium for low performance buildings and a subsidy for highest performance buildings. Another policy that could be enacted at the local scale would be substantial tax incentives for buildings identified within a designated "Green Building Zone" or "Eco District."

Social Benefits of Green Buildings

However, it is important to keep the spatial nature of these benefits in mind. Living Buildings placed upstream of a salmon rearing area could have salmon benefits if they recharge groundwater and increase low-flow water levels for salmon, as well as providing greater groundwater sourced drinking water. A green building located on the waterfront of Puget Sound that recharges groundwater may contribute to improving groundwater in the near-shore territories, but will not contribute meaningfully to groundwater salmon restoration benefits.
Overall, accounting for the cost-avoidance of energy efficiency, water conservation, groundwater recharge, storm water conveyance and other ecosystem services is a very promising approach.[5; 6] Although not sufficiently applied to ecosystem services, cost avoidance is recognized by traditional appraisal and accounting methods.

Moving beyond typical environmental benefits within the built environment, research shows that green buildings provide communities with a variety of social benefits as well. These benefits include improved occupant health and productivity gains, increased comfort, a sense of place, and enhanced transportation accessibility. It is critically important that these social benefits be included along with environmental benefits in an Integrated Real Estate Investment Modeling Tool. Social benefits are likely to be similar in magnitude to environmental benefits and have the advantage of appealing to different constituencies than environmental benefits. Existing valuation methodologies from ecological economics, as shown in Table 2, can be effectively applied to estimate the value of these social benefits over time.

Human Health

Buildings have an enormous impact on the health and vitality of their occupants. For instance, a 1984 World Health Organization report suggested that up to 30 percent of buildings worldwide may be the subject of excessive complaints regarding indoor air quality. The term "Sick Building Syndrome" has been coined to describe situations in which building occupants experience acute health and comfort impacts that appear to be linked to time spent in a building, but where no specific illness or cause can be identified.[11] A comprehensive review of the literature cites studies[12] with the following findings:

- Window views reduce Sick Building Syndrome by over 20%
- Natural ventilation reduces Sick Building Syndrome by 15%; doctor visits by 15%; and headaches and colds by 30%
- Indoor plants reduce Sick Building Syndrome by over 20%

Productivity Gains

Buildings also have a significant impact on worker productivity. Workers experiencing greater health, vitality, alertness, and connection to natural views are able to work more effectively than workers in conventional buildings. Studies have found the following productivity gains relative to conventional buildings:[12]

- Daylighting, 0.5% to 40%;
- Window views, 7%;
- Natural ventilation, 0.4% to 3.2%;
- Operable windows, 7.5%;
- Mixed-mode conditioning, 10% to 18%;
- Indoor plants, 0.6%;

Comfort, Satisfaction, and Well-Being

Many building factors contribute to occupant perceptions of comfort (e.g. thermal comfort, appropriate lighting); satisfaction; and overall well-being. A recent, large-scale study of 16 buildings in England identified several features consistently associated with overall levels of satisfaction:[13]

- Shallower plan forms and depths of space (buildings and rooms that are long and narrow);
- Thermal mass;
- Stable and comfortable temperature conditions;
- Operable windows;
- Views to the outside;
- Usable controls and interfaces;
- Places to go at break time; and
- A well-informed and responsive building management.

Placemaking: The Social Realm

Buildings and sites can provide a wide range of gathering places in both exterior (e.g. parks, gardens, plazas) and interior (e.g. lobbies, meeting rooms) spaces. These spaces, particularly if well conceived within their urban context or designed for a variety of ages and activities, can provide significant social benefits. In addition, provision of indoor and outdoor vegetation provides spiritual and aesthetic value to building users reflected in higher levels of building comfort and satisfaction.

Transportation

Accessibility to multiple modes of transportation can significantly contribute to building occupant and user satisfaction. This depends on both proximity to walking routes, bike paths, and transit and effective urban design. Evaluating proximity and accessibility is a task that organizations and businesses are beginning to consider. For example, Walkscore.com (www.walkscore.com) provides a "walkability" rating for residential and commercial addresses across the U.S. The score takes into account the availability of various types of amenities as well as the safety and quality of the pedestrian experience.

Towards 21st Century Economic Development

The 20th century was built on large centralized infrastructure and institutions to build this infrastructure. This included rural electrification, public water utilities, storm water systems, roads funded through city, county, state and federal institutions.

The 20th century was also built upon cheap and abundant fossil fuels, land, fresh water, forests and other natural resources, a stable climate, little international competition, banking stability (after 1935), rising real wages, real estate values, and tax base.

Though other factors such as technological advancement certainly continue at the same or a greater pace in this century, the physical challenges of water, biodiversity, material consumption and energy supply make clear that utilizing a 20th century economic framework and mentality simply cannot deliver sustainability and prosperity to an ever expanding population in the 21st century. The delay in transitioning to a new and better framework has actually driven us farther away from this ideal.

As watersheds have become more and more crowded, one infrastructure improvement demolishes another. For example, in the Mississippi River Basin, hundreds of cities build independent storm water systems in order to pipe water more quickly from expanding impermeable surfaces (roads and buildings) into the Mississippi River. At the same time, the U.S. Army Corps of Engineers measured higher peak flood flows and as a result, invested heavily in building the levees higher. Higher, more constraining levees and more water actually increased the destructive power of the river which damaged the levees more quickly during higher floodwaters. During all of this, critical aquifers once recharged by rainfall were no longer recharging. To make matters even worse, industrial effluent and sewerage systems were discharging into the river while downstream cities were drawing drinking water from the same source, the Mississippi River. From a regional perspective, levees constrain the river and dump critical water and sediment off the Continental shelf rather than renewing and rebuilding wetlands and barrier islands. These shrinking coastlines, wetlands and barrier islands provide critical hurricane buffering for U.S. coastal and low elevation riparian cities, such as New Orleans and Houston.

In the Northwestern United States, these same systems that once clearly contributed to the development of the region, are not providing the same level of value, and are often at cross-purposes. Urban watersheds have cities building storm water systems that also contribute to greater flooding and damage of larger levees. Storm water no longer needs to simply be conveyed to Puget Sound, but now requires treatment in another large facility. Another approach is to avoid these conflicts and costs altogether by building smarter, greener infrastructure that mimics the processes of nature and is compatible with existing urban development patterns.

Cities can no longer afford to replace the services that natural systems provide. The current model of utilizing large tax districts to provide expensive mega-infrastructure projects such as regional storm water conveyance and treatment systems with a concurrent set of investments being made to try and restore the salmon, shellfish, and other species, and natural systems being damaged by these same large scale infrastructure projects. This approach is also not producing the jobs and incomes it once did, and it is more risky, with a greater chance of catastrophic floods, sewer failures and other problems.

The 21st century infrastructure must employ greater biomimicry, greater utilization of infrastructure that provides multiple benefits. The Told River Levee Setback Project, for example, provides both greater salmon habitat, better flood protection, and, by increasing the flow of water through wetlands during floods, this project also improves the water quality.[14] Whereas the built environment was integrated with massive centralized systems in the 20th century, the 21st century could provide greater development patterns and values by fully integrating natural systems within the built environment and leveraging what nature does best right in the heart of our cities and towns.

Recent analysis in Washington State[15] also shows that "green jobs" related to energy conservation, habitat restoration, natural resources management, and sustainability actually increased during the financial crisis when nearly all other sectors of jobs experienced severe reductions.

In addition, as Living Buildings are being constructed throughout the Northwest, there is real opportunity to calculate both the actual jobs created, and a multiplier for the economic benefits from both building construction and occupancy. This will provide critical comparison data for comparing with the jobs created at comparable standard buildings and the associated economic multipliers.

Financing the Future

When considering how to build a more sustainable, prosperous and fair economy, investments in green buildings and infrastructure that generate ecosystem services within the urban core promises us greater prosperity and resiliency in the decades ahead.

Advantaged Financing Options

There are many financing options that encourage green building projects. These incentives reward both the environmental (e.g. renewable energy, green buildings, sustainable infrastructure) and social (e.g. affordable housing, job creation, community amenities) objectives of the project as currently designed. These incentives are offered in a variety of forms, including below-market debt, below-market equity, federal tax credits and deductions, grants and program related investments (PRIs), and others. Sources of these financing options include federal government, state, foundations, financial institutions, pension funds, and others. Some of the incentives, including certain tax credits, are always available for qualifying projects, while some are modestly to highly competitive.

Setting the Stage for Competitive Sustainability

Incentives

Competitively available incentives should be a last resort for the viability of green building projects. There are several tiers of activity that should minimize (or eliminate) the need for additional competitive sustainability incentives to solve any remaining market "gap". This increases the likelihood the gap can be solved in a timely way using a variety of routes.

The first tier of activity is to use a fully integrated design process with clear sustainability objectives throughout the entire project lifecycle. Extra design costs incurred by greater integration among planners, architects, landscape architects, engineers, transportation planners, and other consultants are paid for many times over in cost savings resulting from synergies across site locations and professional disciplines. For instance, proper massing and orientation of buildings can greatly enhance the natural heating and cooling and renewable energy generation potential of buildings; an improved building envelope can result in downsized mechanical equipment with corresponding capital cost savings; and advanced transportation strategies can significantly reduce parking requirements and costs.

The second tier is to aggressively use all available standard incentives for the project. These incentives include the federal Business Energy Tax Credit for solar PV panels, solar thermal, fuel cells, and microturbines; the federal Historic Rehabilitation Tax Credit for historic renovations; and local utility incentives for water and energy efficiency.

The third tier involves pricing and valuation mechanisms that allow developers to harness some portion of the future stream of cost savings associated with sustainability approaches. For instance, full-service office or retail leases allow utility, operations and maintenance, insurance, and other types of savings from high performance green buildings to directly benefit net operating income. Suitable studies (e.g. energy models, water models, insurance underwriter reports) can then be used to support pro forma projections of increased NOI from decreased operating costs. Such studies are now used by appraisers to establish a higher valuation of proposed green buildings, which may help these buildings qualify for increased senior loan amounts and/or better loan terms. In the case of condominiums, a portion of Home Owner Association (HOA) fees that are less than monthly utility savings can be dedicated to paying off incremental capital costs of green technologies over a ten to twenty year period. Owners then get reduced HOA fees and the benefit of healthy green homes. Other approaches include paying back green improvements financed by municipalities or 3rd party private entities on property tax bills or utility bills.

The third tier can also be applied at the level of homeowners. Energy Efficient Mortgages and Location Efficient Mortgages allow purchasers to qualify for greater loan amounts based on their reduced outlay for energy and transportation expenses, respectively, in a sustainable urban development. This report suggests a greatly expanded role for this kind of third tier financing for a wide range of environmental and social benefits as they become monetized through policy innovations.

The fourth tier is to apply premium pricing to market-rate leases, rents, and sales prices when this does not conflict with social objectives (e.g. subsidized rents for affordable housing or community-based businesses). Green buildings are superior products and many studies demonstrate that they appreciate more quickly in value than comparable conventional properties while offering enhanced health and comfort and decreased operating expenses (to the extent not harnessed by developer as described above). A very modest increase in projected sales prices (even 0.5% to 2%) may solve a significant financing gap. Increasingly, appraisers are able to justify higher valuations based on "green" amenities, particularly when they are provided with supporting analyses.

Integrated Real Estate Investment Modeling Tool and Competitive Sustainability Incentives

The overall financial return (using a variety of standard measures including internal rate of return of capital invested) of a green building project depends on the timing and amounts of expenditures on land acquisition; soft design, planning, engineering, legal, accounting and other costs; permits and fees; infrastructure and other site costs; and hard construction. It also depends on the timing and amounts of sales and rental revenue for residential and commercial components. Finally, the return is highly sensitive to the capital structure of the project: the relative amounts and terms of equity, debt, grants, and other capital sources. All of these factors have complex and non-linear impacts on project financial returns. These factors are modified in predictable ways by sustainable approaches, and can be included in the Integrated Real Estate Investment Modeling Tool that ensures required financial returns for developers are met.

As we have seen, the Integrated Real Estate Investment Modeling Tool augments traditional project pro formas with information on cost premiums or savings for specific green features and infrastructure components; standard incentives (e.g. utility rebates, tax credits and deductions for green or social features); reduced utility, operations and maintenance, insurance and other costs tied to green features; pricing mechanisms to harness future cost savings (e.g. full-service leases or "green" HOA fee components); and pricing to reflect the market cachet of green buildings. This allows project level Returns on Investment (ROI) to be determined for each class of investor, and if hurdle rates are not met, a market "gap" can be determined that will restore required returns.

This section focuses on solving for any remaining gap with competitively available sustainability incentives. Such incentives are provided by social and environmental investors that are willing to take a below-market return in exchange for a project's demonstrable social and environmental returns. For example, a local economic development agency may need to see a certain level of job creation and access to community services; a foundation may need to see a commitment to smart growth design principles; and a green real estate investment fund may need to see a certain level of LEED certification. This can be an important transitional strategy until policies fully support the monetization of environmental and social benefits in appraisals and valuation models.

In Table 7 below, we provide a description of types and sources of sustainable incentives (both standard and competitively available). One or more of these incentive types can then be employed in the

Integrated Real Estate Investment Modeling Tool such that (1) overall project financial return goals are satisfied; and (2) the project has the greatest likelihood of securing the incentives from identified sources in the required timeframe based on the project's triple bottom line returns (financial, social, environmental). This framework may also prove valuable in working with infrastructure providers (e.g. water, wastewater treatment, roads, renewable energy), commercial tenants, prospective residents, utilities, and others. Some of the below-market finance will naturally flow to the project developers. Other portions may flow more naturally to project partners, including non-profits better positioned for certain grants. In this instance, the developers will have to take a leadership role in assisting those partners to access the below-market finance and ensure that enough benefits are retained at the project level to maintain overall project viability. High performance green buildings, including Living Buildings, have a compelling story that lends credence to their ambitious projected social and environmental returns. This should put such buildings in a strong competitive position for the kinds of sustainability incentives listed below. However, it is still critical to minimize the need for these incentives in the first place, and to recognize the complexity and uncertainty in securing them.

Table 7: Summary of Advantaged Financing Options.

Type	Description	Sources
Below-Market Senior and Mezzanine Commercial Loans	Senior commercial loans at ¼% to ½% below market for construction and permanent financing. Awarded on the basis of green attributes of project. Available for site/infrastructure (60% to 80% of total costs); buildings (60% to 80% of total costs); and energy facilities (50% to 60% of total costs).	
	Citi Property Investors (CPI) invests in sustainable building projects. Its first such investment was in the Loreto Bay Company, a 5,000-home community in Baja California, Mexico that is one of the largest sustainable resort communities in North America. Similarly, CPI intends to commit $500 million to investments in sustainable building projects over the next 10 years.	Citigroup – Citi Property Investors unit (www.citigrouppropertyinvestors.com)
	Citi's Markets & Banking group plans to invest in and finance over $31 billion in clean energy and alternative technology over the next ten years through the expansion of existing activities and the launch of new client services. With committed investments and financings approaching $7.5 billion to date, the Markets & Banking group sees tremendous opportunities to support companies working in alternative energies such as solar, wind, hydro and geothermal; helping to commercialize energy efficiency ideas; and facilitating investments in aging infrastructure using cleaner and more efficient technologies. This is a good source for the on-site renewable energy utility.	Citigroup – Citi Markets and Banking Group (www.citigroupcib.com)
	Wells Fargo has financed more than $1.5 billion in LEED-certified green buildings – a result of doing business with experienced customers and internal training to encourage financing of energy-efficient, environmentally-friendly buildings. It has also invested more than $400 million to support renewable energy projects. Wells Fargo will also focus on energy-efficient mortgage products and environmentally-friendly construction and development, including Green EQ2's special financing—five- and 10-year loans with interest rates from about 1 to 2 %—for green affordable homes in low to moderate-income neighborhoods.	Wells Fargo (www.wellsfargo.com)
	Bank of America will commit $18 billion in lending, advice and market creation to help commercial clients finance the use and production of new products, services and technologies: * Commercial Real Estate Banking: The company will build upon its expertise in financing environmentally friendly development by creating customized solutions for clients who are developing and implementing environmentally sustainable designs. Areas of focus include financing real estate projects with LEED certification, improvements in energy efficiency, brownfield redevelopment, promotion of smart growth, and the use of energy-related tax credits. * Environmental Lending Consideration: The company will give favorable consideration, among other existing underwriting criteria, to lending opportunities with clients that are creating and implementing environmentally sustainable products, services and technologies.	Bank of America (www.bankofamerica.com)
	New Resource Bank emphasizes green building projects and offers a range of loan products.	New Resource Bank (www.newresourcebank.com)

Below-Market Equity	Below-market equity for pre-development, construction, and medium-to-long term investment. Available for pre-development (5% to 40% of total costs); site/infrastructure (5% to 40% of total costs); buildings (5% to 40% of total costs); and energy facilities (5% to 40% of total costs).	
	Hines CalPERS Green Development Fund – currently has $277 million in equity capital and is working on $1.1 billion in projects	Hines CalPERS Green Development Fund (hcgreenfund.com/home.cfm)
	The Rose Smart Growth Investment Fund I, LP is the first national green smart growth investment fund to focus exclusively on providing economic and environmental returns. The Fund is committed to acquiring real estate near transit or in walkable communities, and enriching these assets with green management practices, professional real estate skills, and a long-term point of view. This work informs its planning, project management and development work with a deep understanding of the issues of operations, life cycle costs, and responsible citizenship.	Rose Smart Growth Investment Fund I, LP (http://www.rose-network.com/projects/index.html?cat_toc.html&top.html&studio_investment.html)
	Revival Fund Management LLC positions itself as an institutional-quality real estate investment manager focused on high profile, model green developments. It seeks profitable projects that generate value, build community, and integrate proven sustainable solutions with market-driven development and investment practices. It focuses on value-added, proven techniques for energy efficiency, green design, and operations management to drive asset performance.	Revival Fund Management LLC (www.revivalfunds.com)
	Northstreet Partners' mission is to remain at the forefront in the development LEED certified, carbon neutral mixed-use projects; ensure a quality of life that is both socially responsible and environmentally sustainable for residents and merchants; and advance and commercialize clean technologies. Northstreet Partners was founded to provide vibrant mixed-use development to urban centers. Our focus is healthy affordable homes serviced by retailers who share our ethic for a lifestyle of health and sustainability (LOHAS). Each project has its own signature architecture and retail mix to satisfy the needs of its surrounding community.	Northstreet Partners LLC (www.northstreetllc.com)
Loan Guarantees	Loan guarantees and other forms of credit enhancement (e.g. Letter of Credit) can provide a significant incentive available for energy facilities (up to 100% of loan amount).	
	Department of Energy federal loan guarantees for energy efficiency, renewable energy, and advanced transmission and distribution technologies – current solicitation request totaling $10 billion	Department of Energy (www.lgprogram.energy.gov/keydocs.html)
Federal New Markets Tax Credits	Federal New Markets Tax Credits (NMTC) are designed to encourage investment in real estate development (with the exception of rental housing) and businesses in qualified low-income census tracts. They can provide the equivalent of 20% to 25% of a project's total financing in the form of equity and/or debt which receives primarily tax credit returns and only nominal economic returns. NMTC allocations are obtained on an annual competitive basis by qualified Community Development Entities (CDEs). In turn, CDEs pass most of the benefit of the tax credits to projects with greatest community benefits and most distressed demographics. NMTC awards can be used for pre-development, site/infrastructure, buildings, and energy facilities. Single project real estate financing typically ranges from $5 million to $50 million, with a corresponding amount of $1 million to $12.5 million in the form of equity and/or debt which receives primarily tax credit returns and only nominal economic returns.	

Federal Historic Rehabilitation Tax Credits	Federal Historic Rehabilitation Tax Credits provide 10% or 20% federal tax credits on qualified renovation expenses for qualifying historic buildings, depending on how much of the building is left intact. The program is administered by the State Historic Preservation Office, National Park Service, and IRS (www.nps.gov/history/hps/tps/tax/brochure1.htm). Federal Historic Rehabilitation Tax Credits cannot be used for land costs, but can used for pre-development, site/infrastructure, and buildings.	
Federal Low-Income Housing Tax Credits	Federal Low-Income Housing Tax Credits (LIHTC) provide approximately 9% annual tax credits on qualified construction or renovation costs and 4% annual tax credits on qualified existing building purchase costs for a ten year period. These credits are pro-rated based on the percentage of affordable rental housing units provided, and are competitively allocated by state housing agencies (more detail can be found at www.enterprisecommunity.com/products_and_services/downloads/lihtc_101_ppt_10-06.pdf). LIHTC can provide 30%-70% of pre-development, site/infrastructure, and building costs for the low-income rental housing portion of the project.	
	Enterprise Community Investment offers competitively priced Low-Income Housing Tax Credit (LIHTC) equity to non-profit and for-profit developers for new construction and/or rehabilitation of affordable rental housing that generally adheres to the Green Communities Criteria. Enterprise is committed to creating communities of greater sustainability by working with partners who are willing to incorporate green standards into their projects.	Enterprise Community Investment (www.enterprisecommunity.com) and Green Communities (www.greencommunitiesonline.org/tools/funding/housing.asp)
	Local Initiatives Support Corporation, and its National Equity Fund affiliate, has an emphasis on smart growth LIHTC project.	Local Initiatives Support Corporation (www.lisc.org)
Federal Renewable Energy and Energy Efficiency Tax Credits and Tax Deductions	There are a range of federal tax credits and tax deductions for renewable energy systems and commercial building efficiency. These tax credits apply to both small-scale, building-integrated and large-scale energy generation facilities (e.g. proposed cogeneration facility).	
	Under the Business Energy Tax Credit, PV panels, solar thermal, small-scale wind (to 100KW, maximum $4,000 credit per turbine), and fuel cell systems are eligible for a 30% federal tax credit and microturbines, geothermal heat pumps, and biomass/cogeneration facilities are eligible for a 10% federal tax credit. The applicable basis of the tax credit is the cost of energy generation related equipment. Under recently passed legislation, these facilities must be placed in service by December 31, 2016 (except geothermal heat pumps, which have no expiration). This credit could be worth several million dollars with aggressive use of building-integrated renewable energy generation systems. It is not clear if the proposed 35MW cogeneration facility would be eligible for both the Renewable Energy Production Tax Credit discussed above and the Business Energy Tax Credit.	Details available from: (www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US02F&State=federal&currentpageid=1&ee=1&re=1)
	PV panels, solar thermal, fuel cell, and microturbine systems are eligible for five-year accelerated depreciation (MACRS) including 50% depreciation in first year. This tax deduction could be in the amount of several million dollars per year for five years with aggressive use of building-integrated renewable energy generation systems.	Details available from: (www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US02F&State=federal&currentpageid=1&ee=1&re=1)
	A tax deduction of $1.80 per square foot is available to owners of new or existing buildings who install (1) interior lighting; (2) building envelope, or (3) heating, cooling, ventilation, or hot water systems that reduce the building's total energy and power cost by 50% or more in comparison to a building meeting minimum requirements set by ASHRAE Standard 90.1-2001. Energy savings must be calculated using qualified computer software approved by the IRS.	Details available from: (www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US40F&State=federal&currentpageid=1&ee=1&re=1)

Tax Increment Financing	The Tax Increment Financing (TIF) Program is an economic development tool administered in certain municipal areas including Portland but not Seattle. This program allows local governments to sell bonds backed by a development's future taxes, with the bond money helping to pay the developer's construction costs. TIF proceeds are awarded on a highly competitive basis in qualified areas. TIF can be utilized for pre-development, site/infrastructure, buildings, and energy facilities. TIF awards can range from tens of thousands of dollars to tens of millions of dollars and amounts depend on a complex negotiation process.	
Grants	Grants from organizations with a strong program area in sustainable communities and/or smart growth. It may be necessary to establish a "Friends of ..." type non-profit organization, or to work in partnership with an existing non-profit in order to access some of these grants. Grants are available for pre-development, site/infrastructure, buildings, and energy facilities in amounts ranging from thousands to millions of dollars. Specific award ranges are indicated where possible below.	
	Federal grant assistance	Catalog of Federal Domestic Assistance (www.cfda.gov); Access to grant applications (www.grants.gov)
	Association of foundations committed to supporting smart growth developments.	Funder's Network for Smart Growth and Livable Communities (www.fundersnetwork.org)
	Enterprise offers grants to help cover the costs of planning and implementing green components of affordable housing developments, as well as tracking their costs and benefits. Planning & Construction Grants Grants up to $50,000 cover planning and construction expenses including additional costs of architectural work, engineering, site surveys and costs associated with items such as a more efficient HVAC system, green materials and energy efficient appliance. Charrettes Grants Grants for up to $5,000 to assist housing developers with integrating green building systems in their developments and engage in a serious discussion of green design possibilities. Enterprise will award planning grants to affordable housing developers to coordinate a green design charrette. Sustainability Training Grants Green Communities offers Sustainability Training Grants up to $5,000 for affordable housing developers. Funding is available to cover the design and distribution of an operations and maintenance manual.	Enterprise Green Communities program: Enterprise Community Investment (www.enterprisecommunity.com) and Green Communities (www.greencommunitiesonline.org/tools/funding/grants)
	Home Depot Foundation will be awarding $400 million in grants over the next ten years to non-profit organizations. Preference is given to proposals that include community engagement that result in the production, preservation, or financing of housing units for low- to moderate-income families. The most promising proposals incorporate a number of "green" building design practices.	Home Depot Foundation (www.homedepotfoundation.org)
	The Summit Fund's long-term goal is to ensure that the Anacostia becomes a biologically productive, socially viable river that is a source of pride for the national capital region.	The Summit Fund of Washington (www.summitfdn.org/fund)
	This foundation has an emerging program area in Sustainable Design.	The Summit Foundation (www.summitfdn.org/foundation)

Grants (Cont'd)	The Oak Hill Fund's Environmentally Sustainable Affordable Design (ESAD) program promotes the incorporation of the principle of sustainable development into the design of affordable construction, with a primary focus on residential housing.	Oak Hill Fund (www.oakhillfund.org/oakhillesad.hmtl)
	The Surdna Foundation's Community Revitalization Program works in select U.S. cities to support efforts to create equitable, environmentally sustainable, mixed- The Surdna Foundation's Community Revitalization Program works in select U.S. cities to support efforts to create equitable, environmentally sustainable, mixed-income communities that provide residents with choice and opportunity. Communities of choice are economically and culturally diverse, and provide a range of housing choices; promote development that is walkable, environmentally sustainable and cost-effective; support green building and energy efficiency in policy and practice; connect development to jobs and information through transit and wireless networks; and build equity into their systems, to ensure that all residents can benefit from a city's revitalization.	Surdna Foundation (www.surdna.org)
	Planning grants from $50,000 to $100,000 in support of the integrated green design process; Medical and community components would be eligible but not for-profit components.	Kresge Foundation Green Building Initiative (www.kresge.org/content/displaycontent.aspx?CID=59)
	Offers $2 million in prizes for innovation sustainable construction projects.	Holcim Foundation for Sustainable Construction (www.holcimfoundation.org)
	Grants from the Deutsche Bank Americas Foundation support neighborhood-based organizations that develop affordable housing, support the creation of new businesses, generate employment opportunities and address critical service needs. Committed to building healthy and sustainable communities, Deutsche Bank works in partnership with outstanding citywide and national organizations to help community-based initiatives take root and succeed.	Deutsche Bank Americas Foundation (www.community.db.com)
Program-Related Investments (PRIs) and Mission-Related Investments (MRIs) from Foundations	Program Related Investments (PRIs) and Mission Related Investments (MRIs) from Foundations (below-market debt or equity for projects also achieving foundation goals). These investments may be used for pre-development, site/infrastructure, buildings, and energy facilities. They are typically from hundreds of thousands of dollars to about ten million dollars.	
	F.B. Heron Foundation has previously provided several million dollars in below-market loans to Swan's Market and the Jack London Shopping Mall (in Oakland, CA) and private equity investment in the Bay Area Smart Growth Fund I, LLC	F.B. Heron Foundation (www.fbheron.org)
	The MacArthur Foundation has previously provided several million dollars of below-market loans through its Affordable Housing Preservation Initiative and a loan guarantee for mixed-income communities	John D. and Catherine T. MacArthur Foundation (www.macfound.org)
	Blue Moon Fund will consider investments in ventures that are demand driven, with a relatively proven market, and demonstrate that they are environmentally sustainable. Real estate ventures will only be considered if they are part of a larger initiative that has social and/or environmental benefits.	Blue Moon Fund (www.bluemoonfund.org/investment/investment_list.htm?cat_id=1976)
	The Ford Foundation has provided a $2 million below-market loan to Ecotrust in support of the mixed-use Natural Capital Center project in Portland, OR	Ford Foundation (www.fordfoundation.org)

Program-Related Investments (PRIs) and Mission-Related Investments (MRIs) from Foundations (Cont'd)	Enterprise Community Loan Fund offers several lending products to support the development of affordable rental and homeownership housing that adheres to Green Communities Criteria. Early Predevelopment Loans may be used to fund any or all of the following typical costs: green building/design charrette and other services of green building/design professional, architectural drawings or engineering studies, geotechnical study or survey, construction feasibility study incorporating green criteria, phase 1 environmental report, appraisal, legal, and development consultant fees. Predevelopment Loans Predevelopment Loan Funds may be used to fund any or all of the following typical costs related to affordable housing development prior to closing construction financing: architectural, civil engineering and landscape design fees, electrical and mechanical engineering fees, interior design fees, surveys, environmental phase one and follow-up environmental impact studies, traffic studies, erosion control plans, zoning work, legal and title fees, appraisal fees, loan fees, application fees for debt, equity and subsidy financing and the costs of engaging a green design specialist. Acquisition Loans may be used to fund any or all of the following typical costs related to the acquisition of land or buildings intended to be developed as affordable homeownership or rental housing: earnest money deposits or option payments, land or building acquisition costs, title, closing and legal costs related to acquisition closing.	Enterprise Community Investment (www.enterprisecommunity.com) and Green Communities (www.greencommunitiesonline.org/tools/funding/loans)
Supplier Partnerships	It is sometimes possible to work with major project suppliers to obtain enhanced pricing or in-kind materials or equipment donations in exchange for highlighting these products in a high-visibility sustainability project. This approach would be used for buildings and energy facilities, and generate tens of thousands to millions of dollars in savings.	
	Pooling Purchasing Power In order to implement many of the Clinton Climate Initiative's major programs, cities need access to affordable energy-efficient products. CCI is working to leverage the buying potential of cities throughout the world to achieve favorable pricing on – and thus faster adoption of – energy-efficient and clean energy products and technologies. CCI has negotiated discounted pricing agreements with more than 25 manufacturers of energy-efficient products, including lighting, chillers, solar control window films, and "cool" roofing that will help to lower the costs of building retrofits. CCI has also negotiated discounts on clean technology vehicles, energy efficient street and traffic lights, and other products that will be deployed in cities through CCI programs. To date, more than 1,100 cities worldwide, including the U.S. Conference of Mayors, have access to these affordable prices, encouraging more products to emerge into a larger marketplace.	Clinton Foundation – Clinton Climate Initiative (www.clintonfoundation.org/what-we-do/clinton-climate-initiative)
Renewable Energy Credits	Renewable electricity generated on-site that is sold to the grid is eligible for Renewable Energy Credits (RECs) (also known as Green Tags), which can be sold in an active wholesale market to companies like 3 Degrees (www.3degreesinc.com). These RECs are valued at approximately 0.2¢/kWh to 0.5¢/kWh.	

Turn-Key Infrastructure and Mechanical Systems Partners	Turn-key infrastructure and mechanical systems partners install equipment at no capital cost in exchange for a long-term lease or service contract. This can take green capital expenditures out of the initial capital budget. This would be applicable to buildings and energy facilities, and could result in savings of tens of millions dollars in construction costs, but an increase in long-term payments.	
	Turn-key provider of commercial solar systems installs and owns system independently in exchange for long-term power purchase agreement.	No firms currently identified in the DC area. This is an active marketplace that needs constant monitoring
	These firms and others will design, install, and own HVAC and energy efficient technologies on a lease arrangement, decreasing initial capital cost but increasing long-term payments.	Carrier Corporation; Honeywell Building & Energy Solutions; Johnson Controls, Inc.; Siemens Building Technologies; Trane and others.
State and Local Incentives	A wide range of sample incentives are provided in the "Green Building Incentives" worksheet.	

Conclusion

Phase I Review

Many studies discuss aspects of the environmental and social benefits of buildings. Work in Phase I created a research, policy, and investment framework and taxonomy for transforming the built environment that explicitly incorporates a wide range of environmental and social benefits. Phase 1 also created a methodology grounded in ecological economics that allows these benefits to be quantified and given a monetary equivalent. Until these broader environmental and social benefits are routinely highlighted and connected to the economics of the built environment, they will continue to be valued at zero. This creates tremendous market distortions, resulting in the misallocation of trillions of dollars of real estate investment. Sustainability cannot be achieved with an inefficient allocation of resources for the built environment. Investment needs to be shifted to create a restorative, sustainable built environment increasing the full benefits that built structures provide and mimicking natural functions and processes to potentially enhance rather than degrade natural systems.

This framework is the basis for the Theory of Change to be implemented in Phase II. Phase II will:

1. Provide detailed calculations and case studies of environmental and social benefits provided by living buildings.
2. Test their impact on valuation models or appraisals.
3. Create an open source prototype Integrated Real Estate Investment Modeling Tool to demonstrate how environmental and social benefits can be embedded within a pro forma in a new building development context.
4. Show how different policies internalizing environmental and social value creation affect key investment metrics like Return on Investment (ROI), and Internal Rate of Return (IRR).
5. Explore enhanced valuation and appraisal models (e.g. using industry standard software such as Argus.
6. Determine, with the above information, the best policy approaches to shift investment toward a more restorative built environment.
7. Conduct a detailed analysis of local, state, and federal policies that will support the integration of environmental and social values in the built environment. This analysis will weigh factors like level of impact, proposed funding mechanism, ease of measurement and implementation, political viability, and administrative agency.
8. Examine the integration of green building valuation standards into the appraisal standards which would enable practitioners to routinely include the recognition of environmental and social benefits in appraisal analysis and their value.
9. Conduct outreach to the appraisal and valuation (e.g. real estate development and investment) communities.
10. Set a strategy for a shared protocol to incorporate environmental and social value streams in financial models.

As these values are increasingly monetized through policy shifts at various levels, they will then be routinely incorporated in appraisal and valuation models. This will reduce market distortions over time, providing better investment decisions from the perspective of integrated financial, environmental, and social returns.

The overarching goal of this work is to catalyze a shift in mainstream real estate practices to support a restorative built environment that is compatible with healthy natural systems. This work provides monetized environmental and social benefits not currently considered in a conventional real estate investment model. By enhancing the underlying real estate investment model, which includes appraisal, risk assessment, finance, and lending, the full transition to a high performing built environment appropriate for the 21st century can be achieved.

Next Steps

Next steps include a two-year program of activities including linked research, policy, and advocacy work within the real estate development industry. These actions, taken together, should begin to catalyze the systematic incorporation of environmental and social benefits in the Real Estate Industry. Shifting the incentives and the real estate investment model will ultimately drive investment toward buildings and infrastructures that are financially resilient, socially just and ecologically restorative.

The proposed scope for Phase II includes the following:

1. Develop detailed monetization models for the identified social and environmental benefits and are tied to specific building features.
2. Refine the prototype Integrated Real Estate Investment Modeling Tool to utilize the detailed monetization models in (1) above.
3. Make enhancements to the Tool with additional versions suited to the evaluation of existing buildings (e.g. non-LEED™ all the way to Platinum LEED™) compatible with industry standard ARGUS software.
4. Undertake a detailed analysis of potential policy interventions to determine the best leverage points for systematic change. Prioritization will include factors such as:
    - level of impact;
    - proposed funding mechanism;
    - ease of measurement and implementation;
    - political viability; and
    - administrative agency.
5. Lay out a strategy to shift from regulations to "protect us" from the built environment to policies that allow us to create a restorative built environment (a healthy human habitat).
6. Set out a strategy (e.g. legislative, amendment to current building codes and other regulatory barriers, opportunistic funding mechanism, measurement methodologies, industry changes) to implement the investment shift.
7. Identify opportunities for integrated approaches to assessing asset value within the appraisal and valuation industries utilizing interviews with major Real Estate Industry segments (lenders, investors, appraisers),

8. Develop protocols, measurement methods, standard and reports, consistent with appraiser and valuation expert needs and operations. Also allow for the integration of additional financial factors linked to environmental and social benefits. For instance, along with tangible revenue streams tied to policy changes, appraisers can already include a complex analysis of risk and marketability that may already be influenced by green building attributes.
9. Apply these approaches to specific buildings by exploring case studies of projects seeking Living Building Challenge certification as well as nationally recognized LEED™ Platinum certified projects including the Bullitt Center in Seattle, WA; The Oregon Sustainability Center in Portland, and/or One Bryant Park in New York, NY. Using readily available information about these projects, while maintaining sensitivity to confidential financial information. Analysis will be organized to allow for comparative analysis of the benefits of Living Buildings and enhanced value.
10. Explore the detailed case studies showing the estimated value of environmental and social benefits, proposing policy interventions that will effectively capture these benefits, and examine new financing models driven by better monetization of environmental and social benefits.
11. Work with the Insurance, Reinsurance and Actuarial Industries on green buildings and insurance underwriting through interviews to understand factors that may influence property insurance, health insurance, natural disaster insurance, fire insurance, collateral loan loss credit, etc. Examples include a potential decrease in construction risk and defect insurance for green buildings due to the decrease in mold risk. This will provide a series of protocols, measure methods, standard and reports that are consistent with how insurers work but allow integration of additional factors linked to green building benefits.
12. Develop the concept of restorative micro-utilities by systematically addressing current regulatory, code, financial, and other barriers to both small-scale and integrated (e.g. multi-resource) utilities including electrical, natural gas, thermal (water or air), water, stormwater, wastewater, garbage, etc.
13. Link the research with current work on utility accounting principles, funding mechanisms, rate structures, scale of systems versus cost, loss factors of transmission, micro-grids, and related factors.
14. Create a communications and marketing strategy for policy makers, real estate industry, financial industry, green building community, insurance industry, utility industry, and others. The strategy will include a digital platform, book, papers, videos, press releases, and possibly a conference.

Glossary

ARGUS: Computer software that assists the real estate industry in appraising goods and services.

Avoided Cost: This valuation method assesses goods and services that allow society to avoid costs that would have been incurred in the absence of those goods and services.

Biomimicry: Built capital constructed in a way that mirrors environmental processes.

Biophilia: Human affinity towards natural systems.

Built Capital: The goods, benefits, and services provided by constructed systems. Examples include bridges, roads, or buildings.

Cobb-Douglas: An economic production function that calculates the relationship between the output of the firm(s) in question and the quantities of the input factors the firm(s) uses.

Contingent Valuation: Hypothetical estimates of prices of nonmarket goods and services based on survey questions asking how much one would be willing to pay for an extra unit of the good, or how much one would accept for the loss of a unit of the good.

Debt Service: The budgeted repayment of loans.

Demand Charges: Energy charge based on the highest demand. Those periods of highest demand will result in the highest charges for energy.

Discount Rate: This rate addresses the time value of money. It determines the present value of future cash.

Ecosystem Goods: Tangible, quantifiable items or flows, such as drinking water, lumber from trees, fish, and food. Most goods are excludable, which means that if one individual owns or uses a particular good, that individual can exclude others from owning or using the same good.

Ecosystem Services: The conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life.

Ecosystem: A network of biological and environmental relationships. Ecosystems feature natural providers and beneficiaries that create goods and services. The flow of benefits through the ecosystem provides for natural capital.

Externalities: An unintended and uncompensated loss or gain in the welfare of one party resulting from an activity by another party.

Factor Income: Valuing goods and services that provide for the enhancement of incomes.

Feebate: A reward for good practices by reimbursing partially or all fees collected. Feebate programs are intended to discourage a certain practice while encouraging a practice that can replace the original.

Green Triple Net Lease: A lease agreement that provides incentives to the lessee (the tenant) to operate in a more environmentally friendly manner where the tenant is solely responsible for all of the costs relating to the asset being leased in addition to the rent fee applied under the lease.

Group Valuation: This approach is based on principles of deliberative democracy and the assumption that public decision making should result, not from the aggregation of separately measured individual preferences, but from open public debate.

Hard Costs: The costs of actual assets.

Hedonic Pricing: Valuing goods and services that are reflected in the prices people will pay for associated goods.

Home Owner Association: An organization of property owners that manages a housing community.

Human Capital: Includes acquired knowledge through education, self-esteem, and interpersonal skills such as communication, listening, and cooperation as well as creating individual motivation to be productive and socially responsible. It is well recognized that education and training are essential to economic growth, innovation and a high quality of life.

Hurdle Rates: The minimum rate of return expected on an investment

Impact Fees: Fees placed on a property owner or developer by a governing body to offset costs imposed on the public.

Kilowatt Hour: A measurement of energy equivalent to one kilowatt of power used for one hour.

Living Building: A building that generates all needed energy using clean, renewable resources; captures and treats water through ecologically sound techniques; incorporates nontoxic, appropriate materials; and operates efficiently and for maximum beauty.

Loss Factor: A ratio between the total square footage not available for rent in a building and the total square footage in a building.

Marginal Product Estimation: A valuation method in which service demand is generated in a dynamic modeling environment using a production function (Cobb-Douglas) to estimate the change in the value of outputs in response to a change in material inputs.

Market Value: The value of a good or service that arises in a transaction as the result of supply and demand of that good or service.

Natural Capital: Stocks or funds provided by nature (biotic or abiotic) that yield a valuable flow into the future of either natural resources or natural services.

Rentable Square Foot: All area that is used and shared in a rented building.

Replacement Cost: Valuing goods and services that can be replaced with human-made systems.

Social Capital: The social networks and relationships that facilitate the flow of goods and services.

Terminal Cap Rate: The expected resale value of a building or property at the end the period in which it is held.

Travel Cost: This is another valuation method. Service demand may require travel, which have costs that can reflect the implied value of the service.

Vacancy Rate: The ratio of unoccupied assets available for rent to the total amount of assets available for rent.

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Appendix A

The *Integrated Real Estate Investment Model Tool* can be accessed using the following link.

http://www.eartheconomics.org/FileLibrary/file/Green%20Building/Appendix%20A.%20Modeling%20Tool%20v1.2.xls

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