FINANCIAL MECHANISMS FOR ENERGY DESIGN IN ECODISTRICTS

by

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Cities across the United States are increasingly vulnerable to internal and external forces that threaten energy and food security, access to resources, local ecologies and natural systems, global climate, and local economies. Energy is both a driver of these forces and an outcome of them. The City of Portland is promoting EcoDistricts, a strategy to accelerate sustainable development at the neighborhood scale. EcoDistricts could foster greater democratic participation through public and private buy-in while engaging financial mechanisms that could lead to unique, place-based solutions resulting in multiple community benefits. To date, there has been widespread difficulty both in assessing potential clean energy projects from a traditional financing perspective and in connecting projects with appropriate funding mechanisms. This study discusses and analyzes the context for using EcoDistricts to match energy projects in Portland's Lents neighborhood with appropriate financing. Four financial mechanisms were examined in connection to four district-scale energy projects for Lents to determine the associated costs, market analysis, and overall legitimacy of these financial mechanisms to provide for "strong" sustainability.

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CHAPTER I

INTRODUCTION

Cities across the United States are increasingly vulnerable to internal and external forces that threaten energy and food security, access to resources, local ecologies and natural systems, global climate, and local economies in a manner phenomenally different than prior societal challenges (Brown: 2011). They are also facing greater pressures on their public capital and operating resources. Energy is both a driver of these forces and an outcome of them. Self-reinforcing positive feedback loops emerge: energy fueling bigger populations, population growth leading to economic growth, leading to greater energy demand, etc. (Heinberg: 2010, 5).

Changes in the energy production mix will influence every level of society and how our communities function (Odum: 2009). In order to develop greater self-reliance and resilient communities, cities must better balance social, environmental, and economic outcomes to ensure life for all species, not simply humans (Howard: 1965; Lovins: 2004; Brown: 2011). Democracy and local governance are central to communities that want to build energy infrastructure that acts more like an ecosystem in its diversity, participation, influence, and resiliency in the face of large shifting conditions (Geddes: 1910; Young: 2010). Altering our path from a limited resource, fossil fuel economy would significantly change the way that communities balance citizen values, motivations, financial capital allocation, and resources.

Research Questions

To date, there has been widespread difficulty in both assessing potential cleaner energy projects from a traditional financing perspective and in connecting projects with appropriate funding mechanisms (Hinkle: 2010). This study will analyze and discuss the context for using EcoDistricts to match energy projects in Portland's Lents neighborhood with appropriate financing. I will investigate a collection of funding mechanisms for a range of energy projects for Lents and determine the associated costs, market analysis, and overall legitimacy of these financial mechanisms to provide for "strong" sustainability. Strong sustainability can best be characterized as the non-substitutability of non-natural assets, such as technology, for natural ones (Daly, Cobb: 1989). Granted, non-natural assets will be components of systems, but the difference between a technology that harnesses solar energy rather than those that create further ecological devastation beyond their embodied energy. For the purposes of this study, four financial mechanisms from four different stakeholders will be evaluated: (1) Community-driven, (2) Public-Private, (3) Public, and (4) Private. Additionally, I will highlight four energy projects win their respective utility for these financial mechanisms.

The study will be based on three primary research questions. First, is the EcoDistrict the appropriate scale to consider energy level projects, or energy projects that could be scaled up to the level of the EcoDistrict, and other "strong" sustainability projects? Second, are existing financial mechanisms practical and useful at the EcoDistrict scale and how can financing be aggregated at the EcoDistrict scale to make various financing mechanisms feasible? Third, what metrics are emerging to evaluate projects in terms of strong

sustainability, community wealth, and equity? How can these metrics be incorporated into finance mechanism decision-making?

Expected Outcomes

The EcoDistrict will be the focus of this investigation. The fundamental question is whether the EcoDistrict is a scale small enough to innovate quickly and large enough to have a meaningful impact. The main goals of this thesis will be to: (1) develop a process diagram for assessing districts and potential financial mechanisms; (2) provide a full menu of financial mechanisms that could be appropriate and used at the level of the EcoDistrict; (3) determine the relevance of the scale of the EcoDistrict for energy projects and better democratic governance; and (4) assess four energy projects and corresponding financial mechanisms to enable their adoption and implementation.

Why EcoDistricts

The City of Portland is promoting EcoDistricts, a neighborhood scale strategy to accelerate sustainable development, as a strategy to take on issues that effect local and regional livelihoods. EcoDistricts, which foster democratic participation at the neighborhood level and engage financial mechanisms, could be coupled with public and private buy-in to achieve unique, place-based solutions resulting in multiple community benefits. Energy is one of the foundational elements that will need to be better addressed by cities to reduce their carbon footprint and better manage their resources. Yet the question of appropriate financial mechanisms to finance these needed energy changes, as well as the source of this financing and their potential contributions to projects, is a major challenge for EcoDistricts to overcome. A greater understanding of financial mechanisms, both long-standing and novel, is needed to deliver on the vision of a more

socially equitable and environmentally healthy community, a community that is better positioned to respond to changes ahead. Together, these financial mechanisms coupled with strong, bioregionally minded, strong sustainability projects at the appropriate scale could deliver a greater magnitude of change. A bioregional mindset goes beyond ecology and into the fabric of all the perspectives and contributions to life. Looking to a larger web of conditions that include energy, water, cultural, geographical, topographic, climatic, natural resources, and industry clusters we move forward with designs and projects that seek to engage local communities and unearth and foster the inherent intelligence and potential of a place (Berg: 2009) (Sale: 1980) (Snyder: 1995). Assessing the appropriate financing mechanisms for sustainability projects, both established and novel, is timely and necessary (Hinkle: 2010). Defining sustainability and clean energy has led to considerable discussion and debate as they impact all facets of life. Even with a clearly articulated definition of sustainability, an outline of the spectrum of emerging and existing finance options is needed (Pernick et. al: 2010).

Using the neighborhood scale of EcoDistricts changes the conversation further by developing a platform that could aggregate financing, expanding beyond a single building footprint but still smaller than conventionally scaled energy projects (Portland Sustainability Institute). While the focus of this paper will be on the financial mechanisms that can lead to sustainable energy projects in the EcoDistrict, a better understanding of the landscape defining sustainability, bioregionalism, scale, EcoDistricts, district level energy projects, and financial metrics will be required to provide the context for sustainable projects.

Cities and Energy

Cities signify intensive allocation of energy; with concentrations of worldwide population growing in city centers, the energy systems will need to be redesigned in order to face increasing demand and dwindling supply of fossil fuels. Through built environments, manufacturing, transportation and housing, cities consume 75 percent of the world's energy throughput and emit 80 percent of the world's greenhouse gases (Beatley: 2009). By 2050, it is expected that 80 percent of the world's population will live in cities. At the same time, 75 percent of currently existing building infrastructure will still be in use worldwide. We will need to not only find new designs for energy supply and production, but also to reduce energy to manage current and future energy challenges (Living City Block).

Globally, cities have begun to understand their energy challenges. Large metropolitan centers such as New York, Los Angeles, Vancouver, Toronto, and Chicago are all promoting sustainability projects that confront energy challenges while competing to top sustainable city rankings (Karlenzig: 2007). This positive exposure and subsequent increase as led to both tactical and promotional opportunities for cities (Hern: 2010). Projects range from mixed-use dense housing, mass transit, stormwater management and urban forestry. Part of this strategy is no doubt political rhetoric and positioning for certain market segments such as Lifestyle of Health and Sustainability (LOHAS) customers but there is an underlying sense that taking steps toward better public transportation and energy efficiency is not just good business but also a requirement for long-term fiscal viability (Post Carbon: 2010).

Cities and countries have successfully attached financial mechanisms to energy. Spain, Germany, and Japan have implemented feed-in-tariffs (FIT), a superior guarantee payment paid to residents and businesses for providing renewable energy back to the energy grid. FITs in each of these countries have resulted in national changes in energy designs, leading to significant shifts of capital investment in renewable energies principally solar and wind. Pushing the clean technology edge in solar and wind production has not only placed their respective countries in a position of greater control in the face of rising energy prices, but companies such as Spain's Iber Drola are now worldwide players in the growing renewables market. On January 6th, 2011 Spain produced 75% of its energy on that day from renewable energy sources, demonstrating their ability to ramp their national and regional energy systems over a short time horizon. And while feed-in-tariff incentives for home and building owners initially sparked the sweeping growth in renewables, the price of energy has now gone down in Spain and has paid for the feed-in-tariff price subsidies, while providing 100,000 new jobs in the country (Garcia: 2011). Germany has had similar success growing in solar production by 35-50 percent a year and has resulted in a hundred thousand grid-connected PV systems through the implementation of the 2001 German Renewable Sources Act. It is anticipated that with this rate of growth Germany could be completely fueled by renewables by 2040 (Beatley: 2009).

Limits to Growth and Peak Oil

As many counties attempt to restructure their energy paradigms, it is important to understand the context and reasons for such large-scale changes. Beyond reductions in carbon emissions and dependence on foreign supplies of energy, cities and nations are

recognizing the inherent limits to resources, particularly oil and other fossil fuels. Peak oil, like climate change, is a term often used that carries a significant amount of controversy although the vast majority of scientists and specialists support its claims (Schneider: 2010). Peak oil represents the point where worldwide demand meets the world reserves and production of oil.

Demand for energy has been steadily growing across the world due in part to growing populations and economies such as India and China. Yet the tremendous energy and carbon footprints of the westernized world continue to contribute as well. Marion King Hubbert was the first to establish a correlation between the amount of energy production or energy in reserves and the amount of demand to determine when oil resources might expire. In 1956, Hubbert posited that the United States would peak in production in the 1970s, which it later did. Since then scientists and researchers have extrapolated the same production and demand curves in relation to the entire planet. What remains controversial is determining how much time that we have to reach peak oil, or, if we have already reached it in the past few years.

In response to ascertaining the timing of peak oil, the United States Department of Energy (DOE) commissioned a report in 2005. The document now known as the Hirsch report, the report was meant to determine the viability and potential risks associated with peak oil predictions (Chamberlin: 2009). Lead author, Robert Hirsch, and his research team found that the United States faced an "unprecedented risk management problem", one for which "we would have needed to start fundamentally redesigning our national energy infrastructure twenty years in advance of the peak"; a peak that by some counts may have already occurred (Heinberg: 2010, 232). Additionally the report refers to peak

oil not being a temporary energy crisis but rather a serious challenge deserving immediate attention and widespread government support (Lerch: 2007).

It is not a matter of simply weaning cities off of certain energy types but of evaluating how to redesign the energy system. Peak oil becomes an even greater challenge because no one substitute exists for petroleum that can offer the energy return on investment and the ability to offer a stored concentrated energy that can be dispersed as easily (Heinberg). On a daily basis, the world produces about 87 million barrels of oil, or the energy equivalent of over 240 billion person-days of work (Chamberlin).

In response, cities such as Portland, Oregon have developed peak oil reports (Lerch). In 2009, the city of Portland created the Peak Oil Task Force to assess the risks to leadership, urban design for community scale change, expanded efficiency and conservation, sustainable economic development, social and economic support systems, and an emergency plan (City of Portland Peak Task Force: 2009). Reports for peak oil and other declining resources will be important in informing society and governments as to the possible precautionary changes needed.

Mega-Projects in the Urban Core: Bread or Circus?

Cities, in so far as they have been sprawling, auto-dependent, urban landscapes, have begun to focus within and aim to develop greater density. While the benefits to land use and ecology are identifiable there remains a lack of determination as to how cities can involve all stakeholders, residents, motivations, value, and needs. The question as to how to truly develop a living city for nature and people regardless of social class is still unanswered (Bullard: 2007). Many projects that occur in the urban domain tend to

highlight and focus on wealthy families and do not incorporate the needs of the poor (Bullard: 2007). Whether a downtown revitalization project or an affluent neighborhood redevelopment, these projects tend to prioritize and target wealthier constituents (Bullard: 2007).

Jason Hackworth, professor and author, argues that considerable redevelopment, or "circus" projects focus on central business districts of a city because this distracts from the "absence of 'bread' being produced by the local economy" (Hackworth: 2007, 151). Rather than investing in a broad number of projects that reflects the greater population, public governments want the higher promotional and branding identity that comes with behemoth urban core downtown projects (Vale: 2001). Public governments finance these projects through large benefits, incentives, preferential zoning, and abatements. Hackworth does not place the blame solely on localized conditions but finds that they fit into broader forces such as globalization, uneven development, and cultural change" (Hackworth: 2007, 123).

> "If the Keynesian managerialist city was characterized by outward growth, inner city decline, regulated development, and public investments in infrastructure, the neoliberal city is increasingly characterized by a curious combination of inner city and exurban private investment, disinvestment in the inner suburbs, the relaxation land use controls, and the reduction of public investment that is not likely to lead to an immediate profit. If public housing and middle-class suburban housing were icons on the Keynesian mangerialist city, then gentrified neighborhoods and downtown commercial mega-projects are the icons of the neoliberal city. City governments have facilitated this not only through the relaxation of erstwhile regulations like zoning but also with the selective deployment of statecraft to spur real estate development in certain sections of the city" (Hackworth: 2007, 78).

Urban design has been heralded for its ability to engage the monumental but falls short on inclusivity leaving out citizens of the city. Allan Jacobs and Donald Appleyard pose

some of the downfalls of urban design in their 1987 *Towards an Urban Design Manifesto—Problems for Modern Urban Design*. The two authors point to poor living environments in slums and blighted neighborhoods often left forgotten, marking symbols of inequality. They also refer to "gigantism" and the loss of control in development due to the large-scale developers and the public agencies involved. They recognize large-scale privatization and the loss of public life as the individual being separated from the city. "Centrifugal fragmentation," in their words, is the function of white flight, first to the suburbs, that has now reversed to predominantly white professionals moving back to the city and displacing other socioeconomic classes and races. A symptom of our modern mass consumptive culture has led to placelessness. Jacobs and Appleyard determine that "we no longer know the origin of the world around us. We rarely know where the materials and products come from, who owns what, who is behind what, what was intended. We live in cities where things happen without warning and without our participation" (Allan Jacobs and Donald Appleyard: 1987).

In order to counteract urban design challenges, the manifesto calls for a city that is livable, self-reliant, with identity and control, access to opportunity, imagination and joy, authenticity, meaning, community, and public life for all.

Envisioning the New Green City

The city certainly has its challenges both in overcoming current political and land use structural weaknesses and coping with the future urban growth patterns. However, it would be incorrect to restrict the city in its ability to move beyond self-limiting factors. Rich legacies of peoples precede us in shaping a world in such a way that it molds to its place or environment as well as evolving with the people and cultures that inhabit it. Also

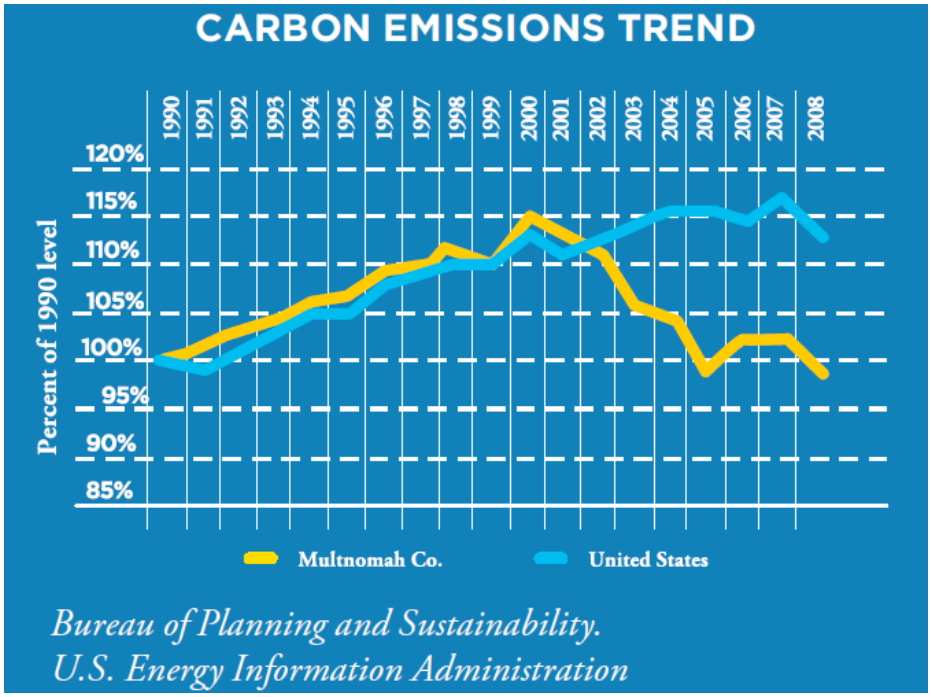
the city is constantly and reinventing itself and will continue to do so. And in the midst of life threatening conditions there are women and men dreaming and developing new ways for humanity to engage with itself and the planet. This critical juncture it is an opportunistic time to move forward an agenda that not only benefits one segment of the population, but that can serve a larger base while adhering to the inherent intelligences based in each region, city or neighborhood. It is possible to envision the new potential of city in its governance, function, and equity. As Patrick Geddes once said: "Civics as an art has to do, not with imagining an impossible [utopia] where all is well, but with making the most and best of each and every place, and especially of the city in which we live" (Geddes cited by Mumford: 1986, 155) It is time to build and grow a new city, a green city that offers equity, greater democracy, ecological resiliency, and the possibility for a more vibrant life.

Portland

Portland is a city that has made extensive changes to its infrastructure and policy in order to instill greater opportunity from its citizens to live sustainably (Beatley: 2011). Over the past few decades, Portland has implemented significant regional planning and environmental policies, a tradition that continues in large part today (Beatley: 2001). No city in the world can boast Portland's fully effective, broad ranging goals resulting in net zero or regenerative energy, transportation, or built systems. Portland, just like Vancouver, British Columbia is often touted as one of the pinnacle cities of sustainable living and infrastructure. These two cities head the list on many green city rankings, such as SustainLane, but much work remains if sustainability goals are to be met, especially with respect to in 80% carbon reduction goals. Large government expenditures in public

transportation (light rail, streetcars, and buses) have encouraged Portlanders to make alternative transportation choices. As a result, Portland is one of the few metropolitan areas in the United States to claim reduced vehicle miles traveled per household over the past fifteen years. In the figure below, Portland takes a sharp decline from the national trend in carbon emissions (Figure 1). Transportation is just a part of the carbon emissions pie for a city. According to a study by economist Joe Cortwright, the economic benefits resulting from the $1.1 billion Portlanders do not spend on car travel translates into $800 million that is not leaving the local region. That money then has the opportunity to recirculate in the local economy rather than leaving to region for international or national energy suppliers.

Figure 1: Carbon Emissions Multnomah County Compared to Rest of United States



Source: City of Portland and Multnomah County Climate Action Plan 2009

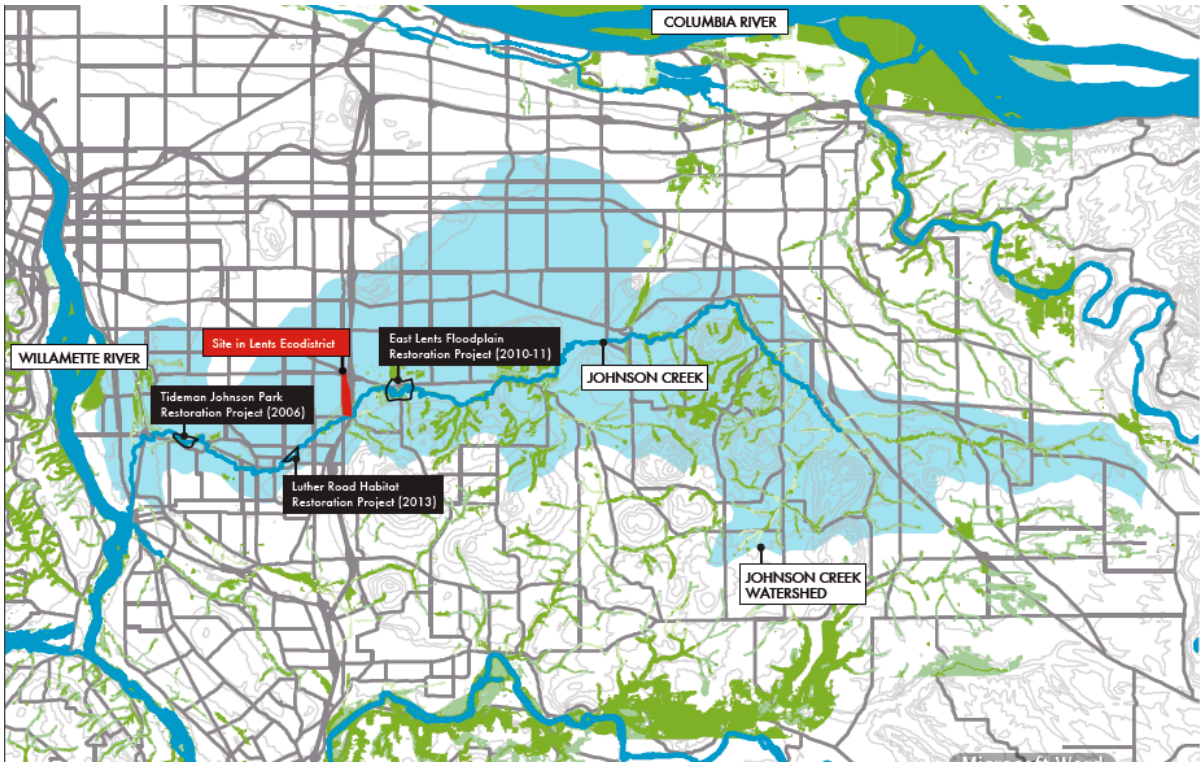
Portland is adapting its transportation systems and confronting issues with energy production and supply. From an energy production mix perspective, Portland does well in comparison to other regions of the country because of a regional advantage of accessing a large percentage of hydroelectric power. Yet 44 percent of energy supplied to Multnomah County comes from coal power, the highest share of the energy production mix. The percentage of coal power will decrease due to enforcement of Power Purchase Agreement (PPA) mandating a certain percentage of power in the state of Oregon to reach certain renewable energy targets. These decisions have already spurred the planned closing of a Pacific Gas & Electric (PG&E) coal plant in Boardman, Oregon. By 2011, a considerable amount of wind turbines have been installed in the Columbia River valley allowing for a marked transition of energy sources.

Energy production is also being focused within city borders. A number of local community groups such as Solarize Portland are installing solar at the community level by collectively aggregating capital and reducing cost by group purchasing. Columbia Biogas, a private Portland firm is turning compostable waste into energy at the neighborhood scale, a pilot project that might be replicated within the city. Beyond energy production, district energy and energy efficiency projects are being implemented in order to better use energy resources. As Portland continues to tackle carbon emissions and peak oil it will find great opportunities within the city to impact energy production, transmission, and use.

The Lents EcoDistrict

The Lents EcoDistrict in Southeast Portland has the potential to develop a resilient community that is deepening its urban ecology and local economic development, and improving social conditions. Nested in the Johnson Creek Watershed, the Lents EcoDistrict is characterized by both a richness of culture and place as well as chaos. The neighborhood boasts many languages and ethnic groups. Johnson Creek, formerly a salmon-bearing waterway runs through the neighborhood (Figure 2). Flooding is common downstream in the Lents and surrounding neighborhoods at times leading to street closures. Johnson Creek could contribute ecosystem services such flood mitigation, reduction in stream temperature, and other water services.

Figure 2: Johnson Creek Watershed



Source: Madeline Carroll et. al: 2010

At the same time, Lents is known for being a poor community. In a March 2011 article, the Portland Mercury identified Lents as a food desert due to the lack of a grocery store within a half-mile of the neighborhood (Mirk: 2011). In 2008, 213 residents were polled and 73 percent listed a grocery store as the most needed retail establishment in the community. The neighborhood did attempt to develop a cooperative food store but unfortunately those plans did not materialize.

In order to take on basic issues such as food and energy it is important to investigate the financial mechanisms available to communities in order to promote projects that respect both its diversity, and developments that allow for current residents to participate, rather than falling victim to gentrification. Up to now communities such as Lents have had difficulties enacting change due to an emphasis on capital coming from outside the community or public subsidies. It is time to change that trend.

CHAPTER II

LITERATURE REVIEW

Definition of Sustainability

Introduction

The term *sustainability* has gained significant traction over the last two decades but it remains a term that defies one specific definition and requires further explanation in most cases (Norton: 2005). Most definitions of sustainability fail to fully address the multiple facets and stakeholders involved in sustainable development. The challenge lies in sorting through a spectrum of values, perspectives, and solutions that relate to a number of dimensions of what people see as sustainable. Similar to political affinity, sustainability generally causes one to find a specific group that reflects their worldview. The result is skewed perspectives that cover the spectrum of sustainability reflecting many different viewpoints. Along that spectrum certain groups place greater emphasis on ecological, social, and economic aspects. For example, deep ecologists support a strong shift to environmental goals and values while sustainable business development advocates are more strongly aligned to the health of the economy.

Part of the problem in defining sustainability is warranted. More specific context and local interpretation are necessary for a statement with greater legitimacy. While one overarching definition might be difficult to articulate, most people can agree on what is unsustainable. A number of definitions exist for sustainability but perhaps the best way to describe the differences in perspective is the use of "strong" versus "weak" sustainability. Ultimately, being able to define sustainability should not be the end game, but rather it

should be the ability to develop a concentrated vision and roadmap of how a community and planet can go about achieving greater livability for all species. At its essence, sustainability is a goal to surpass a simple maintenance of current existence and move into a new possibility for interaction between people and nature. There is plenty of evidence for the need to develop place-based definitions and roadmaps for achieving conditions that allow for a more vibrant way of life.

Existing Definitions

The widely used Bruntland Commission Report definition ("sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs") has become a standard due to its early emergence of the sustainability movement. It is the first popular definition to connect intergenerational equity and establish a baseline for maintaining life systems beyond the current generation.

In a similar vein, the Iroquois held a law that based tribal decisions on impacts to the community over the next seven generations. While not explicitly stated, future life is contingent on functioning ecological conditions. Author Michael Shuman notes that the flaw of the Bruntland type definition is that it leaves out significant aspects such as social inequalities and ecological damage from previous generations that would require restoration in order to ensure future life (Shuman: 1998, 22). Although the Bruntland Commission brings in intergenerational equity issues, its ambiguity and lack of establishing critical indicators reduces its viability in leading the sustainability discussion forward.

The three-legged stool model set forth by the Bruntland Report has also become a classically used model to show the necessary balance of social, environmental, and economic goals. Neil Dawe and Kenneth Ryan make a poignant argument that environment should be classified in a greater hierarchy than just one of leg of sustainability. Without the environment, life would not exist. The environment is the foundation of society and the economy. By taking a more egocentric or anthropogenic view we have lost our connection to the earth and its ecosystem services. Currently natural capital is largely unaccounted for in the present economy. Indicators, such as Gross Domestic Product (GDP), attempt to measure the health of the economy and miss the mark at speaking to larger societal conditions. Equity for the environment and all populations of society is lacking.

Sustainability efforts have had considerable difficulty in incorporating social concerns as part of their mission. In many ways sustainability projects and programs are dominated by more affluent segments of society. Van Jones, founder of the Ella Baker Center and Green For All states that: "we have a moral and political obligation to say that we're not just building a green economy for the people who can afford to buy a Prius or put a set of solar panels on their second home. We are building a green economy strong enough to lift people out of poverty, and we want to be judged based on that" (Danaher: 2008, 62). Finding complete balance on the three-legged stool is not a simple task and requires a concerted effort to understand the implications of policy and economic decisions.

Fritoj Capra and others have attempted to capture the vitality of what social sustainability could be (Stone: 2009). While the sustainability movement has been characterized by strategies to reduce uses of natural resources and asking people to sacrifice, the

movement is learning to positively motivate people rather than turning them off. Capra envisions a sustainable community that is "alive, in its most exuberant sense of that word—fresh, vital, evolving, diverse and dynamic. It cares about the quality as well as the continuation of life. It is flexible and adaptive. It draws energy from its environment, celebrates organic wholeness, and appreciates that life has more to reveal than human cleverness has yet discovered. It teaches its children to pay attention to the world around them, to respect what they cannot control, and to embrace the creativity with which life sustains itself" (Stone: 2009, 122). While Capra's definition does not draw a coherent roadmap of how to achieve sustainability it aptly evokes a connection to people and reengagement with community and surrounding life systems.

Author, professor, and activist Kirkpatrick Sale, takes a more holistic and integrated approach to defining sustainability. First, Sale starts with revering all natural life, a concept that has since taken shape with the Endangered Species Act (Lovelock: 1979). Secondly, limits to growth set the stage for understanding restrictions on current systems and consumption of cities and regions. Sale idealizes the "self-sufficient" community that is capable of fitting into a "self-regarding bioregion".

Kirkpatrick Sale also acknowledges E.F. Schumacher's intermediate technology that embodies smaller, simpler, cheaper, and safer technology that is human scale, "comprehendible, affordable for all, and non-violent." Sale advocates for meaningful work that can further contribute to self and the community. The individual needs to "nourish and develop the individual soul, aiming at fulfilling the highest nature of the human character, including identification with community and the satisfaction of its needs" (Sale: 2006). Finally, under Sale's rubric economic decisions should not show

esteem to maximize profits but rather to fit into the Buddhist principle of ceasing to do evil and trying to do good. In this framework Sale sees a society that exemplifies "integrity, stability, diversity, continuity, and beauty of living species and systems" (Sale: 2006, 167). Sale's approach is important as it carries forward certain maxims that anticipate outcomes of democracy, greater equality, and happiness.

The Natural Step Framework is a set of four conditions developed by Karl-Henrik Robèrt in Scandinavia that can be applied to projects impacting the whole of society. The four design principles outline how to reduce human impact on earth systems, particularly in terms of extraction and pollution (Table 1). The fourth and final system condition relates to people and setting forth conditions that do not undermine people's opportunity to meet their needs and access to livelihoods. The table below references the four Natural Step conditions and their connection to desired sustainability outcomes.

Table 1: Natural Step Four System Conditions

The Four System Conditions...	**. . . Reworded as The Four Principles of Sustainability**
In a sustainable society, nature is not subject to systematically increasing:	To become a sustainable society we must...
1. concentrations of substances extracted from the earth's crust	1. eliminate our contribution to the progressive buildup of substances extracted from the Earth's crust (for example, heavy metals and fossil fuels)
2. concentrations of substances produced by society	2. eliminate our contribution to the progressive buildup of chemicals and compounds produced by society (for example, dioxins, PCBs, and DDT)
3. degradation by physical means	3. eliminate our contribution to the progressive physical degradation and destruction of nature and natural processes (for example, over harvesting forests and paving over critical wildlife habitat); and
4. and, in that society, people are not subject to conditions that systemically undermine their capacity to meet their needs	4. eliminate our contribution to conditions that undermine people's capacity to meet their basic human needs (for example, unsafe working conditions and not enough pay to live on).

Source: Natural Step

Other sustainability definitions hone in on the specific goals or methods to achieve sustainability. David Holmgren developed the Principles of Permaculture to connect to ecological conditions; however, the series of design principles reflect methods that function outside of ecological function and could be applied to other systems at the neighborhood or bioregional scale. The twelve principles Holmgren uses are: (1) observe and interact; (2) catch and store energy; (3) obtain a yield; (4) apply self-regulation and accept feedback; (5) use and value renewable resources and services; (6) produce no waste; (7) design from patterns to details; (8) integrate rather than segregate; (9) use small and slow solutions; (10) use and value diversity; (11) use edges and value the marginal; (12) creatively use and respond to change (Holmgren: 2002). Providing a more definitive series of conditions that can be assessed in local and regional context is appropriate. Surely no one definition or design principle can encompass all of the conditions that inform a community. Priorities and context will emerge but guiding principles adapted at the local level could prove beneficial.

Strong versus Weak Sustainability

In 1989, Herman Daly and John Cobb put forth the distinction of strong versus weak sustainability. Weak sustainability is based in the perspective of mainstream neoclassical economics and aggregates all types of assets together. Moreover, weak sustainability reflects the assumption that non-natural assets can substitute for natural assets as long as profits are left to future generations. Strong sustainability, on the other hand differentiates between assets that are natural. Additionally, strong sustainability argues that natural

assets are essential to life even if technology and human design can find substitutes to natural ones (Schumacher: 1973; Daly: 1989; Rees: 1992).

Bryan Norton proposes an even deeper definition of strong sustainability that he traces back to Aldo Leopold. The basis for normative sustainability uses adaptive management by looking at complex, dynamic systems. This is a differentiated yet similar strain as systems ecology. At the root of this ethic and practice is prioritizing integrity of place and community involvement. These definitions of sustainability might be more place-specific but ultimately they require specific context that emanates from the community and stakeholder groups (Norton).

Regenerative Systems

The precarious condition of our current systems and impending limits to resources impact basic needs such as water and land but permeate to rare minerals and materials that our technological society values more and more. Many researchers are encouraging processes that can reduce, eliminate or restructure our relationship from one of extraction to regeneration (Todd: 1994). Lester Brown, founder of the Worldwatch Institute, is a man steeped in the challenges facing humanity, and calls for shifting design solutions from problems such as the reliance upon an automobile transportation system to redesigning them for people and new forms of transportation and city systems (Brown: 2009).

William McDonough adds that we need to move from a consumption-based society with planned obsolescence to one that follows nature's cues. Further, McDonough explains one basic failure of our products and services is their creation of pollution and toxicity, something embedded in nearly all of our production processes (McDonough: 2002). We

need to change how products and our operating systems are designed from the ground up and understand the implications of their full life cycle. McDonough uses the term cradle-to-cradle to talk about the closed loop functionality of a system or product that goes beyond the thinking of cradle-to-grave (raw material extraction to waste stream). McDonough advocates for starting at the beginning of the process, rather than dealing with the dealing with the problem of waste.

Sustainability through the Lens of the City

In recent years, the lens of sustainability has been narrowed to the scale of a city and neighborhood. The U.S. Conference of Mayors, Seattle 2030, and ICLEI-Local Governments for Sustainability have been important in crafting nationwide and global parameters and solutions for citywide issues. Leadership in Environment and Energy Design—Neighborhood Development (LEED-ND) criteria have also nested in design requirements for LEED-ND certification whereby a community assesses: (1) mixed land use; (2) compact building design; (3) range of housing opportunities and choices; (4) walkable neighborhoods; (5) distinctive, attractive communities with a strong sense of place; (6) open space, farmland, natural beauty, and critical environmental areas; (7) development in existing communities; (8) variety of transportation choices; (9) ways to make development decisions predictable, fair, and cost effective; (10) community and stakeholder collaboration in development decisions (EPA website: 2011).

New Urbanism and Smart Growth have been extensions of sustainable thinking about the built design of communities through the lens of sustainability. The Environmental Protection Agency (EPA), Housing for Urban Development (HUD), and Department of

Transportation (DOT) alliance announced in 2010 marks an important synthesis of governmental offices that are focused on weaving the functional aspects of their programs into sustainable cities and neighborhood development. The idea is to restore brownfield or non-greenfield sites, incorporate public transportation networks accessible to all, and provide a variety of housing options to all socioeconomic levels.

Self-Reliant Communities

Considerable focus in sustainable city literature has pointed towards the need for self-reliance at the community level. In the context of a neoliberal capitalism of global proportions, cities are seeking ways of forming new relationships at the local level that can engender a more balanced relationship between economy, ecology, and equity (Kellert: 1996, Beatley). Globalization and capitalism externalize extractive costs in natural resources and labor. Local self-reliance is about recovering a relationship to the local environment, to each other and the types of economic choices that offer meaningful jobs and outcomes.

Kent Portney describes the benefit of local self-reliance as paying "great attention to the life-support capacities of the ecosystems upon which they rely. This attention is not a matter of choice, other than the choice between life and death. Self-reliance bars access to—and exploitation of—distant 'invisible acres,' and rules out despoliation followed by emigration. Local residents are forced to heed negative feedback signals from their natural environment. Such signals have an immediacy and clarity which is generally lacking for most members of contemporary industrial societies, who have scant knowledge of—let alone concern for—the ecosystems upon which they depend"

(Portney: 2003, 137). Sustainability is not simply about just the local community but its direct impact on people and lands far away from it. It is about responsibility to self, community, and beyond but also allows for greater control at the local level and not needing to succumb so sharply to the fluctuations at the global scale.

Bioregionalism and Scale

Introduction

Acute resource limitations and the externalized impact of a globalized economic system are forcing communities to realize their economic and social wealth, which is largely decided by economic and political institutions often physically detached from their location. A bioregional mindset can lead to greater resiliency for local economies and also engender a higher quality of life for residents, human, plant and animal communities. Bioregionalism teaches about place with an ethic of direct democracy for ecological, economic, and social systems. In my opinion, in its essence bioregionalism seeks balance and mutually beneficial relationships that align with triple bottom line thinking. Bioregional understanding introduces a dialogue of ecology and social memory of place fuse together with the changing dynamics of urban and rural areas and helps identify social, ecological, and economic goals. Bioregionalism informs residents of the multiple scales including the neighborhood, city, and bioregion of the inherent qualities that define a place but also instructs about its most worthwhile uses and functions of a place. This analysis and understanding of a bioregion or a "life-place" ultimately becomes a potential roadmap for the EcoDistrict by taking into consideration the physical attributes and inherent qualities embedded in a neighborhood that give rise to a place with strong identity and clear function (Berg; Thayer: 2003).

Definition and Context

Mistakenly, bioregionalism is generally characterized by the environmental aspects of its definition of place, whether watershed or soil types; however, in defining bioregionalism,

people, community, and associated cultures must be considered in addition to the ecology of place (Berg).

Bioregionalism does not operate on a one size fits all framework but rather seeks to identify the various and unique aspects and their connection to each community. A living tradition of community members, indigenous peoples, designers, planners, economists, business owners, and ecologists among others begins to define the breadth and possibilities of the inherent genius embedded within that geographical context (Geddes). Bioregionalism goes beyond ecology and into the fabric of all the perspectives and contributions to life. Looking to a larger web of conditions that include energy, water, cultural, geographical, topographic, climatic, natural resources, and industry clusters, one moves forward with designs and projects that seek to engage local communities and unearth and foster the inherent intelligence and potential of a place.

A bioregion cannot be bounded by lines drawn on a map but rather contains a myriad of layers that include some static attributes and others that are constantly changing. Scale is intrinsic to bioregionalism and the need to have a more coherent understanding of the full spectrum of nested scales that constitute our immediate environs embedded in a global system. Bioregions in of themselves nest multiple scales, while the immediate geographic context may extend out to include potentially large expanses of land, as is the case with the Cascadia bioregion that encompasses land between Southern Alaska to Northern California, between 110 degrees and 140 degrees west longitude and 40 and 60 degrees north latitude (Figure 4). Traditionally, bioregions have used the watershed as a driver of defining regions but contain political boundaries of neighborhood block, city, county,

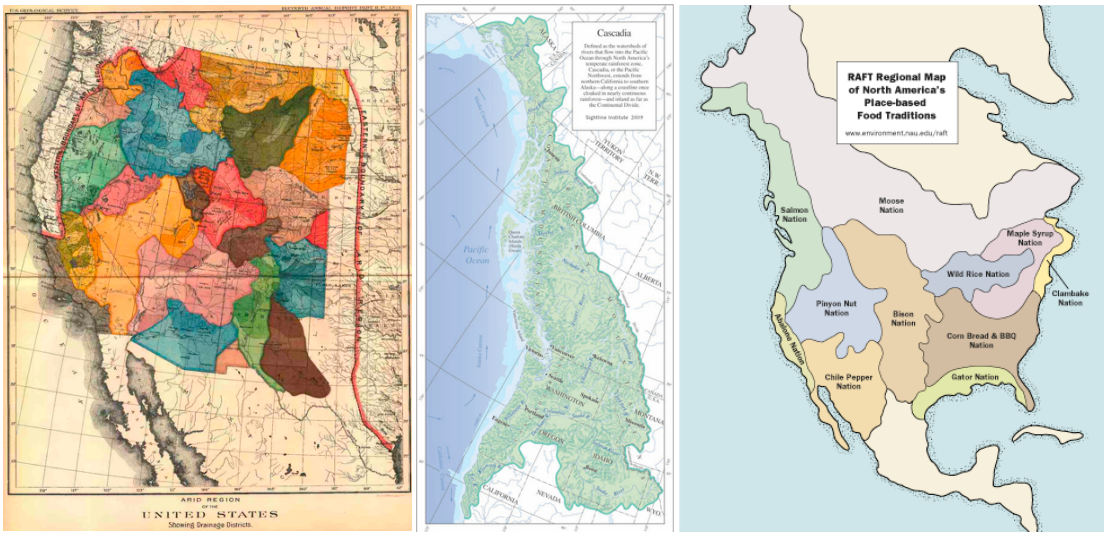
state, while meshing with microclimates, microhabitats, ecotopes, biomes, and ecoregions.

Today we are expanding beyond the focus of watersheds to incorporate the foci of agriculture, energy, and waste through considerations of foodsheds, energysheds, and wastesheds. These changes build off of prior investigation and legacy. John Wesley Powell, U.S. soldier, geologist and explorer, advocated in the 1800s for a watershed boundary system in the Western United States that used individual watersheds as the basis for political boundaries (Figure 3). He believed using the lens of the watershed could encourage an improved understanding and allocation of resources particularly water. Powell's geological survey, pictured below, outlines his vision of how the West's boundaries might be drawn.

Figure 3 (left): Map of Drainage Districts by John Wesley Powell. Source: Aqueous Advisors

Figure 4 (middle): Map of Cascadia Bioregion. Source: Sightline Institute

Figure 5 (right): RAFT Place-Based Food Traditions. Source: Salmon Nation



Bioregions and their complementary multiple scales of geographic boundaries inform us of the multiple dimensions for considering decisions at the local or regional level. Classically, bioregionalism has taken the focus of natural systems but there are identifying cultural and political conditions that stem from living in a particular region. Renewing Americas Food Traditions (RAFT) has gone beyond Powell's work and identified native local and regional foods that bring together the ecological with cultural components of a region (Figure 5). RAFT has developed a bioregional framework that marks those relationships in the map.

Bioregionalism fits into the discussion of sustainability by uncovering and engaging the identities, properties, cycles, and functions that advise the issues that ultimately lead to the health and long-term viability of systems. Ernest Callenbach, author of *Ecotopia*, connects bioregionalism to sustainability in the foreword to Peter Berg's *Envisioning Sustainability* "[Bioregionalism] pushes us forever back toward the local: in food, in energy, in materials, in production and distribution, in culture. It inspires us to take care of local business: nurturing our soil, treasuring our forests, sustaining our fisheries, reducing our footprints, and the impacts of our machines, learning to take care of each other in dire circumstances" (Berg, 2009, Foreword). Taking a look at all of these systems from an interdisciplinary and holistic perspective allows for more coherent and representative solutions but also ensures a more equitable and democratic basis for decision-making.

History

Peter Berg and Raymond Dasmann coined the term bioregionalism in the 1970s yet in practice bioregionalism is embedded in aboriginal and indigenous cultures, and has been practiced since the dawn of humanity. The Anasazi in the American Southwest are an early example of bioregionalism in their strong understanding of the conditions and environments surrounding them, which in turn guided their vernacular architectural forms based on climates and local building materials. Their buildings were connected to traditions and ceremony, and communicated the way that they lived with the land.

Berg and Dasmann, among others such as Gary Snyder and Patrick Geddes, have sought to understand the context of the places they have lived and strived towards a different participation with the human and natural landscape. Through his work with Planet Drum, an organization based in San Francisco, California author Peter Berg has worked for decades to help educate and develop relationships between people and the natural landscape of the Bay Area. Part of place-based understanding is being cognizant of the surrounding flows and resources in addition to governance structures that reflect democracy and decentralization.

It is common sense that a person living in a place for decades has a greater potential for understanding the inherent qualities, assets, challenges, and risks of a place than a governing bureaucrat or corporate manager hundreds or thousands of miles away. This same logic played a significant role in the foundational debate surrounding the powers and control of power of the United States by the federalists and anti-federalists. The anti-

federalists identified the importance of local government representation and the direct impact of such governance on the local ecology and economy.

Ecology Informs

Ecology is a central component of bioregionalism but not simply in inventorying a region's ecological assets. Rather, ecology's understanding of flow and function of ecosystems teaches us how to build and develop human systems. Ecology looks at a multiple scales and biodiversity becomes a significant metric. Healthy ecosystems rely on biodiversity to maintain balance in the face of internal and external challenges. Similar to natural orders human systems that develop large megaprojects may produce economies of scale yet face weakness with risks of systems based on select resources rather than a more balanced, decentralized approach. As an example, modern industrialization has been fueled by fossil fuel energy, a finite resource that endangers a far range of social and economic conditions. John Todd identifies the need to "circumvent clumsiness of large-scale of single source strategies" and find broader, regionally appropriate energy production and utilization strategies, in part to mimic the intelligence of natural systems (Todd, 1994). Peter Berg also cites the importance of building a city upon a "foundation of ecology" that understands the web of activities and systems that are at play (Berg: 2009). Fritjof Capra echoes the inherited intelligence and framework that ecological systems can share in our development of sustainable systems. (Stone: 2009).

Resilience science dedicated to understanding ecological systems translates to exploring and understanding the relationship of human systems. Timothy Beatley argues that human systems are "structurally and functionally inseparable from nature and the human

enterprise is a fully embedded, totally dependent subsystem of the ecosphere—people live within socio-ecosystems" (Beatley: 2009). This translates to the notion provided by Dawes and Ryan that the scale of economics is nested in the social and then ecological spheres. Human systems are dynamic and are under constant change but our ability to continue to adapt on a "crowded and resource-stressed planet" is contingent shifting our relationship to ecological systems and working within in them rather than in defiance or opposition to them.

Sense of Place

Gary Snyder and Peter Berg are two authors that place a great emphasis on the need of finding a sense of place in our environments and communities. Berg refers to "reinhabitation" as a way that we can enliven our relationship with each other and with nature. He argues that a greater emphasis should be placed on ecological values and democracy, and social justice. What leads to this emboldened relationship is a greater connection and understanding of the natural environment.

Gary Snyder in the preface to his Pulitzer prize winning book of poetry *Turtle Island* hopes that we may evolve to "see ourselves more accurately on this continent of watersheds and life-communities—plant zones, physiographic provinces, culture areas; following natural boundaries. The 'U.S.A.' and its states and counties are arbitrary and inaccurate impositions on what is really here. The[se] poems speak of place, and the energy-pathways that sustain life" (Snyder: 1974). Snyder might be more widely known for his poetry, but his influence in bioregionalism has come through his pragmatic work of launching regional watershed councils nationwide.

Many have others including Aldo Leopold, P.V. Walter, and E.O. Wilson have written of the isolation and alienation that people feel as result of losing a sense of place or a connection to something beyond oneself. In their words the loss of a land ethic and place has led to a damaging relationship with the natural world. Indigenous peoples long maintained a sacred connection to the landscape. Aldo Leopold refers to a land ethic that changes our relationship to the earth from "conqueror of the land community to plain citizen thereof" (Beatley: 1997). Walter explains that "we are threatened today by two kinds of environmental degradation: one is pollution—a menace that we all acknowledge; the other is loss of meaning. For the first time in human history, people are systematically building meaningless places" (Walter: 1988, 2). Walter says that we need places that contribute uniquely and speak the language of a place but that are at the same time appropriate to a place given its physical attributes. Harvard myrmecologist and conservationist E.O. Wilson has coined the term "biophilia" to describe the inherent, hardwired need to connect with nature and other forms of life. Wilson suggests that biophilia will guide "design of neighborhoods and living environments in the future" (Piedmont-Palladino et al: 2009, 58).

Robert Thayer echoes the need for an understanding of place and feels that "the bioregional approach suggests a means of living by deep understanding of, and respect for, and, ultimately, care of a naturally bounded region or territory" (Thayer: 2003). Yet it is not just about the physical landscape of a place but its people as well. Wendell Berry speaks to this point in the *Unsettling of America,* as he argues long-term habitation is key to understanding place but also engaging with others. Berry does not see place as simply nostalgic but material. Berry shares that an ethic of place, especially in a period of

significant change, comes out of that transitory experience and with it a constitution of a place even in the midst of transition and transformation. In shaping this ethic of place, authors such as Peter Berg promotes a concept of place that is inclusive for all people and species.

Economy and Governance in the Bioregional City and Region

While not explicitly bioregional authors Lewis Mumford, E.F Schumacher, Ivan Illich, Jane Jacobs, Michael Shuman, and Daniel Kemmis brought into their work the ever present and crucial aspect of economies. Each focuses on the local and regional economy for definitive action in greater economic and social wealth, while improving democracy and engagement at the local level. Governance and business are not merely separate entities. At their foundation is a structure that goes back to the anti-federalist debate and engenders certain limitations and trajectories. Daniel Kemmis frames the "story of resource extraction and faltering efforts to gain local or regional control" as one of the American frontier. Kemmis makes the connection that the federalists were able to "keep citizens apart" and open up the opportunity for such large-scale exploitation of peoples and lands in the West (Kemmis: 1990, 101).

Gary Snyder echoes the anti-federalists' sentiment that a simple vote for local and national representatives is not indicative of a true and pure democracy. The very notion of democracy advocates for an opportunity for voice, opinion, challenge, and ideas to be heard from the whole of the nation, especially at its local level rather than distant discussions. As both Daniel Kemmis and Gary Snyder identify, a connection to place becomes "what holds people together long enough to discover their power as citizens is

their common inhabiting of a single place" This connection to place then encourages engagement with the surrounding community whether service oriented in community projects, school boards, local politics. Snyder identifies this is as a return to civic life as people who stay in a place and become rooted there are open to getting involved in a way that they would not otherwise be (Snyder: 1995, 232).

Jane Jacobs, Michael Shuman, and Daniel Kemmis each advocate for import substitution as an important tool for cities and regions to take greater autonomy in the economy and not be left to the devices and decisions of those far away. As Kemmis explains import substitution is "not just about producing goods for *the* market, but for *this* market, in *this* place" (Kemmis: 1990, 88). Kemmis, former mayor of Missoula, Montana adds that "import replacement depends on a particularly close match between a place and its people; it depends upon a working understanding of what the place can feasibly produce which, at the same time, many of the residents want or need" (Kemmis: 1990, 88). Often conversations and decisions spurred from import substitution are not easy ones as they can often internalize economic, social, and environmental costs that have previously been shifted. With greater control comes greater responsibility and the need to find solutions that are potentially divisive.

Jane Jacob's *In Cities and the Wealth of Nations* (1984) and Michael Shuman's *Going Local* further explain that import substitution in the local and regional economy can increase control but also rejuvenate and re-shape the community. "Jacobs challenges the entire tradition inaugurated by Adam Smith's classic work by arguing that cities, not nations are the natural, organic economic entities. Jacobs' argument is not simply theoretical, but also practical. Her interest is in what actually enables or helps economies

to grow. As Jacobs puts it, "distinction between city economies and the potpourris we call national economies are important not only for getting a grip on realities; they are of the essence where practical attempts to re-shape economic life are concerned" (Jacobs: 1984, 35). To Jacobs the city and the hinterland or rural periphery is intimately connected and that connection can either by mutually beneficial or detrimental (Snyder, 1995, 233).

The birth of regional planning in the 1920s marked an important evolution in the perspective of governance an improved implementation of bioregionalism. In 1923, Lewis Mumford and his fellow distinguished members Clarence Stein, Benton MacKaye, Alexander Bing, and Henry Wright started the Regional Planning Association of America (RPAA), which drew from Patrick Geddes. They adopted city and regional planning standards that were to look at a set of varying scales to better inform planning at the local and regional scales. Today, Oregon is the only state that uses a regional planning framework and complementary urban growth boundary meant to better assess large-scale issues affecting a city and its region.

Bioregionalism in Practice

A community that wants to bring in a bioregional mindset and ethic to their community can follow processes that can educate the community on what currently exists within their geographic, economic, and social bounds. While many have contributed to regional sustainable design approaches the most notable are the social and technological methods of Patrick Geddes, the mapping and layering of Ian McHarg, the systems integration of Howard T. Odum, and the design pattern principles of the Olgyay brothers (Williams: 2007, 27). While many sustainability books will list topics that need to be addressed,

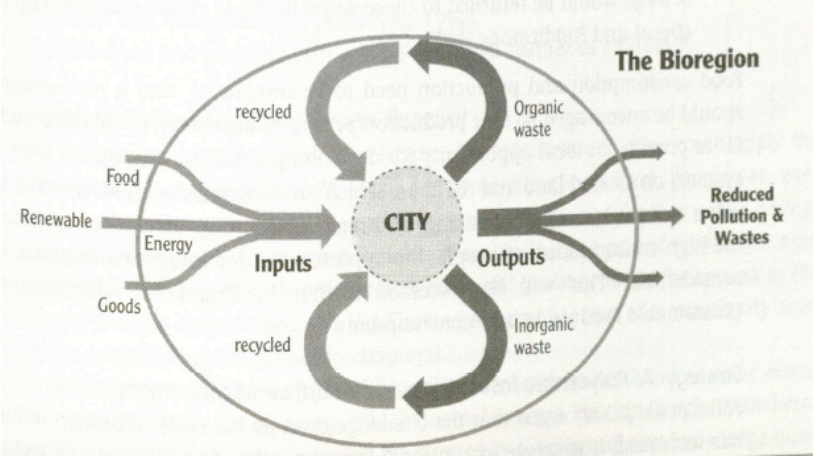
Warren Karlenzig promotes thinking of urban areas as interrelated systems, taking into consideration economics, water, energy, food, and vital material resources. Going beyond a list to understanding function and relationships between processes regional economies are more prepared for the complexity of new dynamics including: energy and water supply shortages, rising population, and changes in regional climate (Heinberg: 2011, 312).

As a part of this learning process research programs studying environments over time are emerging. The Long-Term Ecological Research (LTER) project in United States studies the relationship between human and nonhuman species in Phoenix and Baltimore. Patrick Geddes would also advocate for spending great lengths of time understanding people and their relation to place before making design recommendations. Taking months or even years to understand the interactions, and day-to-day conditions of life informs better design. Author Peter Newman states that we are living in a time that needs to put "humans firmly within the ecosystem, not apart from it as modernist thinking does" (Newman: 2008, 94). While we may have treated systems as separate silos we need to return to thinking that understands systems as interdependent.

Part of understanding the dynamic connections within a place is to first map all of the resource flows of the city and region. These holistic, "metabolic flows" assess the biogeographical and ecological features, in addition to the cultural and economic resources currently present that could be used under the conditions of long-term viability (Figure 6). Another valuable contribution to this understanding is inventorying the number and type of imported goods in the community and assessing whether locally produced goods could replace portions or blocks of those imports. Determining all the

flows and energetic systems contributes to the development of a roadmap or vision for the community.

Figure 6: The Bioregion and Its Flows



Source: Peter Newman

From the perspective of an entire nation, scientists such as David MacKay at the University of Cambridge have developed studies showing potential energy generation solely from renewable sources, given the natural characteristics and constraints of wind patterns, geothermal potential, wave power, and solar gain. His book *Sustainable Energy: Without the Hot Air* seeks to offer opportunities but also demonstrate current limitations to renewable energy production.

Nonetheless, these types of assessments at a regional scale are helpful in providing information to citizens, investors, governments, and clean technology firms. Barcelona did a similar analysis of solar gain and found solar potential amounted to "10 times more than the energy the city consumes or 28 times more than the electricity the city is consuming" (Piedmont-Palladino: 2009). Similar reports for other cities have been

established that articulate the amount of land necessary to support a city both in terms of food and energy. These reports indicate the significant need for land but also water, timber, mineral, and other resources.

For much of the second half of the 20th century, modern planning and architecture promoted suburbanization and similar housing forms that reduced upfront building and design costs. Yet for much of history building and design of communities has been vernacular architecture, locally sourced materials and using local traditions and knowledge to inform building style. Vernacular and aboriginal architecture has sought solutions from understanding the conditions of its unique place. Susan Piedmont-Palladino provides a unique example of a natural cooling mechanism called bagdirs used in Iran for the past 500 years. The towers are based on even earlier technology of "wind scoops" that have been used for more than 2,000 years. Built with local materials of mud brick, "the towers catch wind from one or more directions, absorbing heat in their walls as the air descend". Another example that they give is the municipal and zoning codes of Freiburg, Germany. Regulations have been set forth for new buildings to better harness the regional wind patterns of the Rhine River Valley: "to ensure that cooling summer breezes are not blocked by new development, the size and shape of buildings on certain key streets have been regulated since the 1990s" (Piedmont-Palladino: 2009, 80).

Connection to EcoDistricts

The EcoDistricts project in Portland, Oregon builds on regional planning choices developed since the 1970s that led to the development of an urban growth boundary "separating land for development from land for agricultural preservation and an elected regional government to coordinate and manage regional issues such as waste

management land-use planning, and transportation planning" (Heinberg: 2011, 307). Furthermore, the EcoDistrict model might be the most appropriate project type and scale to continue to evolve regional and bioregional planning to develop social and ecological solutions. The scale of a neighborhood nests well into the micro and aggregate scales of the bioregion. The neighborhood can help meet the need for a place to evoke not only feeling but also function. In terms of bioregionalism, the EcoDistrict offers a unique scale, somewhere between a site and an entire watershed, and the conversation of bioregionalism teaches us to look at multiple scales, both in the micro and regional in order to test and learn from place.

Conclusion

Bioregional thinking may be perceived as simply a romantic notion of place through a poetic connection to the land and its people, but its direct lineage serves as a blueprint and call to action to residents of a life-place. The first step is a cognitive process to establish as John Todd says a "way of being, a way of thinking that is interactive and comprehensive" and utterly different from the consumerist and production model proposed by modernity (Todd, 1994, 47). This process seeks to integrate multiple disciplines, all stakeholders and species to develop whole systems thinking. Bioregionalism teaches us to toggle back and forth between immediate site assets and their associated constraints. The approach that we use in public engagement must follow a similar nature.

EcoDistrict: Typology for Neighborhood Planning

District Terminology and Foci

Local governments and communities are identifying the district scale as an emerging typology that can play an influential role in enacting sustainable projects. The effort to transform cities relies heavily upon a neighborhood governance structure therefore hinging significantly on public engagement. The concentration of localized efforts is characteristic of an emerging bioregional mindset. Greater recognition of the inherent qualities and conditions within a neighborhood can spur economic and cultural improvement. The process of assessment and mapping at the local level can make the neighborhood and its role in the city more effective for citizens and the surrounding natural landscape.

The EcoDistrict pilot project managed by Portland Sustainability Institute (PoSI) is characteristic of a worldwide growth in neighborhood or district scale sustainability efforts whose emergence is largely due to their potential of achieving sustainability targets at a more rapid pace than individual projects. Equally the flexibility and adaptability of a neighborhood could be more adept at prioritizing projects that best fit their conditions rather than citywide mandates that can prove cumbersome. It is also proposed that this scale has greater ability to integrate systems of energy, water, and waste while at the same time focusing the conversation at a scale where residents of a neighborhood can get involved and truly shape the environment.

Similarly to the definition of sustainability or bioregional boundaries, EcoDistricts and EcoBlocks are not easily, nor exactly defined. Each has its own spatial and physical

boundaries defined predominately from existing political lines and vary in size from a single city block to many blocks. The decision for determining size and project emphasis largely depends on the immediate community and local government. And while the term "eco" tends to be placed before district, block, municipalities, and cities, the focus of the district level tends to balance environmental with social and economic goals. In practice, sustainability districts in Europe, China, and the United States represent a wide number of existing and emerging projects that fit into a generalized definition of EcoDistricts. Yet each district ultimately uses different terminology to define its organization and the focus of its work at the neighborhood scale. The capitalized name "EcoDistricts" is not used broadly but rather is a trademarked brand for Portland's pilot districts.

Urban designer and architect Dean Harrison Fraker of UC Berkeley developed the term "EcoBlock" for his work in China. In China, the common frame of measure is the "superblock", a size that was far too large under Fraker's guidance. Rather Fraker, scaled down to what he terms an EcoBlock that can act as a "self-sustained and semi-independent" block of approximately 8 acres and 600 building units, combining predominately water and energy systems (Novotny: 2010). Projects that fulfill working at the EcoBlock scale are decentralized renewable energy production, rainwater harvesting, and water reclamation. Fraker advocates that once intelligent systems are developed on a block scale they can then be aggregated up to the EcoCity fully integrating systems on a macro scale (Novotny).

Timothy Beatley uses the terms "distributed city" or "resilient" city to describe a city that shifts its power, water, and waste systems from a predominantly centralized system to one that distributes those flows through small-scale neighborhood systems (Beatley).

Beatley argues that producing energy closer to its consumption allows for enhanced control of energy, lower vulnerability for the overall grid and community as well greater resilience in the face of natural disasters. This mentality applies to both waste and water systems. Additionally, local districts or neighborhoods could develop a diversity of energy systems (rooftop photovoltaic, micro hydro, geothermal, and small wind systems) that complemented the nature of its physical, geographic, geological assets as well as incorporating more local control, oversight, and ultimately jobs. Beatley also sees an inherent ability for systems flows at the neighborhood scale to be viewed in the aggregate at the city scale. He terms the "eco-efficient city" as one where its regions more toward circular or closed-loop systems and inputs and outputs such as waste streams where substantial amounts of their energy and material needs are provided from waste streams" (Beatley: 200, 79).

Industrial ecology and eco-industrial networking are micro-scale examples a manufacturing or production rich district and the focus of connecting and building mutually beneficial relationships. One manufacturing plants effluent or waste could be the food that feeds an input service. Just as nature relies upon a balance of function in the use of waste, human manufacturing systems can look at larger symbiotic processes that may transform the financial, ecological, and social costs of waste into opportunity. William McDonough speaks to this process to large extent in *Cradle-to-Cradle*, as whole systems whether a city or the full life cycle of a product need to be assessed and understood, and ultimately reimagined to one that does not harm (McDonough: 2002).

EcoDistricts: Beyond Infrastructure

Advocates of a distributed city or regenerative design go beyond hard infrastructure of energy and water systems, to shape a community that takes greater control in its economic and social destiny. Taking a deeper look at the immediate district, city and region will have inherent benefit to build a stronger economy but it will also inform how best to interact with the natural environment. To date, natural capital in the form of physical assets, trees and board feet, and ecosystem services in water and air provision and quality, are assets that have largely gone unaccounted for in our economic system yet they sustain life. Drawing on the Lovins and Hawken's *Natural Capitalism,* David Bollier advocates for a return to the commons, in part through recognizing that the "bounties of nature are not free and inexhaustible, as our current economic thinking does, 'natural capitalism' understands that nature itself is a form of capital—finite, valuable, and irreplaceable—which must be assiduously preserved and maintained. Under natural capitalism, it becomes strategically important for companies to recognize the scarcity value of ecosystem services and to strive to integrate them seamlessly into product design and manufacturing" (Bollier: 2003, 63) (Lovins, Hawken: 2002).

While human activity has largely been criticized and highlighted in its damage to natural environments and processes there are inherently positive ways that humans can fold their practices into more natural and biotic process. Peter Berg and the Planet Drum Foundation have looked to San Francisco as an experiment/model/source of inspiration of what a bioregion can embrace but there are examples far and wide of individual and collective projects that further resilience and environmental health. For example, farmland can be fertilized with processed urban sewage rather than petroleum and

chemical heavy fertilizers and pesticides. Neighborhood common gardens and orchards play a role in Havana, Cuba and Village Homes in Davis, California as food sources for the community but also serve to reduce urban heat island effect, provide habitat for native fauna, reduce the transportation carbon footprint, and provide healthy local food in neighborhoods and schools. Communities have taken greater control of their food purchasing decisions by starting new neighborhood food co-operatives and developing centers for resource sharing tools, vehicles, child care among other community needs.

History Around the World

Similar to bioregionalism, which is a natural design principle of the Earth, the idea of EcoDistricts through greater cooperation in community has been a necessary cornerstone of human evolution. Early settlements survived and thrived only when they were able to collectively pool efforts, share resources, and defend against life-threatening challenges.

> "For most of our existence on earth, Homo sapiens banded together cooperatively to sustainably harvest the natural potentials of finite territories. Perception of the extent of the world and the size of its communities matched the ability of a particular group to derive livelihood from its world. Thus the evolutionary survival of humanity has depended largely upon social cooperation in place" (Newman: 2008, 107).

While we have lost the expressed need in our daily lives to rely upon the whole community there has been fluctuations in the value and participation at the local level. Europe most notably has made a greater shift to a district level emphasis but there are examples of district scale sustainability projects occurring in Scandinavia, Japan, British Columbia, China and across the United States in very different contexts.

Eco-municipalities started in Scandinavia in 1980 in Finland's Suomussalmi and Sweden's Overtornea. A regional conference in 1990 in Orsa, Sweden brought the

Natural Step for Communities Framework that helped over sixty communities officially become certified over the following decade (James, Lahti: 2004, 29). The Natural Step framework looks at the entire community, rather than specific neighborhoods and districts. It offers a set of design principles that a community can embrace leading to a different method of governance, economic production, and energy systems. By developing citywide systems, cities began to take a closer look at the potential synergies and opportunities at the block scale. Malmo and Stockholm is well known for its neighborhoods embracing sustainability at the block scale including the Augenstenborg and Hammarby Sjostad neighborhoods (Suzuki et al: 2010, 187). In the past few years district scale projects have emerged such as Dockside Green in Victoria, British Columbia, Oberlin East College Street Project in Ohio, and False Creek in Vancouver, British Columbia. District energy systems, however, are not novel to cities as they have been conventional energy systems including New York City, Portland, and Eugene, Oregon. District energy systems in Europe promoted by Euroheat and Power have been used since 1954. Japan introduced district planning in 1980 that considered district heating and cooling systems as well as the individual building footprints (Tamagawa: 2006, 135).

Portland EcoDistricts Pilot

The Portland Sustainability Institute (PoSI) and the City of Portland are promoting a pilot project in five neighborhoods in Portland to better take on promoting sustainability at the neighborhood level, which is nested into the city. EcoDistricts hold the promise of a scale that a community can engage sustainability issues with greater success than methodologies that participate at the individual building site or from a citywide

perspective. EcoDistricts are committed to achieving ambitious sustainability goals at the neighborhood scale, offering communities the ability to go beyond individual site scale projects and yet maintain a size dimension smaller than a city that can deliver more appropriate solutions that could in turn could feed into a bioregional planning framework EcoDistricts go beyond the individual building footprint in combining architectural design, community engagement, and financial platforms that aggregate resource flows at the neighborhood level. Working at this scale offers the potential for greater community involvement and buy-in (depending on governance through democratic participation) but also could serve as an important platform for financially investing in local EcoDistrict level projects from the private, public, and community constituencies. While working at the neighborhood scale requires a higher level of community engagement which can take more time and resources, it ultimately offers for greater participation, buy-in, and change in social behavior that is key for change at the local level.

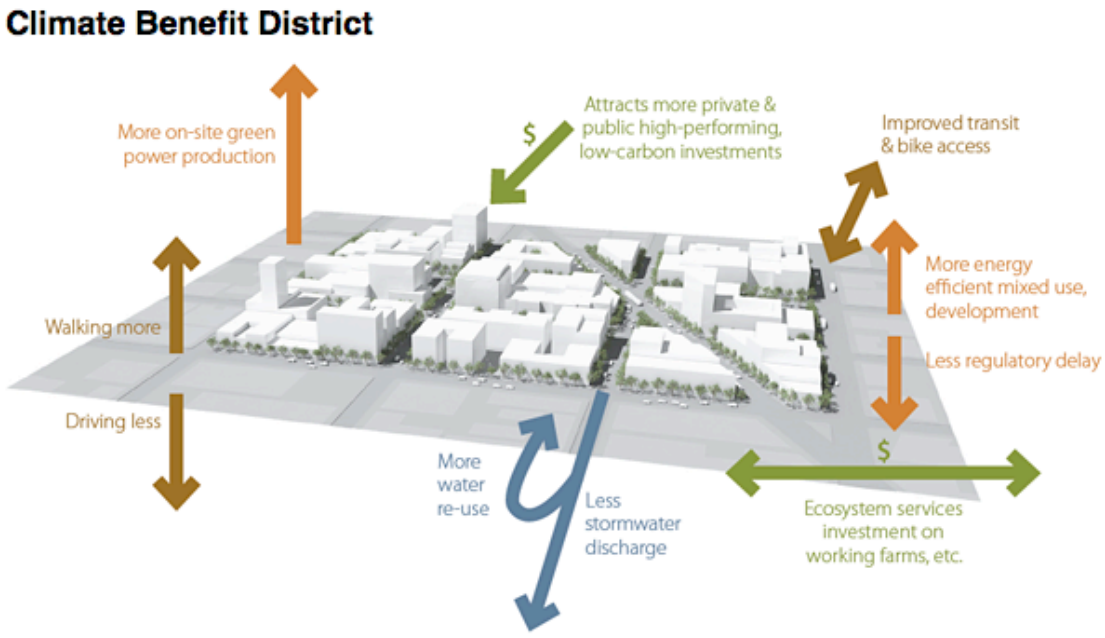
The city of Portland and PoSI have identified five pilot districts that each represents very different points within the city. The five pilot areas are: Portland State University, Lloyd District, South Waterfront, Gateway, and Lents. Speaking to inclusivity of all systems PoSI has established the following performance areas to guide work: community vitality, air quality and carbon, energy, mobility, water, habitat and ecosystem function, and materials management. The EcoDistrict pilot involves a number of stakeholders including local government, business, academia, nonprofit organizations, and most importantly the local community. Potential hard infrastructure projects include: thermal energy, smart grid, water reuse, and green streets while the soft infrastructure (Smith: 2011).

While the EcoDistricts pilot is only in its second year it is attempting to develop a framework that can lead an approach that can lead other neighborhoods in Portland and across the country through a similar process. (1) whole systems integration; (2) increasing capital investment through a different platform; (3) direct link to public policy; (4) monitoring and sharing in learning networks (PoSI: 2010). It is somewhat difficult to provide a comprehensive framework that meets the values, needs, and context of a community while leaving enough of the framework open for the community to take ownership and adapt the model to their unique conditions. PoSI recognizes the importance of an EcoDistrict to have its values reflected in the work at the district level. While difficult, PoSI has outlined a number of shared values that can start as a placeholder or baseline for community including: lowest possible environmental footprint, diversity, encourages participation, health, pedestrian-oriented, multimodal transportation options, access to nature and open space, cultivates conservation and stewardship.

Emerging Practices

Mithun, an integrative design firm based in Seattle has developed Climate Benefit Districts (CBDs), as a district level project that seeks to expand the governmental authority at the local level (Figure 7). CBDs would essentially use a "hybrid approach combining traditional tax-assessed financing mechanisms" to develop "quasi-municipal corporation or an independent taxing authority, as defined per the Washington State constitution." This level of political and financial autonomy could lead to greater power for carrying out a neighborhood sustainability plan (PoSI: 2010, 18).

Figure 7: Climate Benefit Districts Flows and Considerations



Source: Mithun

A strong push for district scale projects has emerged within the United States, although the foci and frameworks differ greatly. Kansas City's Green Impact Zone, Denver's Living City Block (LCB), Cleveland's EcoCity, and Seattle's 2030 project similar to Portland's EcoDistricts project, look at the neighborhood scale.

Kansas City uses a larger geographical area of 150 square blocks and while environmental goals are prioritized there is a deeper emphasis on meeting critical social ends, and the nature of their outreach strategy, going door-to-door with ombudsmen, adults and youth, to educate but also engage residents in the discussion of projects. The Green Impact Zone's genesis started out of a strong private-public partnership, as Kansas City was able to federal funds that in turn were leveraged into over $70 million for

weatherization, stormwater management, energy efficiency retrofits, alternative transportation, and building neighborhood capacity (Green Impact Zone: 2011).

The Living City Block rather is focusing on energy efficiency as one of the most effective formats, as an initial movement. In the interim other aspects/conditions are being approached but there is strong emphasis on energy retrofitting commercial buildings in the inner core of Denver. LCB's mission is to:

> "create a replicable, exportable, scalable and economically viable framework for the resource efficient regeneration of existing cities, one block at a time. As we work with communities to implement this framework we will help create regenerative and resilient cities that are culturally thriving, energy and resource super-efficient, and economically sustainable" (Living City Block: 2011).

The Cleveland EcoCity changed its name to Green City Blue Lake, to reflect a merger the nonprofit made with the Cleveland Museum of Natural History. A new Center for Regional Sustainability was created and there is a strong emphasis on bioregional planning and thinking. The main areas of focus of this project blend ecological design, smart growth, transportation, bioregional planning, and health into a combination of projects that reflect sustainability (EcoCity Cleveland: 2011).

Appropriate Scale

The question remains as to whether the district is the most appropriate scale to enact sustainability type projects. As demonstrated by the variety of EcoDistrict endeavors across the United States, the local community will develop a framework that suits the context of what is most important to their local community, the geographical boundaries, and site conditions. In terms of potential, it is difficult to say that the EcoDistrict does not offer a more reasonable opportunity for greater control of affairs at the local level and

thus offer citizens greater autonomy and influence in the way that their neighborhoods and cities are developed. A net zero or living building does contribute to citywide goals of reducing carbon emissions but the relative impact is small whereas if the Living City Block can affect building retrofits throughout the downtown urban core, a stronger impact is made on not just carbon emissions but also the livability of the community. In bringing energy to the forefront, demonstrating its inherent ability to function as a financial investment but that it should lead to greater local employment and assessment of other energetic and material flows, more reasonably aligns the questions of sustainability. Ultimately what the EcoDistrict offers is a different relationship, an opportunity for local communities to take a larger role in defining the physical space and flows around them and change social behavior to align with that vision.

District Level Energy Projects

Introduction

No city has a simple formula to follow in order to radically improve its energy production, transportation, and usage. From the outset, it is important to recognize the vast number of energy designs that are available to cities and the context for why cities need to act deftly over the coming years to curtail energy use and the large-scale risks to their communities. This paper will focus on: (1) renewable energy production; (2) energy efficiency; and (3) district energy systems in order to demonstrate district level projects that can each serve to play a role in the story of energy at the district scale. These three energy strategies are not limited to the scale of the district but employing them at this level could prove more effective in technical operation and social participation as will be discussed further. Additionally, district level aggregation could lead to great efficiencies and ultimately improved access to investment capital and financial mechanisms.

The energy landscape can become difficult to navigate very quickly, as certain energy design choices will have immediate feedback loops that will change the energy dialogue. For instance, a large-scale energy efficiency project will immediately impact the amount of energy production required for a community. Understanding the energy landscape can also be confusing. A term as simple as solar can refer to passive design, active solar used to produce hot water, or photovoltaics that produce electricity. Building materials, design, solar orientation, home insulation (R-values), energy production mix, and the sources of energy (coal, geothermal, hydropower, etc.) are each interchangeable parts that directly influence the production and use of energy. Finding ways to have each of the energy

design solutions work in concert with one another is paramount. Plenty of energy options await the city, ranging from: (1) treatment of the built environment and building envelope in new and existing buildings; (2) type of energy produced on the grid and on buildings; (3) efficiencies and effectiveness of transmission and monitoring systems (e.g. district energy, smart grid technology).

Energy security as well as energy use patterns for buildings and communities are important considerations for local governments, businesses, and community members. Energy security reflects both our geopolitical role and local energy spending. An average of 75 cents of ever dollar communities spend on energy leaves the community, making it less resilient to price fluctuations and infrastructure choices (Roseland: 2005, 88). On the energy use side, the built environment contributes significantly to the national carbon footprint, with 48% of greenhouse gas emissions attributed to buildings and 76% all electricity generated by U.S. power plants (U.S. Energy Information Administration: 2010).

Changing the built environment has been the focus of a number of cities across the world as some incent new building design to achieve LEED, Living Building, Earth Advantage, or the 2030 Challenge. The two most notable design changes to buildings are either through initial construction or retrofitting buildings to be more energy efficient. Vancouver, B.C. city government is laying the groundwork to mandate that all buildings constructed starting in 2020 or after be completely carbon neutral. The firm Pike Research has noted that the worldwide trend of green certified buildings is growing and anticipates green certified buildings to increase from 6 billion square feet in 2010 to 53 billion feet by 2020 (Brown: 2011). Passive buildings, inspired by German design, are yet

another building design that is gaining traction in the United States. Passive houses focus on the building envelope and utilize a strong insulation layering that reduces the amount of energy necessary to heat and cool the building (Passive House Institute: 2011). Passive design has been used more extensively in Europe, with over 25,000 passive-certified homes (Hiskes: 2011).

Waste streams diverted from landfills to energy production are becoming part of the energy equation from Alaska to New York City. Dynamis Energy, among other companies, is building waste-to-energy projects that are able to take waste destined for the landfill and diverts it to create energy for residential homes, while Newtown Creek Wastewater Treatment Plant in Brooklyn is planning to divert sewage from its wastewater plant and use the methane as a source of energy (Navarro: 2011). In March 2011, Cascadia Capital, a Seattle investment bank, backed $143 million for waste-to-energy projects offering low price electricity, which serves as a positive sign that these projects demonstrate value to investors (Hiskes: 2011).

Beyond looking at buildings simply as individual projects, EcoDistricts and other contexts such as industrial ecology zones, examine the larger geographic context and the relationship and utilization between buildings. This higher-level assessment of the energy ecosystem needs to assess density, building use, and energy patterns through an energy modeling study (Sewell: 2011). Rocky Mountain Institute (RMI) is sharing open source information as to how to perform energy efficiency retrofits, information that may continue to grow in their "Reinvent Fire" project. China's EcoBlock has emphasized a two-pronged approach implementing conservation (insulation, passive solar, natural ventilation, daylighting, energy efficient appliances and lights) and renewable energy

production (on site wind turbines on rooftops, building-integrated photovoltaics, solar water heaters, and bioconversion of sewage sludge, kitchen solid waste, and organic yard waste) (Novotny: 2010).

Potential and Barriers

District level energy projects, including energy efficiency and district energy, may be receiving greater consideration as of late due to their significant potential. However, these energy designs have been used for decades and have failed to gain widespread adoption due to a number of barriers. Energy efficiency will be the focus of investigation for this section, although potential and barriers to energy projects will be elaborated on in the results and discussion section of the paper.

Rocky Mountain Institute (RMI) and McKinsey & Company are perhaps the best at framing the worldwide potential for energy efficiency projects. Since the 1970s, Amory Lovins of RMI has advocated for energy efficiency and "soft energy paths". His stance is not simply an ethical one but centers on energy security and a country's viability to control its fate in the face of waning resources. Hard energy paths in fossil fuels require a country to consider military action abroad to control resources rather than following more pacifistic trajectories within its borders through greater concentration on renewable energies. McKinsey & Company, an international consulting firm, has done significant research to point out the large amount of revenue potential currently unrealized in energy efficiency projects. According to McKinsey, if a comprehensive energy efficiency approach were to be put into operation, energy savings of $1.2 trillion could be realized through 2020, representing $130 billion annually of energy saving opportunities. Despite

decades of public awareness campaigns and incentives from federal and state programs, energy efficiency projects have largely been unrealized (McKinsey: 2009). Recognizing this value, the U.S. government has implemented more energy reducing strategies than any other organization within the United States. Because the government both owns and occupies buildings, it is in their expressed interest to align efficiency and long term profit potential. Aside from important United States General Service Administration (GSA) projects, a number of players and organizations are involved in bringing greater energy efficiency to market.

McKinsey points out four major roadblocks to energy efficiency capturing its market potential. First, $520 billion in financial investment is required to install energy efficiency retrofits market wide. Second, energy efficiency retrofitting is a fragmented market comprised of over 100 million locations and billions of devices. Next, energy efficiency is often times a low priority of most organizations and the bandwidth of CEOs and other decision makers makes it a difficult choice. And lastly, energy efficiency can be hard to measure; verifying exact savings given the large number of variables involved risks “impairing investor confidence” (McKinsey: 2010).

As mentioned, one of the largest barriers to the array of effective neighborhood scale energy projects is the significant capital outlay. Current economic conditions and limitations on lending markets make it a noteworthy challenge (Hinkle). Utilities have been seen as a potential financial vehicle for energy projects due to their access to large capital resources and relative power. At the same time utilities are risk averse. Moving to a greater renewable energy base load from a more predictable base marks a significant risk. Overcoming challenges of transmission costs (e.g. retrofit, new transmission lines)

and the temporal, inconsistent nature of renewable energy will be required before utilities will support these programs broadly. In addition, utility companies generally earn revenues on the amount of energy produced and supplied. Therefore, reducing energy production would actually reduce their revenue and profit potential rather than increase it. Many utilities and states have made efforts to "decouple" profits from this business model and change it to one that would incentivize energy conservation for utilities and ratepayers alike.

Solutions to Address Barriers

Organizations such the Institute for Market Transformation (IMT) are attempting to find financial, and social mediums for promoting energy efficiency, green building and environmental protection in the United States and abroad. RMI and IMT both share strengths as promoters of important research to the marketplace. In the past year, RMI has shared its energy modeling and retrofitting experience for the Empire State building as well as other projects. While RMI's current work is predominantly focused on individual building footprints, the Living City Block is a spinoff RMI enterprise, started by former RMI consultants Llewelyn Wells and Chad Riley. The Living City Block is focused on the urban downtown core of Denver and is assessing the building nexus as an ecosystem for energy efficiency models.

McKinsey has published two groundbreaking reports in the energy and carbon reduction sector. *Pathways to a Low Carbon Economy* and *Unlocking Energy Efficiency in the U.S. Economy* have both focused on resources and overcoming potential barriers. The most important solutions that McKinsey outlines are: (1) information and education (home

labeling, assessments); (2) innovative financing vehicles, tax and other incentives, required upgrades at point of sale or rent; and (3) a developed certified contractor market (McKinsey: 2010). Information and education involves increasing awareness of energy use. Utility bills or in-building displays, smart devices, and awareness campaigns are strategies for improving the human element and impact on energy use. Incentives and financing entails promoting greater buy-in from the investment community to aid in the large upfront capital outlay. On-bill financing and carbon pricing are two examples McKinsey gives as potentials for creating new incentives. And finally codes and standards could use regulation to achieve a certain criteria for participation. For example, California has adopted specific LEED standards that developers and contractors must meet or surpass for new or retrofitted buildings. Energy efficiency could take a similar route, creating a regulatory approach that requires those retrofits to occur as a prerequisite for any building remodeling (McKinsey: 2010).

Decentralized Solar Production

As mentioned in the introduction, solar can refer to passive building design, active solar through solar thermal, and photovoltaics that produce electricity. This section focuses on decentralized or distributed solar energy production through solar photovoltaics and solar thermal collectors. Getting off of a fossil fuel based economy is difficult. Without energy substitutes that achieve the high Energy Return on Investment (EROI), or the high-energy potency embodied. Solar may not be able to compete on par in terms of EROI perspective, but solar does draw on a significant power source in the sun. Solar radiation from the sun is roughly ten thousand times greater than our current commercial energy use (Sachs: 2008). The physical scale of solar production varies immensely from solar

thermal collectors, solar farms or individual rooftop solar panels. One benefit to decentralized systems that place solar collection systems closer to the point of use is the avoided transmission line cost. Also, decentralized solar can be equated with greater democratization, as residents of apartments, houses, and commercial spaces participate to larger degree in energy production, more so than simply paying an electric utility bill.

In order to build up decentralized solar quickly, on a temporal and physical scale, countries such as Germany, Japan, and Spain have each implemented a feed-in-tariff (FIT) that allows solar producers to sell solar generated power not used on the property back to the utility grid for a higher price. The intended effect, which has played out in these FIT countries, is to decrease the payback period for the solar investment project. This guaranteed optimal price allows more customers to purchase systems but also leads to significant regional employment as it requires a new business to take hold in solar manufacturers, installers and repair people. Japan has taken it one step further, and now is requiring that 75% of new buildings install solar.

Beyond FIT there have been unique financing mechanisms that relate direly to solar production. One of these strategies is for a third party company (ProLogis, SolarCity, Sungevity) to make the initial capital investment in solar equipment. Once the solar panels are purchased the third party company is paid a monthly payment by the renter or owner of the property. Electricity bill cost reductions are passed to the resident of the household thereby incentivizing the customer to install solar, while avoiding the upfront capital investment (ProLogis: 2011). It remains to be seen if the contract and format of the agreements are in fact equitable to residents. A number of different formats for aggregating solar at the community level exist. One example is Solarize Portland in

Portland, Oregon that has developed a bulk-purchasing program, which aggregates purchasing over a number of residents to reduce costs for solar renewable energy systems, while also providing a knowledge-sharing forum for program participants.

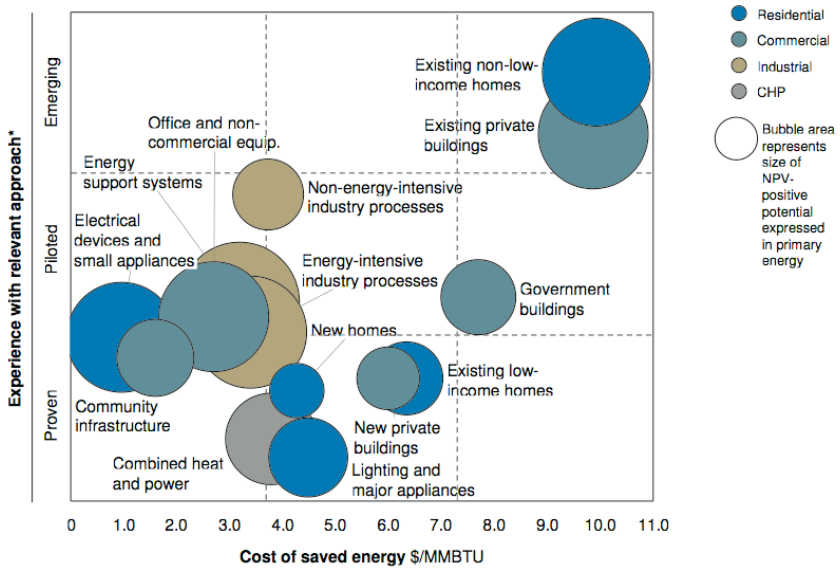
Energy Efficiency and Clean Energy Works Model

Energy efficiency represents a broad range of projects and players that are tapping into the significant potential outlined by McKinsey. First, all building types (low and high income residential, small and large commercial, industrial, public and private) can be retrofitted for energy efficiency. Secondly, energy efficiency measures can include underfloor air distribution (heating, cooling, and fans), lighting, plug load controls, on site renewable, and building commissioning according to the Department of Energy (DOE) Energy Efficiency Toolkit. Some energy efficiency measures are newly emerging technologies and quite sophisticated while others are rudimentary and have been used for generations.

In the Pacific Northwest, Better Bricks, Northwest Power and Conservation Council, Energy Trust of Oregon, and Northwest Energy Efficiency Alliance each provide support in the energy efficiency field. Energy Service Companies (ESCOs) such as McKinsey and PECI help government, commercial, and industrial clients perform energy modeling assessments and develop the infrastructure to improve energy efficiency (Figure 8). The "energy efficiency ecosystem" represents the full landscape of players involved in the energy market counting utility and energy firms, energy efficiency executors, energy efficiency equipment vendors, and energy efficiency funding sources (Equilibrium Capital: 2010).

In March 2011, Clean Energy Works Portland (CEWP), a nonprofit organization working in concert with Energy Trust of Oregon, Enterprise Cascadia, Portland Development Commission, Conservation Services Group, NW Natural, Pacific Power, Portland General Electric, Green for All, and the City of Portland Bureau of Planning and Sustainability completed a pilot project completing energy retrofits for 500 residential houses. Upon completing its 500th retrofit, CEWP announced that it would be expanding energy efficiency retrofits throughout the state of Oregon and will complete 6,000 home retrofits by 2014. The intelligence of the CEWP project is that it accesses the necessary capital financing necessary from the government to complete the energy audit. After the audit, a social enterprise bank provides the upfront capital cost for weatherization and retrofits. The resident through their utility bills pays back the investment in retrofits and the local utility is responsible for paying the bank back the required capital investment.

Figure 8: Carbon Reduction Opportunities



Source: McKinsey & Company

District Energy through Private Funding

District energy systems have an extensive history of use in Europe and are quite common in many places around the United States. District energy systems use a network of pipes to distribute hot and or cool water from a central facility and move that water to residential and commercial buildings. This system foregoes the necessary investment in individual building infrastructure (e.g. boilers, chillers) and focuses that equipment on the central plant and making it the most efficient for the neighborhood system (North Portland District Plan: 2008). According to International District Energy Association (IDEA), district energy systems have the ability to improve energy efficiency and life cycle costs for carbon, thereby improving environmental protection. Additionally, district energy systems offer fuel flexibility, ease of operation and maintenance, reliability, and decreased building capital costs.

Three notable district energy projects that are in productive use in the United Sates are FortZed in Fort Collins, Colorado, Seattle Steam in Seattle, Washington, and St. Paul District Energy in St. Paul, Minnesota. The FortZed project focuses on existing neighborhoods and utility infrastructure to deliver district energy. The St. Paul system utilizes the largest wood-fired combined heat and power (CHP) plant in the US and is able to provide heating or cooling to approximately 50 million square feet (International District Energy Association: 2011).

College campuses across the United States have installed district energy in part because they own their buildings and have a vested interest in seeing buildings reduce their energy costs. Chris Ramey, the Vice President of the University of Oregon referred to

the campus district energy system in a recent article and highlighted the importance of being able to measure and manage energy use between groups of buildings. Ramey sees that "the campus, as a little community, as a neighborhood, as a district, can do things that individual buildings cannot do." (Dietz: 2011) The same rationale for managing energy at the neighborhood block level exists; however, the collective ownership model is not in existence, therefore a proxy or different aggregation platform needs to be adopted to more effectively manage building energy use. Smart grids are a technology that will provide this level of interaction and information at a city and regional level.

A number of barriers to district energy projects prevent district energy from being the single solution for urban neighborhoods to manage their energy challenges. The first barrier is the capital intensity required to install the district energy piping infrastructure under city streets. District energy systems are also generally more conducive in situations where other street enhancements are being implemented so that the significant cost of road construction can be spread over multiple projects. There needs to be a critical mass of customers to reasonably implement the heavy cost burden. A potential barrier to certain communities is the ownership of the piping infrastructure and whether it should be treated as public works, similar to water and sewage piping. Furthermore, current energy prices do not reflect and account for externalities and subsidies. Without carbon pricing it is difficult for district energy systems to compete on price (Seattle Steam: 2009).

Energy Efficiency and On-Bill Financing

On-bill financing works similarly to the Clean Energy Works project model. However, rather than a financial banking institution guaranteeing the loan, the utility would serve as the lending organization and repayment of the loan would appear on monthly utility bills. Many utilities have significant cash assets and have the ability to use that capital in reducing energy use and developing renewable energy production. While the financing potential exists from utilities, there are hurdles that make it difficult at this stage for nationwide adoption. Many utilities assess their income and organizational value by volume of sales of kilowatts to customers. Rather than simply multiplying price and amount of energy produced, some are beginning to "decouple" this equation and instead assess their success not by total amount produced but rather by prioritizing "negawatts", or energy efficiencies gained. This incentivizes utilities as much as consumers to reduce energy usage. Yet, utilities also are not prepared to adopt broad-based on-bill financing because they do not want to take on traditional banking functions and the associated risks (CalCEF: 2011, 19).

Conclusion

Energy is embedded in all aspects of our life. When it comes to developing better designs, it is not about an individual project, but nesting it into a larger web of projects that make sense for the community as a whole. Building materials design, renewable energy production through solar and waste, and energy efficiency retrofits are close at hand at the district scale. Smart grid development and small-scale hydro are other options that could be used in the Lents EcoDistrict. As we take a closer look at the energy

ecosystem, certain aspects become evident such as the evolving term “watergy”, which measures the amount of energy needed to transport water. Part of the energy strategy in a community should be to examine how it can fit into the physical context of the community, yet still meet the financial metrics and have the capability of matching the necessary financing for implementing projects. Communities will need to understand their participation in energy production and how distributed energy may contribute to a community strengthening the democratic process while increasing its self-reliance and resiliency.

Financial Mechanisms

Introduction

Many design projects fail to cross the bridge from idea to installed project due to the inability to access the prerequisite capital financing. It is important for communities and design professionals to understand the wide array of financing methods available for these projects, as well as the implications or restrictions of these approaches. Some of these methods are rather novel and innovative while others are more established. The financing types outlined here focus on four main sources of funding opportunities: (1) community-driven; (2) public-private partnerships; (3) public and (4) private**.** Additionally, it is important to distinguish between a financial mechanism and a governance structure that might carry out a financial mechanism. For instance, B-corporations, Climate Benefit Districts, and Energy Benefit Districts are different forms of governance that can each enact certain types of financing. EcoDistricts may use these governance overlays as they allow for unique funding opportunities.

Community Driven

Although often overlooked, residents are increasingly participating in the development of their community. One of the ways communities are participating is by pooling resources to directly finance projects. Relocalization and the multiplier effect of local economies have received considerable attention in recent years as individuals are beginning to recognize the large amounts of capital that are flowing out of their communities (Shuman: 1998). For example, $1 billion in energy dollars leave Portland annually (Osdoba: 2011). The eminent question is how communities can capture some of that money and have it re-circulate within the community to generate greater local wealth.

One way to do this is through investing in local energy projects that spur economic development in the long term. The following are a list of community finance mechanisms and governance structures, which provide the means to finance these and other types of projects.

Community Land Trusts (CLTs) are nonprofit corporations that acquire and manage land on behalf of a place-based community. Residents enter into a ground lease of up to 99 years and are able to move or sell their rights at any time. Certain restrictions are applied to the amount of profit that can be earned in the sale. In part, this is meant to ensure that increasing property prices do not drive out existing residents nor exclude incoming residents based on affordability (Community Land Trust Handbook: 1982).

Cooperatives are democratically controlled organizations owned and operated by a group of individuals for mutual benefit. Housing, utility, and agricultural cooperatives exist, in addition to cooperative banking and credit unions. This model is being used in emerging contexts because it gives communities and individuals the opportunity to pool resources and mitigate risk (Nadeau: 1996).

Recently, microloans, small loans, have received a considerable amount of press for their ability to generate an entrepreneurial spark in developing countries. In the United States, microloans are becoming popular for both community members and businesses. Small infusions of money into local endeavors can have a dramatic effect on their success, and repayment rates on average are far above 90 percent worldwide. And just as capital leaves a community in the form of energy payments, so does financial investment capital. Even if only a small amount of community members' financial investments were stay

within the community, they could alter local investment regimes and opportunities. ChangeXchange is an example of a website that facilitates community and individual lenders support of projects with socially responsible missions.

Public-Private Partnerships

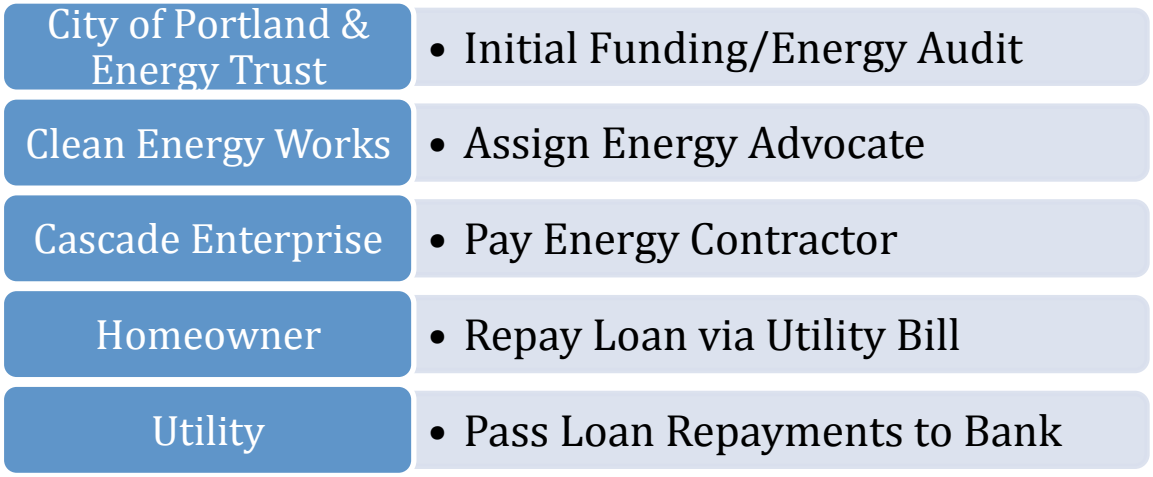
Large capital requirements for projects necessitate partnerships between public and private entities. These partnerships are not simply used to facilitate the funding of these projects, but to ensure that the designs and developments adhere to the social and cultural needs of the community. Utilities and Urban Renewal Districts are two examples of transformative agents at the neighborhood and city scales. Utilities role in providing energy supply, transmission, infrastructure, and long-range strategy for return on investment, make them an important facilitator of change in the community energy framework. Projects that could involve utilities include: energy efficiency retrofits, renewable energy production, and district energy. Urban Renewal or Tax Increment Financing (TIF) districts can also leverage public private connections to develop important neighborhood-scale projects. The following are a list of public private partnership finance mechanisms and governance structures.

On-Bill Financing (OBF) is a utility driven solution that uses the utility as a bank. A rate paying resident repays the initial capital investment to the utility for a project such as an energy retrofit or solar water heater over a 20-30 year window. The utility provides the necessary upfront capital investment and the customer is charged an additional monthly fee that goes towards that initial investment, similar to a mortgage payment. Generally, the customer's bill will decrease rather than increase in this scenario because they benefit from either higher efficiency or on-site energy production. Also the utility can reduce its

energy production needs as a result, while still being able to receive a conservative return on its initial investment (Hinkle: 2010).

The Clean Energy Works Program (CEWP) model is similar to on-bill financing in its form: residents pay for energy efficiency improvements on their monthly utility bills (Figure 9). However, this financial strategy also incorporates considerable contributions from local governments in seed money, banking institutions, and energy auditors. The Clean Energy Works Program model works by using initial capital to pay for audits put forth by the City of Portland; loans from Enterprise Cascadia go to energy retrofits that are then paid back on the customer's energy bill. Loan repayments are taken from the utility and paid back to the original banking lender (Hinkle). In April 2011, Seattle launched a similar program to Clean Energy Works called Community Power Works, which also helps to provide low cost energy audits, connects with pre-approved contractors, and offers affordable loans through the nonprofit community lender Enterprise Cascadia (Sightline: 2011).

Figure 9: Clean Energy Works Process: Start to Finish



Source: Illustration by Author

Partnership for Sustainable Communities is a partnership between three federal stakeholders (Housing and Urban Development, Environmental Protection Agency, and Department of Transportation). The partnership enables private and community development projects that combine potential brownfield remediation, transit-oriented development, and mixed-use affordable housing. In order to receive this funding, a concerted effort from the community to address multiple levels and issues is required (Partnership for Sustainable Communities: 2011).

Leadership in Energy and Environmental Design-Neighborhood Development (LEED-ND) offers community planning grants that allow districts to qualify for certain Housing and Urban Development (HUD) sustainable community grants. The prerequisite for the grant is that the community does the initial work of getting LEED-ND certification (HUD: 2011).

The Public Improvement Fee (PIF) is a new mechanism that essentially acts as a sales tax, which remits to the developer rather than the public in order to pay off the initial investment that a developer puts into a community development project. The city can negotiate the discount rate and the amount of time required to pay off the debt burden with the developer (Dunham-Jones: 2010).

Public Funding

Local, state, or federal grant government funds act as a subsidy or incentive that can be extended to developers to encourage specific types of development such as affordable housing in low income neighborhoods or developments that adhere to higher green

building standards. The following are a list of public finance mechanisms and governance structures.

Local Government

Tax Increment Financing (TIF) districts use future gains in taxes to finance current urban development improvements in blighted urban areas. TIF funds can be used for energy infrastructure, stormwater management, street design, transit-oriented development, and similar projects that promote development that will lead to increased value for residents and the city. California, Oregon, and Illinois have each used this strategy to promote urban redevelopment. The Portland Development Commission (PDC) manages the TIF funding for Portland (Valdez: 2010). TIF districts are by no means a new financial tool, but their recent urban redevelopment success in locations such as the Pearl District in Portland, OR and the Mission Bay development in San Francisco, CA, have spurred increased interest. Urban renewal or TIF districts are not without criticism as they have been responsible for gentrification, favoritism, and at times development where it wouldn't have otherwise gone (Valdez: 2009).

New Market Tax Credits are tax credits that are targeted toward mixed-use areas. The credits seek to enliven the potential for the creation of retail and small businesses that could in turn attract greater density and livability.

Tax abatements from local governments can reduce or eliminate property tax payments for up to ten years as an incentive to developers. These abatements can be targeted at the discretion of the local government to fulfill specific city goals or mandates such as

incentivizing grocery stores to develop in a part of the city that is a "food desert", an area of a city that does not have access to affordable, healthy food.

Tax shifting at the municipal level, is a mechanism that would increase taxes on drinking water, parking, solid waste, stormwater runoff, and sewage, among other possibilities. Those taxes create income that could be used to fund district level improvements. Carbon dioxide is one of the most notable tax shifting opportunities through either a carbon tax or cap-and-trade policy that would allow city, regional, or state governments to reinvest in the community. Tax shifting policies attempt to be revenue neutral and to change behavior and business practices, rather than have negative economic impacts: "The proposition is straightforward: we should shift some of the U.S. tax burden from activities we want to encourage—like working and investing—onto activities we want to discourage, like pollution, inefficiency, and waste. We should shift from taxing 'goods' to taxing 'bads'" (Repetto: 1992).

Property Assessed Clean Energy (PACE) and Energy Financing Districts are one way for a city or county to provide access to capital for their residents' and businesses' clean energy projects, including energy efficiency retrofits and the installation of renewables such as solar thermal or solar electric systems. PACE offers property owners the opportunity to avoid the upfront cost of energy production and efficiency and carry the debt burden as an additional mortgage (often as the primary position on the loan). While currently not employed at the federal level, municipal governments such as Eugene are pursuing PACE (PACENow: 2011). Energy Financing Districts enable local governments to raise money through the issuance of bonds to fund these clean energy projects, though bonds are not the only possible source of funds (Fuller et al: 2009).

State and Federal

State and federal incentives for renewables and efficiency are grants and credits to promote energy efficiency retrofits and decentralized energy production. There are a wide variety of opportunities available to residents and businesses alike. The Database of State Incentives for Renewables and Efficiency (DSIRE) and FCA Solutions are two websites that serve as excellent portals that list all the opportunities for grants and incentives at the state and federal level. Their respective websites are: www.dsireusa.org and http://www.fcasolutions.org/

Feed-in-Tariffs (FIT) guarantee a certain rate payment to residents that install renewable energy projects on their property. Residents are paid for the amount of energy that they put onto the grid instead of a general subsidy amount. These policies have been put in place by Spain and Germany and have had potent impacts on the amount of solar and other renewable energy projects installed by communities.

Low Income Housing Tax Credits (LIHTC), offered by the Housing for Urban Development (HUD) federal office, create incentives for developers, non-profits, and community land trusts to build affordable housing to ensure that cities provide housing for all city residents.

The U.S. National Park Service manages Historic Building Tax Credits, these tax credits target restoration and preservation of historic buildings. These credits can be leveraged with other types of credits to work at the neighborhood block scale.

Private

Private lending institutions in the Pacific Northwest and other parts of the United States are in the midst of developing new lending opportunities for residents, businesses, and developers to promote sustainable building practices, energy efficiency retrofits, and other important projects. The following are a list of private finance mechanisms and governance structures.

Traditional Commercial Banking through Umpqua, Citicorp, Bank of America, and Wells Fargo, among other traditional lenders, offer "green lending" programs in addition to socially driven lending resources such as Enterprise Cascadia and New Resource Bank.

Umpqua Bank Green Mortgages provides mortgage discounts on LEED, Energy Star, Built Green, or Earth Advantage green certified buildings. Borrowers can save .375% on the purchase price. For example, a $300,000 home would get a $1,125 discount (Hiskes: 2011).

The Green Street Lending Program offered by Umpqua Bank grants loans between $5,000-500,000 for residential and business customers for energy efficiency upgrades (Umpqua: 2011).

Joint Venture (JV) Equity is often used when a large amount of capital is needed or the borrower is not heavily capitalized. The project developer takes on an equity partner, which allows for the leveraging of a greater amount of capital. Risk lies in the amount of interest the JV partner takes on. Rather than paying back the principal and interest, the lender takes an equity stake.

Off Balance Sheet (OBS) financing is an option that allows a company to not include its energy efficiency retrofit cost on its balance sheet: the large amount of capital and the low risk of the debt could have an adverse effect on the profitability and valuation of the company. Many companies try and leave those debt burdens off the balance sheet, however, this practice may no longer be used due to incoming changes to the International Accounting Standards Board (IASB).

Efficiency Services Agreements (ESAs) target commercial buildings. Companies such as Metrus develop contracts that allow commercial customers to avoid upfront capital expenditure. Metrus is a first mover in this field, and they pay for all development and construction costs. After the project is operational, the customer uses a portion of the cost savings associated with reduced energy consumption to make periodic service payments to Metrus (Metrus: 2011).

Pension funds are considered patient capital that often looks for nominal returns rather than aggressive returns. Energy efficiency is a solid strategy for a safe and reliable return on investment that does not need to demonstrate rapid returns on investment. The U.S. pension real estate sector totals an estimated $7 trillion. As an example of the potential financial power of pension funds, TIAA-CREF holds $453 billion dollars, which allocates retirement funds for the medical, academic, cultural, and government research fields. Significant institutional investors in this market include the $2.7 trillion state and local pension sector and the $420 billion union pension fund segment. By investing a portion of real estate investment into green and energy efficient real estate, green development and retrofits can be aided substantially (Commission for Environmental Cooperation: 2011).

Social impact funds are growing considerably as institutions such as J.P. Morgan are tracking and offering investment potential in firms and organizations that are not simply maximizing capital, but fundamentally working to meet social and environmental missions. According to data tracked by the Washington-based trade group the Social Investment Forum Foundation, nearly one-tenth of all money that is professionally managed could be defined as socially responsible investment (Compass: 2009). The Hines CalPERS Green Investment Fund and Jonathan Rose's Smart Growth Fund are examples of two existing green investment funds (International Real Estate Review: 2005).

The lease-to-owner model is similar to the on-bill financing model as a private lender provides the upfront investment capital necessary for energy infrastructure, such as solar panels, that would be paid off monthly by the homeowner.

Energy Savings Performance Contracts (ESPC) use Energy Services Companies (ESCO) to develop a contractual relationship with its customers to finance and implement cost-saving energy-efficiency improvements that it initially recommends through energy audits. ESCO pays the initial cost of equipment and retrofits and the customer repays ESCO over the life of the contract (Portland Sustainability Institute: 2010).

Metrics

Measuring Success

Society and particularly business is in the process of a paradigm shifting movement. Bottom line financial profitability continues to be assessed but this standard thinking is attempting to incorporate components that go beyond a simple financial analysis. The viability, longevity, and future considerations of product supply chains and the long-term viability of ecosystems and stakeholders involved is coming into greater focus. While traditionally more rudimentary financial measurements have dictated the types of projects to pursue, more and more studies and current projects are showing integrations of social and environmental considerations not just to build political and social capital but rather because of their profit motive and continued viability. These changes are playing out internally within organizations as well as in the structures that nations and cities develop through alternative indicators and methods of assessment of success. For example, utilities and others are beginning to treat a negawatt (unit of power being saved rather than used) on the same level as its unit equivalent of wattage used, a logical yet important distinction previously unpracticed.

First, we need to distinguish between financial and economic indicators. Financial indicators tend to be more micro in concentration, which focus on a specific firm or industry. And economic indicators that are macro in scale focus on functions that are connected to mainstream society. Within the building and real estate industry, a wide variety of instruments are used to make decisions (Table 2).

Table 2: Financial Analysis Options for Sustainable Properties

Exhibit V-4

Sustainable Property Financial Analysis Alternatives

A. Traditional Sustainability Financial Analyses

1. Simple Payback
2. Simple Return on Investment (ROI)
3. Simple Change in Asset Value: Direct Capitalization (SCAV-DC)
4. Simple ROI and General Cost-Benefit Analysis
5. Life Cycle Costing (LCC)
6. Value Engineering
7. ENERGY STAR Building Upgrade Value Calculator for Office Properties
8. ENERGY STAR Cash Flow Opportunity
9. Life Cycle Assessment (LCA)
10. Post Occupancy Analyses (POE)

B. Traditional Real Estate Financial Analyses

1. Cost Management
2. Discounted Cash Flow Analysis (DCF)
   - Change in Asset Value
   - Net Present Value
   - Internal Rate of Return
3. After Tax Cash Flow Analyses
4. Valuation
5. Total Occupancy Cost (Cost of Ownership) Analysis
6. Economic Value Added

C. Sustainability Sub-financial Analyses

1. Comparative First Cost Analysis
2. DCF Lease-Based Cost-Benefit Allocation Models
3. Sustainability Options Analysis
4. Churn Cost Savings Analysis
5. Productivity Benefits Analysis
6. Health Cost Savings Analysis
7. Government/Utility Incentives and Rebates Analysis
8. Enterprise Value Analysis
9. ENERGY STAR Financial Value Calculator
10. Risk Analysis and Presentation (RAP)

D. Public Sustainability Benefits Analyses

1. Reduced Infrastructure Costs
2. Environmental & Resource Conservation Benefits
3. Land-Use Benefits
4. Climate Change Reduction
5. Economic Benefits
6. Security Benefits

Source: Scott Muldavin

Two of the most common metrics in the news are weather and positive/negative changes in the stock market. Yet while the Dow Jones may go or up or down, and Gross National Product (GNP) can count all of the goods produced within a country; they do not directly reflect the quality of life. Part of the dilemma is that quantitative information, particularly financial information is easier to compile, aggregate and share. As a result, financial indicators and measurements are used more prevalently than other potential indicators in a decision making process. Of course there are value and priorities that are inherently part of the equation besides simply ease of calculating financial metrics. However, financial metrics, particularly project-based criteria used in net present value calculations, assess the validity of the project to be profitable in the future given current costs, including the cost of capital, are missing a key part of the equation. Financial impacts go outside of the

normal boundaries taken into consideration, can affect the health of people and ecosystems that have financial and economic value but are more ambiguous and generally not included due to their difficulty in calculation. Profitability of businesses and organizations is a necessary function. That is not in dispute. Rather, there are plenty of examples of how current financial measures do not correctly account for how society is functioning; the type of indicators that really measure the health and wealth of a community or nation.

While the economist Herman Daly and others have criticized the lack of integrity/completeness in GDP, Robert F. Kennedy perhaps articulated best the negative implications associated with GNP in a 1968 speech.

> "The Gross National Product includes air pollution and advertising for cigarettes and to clear our highways of carnage. It counts special locks for our doors and jails for the people who break them. GNP includes the destruction of the redwoods and the death of Lake Superior. It grows with the production of napalm and missiles and warheads. And if GNP includes all of this, there is much that it does not comprehend. It does not allow for the health of our families, the quality of their education, or the joy of their play. It is indifferent to the decency of our factories and the safety of our streets alike. It does not include the beauty of our poetry or the strength of marriages, or the intelligence of our public debate or the integrity of our public officials…GNP measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile; and it can tell use everything about America—except whether we are proud to be Americans" (Hargroves and Smith: 2005, 44).

In that same tradition of challenging the ethic and intelligence of using GNP as a valued metric, Paul Hawken, Amory, and Hunter Lovins discuss in Natural Capitalism how an oil spill would count as an increase in GDP and thereby appear positive from an aggregate economic perspective even though it was detrimental to coastal ecology, and potentially the fishing industry and those that earned a living from those ecosystems. In

reaction to the incompleteness of GDP, the country of Bhutan has developed the Genuine Happiness Indicator (GHI) and economist worldwide, including Herman Daly have contributed to the Genuine Progress Indicator (GPI). These indicators, while more useful in assessing well being have a certain bias in what they do measure and are largely dependent upon ideology and certain perspectives. William Rees, professor and author from the University of British Columbia, developed the carbon footprint to attach value, damage, and measurement that was previously unaccounted. His concept of the carbon footprint has helped to explain the ecological damage cause by individuals, corporations, and supply chains.

> The 'footprint' of the average North American is quite large, and the resource requirements of North American population centers extend well beyond their limited jurisdictional boundaries. Rees's analysis of the lower Fraser Valley in British Columbia is particularly telling. He finds that the land requirements of the 1.7 million inhabitants of the region—requirements for such needs as food production and forest uptake of carbon dioxide—total 8.3 million hectares. The region, however, comprises only 400,000 hectares. Thus, the resident population of the lower Fraser Valley requires something like twenty times its total amount of land to meet its own needs. The result is the need to 'appropriate' the carrying capacities of other regions to supply these needs. However brilliant its economic star, every city is an ecological black hole drawing on the material resources and productivity of a vast and scattered hinterland many times the size of the city itself." (Beatley: 1997, 88)

Cost and profit have taken the priority as net present value (NPV) calculations to ascertain the financial viability of a project prior to taking it on. Yet there should be improved selection of projects, particularly energy projects that consider the environmental and social impacts and impact on different actors. That analysis should consider, as Ghafghazi suggests, multicriteria decision making (MCDM) methods that include "use GHG emissions, particulate matter emissions, maturity of energy system (maintenance, break down, locally sourced, traffic load" (Ghafghazi et al: 2010, 2). Often

not considered in financial calculations are government subsidies that promote other energy technologies such as oil and hydropower that would not exist without considerable subsidy. Without these subsides we would not have nuclear power nor much of the ranching and agriculture systems that dominate our landscapes as Marc Reisner, author of Cadillac Desert, points out (Snyder citing Reisner, 1995).

It is not simply a question of what we should and should not measure either but about the notion of how we see economic growth and its direct implication for society. Exponential growth in a finite world is impossible. Currently, we are propelled by a concept of constant growth, short-term focused, but under the assumption of perpetual growth. Corporations regularly submit quarterly reports and the justifications for stock price are not based on value provided to the market place and society but rather hinge significantly on financial profit and debt service. Yet this structure is changing on the fringes as companies are starting to take on new ownership models and assess their value to society beyond a simple financial stake. And many organizations center themselves on a mission that stretches into what has been popularized as triple bottom line thinking.

Emerging Metrics and Indicators

A series of metrics and indicators are surfacing locally and internationally to shift the idea that perhaps we are not measuring the right things to solve challenges confronting us and we must bring in a larger series of decision factors to shape project trajectories. For instance, to tackle the comprehensiveness issues with GDP, the country of Bhutan has its citizens complete a survey that informs the country of its Gross National Happiness (GNH). GNH explores facets of Bhutan life including happiness (satisfaction with life, stress), spirituality (practice meditation, level of spirituality), health, cultural literacy,

civic literacy (name the candidates from local constituency), ecological literacy, food and nutrition literacy, indigenous knowledge literacy, and core values, participation in community events, political participation, volunteering, donations, connectedness to nature, and living standards. Only does the last section of a 72-page survey reflect on income of the individual or family. Ultimately, the GNH survey provides a more balanced understanding of what life is like and being lived in Bhutan than a simple income per household or GDP figure could elucidate. The governments of China, France, Japan, China, and the UK are in the midst of adopting an increased focus on measuring well being. In March 2011, China formerly declared a reduction in GDP and increased focus on an indicator of happiness.

> "Ask your family, friends, and neighbors what matters most to them, and you're likely to hear words like love, security, spirituality, beauty, good health, even fun. Americans wax eloquent about their children and grandchildren having a decent education, safe neighborhoods, and humane values. They reflect on the importance of their church or synagogue, their favorite sports teams or television show, or their latest political cause. Coloradans brag about the snow-capped Rockies, Midwesterners about the muddy Mississippi River, and Californians about the breathtaking coastline. Even the most business-minded mention families and passions before they turn to shopping, mortgages, wages, and material possessions that are the preoccupation of economists" (Shuman: 1998, 31).

The Happy Planet Index (HPI) is a comparable indicator that compares countries worldwide. Nine of the top ten HPI countries are located in Latin America while the bottom ten is all located in Africa. Western developed countries fall somewhere in the middle of the ranking of 143 countries. The United States ranked 114th with the Netherlands ranking highest Western nation at number 43. Costa Rica ranked first on the list, with a longer life expectancy and a quarter of the carbon footprint of the United States. (Happy Planet Index: 2011)

The City of Seattle has taken a more local focus following suit with lessons learned from Bhutan and HPI. Sustainable Seattle is in the process of developing a similar survey with Seattle residents that could paint a more realistic picture of how life is being lived in the community and what should be the focus of local government, business, and community initiatives to respond to such information. This course of assessment is not new in Seattle, as the Sustainable Seattle program started in 1990 to track certain indicators at the city scale.

In the private sector, other movements are at play to influence stronger sustainability projects. The Carbon Disclosure Project (CDP) in England advocates for over 550 institutional investors and organizations such as Dell, Pepsi, Walmart and holdings of over US $71 trillion in assets. Since 2007 CDP has asked that companies across the world submit annual reports assessing their carbon footprint and the direct and indirect influences of carbon emissions on their business model and society at large. CDP's message to companies is clear: reduce your carbon emissions throughout your supply chain because it is an economic risk, not to mention a societal one. And companies have responded in earnest and have looked at their operations differently cutting emissions and changing business practices. Early in 2011, CDP went one step further and began to require companies to report water usage and practices as it relates to their business. CDP now is telling companies that if it does not meet certain emissions reductions based on baseline reports that its institutional investors will see the company as a liability and stop their investments with those companies. In a recent April 2011 article, Environmental Leader shared research that reveals that companies in Standard and Poor's 500 companies show a $202,000 reduction in firm value for every additional thousand tons of carbon that

they emit. This research shows that while there is not an explicit value to carbon in the United States, there is an implicit value attached. (Environmental Leader: 2011)

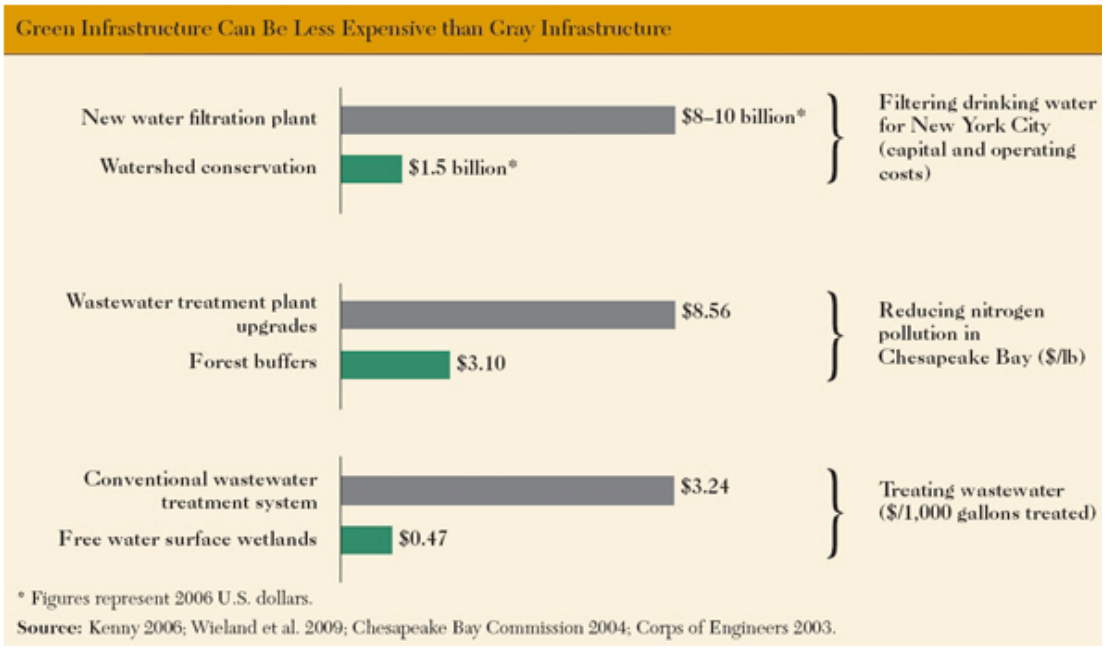
On a more micro scale, L3C and B Corp are two recent additions to the business formation and structure terminology. L3C is a "low-profit limited liability company" (LLC), with a primary priority to social mission and function followed by profit. A L3C acts as a hybrid taking the legal and financial advantages of a LLC and combining those with social advantages of a nonprofit entity. Vermont, Michigan, Wyoming, Utah, Louisiana the Crow Indian Nation, and the Oglala Sioux Tribe have adopted the L3C legally into their respective state legislations, thus making it possible for L3Cs from those states to operate in other states. This might not seem revolutionary, but in some sense it is as managers of L3Cs are responsible for: pursuing the accomplishment of a charitable or educational purpose and this spells out a very different relationship. Yes, profit and feasibility will be necessary but not paramount. As for B Corporations, these are a different take on L3Cs, as B Corporations maintain their same financial and legal structure yet they obtain B Corporation certification. Namely the certification ensures that B Corporations solve social and environmental problems. Apart from these requirements there are environmental and social performance standards and higher legal accountability standards. "[B Corps] might turn out to be like civil rights for blacks or voting rights for women — eccentric, unpopular ideas that took hold and changed the world." (Richardson: 2010) Emerging legal and ownership structures are impacting the way that companies see their involvement and commitment to their employees, customers and society-at-large.

As an extension, the financial community has begun to participate in social entrepreneurship and social impact investing. Traditionally, financial institutions have been risk averse and conservative and have focused their investments on principally profit motivations. While profit is still a main priority, socially responsible banks have gained a foothold in the investment market. Banks such as New Resource Bank, Shorebank, and Cascadia Enterprise each are known for their stalwart connection to projects that have a community or societal connection. An emerging asset class of impact investing is moving to promote change at the heart of capital markets. Equilibrium Capital, managed by principal David Chen, is on the leading edge of impact investing, investment that pursues businesses and organizations that serve social and environmental missions in addition to financial profits.

In the past, providing for nature or choosing a project that defers to nature rather than economic profit has been seen largely as weak and lacking economic logic. That notion is being largely dismissed in the face of limits to growth and changing dynamics of raw material supply chains and direct impacts to business and society. Companies such as Walmart, Procter & Gamble, and Coca-Cola are assessing their impact up and downstream from their core business, suppliers and consumers. Going a layer deeper, more refined metrics are emerging to demonstrate the true values to society that alternative design methods can achieve. Tim Beatley, refers to the economics of "biophilia" (our direct and instinctive bond to nature) as a significant neighborhood asset. He points hedonic pricing studies that show higher property values for homes with trees compared to similar homes and neighborhoods without trees. Beatley further explains that "green infrastructure, provide cities with tremendous amenities and ecological

services (economically viable benefits that might otherwise have to be provided through expensive technology and built projects), and though frequently obscure and ambiguous (rarely do we calculate them), the economic or fair market value of these benefits is great. (Beatley: 2011)

Figure 10: Financial Comparison of Green versus Gray Infrastructure



Source: Logan Yonavjak

Yet recent studies are beginning to show the strong correlation for maintaining or restoring ecological systems and their direct economic and social benefits, not to mention ecological. The study below shows the difference between strengthening natural systems through conservation, riparian buffers, and wetland restoration in comparison to hard infrastructure projects (Figure 10). The order of magnitude in savings is considerable by reinforcing existing natural systems. Often times these decisions have further reaching benefits that go outside of the site context and relate to larger wildlife corridors and

watersheds. For instance, a recent study of coastal wetlands concluded that $23 billion dollars per year in hurricane protection was already being provided. As more studies emerge that advocate for determining the best overall solution, the viability of taking a different trajectory will emerge.

Building and Energy World

Taking a look at the neighborhood block scale, a joint venture between Leadership in Energy & Environmental Design (LEED) and the Natural Resource Defense Council (NRDC), developed a rating system for neighborhoods known as LEED-ND (Neighborhood Development) This design process certifies neighborhoods by a third-party and integrates much of New Urbanist and Smart Growth planning that focuses efforts on high density, multimodal neighborhoods that promise higher ecological, social, and economic benefits. While few neighborhoods have achieved LEED-ND certification, the process offers a more large scale one that allows a community to assess some important criteria. A 2009 study by CEO for Cities found that homes in more walkable environments carried a price premium of between $4,000 and $34,000 when compared with similar homes in other places." (Beatley: 2011, 7) Determining neighborhood walkability can be assessed with tools such as the Walk Score. Walk Score is an Internet tool developed to educate albeit not conventionally residents and communities as to their proximity by foot to local shopping, entertainment facilities, and amenities.

Much discussion and research has focused on the financial values associated with energy efficiency retrofits, Energy Star and LEED certified buildings. According to one such study, CoStar Group revealed in a March 2008 national study that rental rates in Energy

Star-labeled buildings command a $2.40 per square foot premium over similar non-labeled buildings and have 3.6 percent higher occupancy rates. The authors also found that Energy Star buildings sell for an average of $61 per square foot more than their peers." (IMT: 2010 Background on the Economic Benefits of Building Energy) LEED for Existing Buildings (LEED-EB) is the highest growing area demonstrating the energy retrofits. In addition to yielding higher rental or sales rates, green buildings can also secure buyers or renters faster than conventional buildings; cost less to maintain over the life of the building (Oregon Department of Environmental Quality: 2009), reduced tenant turnover, and increased occupancy health. Federal agencies, particularly the General Services Administration (GSA), have been instrumental in promoting both energy retrofits and green building in part because the government is more likely to consider life cycle due to the fact the government buildings are owner occupied. Additionally the federal government represents $7 billion in annual utility bills and more than 350 million square feet of building space thus incentivizing the government to cut costs and motivate others (Rocky Mountain Institute: 2011). In sum, retrofits and green building can lead to cost, marketing and user benefits (RS Means: 2006).

In large part green building is moving forward not because of the benefits to society at large but rather because the financial benefits are changing the language of real estate. Net operating income for any developer or building owner can be improved and directly translate into a better capitalization rate used to value property. Up to this point there has been insufficient information in the market as to the particular benefits to stakeholders

however that is changing as direct research shows green building design and certification does raise the economic value of the properties to a great extent.

Democracy and Ethics

Introduction

Given that considerable challenges presented to our local, regional and global communities. We are faced with understanding the tools of enacting change that can engage people. Social behavior contributes significantly to how we will. Before getting to behavior at the individual level a better understanding of institutional structures Is required to understand how best to move forward with projects that promote both local and global changes. This section will focus on the lack of local governance stemming form decisions made during the birth of our nation and how that translates to current management and engagement with societal issues. Additionally, Jason Hackworth provides an important voice in explaining how the neoliberal city has emerged as a result of our economic system and high-level public policy that directly affects how communities are designed and function. Robert Bullard brings the discussion to the local community level of how environmental justice issues are inherently dividing racial and socioeconomic boundaries. By understanding the challenges, a more coherent direction of reclaiming the commons and building greater participatory engagement is outlined.

Local Governance Lost

While the United States may consider itself the bastion of democracy it realistically falls short along the spectrum. Generally democracy gets branded as one version, one archetype yet there are a wide variety of versions available to the United States and countries around the world. The federalists and anti-federalists initiated this dialectic debate, one that continues today. The framers of the Constitution through the Articles of

Confederation battled between emphasizing control at either a central or local level. The decision to go with a central, federal weighted government came in response not solely to limit the rights of individual citizens but also to keep diverse states, at a critical juncture of weakness together under the umbrella of one nation. Additionally, an interest in creating a domestic economy that had greater strength internationally played into choosing a priority to federal government. As a result individual states lost greater ownership over decisions, taxation, and more generally representation.

Voting is an open expression of a citizen's rights to weigh in on local, state, and national political positions. While there are ways of getting involved beyond a yearly or bi-annual vote, largely most citizens limit their connectivity to local government. United States is being managed from a higher pulpit, rather than having more local control. Lester Brown explains that "real democracy means more than voting once every year or two and then hoping that the people we elect do the job. If we believe the theory that those closest to the problems need to plan and implement solutions, then those closest to the problems need information, resources, and grassroots organizations where they have power (Brown: 2006, 359). Low voting records and a disengagement with national politics (due to the distance of decision-making and opportunity to influence decisions is limited). As discussed in the section on Bioregionalism, greater understanding of the local conditions will not only promises to draw out better discussion and solutions to local problems, it is much easier to collectively discuss and act in a local community than it is bring that group to the steps of Capitol Hill. Further fueling the weakness is the continued debate and failure to enact campaign finance reform. Congress and the U.S. Supreme Court has decided that corporations, already with the same rights as citizens/people now have no

limit of potential giving during political campaigns. The 2012 election is projected to reach over one billion dollars in campaign finance due to the new law and ever growing corporate contributions. Already with a ratio of 12 lobbyists for every representative in Washington, the average citizen is not being heard.

In his book *Politics of Place*, Daniel Kemmis, a former mayor of Missoula, Montana reflects on the opportunity to keep citizens apart and its early connection to the Constitution and the federalists. Kemmis argues that it was not simply a structure of government but an economic one. A centralized government allowed for the foundation of industrial capitalism and facilitated international trade. Kemmis also explains that Adam Smith's "invisible hand" of the market relied on the caprice and facilitated a national marketplace rather than a more localized one. All in all responsibility to fellow citizens could be avoided in a national marketplace through anonymous, disconnected. For that reason Thomas Jefferson opposed the idea of "large numbers of people making their living by depending on solely upon the choices of other people with whom they had no social or moral ties of any kind" (Kemmis, 1990:21). Kemmis advocates for a return to local politics but also local economies as a method of implementing a stronger democracy and society. Kemmis believes citizens should no longer be kept apart.

Neoliberal capitalism has gained a significant adoption worldwide. In that process of growth, multi-national corporations have demonstrated their strength and control, economically and politically. Constitutional rights given to citizens have now been transferred to corporations, and are legally treated as humans (Danaher: 2008). Corporations such as General Electric are also quite effective at using corporate tax loopholes in their favor. For instance, in 2011 GE did not pay corporate tax but rather

were given 3.2 billion in tax subsidy from the government. While large corporations do provide jobs for thousands there is considerable evidence that they do not pay their share to society and actually subtract from it by the externalities of their production and supply chain. Feeding into the discussion is the incredible inequity in income between the lowest and highest paid workers in companies. Also corporations have incredible lobbying powers for their interests that are simply not available to individual citizens. For example, there are more than two-dozen lobbyists for every elected official in Washington.

Globalization and the Neoliberal City

James DeFillippis and Jason Hackworth are two authors that focus on the city and attempt to better characterize how neoliberal capitalism and globalization has reduced the self-reliant and democratic potential of a community and left many cities with poor housing and unemployment. Not only do they present the history and implications powering neoliberal capitalism but also they grapple with the worthwhile strategies at hand for cities to develop greater autonomy and control at the local level. Neoliberal capitalism can best be characterized as a free market system that relies on the strategic points outlined by John Williamson in the Washington Consensus. Neoliberal strategy includes reducing government spending for subsidy and spending on infrastructure that benefits the poor such as education and health care. Also a key element is tax reform and limitation of taxes to incentivize business growth and innovation. Neoliberalism also promotes the privatization of state enterprises such as telecommunications arguing that it can operate these functions far more efficiently than government institutions. Neoliberal capitalism scales up to globalization as it liberalizes imports by creating closer uniform tariffs, a tactic that the World Trade Organization, International Monetary Fund, and

World Bank have orchestrated well in the past couple of decades through a litany of trade agreements (Williamson: 1990). As such, neoliberalism has had a significant impact on the markets in the United States as well as the rest of the world.

Hackworth and DeFillippis consider how neoliberalism has affected the city and communities as well as foregoing other responsibilities to society beyond the maximization of efficiency and profits. DeFillippis quotes Milton Friedman, the notorious economist, on the role of economic efficiency in a New York Times article: "There is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits." Therefore, DeFillippis surmises that mainstream economics have "no place for notions of place or community" as it focuses on the economic and profit dimension, a reckless strategy in his opinion (DeFillipis: 2003, 3). Thereby the danger of globalization comes through neoliberalism and its deregulation that allow international companies to enter local markets. An expansion of business that takes the shape of colonialism, as social and environmental goals are downplayed in the face of meeting superior profits and efficiencies. Both Hackworth and DeFillippis reflect on the economic inefficiencies of mainstream economics that "destroys the worth of investments fixed in places, by making those investments no longer able to reproduce capital, and thus, ultimately, no longer forms of capital at all." (DeFillipis: 2003, 3) This form of capitalism destroys the very thing that produces value and in doing so impedes the local community from building its own future self-reliance, once its values are mined. Ultimately, the most significant reasoning against neoliberalism is that the economic system is not working for a larger percentage of

Americans due to increasing income disparities and employment levels (DeFillipis: 2003, 4).

The past couple of decades have framed a strong belief that there is no other economic system as an alternative to neoliberal capitalism. Certainly communism and socialism have faced criticism and problems with functionality worldwide. Marcuse and van Kempen attribute the success of neoliberalism to the "widespread belief that 'there is no alternative' (TINA)." Hackworth furthers this point by explaining that neoliberal capitalism is nearly unchallenged at present for the first time in history. As he sees it a "more progressive urban realm" cannot be formed if this idea of TINA is not rejected. He also argues that neoliberalism is "hegemonic not because it 'won' in a democratic, intellectual, or moral sense. It 'won' because its powerful institutions and individual proponents organized enough people and interests to believe that there is no alternative; as with all hegemonic orders, its 'victory' is always incomplete, contestable, and in flux." (Hackworth: 2007, 201) In order to change the dominant paradigm, alternatives need to be enacted at the local and regional level.

Certainly the local cannot replace what the global economy currently provides and therefore a hybrid emerges. Swyngedouw calls this restructuring "glocalization" because it combines global and local scales. Regulation is neither localized nor globalized but rather simultaneous downward movement to local institutions and upward to global institutions diffuse regulatory power. "On its face, then, both global governance institutions (the IMF, WTO, bond rating agencies) and local institutions (cities, towns, regulatory districts, public housing authorities) are less 'constrained' by Keynesian nation-state politics than they were in the mid-twentieth century." (Hackworth: 2007, 42)

Strategies for Localization

Both authors lend ideas for turning a disempowered community into one that has more control over its destiny and counter neoliberal globalization. One of those strategies is collective ownership that aggregates or shares various resources. Collectives are not a new structure but have been in existence since the 1800s. DeFillipis points to two ways that capital can be rendered immobile from leaving a region. First, an organization or institution such as municipal government or community-based organization could own capital. The second method is to create collective ownership structures that are place-based within the community (DeFillipis: 2003). Jason Hackworth adds that communities could print their own currency, a project that is being promoted internationally through Transition Towns. Also, local production of imports and collective housing ownership such as a community land trust are strategies for greater local autonomy in the face of global structures. (Hackworth: 2007)

> Local autonomy is not simply a matter of productively fitting into the global economy, but instead is about controlling how the very interactions between the local and larger scales take place, on what kind of playing field, and with what rules and values. In short, the entire understanding of local autonomy in the global economy needs to be re-examined and retheorized (DeFillipis: 2003, 24).

Most collective ownership situations have emerged in times and conditions of economic deprivation but they do offer new ways of envisioning how a city could function under a more engaged paradigm.

Environmental Justice

In line with uneven development and disproportionate incomes that affect certain segments of the population, environmental justice has been a rallying cry within cities.

Yet environmentalism has distinct segments that rally for specific needs such as species, carbon reduction or environmental justice. Robert Bullard points out the racial divide of environmentalism, particularly in the smart growth movement that is a predominately white. Bullard sees the potential to bring whites and people of color on urban growth issues. Not only is it an opportunity to find greater solutions but also it is important to collectively bring together factions to orchestrate greater strength in environmental efforts (Bullard: 2007, 24). What is problematic is middle-class white environmentalists in professional positions that make policy decisions *for* people of color and the poor, not with them" (Bullard: 2007, 25).

CHAPTER III

METHODS

This principal focus of this thesis dissects energy and corresponding financial mechanisms within the scale of the neighborhood district. The author approached this task with the humility and knowledge that a vast number of relationships are at play within the city and neighborhood. It is either naïve or bold to expect that one could speak to all the implications for energy within the EcoDistrict. In order to balance both the nature of this emerging field and develop content that can speak to the changing dynamics of the energy and EcoDistricts space, the author used three main sources of investigation. The author used three main sources for research: secondary sources for the literature review, a small subset of interviews with professionals and organizational representatives, and energy design financial analysis. The author's study focused on four energy designs and four corresponding financial mechanisms. More broadly the author chose to understand the wide number of implications that energy has to the neighborhood and that level of study proved useful not only to begin to understand the landscape as a whole but make larger connections that may have otherwise gone unnoticed.

This thesis is a product of over three years of interdisciplinary study. The author incorporated both the processes and lessons learned from an EcoDistrict architecture studio course taught by Brook Muller and an independent research project with Charles Deese, a master's of architecture student. The author's experience living in small communities both internationally and in rural Oregon also generated a significant exploration of community development and the need for citizen participation. The

exposure to a variety of conversations in the classroom, field, and Portland EcoDistricts conference in November 2010 were important in helping to frame both the development of this thesis project but directly related to the questions and considerations made throughout this process. Some of these findings were communicated and learned from the start of this study but others took considerable time to reveal.

Given the relatively new sphere of EcoDistricts, considerable efforts concentrated on the dynamics surrounding the "green city" or the development of ideal city landscapes that offer an ethic and functionality that attends to all species. The green and resilient city became the proxy for the EcoDistrict as both are achieving a similar trajectory in vision. The genesis of this project and the impetus for developing a thesis project focused on the Lents EcoDistrict emanated from a fall 2010 architecture studio titled "*Integrated Urban Green Systems"*, taught by Brook Muller. The studio offered an interdisciplinary venue and wide background of students and resources. Josh Cerra, a trained ecologist and designer and Tom Osdoba, managing director of the Sustainable Business Practices Center at the University of Oregon served as consultants to the class. The course and its participants a final product put forth a number of designs that take on critical issues at the block level that consider the existing assets and conditions. Ultimately, the question remained as to how to determine how to move forward these designs with appropriate funding mechanisms.

While a vast number of energy designs are plausible for a community or neighborhood, the author wanted to understand the possibilities of looking at energy through the lens of production, transmission, and use. Decentralized solar production, district energy, and energy efficiency became sound choices for energy projects because they involved a wide

number of stakeholders and actors in addition to requiring very different levels of capital and funding structures. Upon defining the energy designs it was necessary to understand the large array of financing options and which would relate to community, public, private, and public-private partnership. The four energy design projects and financial mechanisms are: (1) decentralized solar production, community financing model; (2) energy efficiency, public-private financing model using Clean Energy Works; (3) district energy, public financing; (4) energy efficiency, private utility and on-bill financing. Lastly, it became the important to examine and ascertain the relationship of these financial mechanisms and projects for the Lents EcoDistrict. The analysis does not simply assess the financial considerations of the projects but assesses their adherence to strong sustainability criteria, equity criteria, and criteria related to community wealth.

Apart from studying financial mechanisms and energy designs three primary research questions needed to be answered. First, is the EcoDistrict the appropriate scale to consider energy level projects and other "strong sustainability" projects? Second, do existing financial mechanisms function well at the EcoDistrict scale and how can financing be aggregated at the EcoDistrict scale to make various financing mechanisms feasible? Third, what metrics are emerging to evaluate projects in terms of strong sustainability, community wealth, and equity? And how can these metrics be incorporated into finance mechanism decision-making?

CHAPTER IV

RESULTS AND DISCUSSION

"There are huge capacity barriers. Sometimes I catch myself and realize the magnitude of radicalism. It can be easy to get caught up and forget how radical the idea of EcoDistricts and what it could lead to. Therefore the concept needs to proven through innovation. Getting out in front on engagement is step one." –Interviewee

Introduction

The combined methods of interviews, financial analysis, and literature review uncovered both broad and specific findings. Using all three methods verified these findings. Given the rich and complex nature of this study, the author must first offer a disclaimer that the EcoDistrict and the challenges and conditions it faces are in a state of phenomenal change. Everyday an article or study emerges that could be weaved into this discussion. This new information reflects a continuing dialogue of potential solutions to community energy and resiliency. Regardless of the novel and changing dynamics of this field, patterns have emerged from my research. Different stakeholders and information sources corroborated each other in a way that shaped a set of considerations and findings. These ideas were repeated over and over from different stakeholders, developing both a theme and identification of possibilities and barriers. In part, this is an emerging field that will continue to evolve and develop. Beyond general findings, the author has also shared Lents-specific findings. The author also strove to answer the questions that were set forth at the outset with regard to appropriate scale, design, and financing. Finally, the author offers further research areas needed to continue this important research forward.

General Findings

1. Local Context

Local characteristics are important for design, especially energy design. The enormity of the challenges we face implore us to act immediately; however, it is crucial that design and the layering of projects are done in such as way that it fits within the local context. Paying attention to local context and conditions can better inform and change behavior. The problems that confront us relate to not only on infrastructure but changing human values and perception. We are also beginning to realize that the same solutions cannot simply be broadcast and replicated through a city and country. Even in the context of one city, each neighborhood and district have very unique considerations that require place-based solutions. We need to understand a place, its people and ecology, and the repercussions of design before moving forward. An interviewee from a private energy services company stated that it is "not just a question of technology but human behavior. We are not waiting to build a better mousetrap. The technology is ready today." This comment related particularly to energy efficiency but reflects a significant challenge that we have largely ignored. Technology is not the savior but rather human behavior is. If thriving livelihoods are our goal for our cities and supporting regions, we must start to look at systems and the way that they connect to people and behavior.

Bioregionalism

Bioregionalism is an answer for understanding systems and flows from a city block to regional landscapes to a planetary scale. Bioregionalism is not simply about mapping relationships, but more importantly about reconnecting people to place and continuing the conversation of evolution in a place. At present, we do not have this holistic process or

the relationship to place as part of the design process. If we were to follow a bioregional mindset, the process would radically shift the way that we incorporate information and build our systems. By understanding the appropriate context, technologies, and processes can be uncovered that operate in concert with one another. Energy systems can connect with waste and water systems that not only use resources more effectively but also improve conditions. Waste to energy and stormwater management systems that reuse and treat water are fundamental shifts in thinking from the traditional landfill and storm drain infrastructure of the past that sent problems away. Instead we are looking at these aspects as food for other systems that actually build value rather than detract from our communities.

> Here is an example, then, of how the effort to inhabit a place—to respond to things like trees and airsheds—can lead to import substitution and from there to a healthy, indigenous kind of growth in the local economy. Notice, however, that this kind of economic development is not possible without a shift in thinking which replaces the abstract, placeless notion of the market with the localized, particularized concept of a marketplace (Kemmis: 1990, 92).

Interdisciplinarity

In order to facilitate an implementation of designs with human systems, a significant coordination of people is required. The terms "interdisciplinary" and "integrated management" have become more prevalent in the past few years. In my interviews many organizational leaders and practitioners referred to this trend in the professional world. Project teams increasingly represent different professional backgrounds and disciplines. This trend is also characteristic of a trend in academia to train students for the integrated challenges that they will face in their careers. Also many firms such as SERA Architects are touting the necessity of bringing the community into the fold of the design process as

an integral player. Designers, professionals, and community members can help facilitate the design process.

Top Down versus Bottom Up

> "Civic Ecology is the integrated web of energy, nutrient, resource, financial, information, and cultural flows and interactions that are envisioned, created and managed by citizens acting for the common good within a geographically-defined community and its city-region. It is a human ecology of place, intimately integrating both natural and social/culture systems" (Tim Smith: 2010).

Rather than being a top-down model, Tim Smith of SERA Architects, sees the EcoDistrict as particularly informing a conversation between design professionals and the community. The community knows the place, history, and vision more than a designer could. But a designer's training and expertise can be used to amalgamate what a place is and wants to be. This is a deliberative process that seeks to remove a traditional top-down relationship and balance the conversation. A designer educates the community as to possibilities but also helps to facilitate and assemble the variety of components into a coherent community vision or narrative. The reason for this new engagement is that in the past, designers and other professionals could be the problem rather than part of the solution. Having selective perspectives due to their craft, or opinion without greater connections to the community and other disciplines can leave a project isolated from functionality and meaning.

In truth, not one design solution exists nor can we rely on one energy design. Similar to the diversity of communities and regions throughout the United States, energy designs need to nest appropriately into the surrounding context. While we may prefer a "silver bullet" solution, no silver bullet exists to solve energy challenges, limited resources, and

local economic development. Andrew Hoffman suggests that instead of silver bullet solutions we require silver buckshot or a series of solutions (Hoffman: 2005).

The EcoDistrict must be initiated from within the community for its projects to demonstrate multi-level benefits, longevity, and value. The framework of the EcoDistrict must first be established at the level of community and reflect the complexity of networks related to place. This process is part archaeology, education, and visioning. It is about understanding what came before, what place existed before an industrialized society and how moving forward mutually beneficial vision. It is not simply an exercise for professionals but one that must take place at the level of community for widespread adoption. Without community and local governance the potential of EcoDistricts will simply be a mirage, speaking to a higher ideal but not delivering anything in the end. The community's participation ensures that the projects are tailored to local conditions and can evolve with the local culture. The question that confronts communities such as Lents is how to implement EcoDistricts and a new vision for the community where previous projects have failed.

Not all authors and practitioners see the community as the fulcrum of power necessary for the EcoDistrict to take hold.

> Despite the attractiveness of communities as alternative agents, the idea that neighborhoods of dispriveleged urban households might become agents of livability is audacious. The romantic vision that 'community' automatically entails homogeneity and unity of purpose is misleading even in traditional rural settings; urban communities contain an even more daunting spectrum of interests, identities, and political positions. Communities also lack power. As long as they act by themselves, the capacity to reshape the larger urban environment is beyond them (Evan: 2002, 15).

The community is an asset but community participation is a more intensive route and does not ensure. Greater sustainability and ownership of energy and other projects are probably not the first priority for most communities. As such, making decisions without the participation of a community marks a potentially easier path of implementation yet reduces greater economic and governing autonomy.

2. Local Governance

Local democratic governance and economic development are important to EcoDistrict success because they have the potential to engage in the challenge of gentrification, allow for greater autonomy of EcoDistricts, and create profit from local investment.

> "Let's unpack gentrification. Is it bad in and of itself if property values increase and demographics change? The problem rather is dislocation, not gentrification. The increase in property values is a desired income for all living in the community. It is about creating access to capital and affordable housing. Zoning and policy, particularly performance based zoning plays part of the performance around inclusion." (Interviewee: 2011)

A community, especially one that is primed for significant local investment and redevelopment, must confront the issue of gentrification from the start and develop strategies to avoid ostracizing its current residents in favor of wealthier future ones. Certainly, socioeconomics will change over time and should not remain static; however, local economic development strategies and pubic policy initiatives should be paired with redevelopment. One interviewee commented: Local economic development throughout a community would allow income levels to rise as property values do. Rather than being left out from growth, public policy and local economic development could ensure greater protection and participation for all residents.

In my research within the EcoDistrict context I found no single effort to specifically confront gentrification. Literature and panelists at Portland's EcoDistrict conference addressed unsatisfactory efforts to date to address on the social aspects of sustainability. Of the three legs of sustainability, the social leg has lagged in comparison to the others. One distinctive development that has incorporated social metrics and goals into their mission is the Noisette Company, a private developer in the American South that of their own accord chose to engage the community in a long-term effort to not only imbue a place that was worth living economically but that could provide a sense of place for residents. The South Carolina community Noisette worked with was riddled with closing schools, foreclosures and markedly high unemployment. Rather than backing away from such difficult prospects Noisette set forth a plan to work with the community to bring it back to life by not simply impacting the built environment but the also social and economic activities. Kansas City's Green Impact Zone, another EcoDistrict modeled project, operates in lower income neighborhoods with the express interest of improving local economic development by putting people to work in the green collar jobs that will build the energy efficiency and effectiveness of the community.

Many authors and practitioners see the potential for greater autonomy at the community level through stronger democratic governance. Democratic engagement at the neighborhood level has the potential to allow a neighborhood to have more participation in how the neighborhood looks, feels, and operates. Participatory engagement and democratic governance are key components of improving local economies and governance. Tim Smith, an architect with SERA Architects, calls for reinvigorating democracy to empower people to engage sustainability on their own terms. Part of the

flexibility is leveling the playing field but also recognizing that sustainability is also about keeping options open.

Local economies may be the best strategy for working towards a more equitable society that does not experience mass layoffs and unequal income levels between poor and wealthy. As Daniel Kemmis, Michael Shuman, and Jane Jacobs have revealed, local economies and governance structures are not simply attempting to selfishly hold power but instead ensure resilient economies take on controversial challenges rather than externalizing those costs to other communities. As a result, communities can grow more sustainable, viable economies in concert with a surrounding ecological region that is capable of supporting the economy. Kemmis points to the anti-federalist debate as the timeframe that determined the trajectory of national rather than local economies and governing structures.

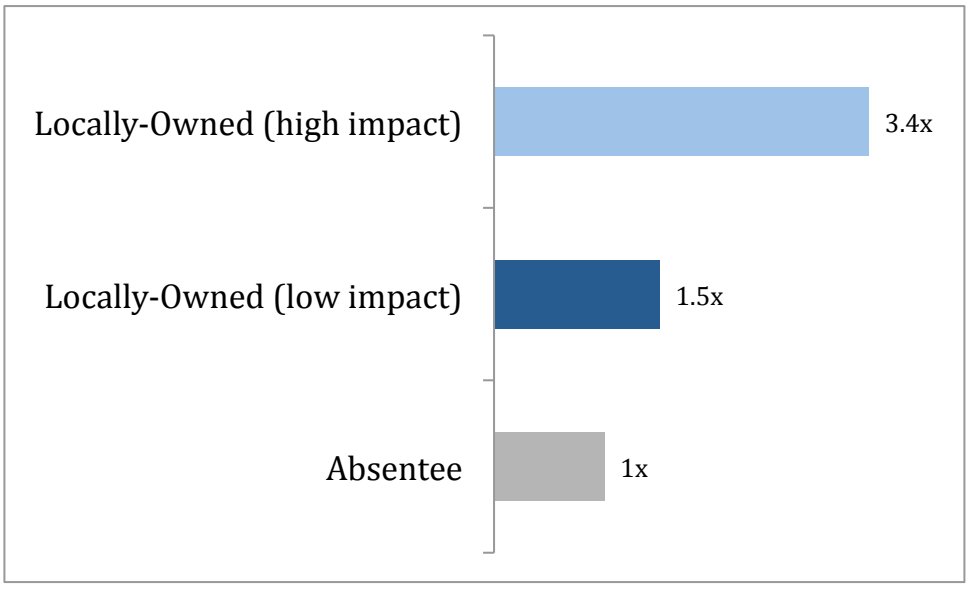
> The 1787 Constitutional Convention itself was called largely to respond to the growing clamor to create a national economy and to protect it against the actions of states, which were trying to build their own economies. If there is anything new in the current situation it is the growing recognition that the idea of a national economy may be too seriously flawed—that the nation may be either too small or too big (or maybe both) to be an effective locus for the 'economy' (Kemmis: 1990, 99).

Emerging buy-local programs and regional assessments of food and energy are results of the inherent strengths of local systems.

John Farrell, a researcher at Institute Local Self-Reliance, specializes in learning how communities can participate to greater degree in energy projects. His research has been assessing the barriers to participation by communities and he points to a 2011 European study by ReShare that assesses how to increase the acceptance of local energy projects. He says "in a sentence: people want to avoid environmental and personal harm and share

in the economic benefits of their local renewable energy resources and developers will increase their chances of success by addressing local desires" (Farrell: 2011). Communities no longer want to see investment in energy projects continue to go to outside companies and organizations but rather benefit local communities. A locally owned energy project also can keep construction and maintenance jobs within the community rather than going to firms outside the region. The economic multiplier of money for renewable resources circulating within a local economy versus being exported to international firms has a significant impact on local communities. The graphic below illustrates the range of impact between 1.5 and 3.4 times more local economic benefit that locally owned energy projects could have in comparison to absentee, external firms (Figure 11). Clean Energy Collective in Denver Colorado and Community Wind in Minnesota are two examples of local ownership projects for wind and solar that is redefining the relationship to energy and ownership.

Figure 11: Economic Impact of Locally-Owned Versus Absentee Owned Energy Projects



Source: Farrell: 2011

3. System-Wide Approach

A system-wide understanding is necessary for success. The difficulty with this thesis project is that it simply focuses on energy. Energy is just one of the flows occurring at the neighborhood scale albeit an important one. Waste and water, among other important contributions to the flows and conditions of the neighborhood, need to be assessed in concert with energy. Also the energy models I chose to focus on relate to three separate aspects of energy—energy production, transmission, and use. These three areas are not directly comparable to one another. The value in considering these three design aspects is that they impact one another. For example, if energy efficiency retrofits are implemented on a large scale it will have a direct feedback loop as to the amount of energy needed.

Cities need to be considered holistically as ecosystems. Most, if not all EcoDistrict types use a political boundary to identify the location of an EcoDistrict. These lines are actually false borders. While these lines may convey the political boundary and some level of identity, they fail to broadly define the extent of relationships both nested within and outside an EcoDistrict. Just as ecological and natural flows are layered upon one another going beyond the framed structure of the district, so too are the relationships of the EcoDistrict, whether one is mapping energy flows in and out of a city or neighborhood or simple commuting patterns of residents. We need to look beyond simple distinctions of territory and instead seek to understand the relationships between flows and their unique geographic locations whether on one individual block, EcoDistrict, city or region. The EcoDistrict is an appropriate and useful scale because it begins this conversation by looking at a scale between the individual footprint and the city. Yet the EcoDistrict cannot be the end of the conversation. Rather it becomes a process of understanding the

relationship between energetic flows and the inherent intelligence embedded in the landscape and its people.

Learning from Nature

Human solutions at the neighborhood level can also mimic solutions that also take place at the level of an ecosystem disregarding formal borders and looking at nested relationships. Similar to the intricacy and functional nature of microclimates, a neighborhood block has the potential to make changes both formally and to informal patterning. A representative from a nonprofit neighborhood community energy organization shared an example of a Portland resident that did not have solar access. Rather than cut down the tall trees surrounding a resident's home, they spoke to their neighbor that had solar exposure. The initial resident purchased a solar thermal system and placed the panel on their neighbor's house. This example finds an interesting parallel in the natural world. Old growth Douglas Fir trees, as well as western red cedar and paper birch, are able to get nutrients and water in the dense canopy by relying on plant and fungi systems that connect to the periphery and supply them with necessary energy and nutrients (Stamets: 2005). Douglas fir trees grown in similar environments such as density and shade were unable to stay alive without these important supply lines provided by neighborhood plant and fungi communities. This example speaks to mutual aid within community but how human relationships can foster unique solutions to immediate conditions.

Crafting a New Narrative: Mapping and Analysis

The path to starting the conversation of sustaining and building thriving social, economic, and environmental systems starts with mapping, which examines which borders are relevant and irrelevant to the discussion and creates holistic thinking. A number of factors can be assessed in this process. Studying natural flows of wildlife corridors, water regimes, native plant types, and other weather patterns can communicate key environmental considerations that need to be made in designs. From an economic perspective, a community should understand the types of products and services that make up the majority of local expenditures and where that money is going (i.e. within or outside the community). Socially, communities need to recognize the focal points where community gathers and the types of activities and places that a community wants to nurture. Understanding the relationship and movement of social, environmental, and economic flows can open up dialogue for how to move forward. It is not just about mapping and flow diagrams but it is about storytelling and defining a continuing narrative that connects to the root of a community.

Mapping and the subsequent analysis that takes place through an iterative process shapes the bioregional context. This level of mapping and analysis offers a holistic, whole systems approach before narrowing in on the specific details. Vladimir Novotny, in his recent book *Water Centric Sustainable Communities: Planning, Retrofitting and Building the Next Urban Environment*, sees the rich relationships that energy, waste, and water can have in the residential environment (Novotny: 2010). Throughout his book he gives many examples of water and waste strongly correlating to energy systems.

Before developing a holistic master plan based on analysis and vision, it is worthwhile to complete feasibility studies and combined energy and waste master plans that will inform next steps in the process (Oregon Solutions: 2009). Portland Sustainability Institute (PoSI) shared an example of the Lloyd Crossing Sustainable Urban Design Plan that was able to simultaneously look at multiple aspects of water, energy, and habitat. While a normal business analysis on its own might cost $125,000, this integrated plan cost $250,000, which provided a deeper analysis that better informed the community. (POSI: 2010, 9). PoSI points out that most cities and developers do not generally integrate feasibility studies and consequently miss big opportunities. By matching needs with relative capabilities, it can lead to the discussion of important stakeholders and the financial strategies for project implementation. PoSI sees the value in pooling resources and skill sets. Partnership between the community, utilities, energy service companies (ESCOs), and private firms can be the source of funding those initial studies (PoSI: 2010, 11).

4. Significant Capital Required

Currently, the necessary capital required is not available.

> "We need to start thinking about the margins, relatively modest returns, given the desire to bring in private investment. The main need is to drive risks down by using a simple stable mechanism for capturing revenues. It cannot be too fancy. There needs to be an elegance of pace. Administratively, On-Bill Financing sounds easy but it is not, basically because utilities create overly complicated energy bills. To me, there is a premium on simplicity. That is where I would start. That is why PACE and Climate Benefit District make so much sense creating an 'opt-out model' rather than 'opt-in model.'" (Private sector representative)

Even mature lending and capital sources cannot immediately provide the necessary initial investment capital. Just as there is not one overarching energy design that can take the

lion's share of the market, one financial mechanism does not lead the entire market. Rather, in its place a patchwork of financial mechanisms will be required in order to finance the breadth of projects needed. Due the significant reliance on public-private partnerships to finance projects, both cities and citizens will need to participate financially to greater extent in the adoption of neighborhood and city projects. Additionally, emerging financial mechanisms may be better suited to the EcoDistrict level, but many of those mechanisms are not mature or fully deployable yet.

As a result of limited capital, we need solutions that solve multiple problems at once, as well as those that find a common language or set of metrics to discern appropriate projects. Rather than looking at one problem on its own it is beneficial to look at a suite of conditions in order to implement solutions that have a host of benefits. Conflicting data abounds in the marketplace with respect to costs, energy use, embedded energy, return on investment, carbon and water footprints. Lifecycle analysis is becoming a way to identify the full scope of considerations rather than simply looking at one static dimension. Lifecycle thinking fuses well with whole systems thinking. Even just taking the complete range of factors can lead to important decisions. For example, energy rates and energy costs are not one and the same. Price per kilowatt cannot be directly compared to the infrastructure subsidies and carbon externalities.

Metrics within the business landscape are changing as is the realization of the inherent risk in business-as-usual activities. While once viewed as simply Socially Responsible Investing (SRI) or more of a charity/philanthropic effort, business are realizing that taking care of employees, customers and the environment is an intelligent and profitable business strategy. At the same time, the financial collapse of the past decade has changed

financial return expectations from those in the double digits to more modest returns. Risk associated with environmental and social externalities is beginning to represent a significant cost to companies, one that will only grow in time with declining resources. It is naïve to believe that business is going to shift entirely on its own due to market conditions. Changes in business are primarily based on cost-benefit analysis, assessing generally private benefits not societal benefits. That is starting to change. Organizations such as the Carbon Disclosure Project (CDP) are influencing stragglers in business to make decisions challenging conventional business decision-making. CDP represents 551 institutional investors and $71 trillion in investment and a dedicated insistence that firms do not take on carbon and water issues institutional investors will start to disinvest.

Apart from individual business decisions there is a growing dialogue that questions reliance and prioritization of higher-level economic indicators such as Gross Domestic Product (GDP), and moving to indicators that encompass wider goals. Cities such as Seattle and countries like Bhutan are implementing indexes that serve broader societal goals. More specifically to nature, environmentalists have long waged a debate sharing the inherent intrinsic value the environment. While society has not fully embraced the intrinsic value, stronger quantitative values of ecosystem services are encouraging business and society to explore alternative options. More and more pioneering studies and life cycle analyses demonstrating economic viability of more ecologically sound projects will continue to shape the changes in business decision making. Even with changes to criteria for decision-making, projects will need to demonstrate financial viability.

> "I suggest some candid reflection. With the possible exception of very large energy users, energy consumers generally are not the best investors. We often lack the time and information to make decisions, and we're just not willing to tie up our money in things that pay off over long periods of time. It would be a serious mistake to assume this behavior will change in response to climate change concerns, belief in the value of clean energy or even moderate price increases in fossil fuels. The early adopters (those willing to invest in efficiency and green power) cannot, by themselves, pave the way for the broad market transformation necessary to replace fossil fuel energy sources" (Osdoba: 2011).

Interviewees identified the current challenge of developing clear and simple business models with corresponding financial mechanisms that are easy to understand and carry out for all involved. We are not ready to plug into a new energy system without aligning government, private and public interests. Without public policy and matching education to prioritize energy, water, waste and local economic development security and are keystone elements to incenting business and changing human behavior. Without the feed in tariffs in Germany there would be no significant pace to meet majority renewable targets by 2030. Similarly in the United States the growth of wind power has largely been connected to financial incentives that moved the business sector to action. While one could wait for grid parity, or the equivalent rate for energy and renewable energy, which by some estimates should be coming within the next year or two for certain regional markets, public policy will dictate how business acts whether through incentive or regulation. The Business Energy Tax Credit (BETC) and Residential Energy Tax Credit (RETC) programs have proven their value by matching $614 million in BETC credits to $2.7 billion in private investment ultimately leading to $3.3 billion in projects and large energy savings (72 trillion BTU in 2009 or enough energy to power 1,750,000 homes (Climate Solutions: 2011).

One novel strategy, Climate Benefit Districts (CBDs), is currently being lobbied for by the legislature in Washington State. Mithun, a Seattle design firm, is playing off this EcoDistrict-esque program that also works at the neighborhood scale with "integrated solutions that increase urban livability, support and provide transit, conserve scarce energy and water resources, and increase access to healthy food are central to addressing these challenges." CBDs increase the influence of local governance. Districts would have access to funds generated from their district. Over time this pool of capital would grow with carbon and water pricing, or other tax shifting strategies (Mithun: 2011).

Resilience

Tensions exist when looking at the local and regional models for self-reliance because most cities' footprints whether food, water or energy-related, extend far outside of the immediate city region. These tensions are not simply questions of supply but also access and quality to all people. Often times the cost of local products can be far more expensive than products shipped from across the world.

> A community can best strengthen its economy when it builds on its internal strengths. Going local does *not* mean walling off the outside world. It means nurturing locally owned business, which use local resources sustainably, employ local workers at decent wages, and serve primarily local consumers. It means becoming more self-sufficient, and less dependent on imports. Control moves from the boardrooms of distant corporations and back to the community, where it belongs (Shuman: 1998, 6).

Cities are becoming more resilient or at least asking questions that could lead to more resilience. Community Resilience & Multiplier Effect: Large amounts of capital constantly leave a local community in order to pay for energy. Both economic and national security is tied to energy decisions. Whether oil from the Middle East,

hydropower or wind farms in eastern Oregon, nearly all money spent on energy goes outside of the borders of a city. By no means is it economical at this stage to provide all local energy; however, there are reasons that a community might wish to produce some of its energy for economic resiliency reasons as well as to capture local dollars in the community. If communities are able to keep a greater percentage of capital within the community, that money could circulate within the community and offer higher value. For example, studies through the Business Alliance for Local Living Economies (BALLE) have generated findings that show that a modest change in consumer behavior—10 percent shift in market share to independent businesses from chain stores—results in 1,600 new jobs, $53 million in wages, and a $137 million economic impact to the area (Civic Economics: 2008). It is not simply energy but localization of economies would have a strong benefit to local employment and entrepreneurship as well as improving social equity as jobs stay within the community and are not outsourced elsewhere.

5. Sustainability: Far to Go

Only very modest gains have been made in sustainability whether in energy efficiency, renewable energy production and district energy in the Pacific Northwest. Energy efficiency for decades has been financially viable and fairly simple strategy yet it still remains out of reach from reaching expected impacts. A number of challenges stand in the way of implementing these projects. The main two problems stem from a lack of financial capital to fund these projects as well as difficulty in measuring return on investment and the valuation of benefits i.e. appraisals for energy efficiency retrofits may not reflect the true financial benefits or return on investment of the retrofits.

Sometimes we get caught up in dualistic scenarios and attempt to make a clear distinction between designs and even financial mechanisms. Yet it is near impossible to develop either or criteria that fit every context around the world. The idea of "glocalization" while not largely popularized speaks to this continued expansion externally to global markets but at the same time explains this nuanced, movement back to the local and regional (Swyngedouw). And very few decisions, if any, have no direct or indirect impacts to the environment or one group of stakeholders. Therefore we must get comfortable with the idea of making decisions in the midst of convoluted grey areas. Issues such as climate change can move us to create immediate changes. We are already seeing that we cannot make sweeping changes based solely on carbon criteria or we will develop projects on the landscape that egregiously disregard significant priorities for society today and tomorrow. At the same time we cannot become transfixed and paralyzed on the enormity of the issues confronting us. At present, we lack the vernacular not just to embed bioregional thinking in our processes but to have it fundamentally shift the way we see and engage with the world.

Research Findings Specific to the Lents EcoDistrict

1. EcoDistricts: One Appropriate Lens

The Lents EcoDistrict is a worthwhile scale to assess but it cannot be the only lens or scale through which we look at development projects local to Lents. The district may be the best scale to consider projects under certain contexts and situations. In other cases, it might make far more sense to focus on a small group of houses within one block or less. N2e Neighborhood Energy Design assesses energy projects at multiple levels. Sometimes it may be a pair of neighbors that want to group purchase solar panels and other times

district energy may be more relevant if there is a nearby boiler or energy source that could share energy between individual buildings. In Eugene, for example, 10 houses on the same block can change zoning within their boundary if they completely agree on the changes. These scalar differences operate functionally within the EcoDistrict but they do not require an EcoDistrict. In contrast, as previously quoted, an interviewee commented on the importance of opt-out models. Essentially an opt-out model, such as a Climate Benefit District (CBD), starts by affecting all residents within its boundaries through taxation or otherwise instead of building support for projects from the ground up. This type of governance structure has its benefits in ensuring greater efficiency and potential impact but it also makes the assumption that all the local citizenry are well served by district wide mandates.

2. Lents Governance Structure Still Developing

A governance structure is step one and Lents is at this early stage of development making the EcoDistrict difficult to assess. Lents is currently undergoing the process of developing governance structures for the EcoDistrict. Even at this early stages it is interesting to see the difference in governance and participation at each of the other four pilot neighborhoods are also undergoing the process of developing district governance. The Lents EcoDistrict is using philanthropic funding and personnel from the Bullitt Foundation to staff the initial development of the EcoDistrict. On the other hand, the Lloyd District is in the process of hiring a sustainability director that is funded completely by local businesses. Lents is focused more on community whereas other districts, such as the Lloyd District, are focused and represented more strongly by local

business interests. At this stage it is pure speculation as to the nature and priorities of projects that will that may take place in Lents EcoDistrict. More time is needed to develop the local infrastructure and a governance structure will be required before moving forward. Energy, waste, and water plans could be initial studies that the district would use to inform residents of the current situation and its options moving forward.

3. EcoDistricts Also Urban Renewal Districts

It is unfair to pilot EcoDistricts that are also urban renewal districts. Each of the five districts participating in the EcoDistrict pilot is also an urban renewal district. As urban renewal districts these districts have access to funding through the Portland Development Commission (PDC). Because EcoDistricts are benefiting from significant pools of PDC funding, it makes it difficult to differentiate if success is based on the EcoDistrict model, urban renewal district or both. It is also unfair to other communities that may also seek to become EcoDistricts because they will have to follow a trajectory very different from these districts. One interviewee saw this inequality as an "uneven playing field" stated that PDC and PoSI are "stacking the deck".

4. Energy Designs Limited

Current land use, energy context, and financial conditions limit the deployable energy designs. Given the relative low density of Lents, not many energy options are currently employable without a cost of carbon or large increases in energy rates. Currently, Lents does not have any anchor points such as a large school boiler or industrial connection that could be utilized for a district energy project. The relatively inexpensive energy rates of approximately nine cents per kWh in Portland, Oregon in comparison to fifteen cents in

California makes renewable energy and other energy design projects financially unfeasible at this stage (U.S. Energy Information Administration: 2011).

5. Phasing in Lents

In terms of phasing energy design projects, energy efficiency would be the most reasonable and readily available project in Lents. Yet even a viable project like Clean Energy Works Portland (CEWP) took considerable time to implement energy efficiency retrofits in 500 homes during the pilot project phase. The CEWP project makes it incredibly easy for homeowners to participate yet the slow adoption by homeowners speaks to the challenges of overcoming human behavior. In addition, financial mechanisms such as CEWP are not at a stage of maturity that could scale up to a level of magnitude that will change the scale of energy use for residential homes in Lents, let alone in Portland. Grid parity in the next couple of years could make solar viable particularly on a cooperative or group purchasing agreement. Projects such as district energy are going to be most viable in the long run if in fact the urban renewal and transportation related infrastructure does increase population. Changes are not going to be able to take place overnight. With a limit of capital resources, priority projects will demonstrate benefits that extend beyond financial considerations. Energy projects hold influence at the district level because they can ripple through and influence the electric grid, buildings, and transportation. Energy is important because it could lay the foundation for other projects to branch off. Decentralization of energy systems (e.g. solar) could be used to install electric car charging stations and play off an industry cluster in automobile repair.

Returning to Research Questions

First, the author found that the EcoDistrict is an appropriate scale to consider energy level projects and strong sustainability projects. Energy design projects, however, are often not inclusive to the neighborhood scale as they take on forms that either are nested within the district or go far beyond its boundaries. Yet many energy companies, such as McKinstry, are beginning to place greater concentration on the interactions and symbiotic relationships between buildings within neighborhoods. Many interviewees expected that the conversation would continue to move from individual building efficiencies one of assessing large interconnected systems both in energy production but also transmission and monitoring of energy. The physical conditions and scale make EcoDistricts appropriate but also proves to be particularly relevant to develop a platform that could engage social change at the level of the community. This greater opportunity for local governance could translate into developing projects that have greater impact on local citizens but also improve the participation and economic benefit locally.

Second, existing financial mechanisms do function at the EcoDistrict scale although they are not limited to working at this scale. The Climate Benefit District and tax shifting may be the only financial mechanism that would operate exclusively at the level of the neighborhood. Some financial mechanisms generally target individual projects while others are capable of aggregating thousands of projects, as is the case with Clean Energy Works. The significant capital outlay to reduce energy costs through energy efficiency retrofits represents a particularly daunting capital investment as does moving to more renewable sources of energy. Due to the lower socioeconomic means of Lents it does

represent as significant of a draw for external investors. Tom Osdoba, managing director of the University of Oregon's Sustainable Business Practices Center identifies the importance of being able to aggregate up to a financial platform within the community, whether a B-corporation or cooperative that would give the community the means to implement projects. The B-corporation would be a structure that would allow residents to buy in at an amount that is viable to them. In Osdoba's words this platform could "rewire cash flows" and the movement of capital within a community to "deliver greater community wealth and equity". In many ways the EcoDistrict is the appropriate scale to create such a platform. The sizeable investment capital necessary to transition into a new energy paradigm is beyond the means of any one capital group whether private business or public purses. Therefore, a united effort in stakeholders and finance sources is principal to moving forward.

Pairing energy design projects with financial mechanisms is best done by evaluating: (1) the intensity of needed investment; (2) the potential stakeholders that benefit or should participate in the process; (3) interconnection between other projects at the district level and (4) whether there is an opportunity to leverage layered value or partnerships.

Third, metrics are emerging to evaluate projects in terms of strong sustainability, community wealth, and equity but projects for the most part prioritize financial profitability and feasibility. David Chen, the principal at Equilibrium Capital, states that this is exactly how it should be. Companies, organizations, and communities should not be forced to suffer financial losses for the sake of other benefits. Rather, he sees an environmental and social mission, combined with financial goals as the better strategy and better performer. His investment capital firm is proving double-digit returns in many

different sectors and he sees social impacting investing becoming synonymous with good business. Just as people are touting sustainability, he sees these terms going away and just amalgamating with the way business is done. Perhaps the greatest risk that is being analyzed currently is risk, whether this is the insurance or financial institution assessing projects. Questions of climate instability, water resources, among other declining resources are changing the nature of the conversation in metrics. This is a field that will only mature and continue to innovate methods for incorporating more holistic metrics into financial decision-making.

Energy Design Assessments

While each of the energy projects has some level of validity and opportunity at the scale of the Lents EcoDistrict, there are energy designs are more readily employable given current conditions. With any design project it must be nest well in its environment. At times it might make sense for a community to implement minor changes such as energy efficiency that can have monumental impacts in the aggregate. Energy efficiency and conservation is where the energy conversation should begin. In other cases, that either have the built landscape and opportunity for symbiotic energy relationships, it makes sense to develop district energy systems that can have a higher level of impact and use resources far more efficiently. Ultimately, energy Designs need to fit into the context of the built environment but fit the ethic and interests of the local community. The Lents community is going to engage different priorities and interests than are the predominant business makeup of the Lloyd District. This is not simply for energy design but for all projects at the district level. Projects should no longer be insular, but should also understand relationship to criteria and context. For example, a Living Building or LEED

certified building may reduce energy usage but if it is built in an area that requires a car it defeats the ethic to the design. Tools such as the web based WalkScore allow users to determine how walkable their residence or workplace is. Energy designs and the built environment need to connect to a greater system. And even a sustainable neighborhood is not the end game, needs to be a sustainable planet.

Community Financing and Distributed Solar

The New Rules Project is the perhaps the best source of information regarding community solar and group purchasing projects. Not all projects are developed equally and in their November 2010 report titled *Community Solar Power: Obstacles and Opportunities* John Farrell outlined a report card system sharing weaknesses, differences, and best practices. Ultimately, the goal of the report card system was to inform interested communities as to how they could address the following areas: (1) overcame barriers; (2) expand participation; (3) expand ownership; (4) affordable; (5) location; (6) replicable (Farrell: 2010).

Additionally, the report lays out the complex roadmap for developing a community solar project. Farrell uses three predominant methods for going through the process. First, an organizational format must be developed for aggregating capital and accessing financing options. In his research, municipal utilities and rural electric cooperatives account for four out of five community solar projects (Farrell: 2010). Secondly, the organizational format directly affects the ability to receive federal tax credit for renewables. These government incentives are only available to taxpaying individuals or entities. Third, a community must understand how the investor benefits whether that is through ownership

of specific solar modules, ownership shares, lease of a portion of the electricity output or otherwise. Through his research he has determined that most community solar projects a "term-limited right" giving the investor access to electricity output from a certain amount of panel capacity over a certain time horizon (Farrell: 2010, 4).

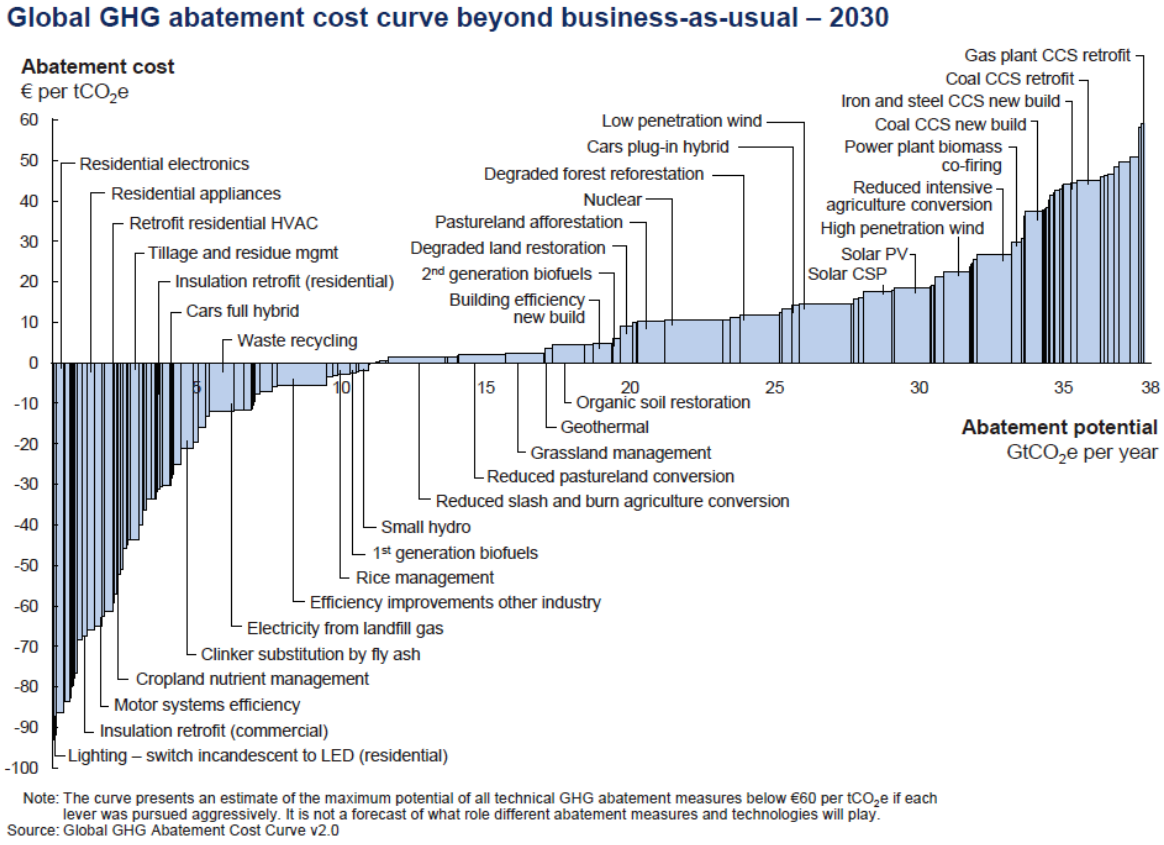
While distributed solar may be an avenue to greater autonomy at the local level it is in fact not a completely benign power source. Although the embedded energy for production of the silicon wafer cells is generally recouped within four years time the process requires significant amounts of water and energy. SolarWorld, a German firm based just outside of Portland, has located there primarily due to the abundant amount of water and inexpensive energy. The SolarWorld plant's silicon furnaces use approximately $500,000 worth of energy per month to grow the silicon. That energy is produced by large amounts of hydro and coal energy, not renewable energy sources. Also distributed energy may be synonymous with greater autonomy and smaller businesses, but the likes of SolarWorld and Vestas demonstrate the extremely large role that multi-national companies play. And companies like Vestas are moving hundreds if not thousands of jobs in the Portland, Oregon area is doing so by mass layoffs of over 3,000 employees in Denmark. Overall distributed solar has enormous potential to improve energy conditions on the local level; however, it should be noted that solar and other renewables are far from perfect energy sources.

Energy Efficiency and Clean Energy Works

Energy efficiency is the most reasonable of energy projects given current financial considerations as well as the incredible need across residential, commercial, and industrial buildings (Figure 12). As previously explained in the energy design section,

energy efficiency has widespread opportunity to be adopted even in the face of human behavior and aggregation barriers. McKinsey & Company's renowned abatement cost curve shows examples of projects or practices that could significantly reduce carbon emissions while at the same time. Energy efficiency savings of $1.2 trillion could be realized by 2020 through $520 billion in investment that would to even further overall savings (McKinsey: 2009).

Figure 12: Green House Gas (GHG) Abatement Cost Curve



Source: McKinsey & Company, Pathways to a Low Carbon Economy

Clean Energy Works Oregon (CEWO) has been a successful pilot of energy efficiency. Not only did the project demonstrate that it could get 500 households to make energy

efficiency changes, albeit over a longer time horizon than it should have. CEWO is now expanding beyond Portland and is planning on completing 6,000 home energy retrofits, creating 1,300 jobs, and retrofitting 3.5 million square feet of commercial buildings in order to save 300,000 MBTUs of energy. Apart from the larger impact ahead of CEWO, the project has had significant impact on minorities and local economic development. The nonprofit, Green For All, reports that "people of color worked 49.5% of the trade and technical hours, 22.9% of the pilot dollars went to minority- and women-owned firms, 381 construction workers were employed on pilot projects, and $24.66/hour was the average wage, far above the $8.73 living wage for an adult in Portland." (Green For All: 2011) Local economic development is a strong component of the program as 100% of the contractors were Oregon-based businesses.

While the Clean Energy Works program has been so successful it does lack the ability to scale up to the level that will create 500 or even 6,000 houses across the state are never going to have the large impacts that they could hold. The first barrier to growing CEWO is to access methods for developing financial platforms connect those toe sources that will be required to move energy efficiency up the food chain. Energy efficiency does not represent large earnings and returns potential generally generating between 5-10%. However, given current interest rates and the subnormal savings and treasury bond rates of less than 1-2%, energy efficiency is a good investment. Also energy efficiency, is perfect for conservative investors that do not care for the volatility in the market, marked by other investments. Matching energy efficiency with funds such as TIAA-CREF or other pension funds CEWO could access the funding needed to retrofit many more thousands of houses. CEWO is piloting this process but more importantly they are

building the contractor foundation and skills that will allow energy efficiency retrofits to grow exponentially. Perhaps the most difficult barrier is to work with the low level awareness of homeowners. Education of residents, as well as word of mouth, is essential if energy efficiency is to move beyond an early adopter phase (Hinkle et al: 2010, 11).

Private Funding and District Energy

District Energy more than any of the other energy design is context specific. The relatively high cost associated with installing piping infrastructure below the street requires either a solid financial motivation or the coordination with another streetscape project such as public works or stormwater management where the costs could be distributed over a couple of projects. Similar to energy efficiency district energy typically provides a steady and modest payback to the investor (PoSI: 2010). Before district energy can even work in the appropriate contexts a few considerations need to be made. First, utility pricing promotes consumption rather attempts to reduce it. With "decoupling" this is starting to change, utility to utility. As with other energy designs, traditional financing does not allow for alternative energy type models. Therefore, we need to adapt finance mechanisms to suit energy projects. Regulations and standards make it difficult to adopt whole-systems integration, as do bureaucratic silos. This is an area that public policy can help assist to more whole systems thinking and design. (Seattle Steam: 2009). District energy fits into forward thinking notion of smart and microgrids. In the future, no building will be an island, the intelligent energy systems that connect (Stroud: 2011).

Designing for EcoDistricts

Principal to EcoDistricts is the ability to consider each place, its context, and people in order to best develop the structure and priority designs within the EcoDistrict. There is not one prototype EcoDistrict, nor can specific prescriptions be made with respect to population numbers or specific designs. Modern society has largely developed both economies of scale and large centralized systems to generate energy, process water, dispose of waste as well as producing goods and services. While some of these systems will need to carry out their useful life based on economic and public budget concerns/priorities, new green infrastructure and systems will need to take the place of deteriorating grey infrastructure and antiquated systems.

Rather than implementing systems to be reactive, we should instead develop basic systems that are proactive and fit the bioregional context. The initial focus on basic needs of energy and food within a community not only develops a resiliency to external factors but also develops local economies that are propelled around legitimate areas of need. While energy conservation and efficiency may not seem as groundbreaking as clean technology, it can move the needle on energy generation needs as well as being human centric work that adds tremendous value to the local community. Once water, energy, and waste systems are developed, opportunities await the local community to create import-substituting economies around clusters of community skill and bioregional potential.

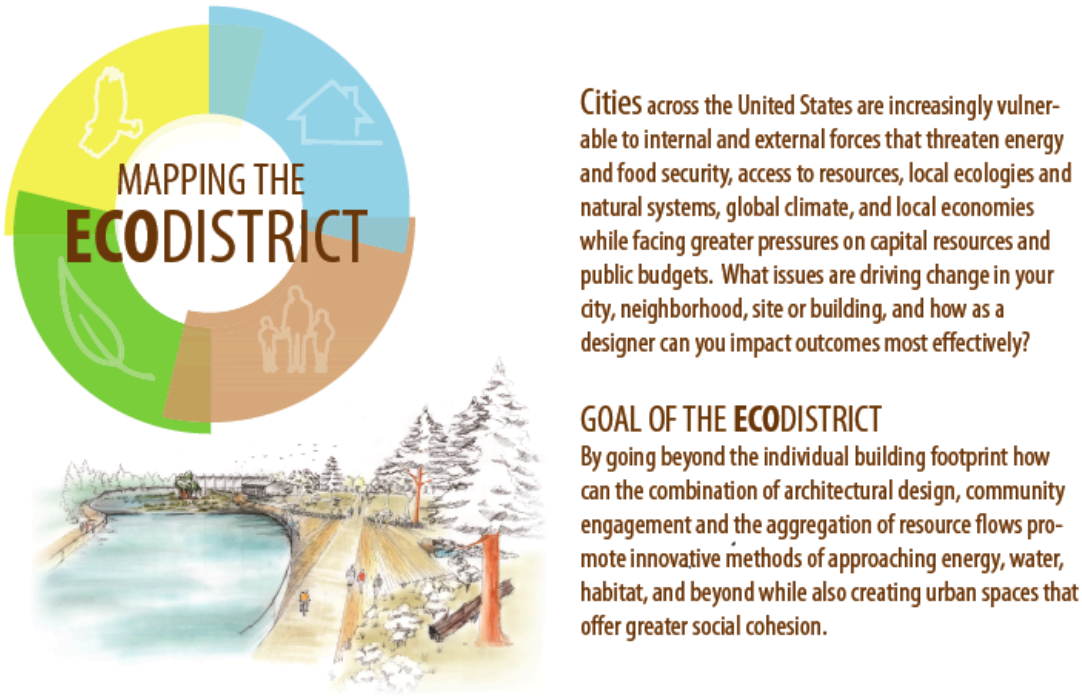
The EcoDistrict in its greatest potential uses a multi-layered governance and finance structure that starts with the community but adds The community does have limits to power and financing potential but can leverage its participation and local ingenuity and character. And capitalism left to its own devices will not develop the elements necessary

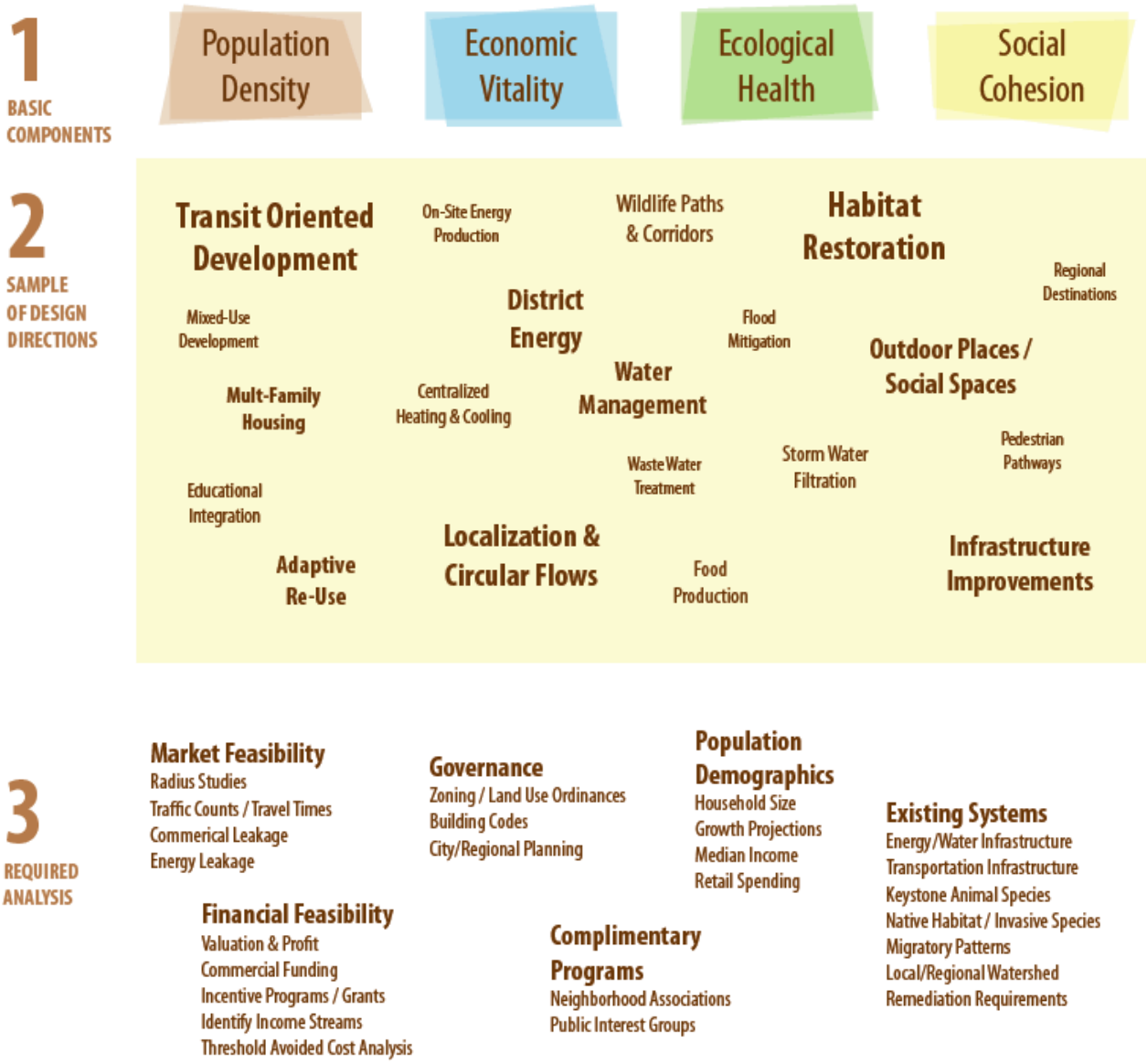
for equitable social and environmental sustainability. Therefore, a pragmatic exchange framework and subsequent series of solutions. Perhaps one of the best ways for developing a collective partnership in order to enact the magnitude of radical change that is necessary is to use mapping and analysis to dictate the types of designs necessary. In my opinion, beyond mapping we should develop closed loop systems and nested economic clusters that lead to different levels of economic and social engagement.

Mapping and Analysis

While a myriad of maps exist that can inform of us, we need to move beyond static information to assess the multiple flows entering and exiting a district, city, and region. Government does have the potential to move the conversation between EcoDistricts and businesses. Government along with potential partnerships with regional college and universities could be the appropriate medium for providing communities with the mapping and analysis necessary to inform local system priorities and designs (Figure 13). Of course, the analysis will have to take into consideration the local elements, ecologies, and human context.

Figure 13: Mapping the EcoDistrict





Source: Deese and Overdevest, Finding Feasibility for Lents EcoDistrict, Winter 2011

Nested Economic Clusters and Closed Loop Systems

Two identifying features could exemplify the relevance and functionality of EcoDistricts should be nested clusters. First, economic clusters could be developed not just at the state or regional level but also at the EcoDistrict scale. Through the Oregon Business Plan, the state of Oregon has created an effort to advance industry clusters within the state

including: natural resources, advanced manufacturing, high technology, clean technology, footwear, outdoor gear, and apparel. The EcoDistrict could take this step further on a more localized level uses the local skills and qualities of its residents with the physically existing qualities of the district, as each district represents very different constituencies and characteristics.

Secondly, closed loop systems not only offer a manner in which to better utilize resources but also from an ethical standpoint seek to take greater care and responsibility for the impacts and conditions that we create. For example, Israel is a country that reuses over 90% of their water while most countries use 3% in comparison. The growing need for water is important irrespective of physical location as rain rich regions such as the pacific Northwest are expected to suffer reduced snow pack and precipitation in climate change scenarios. Rather than waiting to accommodate needed changes, more immediate action and infrastructure should be developed. Just as the Hirsch report recommended effort decades in advance of peak oil, so too will water and other limits to resources require action sooner. The Oregon Sustainability Center, a soon-to-be constructed "Living Building" in Portland, will treat all of its greywater and water runoff rather than using sewage piping infrastructure. The possibility exists to extend this thinking beyond one building footprint into the EcoDistrict, combining stormwater and greywater treatment and reuse at the block or EcoDistrict scale. Depending on the district waste to energy projects could be coupled and intertwined with other systems. And just as E.F. Schumacher advocated for appropriate technology could reconnect people to higher order meaningful jobs in this type of scenario.

EcoDistricts, apart from energy, water, and waste systems, need to consider other aspects of developing more of closed loop systems.

People centric

Humans are by their nature a transitory species and are apt to movement around the city, region, and planet. Cities should continue to provide opportunities to develop a smaller bounded area that offers all of the needed within smaller geographic bounds. . Rather than being as prescriptive as Ebenezer Howard, certain locations may choose to remain low density but others particularly those in nodal and transportation networks are prime to grow. Still allow for movement but drop the option from principally the automobile to travel by walking, biking, or shared electric commuter vehicle.

Food Systems

Urban agriculture in and of itself will not allow for self-sufficiency regardless of the number of ecorooftops employed. Rather urban agriculture is an opportunity to shave off a percentage of demand and complement that with regional food systems. Food assessments as a part of mapping and analysis is a first step in order to understand missing links in supply chains, production opportunities, and gaps that are not being fulfilled. Local and state governments should continue to facilitate this process of information. Locally, confronting issues of accessibility and food deserts should also be a role of government.

Build Local Economies and Human Intensive Work

Buy Local programs and the Business Alliance for Local Living Economies (BALLE) has gained a foothold in some communities over the past decade. Further education is required regarding the augmented economic and social benefits to communities rather than corporate alternatives. In Australia, a local nonprofit Renew Newcastle is changing the software of the community in Newcastle. In depressed vacant parts of the city, a nonprofit is negotiating month-to-month leases of retail spaces and facilitating their rental to local artists, food cooperatives, and the like. As a result, the once run down district is beginning to flourish and was recently named as one of Lonely Planet's top 10 cities to visit worldwide. A prescriptive model cannot precisely state that we need art, food related, or craft businesses but once the framework and new relationship serviced by a conduit such as Renew Newcastle a different level of engagement can surface. Apart from local business endeavors, more intensive human labor projects such as urban forestry, brownfield remediation, and ecological restoration should be employed at the district scale. These types of projects strengthen the local ecology but they also give valuable work to local residents.

Government Incentives and Regulation

Whether a Feed-in-Tariff (FIT) or regulation surrounding carbon emissions, business and consumer behaviors are changed by either incentive or regulation. Given the threats to resources, particularly water and energy, as well as climate change governments need to act in the interest of current and future generations by enacting conditions from which can spring forward thinking, proactive solutions. Education must be a component beyond restructure in taxes or other regulations. Resource sharing is already an organic form of

sharing resources as simple as a garden tool or vehicle. Community finance mechanisms or structures such as a Climate Benefit District or B-Corporation could lead to even greater participatory and financial contribution.

Topics for Future Research

The scope of this project by its very nature needed to access a fairly narrow area of research, even in the midst of such a great spectrum of considerations and contexts. By sheer necessity, the author chose the scope of specific energy designs but there would be a significant value derived from assessing all of the energetic flows of energy at the community level. Energy in and of itself is embedded at all levels of our lives including the food that we eat, the energy to move resources, heat and cool buildings, power electricity. The context of energy use is different in each community. Assess a broader range of energy design projects that includes waste-to-energy projects could also prove extremely useful. While designers were a significant component of the interviews, it would be worthwhile to conduct interviews with the local Lents community and other EcoDistricts in order to assessing the governance in the Lents EcoDistrict and how energy fits into that discussion.

CHAPTER V

CONCLUSION

> "There are clearly moments to demonstrate, but perhaps more importantly, there are moments to build the connections that make demonstration more than theatre. There are clearly times when radicalism means standing up to the police, but there are many more times when it means talking to your neighbor" (Klein: 2007).

The EcoDistrict, working at the neighborhood level for sustainability projects, in its essence, is quite radical as it develops a new lens to look at the city, its people, and ecology. It should be remembered that the EcoDistrict is a nascent typology for the city and therefore needs to be shepherded by multiple stakeholders to ensure that it meets strong sustainability goals and does not become co-opted by outside interests. As discussed, bioregionalism and context for a community are the building blocks for the unique, whole systems projects that can take place on the landscape. The urban metabolism connects to surrounding natural cycles and flows, and ultimately reshapes how people see and interact with the world around them. These emergent relationships build not only on function but also financial and ecological impact. Proactive, closed loop systems promise enhanced utilization of resources and ultimately contributions from residents in their citizenship, investment, and employment that participate in healthier systems. Once systems are designed with community buy-in a layered approach to financing, a patchwork of finance mechanisms that can not only offer the needed investment but also profit opportunity for community stakeholders.

The EcoDistrict should not be simply considered a feel good, idealistic framework but rather a pragmatic scale to access challenging issues. We face extreme barriers of peak

oil, climate change, resource depletion all at the same time trying to balance volatility in economics, tight public budgets, divisive political climate, and economic recession. Adding to this is the concentration on economic indicators when our lives require a more qualitative set of indicators that can move the needle with respect to the United States' 30-year high poverty rate, lowest social mobility out of 30 Organization for Economic Co-operation and Development (OECD) countries, and continued growth in income inequality and accumulated capital wealth (Stiglitz: 2011). At the same time we are in the midst of a divisive political environment when political fusion is needed. We need to push past shallow democracy and disinterested citizens and engage people in participating in solutions, rather than further disintegration. And while sustainability has become a controversial and difficult subject for many, the EcoDistrict has the opportunity to bring this conversation into an active and relevant role at the district scale. At the root, it is my hope that the EcoDistrict will follow through on the vision of developing catalytic projects in order to create a different relationship, one with the earth and people that can create greater authenticity.

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