# The EcoDistrict Approach: Potential for an AmberGlen EcoDistrict

**June 16, 2011**


**City of Hillsboro, Oregon**

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EXECUTIVE SUMMARY

The AmberGlen Community Plan adopted in January 2010, establishes the policy framework and implementing actions to guide development and implement the community's vision to transform existing suburban development into a mixed use regional center. AmberGlen is planned to provide a high-density alternative for people seeking an urban lifestyle based on sustainable urban development practices.

During about the same timeframe as the AmberGlen Community Plan efforts, the City acknowledged that the rapid growth and diversification in its population and economic base over the past 20 years created new economic opportunities as well as pressures on economic, social and environmental resources. There was also an increasing awareness among its citizens and business owners of the need to be more resource efficient in the way that we live and work. In September 2010, the City Council adopted the City of Hillsboro Sustainability Plan. The Plan details the structure and process of the City's sustainability efforts including long-range goals, principles, past and ongoing efforts, committee and working group structure, and new opportunities.

The Sustainability Plan established principles by which all City policies and actions can be assessed relative to long-term sustainability goals. These principles address economic viability including financial stability and independence and sustainable development, social responsibility including earning a high level of citizen trust, and environmental stewardship including reduced consumption of resources and material inputs, reduced emissions and reduced use and dependence on non-renewable fuel sources (renewable energy). The development of the sustainability guiding statement and principles was informed by The Natural Step framework, which is commonly used in Oregon and beyond as a way to understand and implement sustainability.

In the City's Sustainability Plan, the Triple Bottom Line (TBL) was also discussed as a tool for measuring impacts from sustainability actions. The TBL seeks to broaden what is commonly a singular economic measure of human activity to include social and environmental conditions or trends, where economic, social and environmental aspects are considered interdependent. In the TBL view, no organization or activity can be sustainable if it optimizes one of these three aspects at the expense of either of the other two.

By following the principles of sustainability established in the Plan and using Triple Bottom Line to measure impacts, the City is leading the community to identify strategies for increasing the efficiency of service delivery, to facilitate long-term sustainable development and to contribute to regional prosperity for all citizens. Implementation of the AmberGlen Community Plan represents an opportunity to achieve long-term sustainability goals for the City as the Plan Area transforms from suburban development to a regional mixed use center. In this document, the City explores the potential for establishing an EcoDistrict to achieve sustainable neighborhood development in AmberGlen.

The Portland Sustainability Institute (PoSI) in partnership with the City of Portland established the EcoDistricts Initiative[1] in 2009 to advance the region's sustainability agenda. The Initiative

[1] The Portland Sustainability Institute has indicated on its website that the suite of tools, resources and services (including consulting services) that they provide is geared to help cities create successful implementation and policy framework to launch EcoDistricts. PoSI's intent is to create a national learning network and that they expect the EcoDistricts Initiative to produce a set of precedents that other cities can use in support of similar neighborhood-scale sustainability initiatives. Throughout this document are excerpts from PoSI documents or

is a comprehensive strategy to accelerate sustainable development at the neighborhood scale by integrating building and infrastructure projects with community and individual action.

An EcoDistrict is a neighborhood or district where is a commitment has been made to achieving sustainability performance goals over time. The EcoDistrict process includes:

- Engaging the community to formulize a local governance structure
- Completing an integrated sustainability district assessment and action plan
- Feasibility analyses and project implementation to support achievement of goals
- Tracking and monitoring the results over time

There are technologies and strategies that are well known worldwide to achieve sustainability performance goals such as mixed-use development, green streets, district energy systems, education and demand management. However due to a lack of comprehensive policy or an implementation framework at the municipal level, widespread deployment of these strategies has been slow. PoSI's EcoDistrict Initiative focuses on removing these implementation barriers and creating an enabling strategy to accelerate neighborhood-scale sustainability[2]. PoSI believes that EcoDistrict success will require a holistic approach that includes comprehensive assessment tools, active citizen engagement and governance, new forms of project and infrastructure capital, and public policy support.

The EcoDistricts Initiative proposes to create neighborhood sustainability innovation with a range of outcomes including improved environmental performance, local examples of emerging technologies, equitable distribution of investments, community participation, new patterns of behavior, economic development for local businesses and job creation, by bringing together neighborhood stakeholders, property developers, utilities and the City of Portland. PoSI is taking certain actions to accomplish these outcomes including developing outreach and training tools to promote widespread adoption of EcoDistricts and testing the EcoDistricts approach by working with five pilot districts in Portland.

This document is organized by section to describe why EcoDistricts are important, what an EcoDistrict is in greater detail, and how an EcoDistrict is established, including phased actions[3] and finance and public policy mechanisms. Potential components of an AmberGlen EcoDistrict are outlined, and initial next steps are identified for the City and AmberGlen area stakeholders toward establishing an EcoDistrict in AmberGlen.

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attached handouts that are used to clearly describe what an EcoDistrict is including its components, why it may be an important strategy to consider for the AmberGlen Community Plan Area, and how it may be applied in AmberGlen.

[2] Sustainability as used in the EcoDistricts Initiative means Triple Bottom Line (TBL) sustainability with environmentally driven projects that bring social and economic returns. As mentioned previously, the City uses TBL as a way to measure impacts from sustainability actions. Rob Bennett, PoSI, also describes EcoDistricts as a strategy to build "Triple Bottom Line" neighborhoods with the lowest possible environmental impact and highest long-term economic and community returns. Additional discussion of TBL is provided by Johnson Reid in Appendix B, pages 1-3.

[3] The section on phased actions notes the need to assess the feasibility of specific projects in terms of technical and economic factors (Section III. How? Establishing an EcoDistrict, pages 10-11). This section references a preliminary exploration of district system opportunities in AmberGlen by Brightworks Northwest LLC. An excerpt from Brightworks' project report detailing an example for a district energy system based on estimated demand for AmberGlen is provided in Appendix A. A related discussion by Johnson Reid LLC of sustainable infrastructure economics and the district energy example analyzed by Brightworks is provided in Appendix B.

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## I. WHY? Why EcoDistricts Matter

Global challenges such as climate change, resource scarcity and urbanization are threatening the stability and quality of life in metropolitan regions, where the majority of the world's population lives. Even greater growth is anticipated in urban areas (cities). Sustainable urban development including conservation and wise use of natural resources as growth occurs has surfaced globally as a means to address fears about the consequences of carbon and greenhouse gases (climate change), price and availability of fossil fuels, declining availability of water, and degradation or loss of natural resources including loss of wildlife habitat.

A June 2011 telephone survey of 500 residents throughout the state by Davis, Hibbitts & Midgall, Inc on the behalf of Oregon Public Broadcasting and KPTV Fox News, to assess attitudes towards current news events including climate change, revealed that 53% of respondents in the Tri-County area and 48% in the Willamette Valley strongly agree that climate change requires us to change our way of life such as driving less and consuming less goods. When asked if climate change turns out to be a problem, if we can deal with it later, 9% of the respondents in the Tri-County area and 15% in the Willamette Valley strongly agreed, and 10% in Tri-County area and 13% in the Willamette Valley somewhat agree. These responses indicate that the majority of residents in these areas do not feel that we can wait and address climate change later.

Surveys such as this one give cities an idea that its citizens are aware of these global issues and that change in the way in which we live, work and play is needed to address pressing issues such as these and that they are not the kind of problems that we can deal with later. Many people feel frustrated or are concerned that even though they modify their individual behavior in how they live, work and play to help address these issues, their efforts may not be enough to have a significant impact. As cities around the world grapple with how to address these issues, the question of scale becomes increasingly important – scales of change, scales of impact and scales of risk.

For example, to address climate change, the City of Hillsboro, along with over 900 cities across the country have signed the US Mayors Climate Protection Agreement, and are taking action at the local level that includes ambitious climate and energy reduction goals. Most cities are struggling to bridge the gap between policy aspirations and practical investments that have significant on-the-ground impacts. PoSI believes that given the modest results to date, more ambitious performance-based planning, investment and monitoring strategies are essential to be successful.

International precedents show that smaller scale districts or neighborhoods provide the appropriate scale to test integrated sustainability strategies because they concentrate resources and make size and risk more manageable. Districts like Western Harbor in Malmö, Sweden, Southeast False Creek in Vancouver, Canada, and Dockside Green in Victoria, Canada, are creating a new generation of integrated district-scale community investment strategies at a scale large enough to create significant social and environmental benefits, but small enough to support quick innovation cycles in public policy, governance, technology development and consumer behavior. Each of these districts is measuring a set of important sustainability indicators – local greenhouse gas emissions, stormwater quality, vehicle miles traveled, transportation mode splits, utility savings, job creation, access to healthy local food, and access to services, among others.

However, most of these projects are not designed to be replicable. The Portland Sustainability Institute has found that in order for sustainable neighborhoods to grow roots and propagate over time, cities must align efforts in the following three areas:

1. Social, political and institutional interests to support new governance and finance models
2. A set of new technical and policy instruments to guide investments and monitor results over time
3. New engagement strategies to build broad-based support

The following summarizes the benefits of the EcoDistrict approach for a range of stakeholders:

- For Municipalities: EcoDistricts support a neighborhood sustainability assessment and investment strategy to help meet broader sustainability policy and economic development goals. EcoDistricts put demonstration projects on the ground, save local money and resources, and stimulate new business development.

- For Utilities: EcoDistricts create a model for integrated infrastructure planning to guide the development of more cost-effective and resilient green infrastructure investments over time. EcoDistricts also provide a mechanism for scaling conservation and demand-side management goals by aggregating district-wide projects.

- For Developers and Property Owners: EcoDistricts create a mechanism to reduce development and operating costs by linking individual building investments to neighborhood infrastructure.

- For Neighbors: EcoDistricts provide a tangible way to get involved to improve and enhance the neighborhood's economic vitality and sustainability, as well as a new form of organization.

- For Businesses: EcoDistricts provide a platform to deliver district-scale infrastructure and building products and services to market.

**Sustainable Development and the City of Hillsboro**

The City of Hillsboro has demonstrated that within a rapidly changing metropolitan region and global economy, it has accommodated new growth in its population and local economy. This includes attracting sustainable clean-tech companies such as SolarWorld and supporting leading industries such as Intel as they innovate and develop new technologies, while maintaining Hillsboro's sense of place by preserving its agricultural and historical heritage, rich natural resources and quality of life.

Hillsboro has made great strides in addressing sustainability by constructing green civic buildings and mobility investments including:

- Hillsboro Civic Center (2005)
- Hillsboro Main Library Building (2007)
- Intermodal Transit Facility with Bikestation Hillsboro (the first of its kind in Oregon, and also includes 13 electric vehicle charging stations (2010)

- Cherry Lane Fire Station (2011)
- Jones Farm Fire Station (broke ground in 2011)

In the past four years even in the down economy, green educational, commercial and industrial buildings have been built in and around Hillsboro including:

- Pacific University's Health Professions Campus (2007)
- The Standard Insurance Building (2008)
- Tualatin Valley Waste Recovery Center (2009)
- Rosedale Elementary School (2010)
- Portland Community College (2010)
- The Chainring Building (2010)
- Jackson Elementary (2011)

This activity is indicative of how sustainable development takes root within a community – first with green buildings, then by adding green infrastructure including renewable energy. As more green buildings are constructed, the economic benefits of sustainability investments including creating significant competitive and livability advantages for the region while providing long-term value for the existing business community and creating job opportunities becomes a reality.

Metro's recent designation of portions of the AmberGlen Community Plan Area and Tanasbourne Town Center as a Regional Center represents a significant opportunity for the City and AmberGlen stakeholders to be provide innovative leadership in taking the next step toward sustainable urbanism by considering AmberGlen as an EcoDistrict pilot project.

## II. WHAT? WHAT IS AN ECODISTRICT

An EcoDistrict is a neighborhood or district where a commitment has been made to achieving sustainability performance goals over time. It is also a visioning and investment strategy to manage growth and development in major redevelopment areas like AmberGlen, where the next generation of best practices in green development and civic infrastructure can be scaled to create neighborhoods with low environmental impacts and high economic and social resiliency.

EcoDistricts are different from other redevelopment efforts such as master planned communities in that they target existing neighborhoods through a strategic combination of public policy, catalytic investments from local municipalities and utilities, private development, and the participation of residents and businesses who are motivated to improve the quality of life and environmental health of their own communities. The work conducted by these public-private partnerships encourages neighborhoods to develop more sustainably through the provision of tools and supporting strategies for engaging the community, conducting integrated performance assessments, and project implementation.

There are technologies and strategies that are well known worldwide to achieve sustainability performance goals such as mixed-use development, green streets, district energy systems, education and demand management. Specific green development strategies within an EcoDistrict may include:

- Building and District-Scale Energy Efficiency Measures
- Renewable and Low Carbon Energy Production
- Water Conservation Strategies such as Water Reuse (rainwater collection and greywater reuse)
- Stormwater Management
- Emphasizing walking, cycling and taking transit over cars
- Urban Agriculture (incorporated into open spaces and allowed to meet landscaping requirements)

Within an EcoDistrict, a range of strategies that are most effectively applied at a range of scales would be developed. Catalytic projects at the site and block scale, which may include local examples of emerging technologies or demonstration projects, as well as larger-scale infrastructure investments would be identified and implemented.

The EcoDistrict process includes engaging the community to formulize a local governance structure, completing an integrated sustainability district assessment and action plan, feasibility and project implementation to support achievement of goals, and tracking and monitoring the results over time.

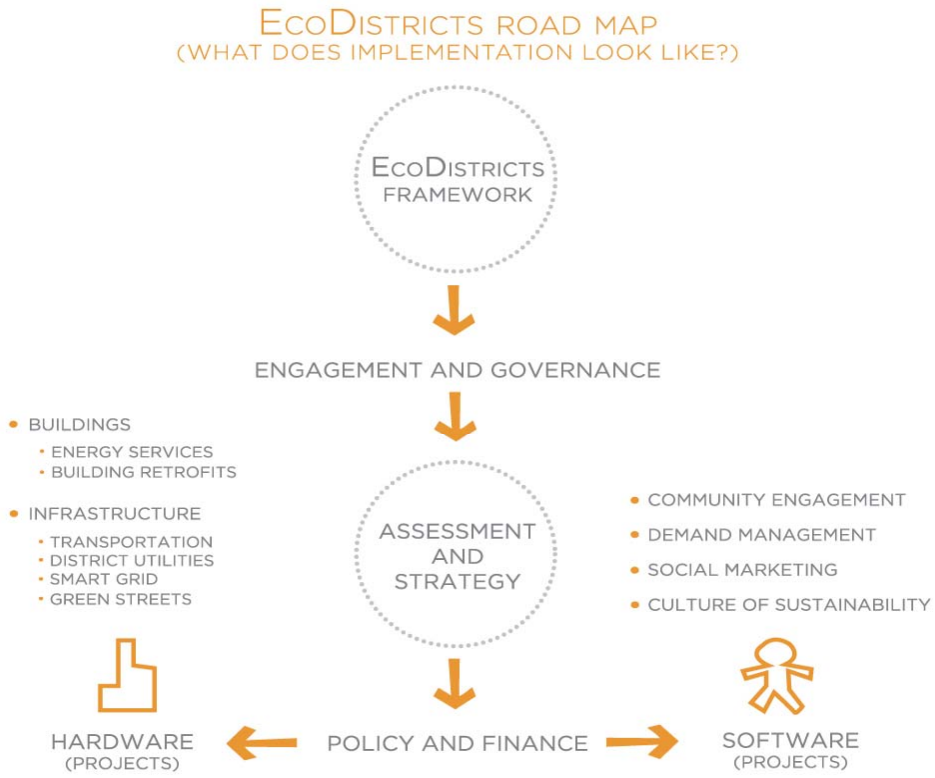


**Figure 1. EcoDistricts Road Map**
Portland Sustainability Institute. June 2010. The EcoDistricts Initiative Framework, page 10.

The EcoDistricts Road Map (Figure 1) created by Portland Sustainability Institute (PoSI) shows the path to implementation. PoSI has created EcoDistrict Toolkits to formalize an implementation strategy and address the challenges and barriers to EcoDistrict implementation for use by public agencies, developers, design teams and community organizations interested in forming an EcoDistrict. Four toolkits have been designed to respond to key challenges inherent in EcoDistrict development and to ultimately enable the kinds of projects and strategies essential for implementation:

- Engagement to Governance
- Finance
- Policy
- Performance Areas

The toolkits will be refined over Portland's three-year pilot district formation process as the implementation experience captures lessons learned and creates new models for best practices.

## III. HOW? ESTABLISHING AN ECODISTRICT

Establishing an EcoDistrict includes the following phases:

1. Engagement to Governance
2. District Assessment and Action Plan
3. Feasibility and Project Implementation
4. Ongoing Monitoring

In the previous section, the EcoDistrict Toolkits were listed. The toolkits are not intended to be step-by-step guides as each EcoDistrict's process will be unique, however they do provide a menu of options to be customized to a particular neighborhood when establishing an EcoDistrict, with the recognition that some strategies may be better suited to one community than to others.

### Phase 1: Engagement to Governance

In order for an EcoDistrict to be successful, the range of district stakeholders must be able to manage the district's environmental performance and implement projects that support their sustainability goals. Because an EcoDistrict represents a public-private partnership between district neighbors (the people who live, work and play in the district), property owners, the public sector, developers and utilities responsible for accomplishing a range of sustainability improvements into the future, the first step in establishing an EcoDistrict is engaging the stakeholder community and establishing a shared vision, goals and an organizational structure to ensure that these stakeholders have the capacity and resources to move forward. PoSI created the "Engagement to Governance" toolkit to help newly forming districts to take ownership of their goals and manage projects over time.

The "Engagement to Governance" toolkit provides tools in two sections:

1. Engagement
   a. Outreach to stakeholders to identify problems they want to solve, values (e.g. what motivates them), and specific behavior patterns related to the environmental impacts.
   b. Engage stakeholders in developing an action plan. Stakeholder responsibilities include:
      - Develop the vision, mission and goals
      - Determine performance areas for the EcoDistrict
      - Identify the community issues to be addressed and develop the plan
      - Initiate and carry out the EcoDistrict projects
      - Be responsible for leading the EcoDistrict performance assessment process
      - Set up the EcoDistrict governance structure
2. Governance
   a. Determine roles and responsibilities of the governance entity:
      - Establish how the complex set of activities that would be undertaken by a large group of stakeholders would be organized and managed
      - Determine what system would best position leaders to achieve sustainability goals and objectives and how the collaboration that will be necessary to achieve goals and objectives can be institutionalized

- Consider whether the entity needs to be flexible, if there would be a profit associated with projects of the district, and who will control the EcoDistrict

b. Formalize the EcoDistrict's governance structure

AmberGlen Area stakeholders have actively particpated in the process of creating the AmberGlen Community Plan (Plan). Zones and regulations to implement the Plan are being developed and reviewed by the stakeholders, and they include design and sustainability standards. Based on the stakeholders' response to regulatory concepts, amendments to the Hillsboro Zoning Ordinance will be drafted with adoption targeted for late 2011. Because the Plan was designed to establish AmberGlen as a model of urban sustainability, its goals, policies and implementing actions reflect this vision, and there is an opportunity for the stakeholders to consider whether establishing an EcoDistrict could be an effective framework for implementation. If amenable to pursuing an AmberGlen EcoDistrict, interested stakeholders would need to commit to participate in the formation of the EcoDistrict through a public-private partnership (working group) arrangement as described previously.

Because of the importance of AmberGlen as a Regional Center and to the state, there is an opportunity to request assistance from Oregon Solutions, to establish AmberGlen as an EcoDistrict that represents a model of urban sustainability within a suburban context.

Oregon Solutions grew out of the State of Oregon's Sustainability Act of 2001. First inside the executive branch of state government, then since January of 2002 as a program of the National Policy Consensus Center at Portland State University. Oregon Solutions has promoted a form of community governance based on the principles of collaboration, integration, and sustainability. Its mission is to:

> "Develop solutions to community based problems in a way that provides sustainable support for the economy, the community and the environment through the collaborative efforts of business, government and non-profit organizations."

Oregon Solutions can often provide up to 50% of the funding for project management. In its short tenure, Oregon Solutions has fostered the development of over 60 projects around the state.

For example, the City of Portland, Portland Development Commission, Metro and the Lloyd Transportation Management Association received assistance from Oregon Solutions for the Lloyd Green District, which was described as a premier sustainable multi-use development district within an urban center. Specifically, the assistance was requested to develop community/district level sustainability management and financing tools to implement joint sustainability projects and programs in the district and to develop implementation agreements for sustainability projects and programs that require district-wide public/private agreements for management and financing. They also indicated that they would be piloting it with up to three projects. The first stages of the Lloyd District stakeholder engagement process required about a year of managing and facilitating a working group made up of representatives from the district's major property owners. The estimated $50,000 budget for this process came from various sources including the Lloyd Transportation Management Association, the City of Portland, Portland Development Commission, Metro, and Oregon Solutions.

**Phase 2: District Assessment and Action Plan**

The "Engagement to Governance" phase discussed in the previous section identifies stakeholder responsibilities which include creating a shared EcoDistrict vision and goals to provide focus, purpose and direction, and to mobilize participants to achieve their vision for the future. In order to develop the EcoDistrict vision and goals, it is necessary to get a comprehensive picture or assessment of district performance (baseline), existing conditions (site conditions and community assets), and projected growth to determine the performance areas of greatest challenge and opportunity. The intent of the assessment is to determine the performance areas of the greatest impact and to understand the most appropriate strategies and projects for a particular district.

PoSI developed the "Performance Areas" toolkit to support this work. It includes targets and metrics for setting goals, baselining performance, and prioritizing projects and community action over time. The toolkit describes the following seven performance areas, each of which include a vision (aspiration for performance), intent, goals, targets, metrics, potential strategies, a glossary of terms used in each performance area, related rating systems, related policy precedents, and related examples in action:

- Energy
- Air Quality & Carbon
- Water
- Access & Mobility
- Habitat & Ecosystem Function
- Materials Management
- Community Vitality

These performance areas were developed specifically for application within the Portland pilot EcoDistricts. For development of an EcoDistrict in another city like Hillsboro, some of the performance areas may be similar in their vision, intent and goals, or not considered at all. There are also significant areas of overlap, and many projects and strategies will span these categories.

A review of AmberGlen Community Plan goals, policies and actions provides a starting point for identifying performance areas to be considered and specifically assessed. Plan goals, policies and actions highlight:

- Energy: passive solar design to reduce energy costs related to lighting and heating; energy conservation or energy efficiency measures; energy production – carbon-neutral power sources such as solar and wind, and district energy.
- Water: capturing and reusing stormwater for irrigating parks and landscaped areas and for other non-potable water uses; encouraging use of native and drought tolerant landscape materials in parks to reduce irrigation requirements; improving stormwater efficiencies and water quality; assessing the viability of incorporating green street features in the design of streets, greenways and green access lanes as part of comprehensive stormwater management strategy; completing a comprehensive strategy based on development of a stormwater master

plan; and use of Low Impact Development Approaches for sites including public open space and streets

- Transportation Access and Mobility: development of a balanced, multimodal transportation system including creating and maintaining an environment where there is less reliance on motor vehicle trips; public and private trip reduction strategies; pursuing a comprehensive travel demand management system; improving access to and within AmberGlen; creating a pedestrian scale environment and providing strong pedestrian and bicycle connections throughout the plan area; pursuing extension of High Capacity Transit; supporting a local transit circulator within the Tanasbourne Town Center and AmberGlen; developing a district parking strategy including parking requirements to foster non-auto trips; and incorporating sustainable features, methods and materials into the design and construction of the transportation system.
- Habitat Conservation and Ecosystem Function: improving wildlife habitat and enhancing the natural environment.
- Materials Management: using locally produced and available materials in the design and construction of park and open space areas to reduce transportation costs and support the local economy; composting landscaping material or organic waste for reuse in new parks; and promoting the use of building materials that enhance efficiencies and ecological functions
- Community Vitality: Economic vitality is a key principal of the AmberGlen Community Plan, and this performance area should emphasize economic development actions based on sustainability to create a strategy for marketing the area to investors, businesses and residents, and to showcase local sustainable products and programs. This performance area also highlights social interaction – e.g. access to parks and open spaces and third places; strengthening community relationships; promoting human health and well-being; housing diversity to ensure a mix of housing sizes and price ranges; and access to local food including food production – urban agriculture.

A thorough review of the Plan goals, policies and actions would be necessary to establish the specific vision, intent, goals and targets for each of the performance areas for an AmberGlen EcoDistrict.

**Phase 3: Feasibility & Project Implementation**

Once key project opportunities are identified through the assessment process, they require deeper technical feasibility and exploration of a business case and social value. In this phase of EcoDistrict development, the catalytic potential of these projects would be identified, a further business analysis conducted and an implementation strategy development. Projects may range from new green buildings or infrastructure improvements such as district energy or district stormwater management systems to demand management projects that use education and advocacy to promote lower-consumption behaviors. In this phase, there needs to be a new alignment and coordination between district stakeholders, public agencies and utilities to develop and finance projects at a scale that has meaningful impact. It also involves predevelopment planning, financing, partnership building and regulatory engagement.

Concurrent with work to develop new zones and regulations for the AmberGlen Community Plan area, the City contracted with Brightworks Northwest LLC to conduct a preliminary exploration of district system opportunities in AmberGlen. Brightworks' study focused on a

district energy system example to begin to assess the opportunity provided by planned densities and related energy demand in AmberGlen. The district energy system example analyzed by Brightworks for AmberGlen is a CHP Biomass District Heating and Cooling Plant. Brightworks' analysis of how such a system could address energy demand in Amberglen is provided in Appendix A. In coordination with the energy analysis by Brightworks, the City contracted with Johnson Reid LLC to provide economic context for the planning of "sustainable" infrastructure systems for the AmberGlen Community Plan. Johnson Reid discusses factors that would need to be addressed in a full analysis of the economic/business case for sustainable infrastructure systems and specifically, for a combined heat and power (CHP) system. Financing and incentives for district CHP systems are also outlined. Johnson Reid's Memorandum is contained in Appendix B.

A district energy system is one strategy that an EcoDistrict could consider for the Energy Performance Area. District energy involves the central provision of heating and/or cooling. Heating typically encompasses both domestic hot water and space heating for suites, common areas and ventilation air. The focus of district energy is on the provision of heating and cooling, however electricity may sometimes be produced as a by-product of district energy through the use of combined heat and power technologies (CHP). The waste heat from the CHP plant is used in the district energy system, while the electricity output may be used on-site and/or sold to the local electrical utility.

Before an actual recommendation for a specific district energy system for AmberGlen can be made, the fundamental case for district energy needs to be made. A detailed feasibility analysis would examine the technical and financial feasibility of district energy systems and make recommendations for the systems that offer the highest returns in terms of financial and environmental benefits. The CHP system analyzed by Brightworks is one example of a potential district energy strategy for AmberGlen. A more detailed level of analysis is required to determine technical and economic performance required to make the business case for a CHP Biomass District Heating and Cooling Plant. An example of the level of detail that would be appropriate for this type of feasibility analysis is the "Business Analysis for a Neighborhood Energy Utility in the North Pearl District Report" dated March 31, 2009, prepared by Compass Resource Management Ltd in association with FVB Energy Inc. and available from the City of Portland Bureau of Planning and Sustainability.

**Phase 4: Ongoing Monitoring**

As EcoDistrict projects are planned and built, ongoing monitoring and capturing of lessons learned is essential to understand the full spectrum of social, economic, and environmental impacts. Performance standards can be used to regularly collect performance data to track the overall value of particular project interventions. It is expected that the district's governing entity will oversee this work to report progress and inform additional investments over time.

To support establishment of EcoDistricts, PoSI has also developed finance and policy tools. These tools are described in the next two sections.

**Financing**

Underlying all EcoDistrict assumptions is the premise that these projects will be able to attract adequate financing. Finding capital will not be easy for a number of reasons including complexity of its structure and projects, time horizons and risk. The key issues for financing EcoDistricts identified by PoSI include:

- Many EcoDistrict projects, particularly infrastructure projects will involve multi-year investments
- Some infrastructure will likely need to be installed in advance of need, increasing risks and therefore, the returns required by some types of investors
- Projects will typically provide a mix of private and public benefits, and financing will require separate mechanisms to support these different benefits
- Private benefits will have to be aligned with existing market prices and potential, whereas public benefits will likely be funded by grants and other means

PoSI developed the EcoDistricts "Finance" toolkit to provide an overview of strategies for funding EcoDistrict projects through various stages of development. The goals are to:

1. Catalogue existing public and private funding streams that may be available to EcoDistricts, including district-scale financing strategies that aggregate dollars across multiple property owners for shared investments that benefit the district
2. Explore the creation of potential new funding mechanisms
3. Outline strategies for blending various types of market-rate and below-market-rate funding sources to finance EcoDistrict projects

The Finance toolkit addresses:

1. Financing Predevelopment Activities: discusses sources and types of funding to finance p*redevelopment* EcoDistrict activities (the organizational phase)
2. Integrated District-Scale Financing Strategies: addresses financing strategies and structures to pay for EcoDistrict *planning and assessment*. These include the establishment of various tax-assessed and non-tax-assessed entities that can fund a range of project types.
3. EcoDistrict Projects: looks at *project-level* financing strategies, which are generally based on successful past efforts to finance energy-efficiency, district energy, water, mobility, materials management, and habitat and natural infrastructure projects.

The diagram below was developed by PoSI to outline phases of a comprehensive EcoDistrict implementation strategy from predevelopment through performance monitoring of a thriving EcoDistrict.

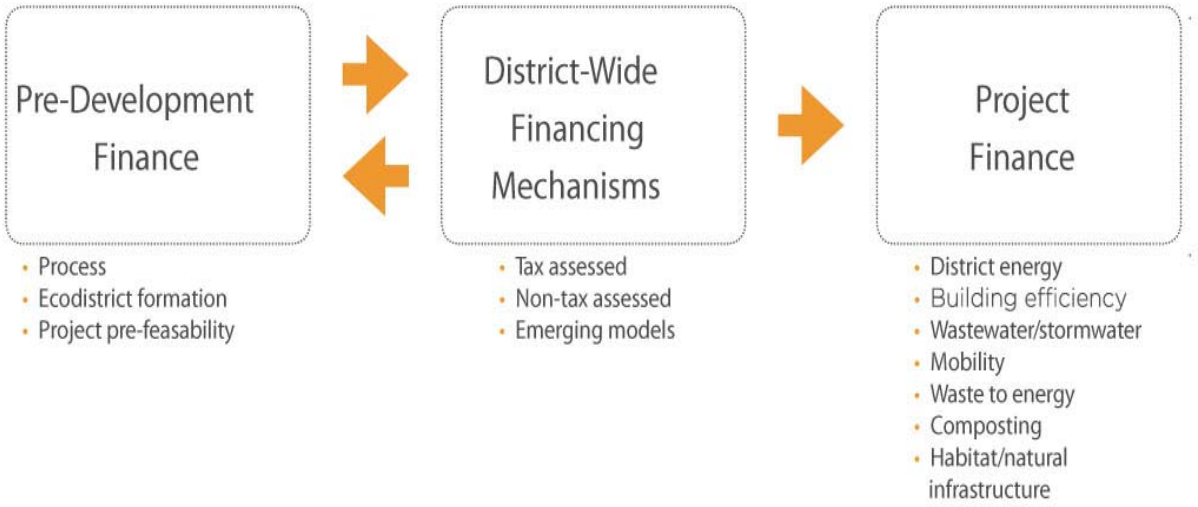


**Figure 2. EcoDistricts Finance Toolkit: Implementation Phases**
Portland Sustainability Institute. June 2010. EcoDistricts Finance Toolkit, page 6.

PoSI's EcoDistricts Finance toolkit provides an overview of various financing strategies and is not designed as a step-by-step "how to" guide. EcoDistrict implementation involves many financing strategies that:

- Occur in stages
- Use multiple forms of capital
- Are influenced by the programming, design, and goals of a particular district
- Reflect the natural, social, and financial capital currently available in the district

Given that each EcoDistrict is distinct and different, its overall financing strategy will be unique and will involve various capital sources. Success will require collaboration between public and private sectors to share resources and to appropriately allocate risks and benefits.

Districts will require multiple forms of public and likely, philanthropic capital (such as cost-sharing, grants, tax incentives, subsidies, and below-market-rate loans) as much as they will require private forms of capital (tax equity, debt, venture capital, etc.). The chart on the next page developed by PoSI provides a framework that maps the potential types of capital according to the phase of EcoDistrict implementation.

| Capital Type | Predevelopment | District wide Financing | Project Financing |
|---|---|---|---|
| Cost-Sharing / Partnerships | x | x | x |
| Below-Market-Rate Loans | | | x |
| Debt / Bonds | | x | x |
| Grants | x | | x |
| Impact / Service Fees | x | x | x |
| Private Equity | | | x |
| Revolving Loans | x | | x |
| Subsidies | x | | x |
| Tax Assessments | x | x | x |
| Tax Incentives | | | x |
| Tax Increment Financing | x | x | x |
| Third Party Ownership | x | x | x |
| Voluntary Contributions | x | x | x |

**Figure 3. Potential Capital Type per Implementation Phase**
Portland Sustainability Institute. June 2010. EcoDistricts Finance Toolkit, page 7.

The previous section of this paper, Engagement to Governance, describes costs associated with a predevelopment activity for the Lloyd District. Another predevelopment activity is conducting an integrated feasibility study of a potential environmental system(s). An integrated study of multiple environmental systems, such as energy, water and waste, can cost between $100,000 and $350,000. Single system feasibility studies, district energy for example, may cost between $100,000 and $150,000, but can run as high as $350,000 for a more complex analysis. Some examples of comprehensive feasibility studies include Lloyd Crossing, PCC Sylvania Net-Zero Energy Study and the Seattle University Resource Study.

The intent of this section is to give a general overview of issues associated with EcoDistrict financing and financing strategies. Detailed financing strategies are necessary to identify costs, risks, and requirements for matching funds that may be associated with specific capital sources, and to prioritize these funding sources by magnitude.

**Policy**

Municipalities will play a central role in supporting the creation of an EcoDistrict. Cities looking to adopt and ultimately institutionalize district scale sustainability will need to examine relevant public policy mechanisms that impact private development, infrastructure and consumer behavior. This includes providing positive support through direct pilot projects and specific district investments, as well as realigning existing policies to overcome regulatory and market barriers, foster innovation and accelerate scalable project implementation.

The PoSI has developed the "EcoDistricts Policy" toolkit to assist local jurisdictions contemplating formation of an EcoDistrict. The toolkit identifies a range of strategies available to cities to support district scale sustainable development. The term "policy" is used broadly to characterize a range of public activities including regulations, incentives and actions. The approach is to:

1. Identify the current policy barriers
2. Outline the potential actions based on a range of policy precedents, and
3. Recommend a menu of public sector actions to support EcoDistrict implementation

Many of the practices and projects envisioned for EcoDistricts challenge current regulations and standards. This is largely due to the fact that the projects, financing and governance concepts proposed for EcoDistricts are emerging models, and there are limited precedents for policies that support this kind of integrated sustainability development. It is not a factor of existing policies being inherently bad, rather that many jurisdictional regulations are outdated, are designed to meet single objectives, have unintended consequences, and/or do not support emerging community sustainability priorities.

In evaluating policy options, it is important to assess the types of projects anticipated within EcoDistrict developments. PoSI's Policy toolkit outlines potential projects such as green streets, district energy, more efficient building and zoning codes, performance disclosures, district-scale stormwater management, demand management, and actions to promote equity, diversity and sustainable economic activity. The Policy toolkit also includes precedent policies implemented by cities, states, and countries in an international scan of policy structures that support district-scale sustainable development practices. It identifies policies, processes and incentives that the public sector can take to support the deployment of EcoDistricts, to help cities accelerate sustainable neighborhood development agendas. These EcoDistricts policy options provide a snapshot of an evolving menu of approaches that can be refined and developed further over time with experience.

## IV. POTENTIAL COMPONENTS OF AN AMBERGLEN ECODISTRICT

As described in the previous section, a review of the goals, policies and actions for the AmberGlen Community Plan provides a starting point for which performance areas should be considered and specifically assessed. This review also gives an idea of what the potential components of an AmberGlen EcoDistrict might be. Potential EcoDistrict performance areas to be considered for AmberGlen include:

- Energy
- Water
- Materials Management
- Transportation Access & Mobility
- Community and Economic Vitality

An AmberGlen EcoDistrict could also consider the Habitat & EcoSystem Function Performance Area, however it should be noted that a lot of the strategies for implementing the performance goals for the Performance Areas listed above also accomplish integration of built and natural environments for healthy urban ecosystems. When combined with existing environmental regulations, ecosystem health should not be compromised and a balance between natural and human needs should be achieved.

The process of forming an AmberGlen EcoDistrict and creating a district vision and goals requires identifying a comprehensive picture or assessment of district performance (baseline), existing conditions (site conditions and community assets), and projected growth to determine the performance areas of greatest challenge and opportunity. In the previous section, applicable AmberGlen goals, policies and actions that would be associated with these Performance Areas are generally described, including different strategies or means of implementation that address the Performance Areas. To provide clarity for each of the potential AmberGlen EcoDistrict Performance Areas listed above, a description of what the general intent of each Performance Area (per guidance from the EcoDistrict "Performance Area" toolkit), what each Performance Area could potentially address, potential metrics for measuring performance, and potential strategies are outlined below:

### Energy

Provide energy resources necessary for a fully functional EcoDistrict while providing positive environmental benefits such that all negative impacts associated with energy use in the district are either eliminated (this means carbon neutral or achieving net zero carbon emissions, also known as having a net zero carbon footprint). Success presumes that EcoDistricts can improve quality of life, and that of the environment, while meeting district energy needs.

Energy Goals: An AmberGlen EcoDistrict could address reducing energy use by:

- Minimizing demand and maximizing conservation; and/or
- Optimizing infrastructure efficiencies at all scales, and/or using renewable energy.

Energy Metrics:

(Note: Related goals and metrics for carbon emissions may also be employed.)

- Annual energy demand (kBtu/SF/year) including:
  - Aggregate Buildings EUI (Energy Use Index -- the measurement of energy per floor unit in a building, expressed in kBtu/SF/year) – baseline, proposed, and current/actual
  - EUI measured as source energy intensity – baseline, proposed, and current/actual
  - Infrastructure EUI (Source EUI – Site EUI = infrastructure EUI) – baseline, proposed, and current/actual
- Annual energy demand per capita, metric of how the energy is or is not efficiently used to provide services to people, including:
  - People EUI (kBtu/SF/year per FTE) – baseline, proposed, and current/actual
- Net-Positive Energy:
  - Percentage of the district (site) energy consumption is met or exceeded by district (site) energy renewable production
  - EUI – Site Energy Production = Minimum Renewable
  - Energy Credit purchases
- Relative performance:
  - Relationship to Climate Action Plan targets – in leadership position allowing for market uptake of tested concepts (e.g., same targets, but 10 years ahead)
  - Rate of district aggregate improvement over baseline

<u>Energy Reduction Strategies</u>:

- Energy-efficient buildings
- Bulk purchasing for existing buildings
- Energy reduction challenge
- On-site renewable energy (solar, wind, small geo-exchange (geo-thermal), small hydropower, biogas, and biomass)
- Vegetation for energy conservation and overall cooling
- District heating and cooling
- Third-party power purchase agreements (allowing private or public ownership entities to lease space to a third-party energy developer, which installs a renewable energy system (typically solar) on the owner's property. The property owner can obtain on-site renewable energy through an agreement/contract with the third-party energy provider without incurring the capital expense of the energy system)
- Waste-to-energy production (process of converting biomass, landfill gas, or municipal waste into an energy source such as electrical or thermal)
- Consumer education
- Energy storage to reduce waste associated with energy transmission loss
- Separate lighting energy

- Thermal comfort energy (thermal comfort: that condition of mind which expresses satisfaction with the thermal environment. Perceptions of this environment are affected by air temperature, radiant temperature (radiant heat transfer), relative humidity, air velocity, and activity)
- Plug loads for separate metering (plug loads: energy consumed by the electronic devices and equipment plugged into outlets in a building. This is not generally accounted for in energy models)
  - Training programs for occupants and building managers to understand newly applied energy management systems and to build awareness of demand-reduction strategies
  - Integration of measurement and verification systems throughout existing buildings
  - Building and district dashboard systems to track, compare, and incentivize behavior change

Current Energy Reduction Actions by AmberGlen Stakeholders

Activities underway by AmberGlen stakeholders[4] that fall within the Energy Performance Area include:

- Energy efficient buildings: Principal Financial and Felton Properties are performing retrofits of building energy and water to improve resource use and to reduce costs and attract tenants. Principal also manages a fund called the "Green Fund", which only holds LEED certified buildings. The buildings that are receiving energy efficiency retrofits are not included in this fund however future new construction could contribute to this fund.
- Waste-to-energy system: OHSU West Campus' Oregon National Primate Research Center (ONPRC) is considering the use of primate feces and bedding material in a waste- to-energy system for campus heating.
- Renewable energy: OHSU West Campus commissioned Mazzetti and Associates in 2009 to conduct a solar feasibility study to explore the use of on-site solar photovoltaic (PV) and solar thermal installations. The study found that the campus could support a 1 MW (150,000 SF) solar photovoltaic system or a 20,000 SF solar thermal system, but neither would yield a positive net present value without a third-party financier who could take advantage of the available tax credits. Mazzetti and Associates recommended that OHSU West Campus initiate an RFP for a demonstration solar PV project on the roof of the Cooley Building. If that demonstration project was successful, it was recommended that OHSU West Campus issue an RFP for additional solar PV and solar thermal projects and consider partnering with a single installer or financial entity to complete solar work on the entire campus.

[4] Brightworks conducted interviews with major property owners and representatives (stakeholders) in AmberGlen to ascertain current sustainability projects and future interests, as part of a preliminary exploration of district system opportunities for AmberGlen.

**Water**

With practices that use water appropriately, EcoDistricts can develop a balance between natural and built systems and achieve a balance between natural and human water needs that does not compromise watershed health. By valuing wastewater (greywater and blackwater) and appropriately implementing reuse strategies for greywater (wastewater from bathtubs, shower drains, sinks, washing machines and dishwashers), blackwater (wastewater from toilets), and rainwater, a district can significantly reduce potable water demands.

Water Goals: An AmberGlen EcoDistrict could address reducing water consumption through:

- Water conservation;
- Reusing and recycling water resources,
- Using potable water only for potable needs;
- Managing stormwater and building water discharge within the district; and
- Maintaining availability, reliability and affordability of water.

Metrics:

- Annual water demand (gal/year) total districtwide:
  - Potable
  - Non-potable
- Annual water demand per capita (gal/capita/yr)
  - Potable
  - Non-potable
- Annual hydrologic balance: baseline and predeveloped
  - Rainfall
  - Infiltration
  - Evapotranspiration
  - Runoff
  - Groundwater
  - Populations
- Water quality
  - Existing temperature of creek runoff
  - Pollution generating surfaces
- Transition Plan
  - Achieve goals over a particular timeline
  - Incremental targets

  - New development achieving the long term sustainability goals of the EcoDistrict
- Number of times that water is used before leaving the district

Water Reduction Strategies:

- Implement water reuse or reclaimed water systems
- Increase groundwater infiltration to improve watershed health
- Satisfy non-potable water demand through recycled water sources
- Design landscape and other vegetated infrastructure to minimize need for irrigation
- On-site wastewater treatment
- On-site stormwater management
- Metering and sub-metering

Current Water Reduction Actions by AmberGlen Stakeholders

Activities underway by AmberGlen stakeholders[5] that fall within the Water Performance Area include:

- Rainwater collection and reuse: On the western edge of OHSU West Campus, there is a manmade pond that can supply 1 million gallons during the rainy season. During a 24-hour period, the pond can supply approximately 100,000 to 150,000 gallons of water. Facilities management is currently considering ways to use this collected rainwater for geothermal exchange heating and cooling, or to draw water for irrigation or grounds maintenance.
- OHSU West Campus commissioned M+NLB in 2009 to assess the viability of installing a rainwater harvesting system to supply non-potable cold water to the existing animal wash system in the Animal Services Building of the ONPRC. M+NLB conducted a potential rainfall demand, supply potential and lifecycle cost analysis to this end. They concluded that the water cost savings for 100% offset of the non-potable cold water used for the animal wash down system would be approximately $1,540 per year, resulting in a payback period that would likely be much longer than 10 years (dependent on the actual cost of the system). The actual offset potential would also be considerably less than 100% due to tank size limitations.
- M+NLB also stated that the current low cost of water is the primary determinant of the long financial payback period for a rainwater harvesting system, however many facilities still choose to install such systems in response to organizational water reduction goals and/or in anticipation of future water cost increases.
- Efficient water use: The AmberGlen Business Park surrounds a 37-acre central green open space area, with an extensive manmade pond. Pond water is circulated and supplemented by direct precipitation. Unfortunately, there is not enough water to irrigate the turf; instead, an efficiently managed irrigation system tied to weather data maintains the open space.

[5] Brightworks conducted interviews with major property owners and representatives (stakeholders) in AmberGlen to ascertain current sustainability projects and future interests, as part of a preliminary exploration of district system opportunities for AmberGlen.

**Materials Management**

By targeting waste and optimized materials management, EcoDistrict can reduce the negative environmental impacts of materials and products that flow through the district.

Materials Management Goals

An EcoDistrict could reduce impacts of materials and products in AmberGlen by:

- Eliminating environmental impacts of materials and products by eliminating practices that produce waste wherever possible
- Minimizing use of virgin materials and toxic chemicals in new products purchased
- Optimizing material reuse and salvage and encouraging use of regionally manufactured products or parts
- Capturing the greatest residential value of organic wastes (including food) through energy recovery and/or composting
- Maximizing use of products made with recycled content where opportunities for waste prevention are limited

Metrics:

- List of salvaged products
- Lbs/tons of recycled materials leaving district
- Lbs/tons of composted material within the district
- Percentage of total organic waste composted out of total generated

Materials Management Strategies:

- Composting
- Recycling
- Waste to energy
- Utilizing district material resources
- Waste-reduction challenges
- Using materials for their highest and best use
- Materials exchange
- Finding multiple functions for one product
- Conversations with manufacturers to convey material purchasing priorities

**Transportation Access and Mobility**

EcoDistricts provide effective access to jobs, housing, goods and services through choices that reduce vehicle miles traveled. Factors of success include the urban form, accessibility of services, and multimodal transportation options.

Transportation Access and Mobility Goals

For Transportation Access and Mobility goals, an EcoDistrict could address prioritizing active transportation; reducing vehicle miles traveled; achieving clean, low carbon transportation access; and meeting goals affordably.

Metrics:

- Prioritizing active transportation:
  - Percentage of trips made by bike
  - Percentage of trips made walking
  - Mode split for the district of all modes
  - Miles of sidewalks
  - Miles of bicycle infrastructure
- Reduce vehicle miles traveled:
  - Daily vehicle miles traveled

- Achieve clean and carbon neutral transportation access:
  - Percentage of households that are cost burdened in the district
  - Percentage of residents with access to retail and commercial services, and community and social services within 20 minutes
  - Percentage of residents with access to educational opportunities within 20 minutes
  - Percentage of residents with access to full-service grocery stores, farmers' markets and community gardens
  - Percentage of residents with access to neighborhood parks, trails, natural areas and recreational facilities
  - Percentage of residents with access to community centers and libraries
  - Distance to other vital neighborhood centers
  - CO2 emissions
  - Outdoor concentrations of NOx and PM2.5

  Transportation Access and Mobility Strategies:
  - Desirable biking and walking options
  - Transit options

- Incentives for alternative modes of transit
- Increased parking costs
- Congestion pricing
- Parking benefit districts
- Flexible work schedules

**Community and Economic Vitality**

EcoDistricts generally promote human health and well-being based on the relationship between social and physical infrastructure and how they work together to influence well-being. For example, urban form contributes to human health and social equity outcomes; community cohesion and social networks support collaborations that yield environmental and economic benefit; and investments are structured to generate financial savings, environmental health, local jobs and community learning. EcoDistricts can support economic vitality by increasing long term efficiencies and related costs, and by their role in promoting an area in the marketplace. They may also provide opportunities to showcase local, sustainable products.

Community and Economic Development Goals:

The fundamental success for an EcoDistrict is based on engagement and investment strategies that benefit district property owners, businesses, residents and workers. For Community Vitality Goals, an EcoDistrict could address promoting human health and well-being through social, ecological and built conditions and physical infrastructure. Pursuing an AmberGlen EcoDistrict could play a key role in a branding strategy that promotes the area as a distinct, desirable location for investment. There are opportunities to partner with local employers to feature sustainable products (SolarWorld) and to promote health (Kaiser Permanente, Providence Health Services). Public-private partnerships and financing strategies identified for Plan implementation may be aligned with those for establishing an EcoDistrict in AmberGlen. For AmberGlen stakeholders, scale (scales of change, scales of impact and scales of risk) of a project may not make economic sense to implement on a site-specific basis. However, a district system could be effective in addressing the needs of stakeholders and also benefit the neighborhood or community in addressing sustainability issues.

Metrics:

- A range of economic indicators should be agreed upon. These may include rates related to leasing, turn-over, development and others.
- Percentage of residents satisfied with the amount and type of natural features in the district
- Percentage of residents satisfied with the closeness of parks or open space
- Percentage of residents exposed to toxins (indoor, outdoor)
- Traffic statistics/travel safety (e.g. accident rates per capita, per vehicle miles traveled (VMT) for auto, bike, transit)
- Health outcomes (possibly an index score or key metrics that relate to environmental influences of health, such as rates for obesity, diabetes, asthma, cancer, mental well-being)
- Perception of safety (a time during the day where residents feel their safety is undermined)

- Ambient noise (both indoor and outdoor acoustic comfort)
- Strategies:

Community and Economic Development Strategies:

- Establish and promote the location as distinct and desirable based on sustainability attributes
- Partner with local employers to showcase sustainable products and services
- Establish consensus on what is understood as "sustainable" regarding infrastructure and business practice, and on what aspects of the Triple Bottom Line definition of sustainability are worthwhile addressing
- Human-scaled places
- Accessible natural areas
- Community engagement
- Indoor air quality programs
- Walkable urban design
- Urban agriculture

## AMBERGLEN ECODISTRICT NEXT STEPS

The first next step is for the AmberGlen stakeholders to engage in a discussion about exploring the possibility of establishing an EcoDistrict for the AmberGlen Community Plan Area. There is an opportunity to begin the discussion at the July 20, 2011 meeting. Other steps would be determined depending on stakeholder interest in moving forward.

# District Energy System Example

## CHP Biomass/Solar Thermal/PV District Energy System

### *Introduction & Background:*

To take advantage of the planning process and the benefits/ efficiencies realized when long-term, holistic strategies are employed; a potential district energy system to provide utility service for AmberGlen has been identified and analyzed. District energy systems have efficiencies in the 70% to 90% range, where standard power systems distribute only 40% of the energy contained in the source fuel, reducing the greenhouse gas (GHG) footprint of the development. Additionally, a district energy system relieves the district's dependence on public utilities, and enables any of AmberGlen's occupants to contribute to or remove energy from the grid depending on daily or seasonal usage patterns. Electricity can be introduced into the grid without the typical transmission losses associated with most large-scale power systems, and heat energy can be captured and distributed anywhere on the grid in a hydronic loop for use in heating and cooling.

To reduce the demand that AmberGlen places on the system, minimum efficiency goals are recommended to be set for residential and commercial energy consumption (the predominant land-use types). Building envelope design should be high-performance, responding to seasonal solar thermal patterns as well as the micro-climates and wind patterns specific to Hillsboro, OR. Solar energy should be collected through natural ventilation, daylighting, solar thermal panels, and photovoltaic panels (PV). Building integrated solar thermal and PV systems can provide energy inputs of heating/cooling, domestic hot water (DHW), and electricity for lighting and equipment.

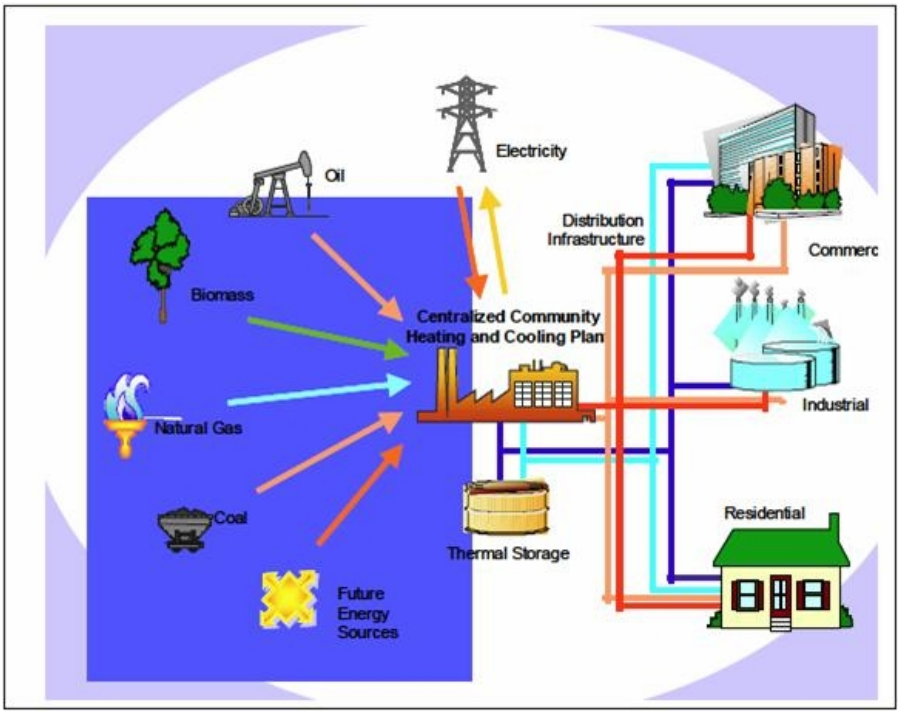


**Figure 1: Energy System Diagram**
The figure illustrates how a central energy facility can utilize various sources of fuel to create electricity, heating, and cooling to supply a variety of users in a community.

St. Paul, MN, District Energy is a time-tested example of a hybrid distributed and centralized district energy system. The system includes a network of building integrated solar thermal panels that will equal 1-MW of output. To compliment, industrial biomass combustion facilities produce biomass fuel from forest products, and agricultural and landscape refuse. The facility converts biomass fuels into several forms of useful energy for commercial or industrial uses, including hot air, hot water, steam, and electricity.

Courtesy of District Energy St. Paul. [1]

### *CHP Biomass District Heating and Cooling Plant*

A biomass combustion facility is explored due to resource availability surrounding Hillsboro, most notably, high-energy content timber harvest refuse from the Coast Range. Biomass systems allow developments to stay within the current carbon cycle of the GHG footprint, and use only carbon that is generated and sequestered within vegetation lifetimes, rather than carbon that is stored over millions of years and released in mass (as is the case with fossil fuels). Many Oregonians convert biomass to useful energy in their homes by burning wood in a fireplace or woodstove. Newer forms of residential and commercial biomass technology and fuels include biomass boilers, pellets, and manufactured logs. A biomass-fired boiler is a more adaptable and efficient direct-combustion technology, because a boiler transfers the heat of combustion into steam. Steam can be used for electricity, mechanical energy, or heat. Biomass combustion facilities that produce heat and electricity (called cogeneration or combined heat and power [CHP]) from steam-driven turbine-generators have a conversion efficiency of as much as 85%. Biomass boilers supply energy at low cost for many industrial and commercial uses.

Several biomass sources will be needed to ensure a secure fuel supply given the fuel demand of the heating and cooling plant. Using fuel from several vendors always results in variation of fuel quality. A moving-grate furnace is therefore the combustion technology of choice, as it is the most flexible in handling biomass of varying moisture content, ash content, and particle size. Relevant biomass sources near AmberGlen may include agricultural, landscape, and timber harvest refuse, as well as direct biomass-specific vendors from surrounding farms and the Coast Range. A detailed fuels study that looks at potential sources and the quality of the source fuels should be conducted in parallel with a detailed engineering and economic study for a deeper analysis of feasibility.

**Figure 2:** Biomass systems can be stand alone or building integrated as seen above

**Figure 3:** Comparably sized biomass CHP plant with fuel storage, administrative offices, and solar thermal preheat

**Table 1: Components of an AmberGlen CHP Biomass District Heating and Cooling Plant***

| Component | System Detail |
|---|---|
| Storage | Outdoor storage on a paved surface |
| Fuel feeding | Sliding bar conveyor and fuel dosing system |
| Combustion technology | Moving grate furnace |
| Boiler technology (CHP) | Thermal oil boiler |
| Heat recovery | Economizer |
| CHP technology | Organic Rankine Cycle process |
| Flue gas cleaning | Multi-cyclone and wet electrostatic precipitator |
| Ash removal | Sliding bar and chain trough conveyor |
| Peak-load boiler | Gas-fired boiler |

*A base natural gas and peak natural gas boiler can be installed first while biomass is transitioned to overtime.

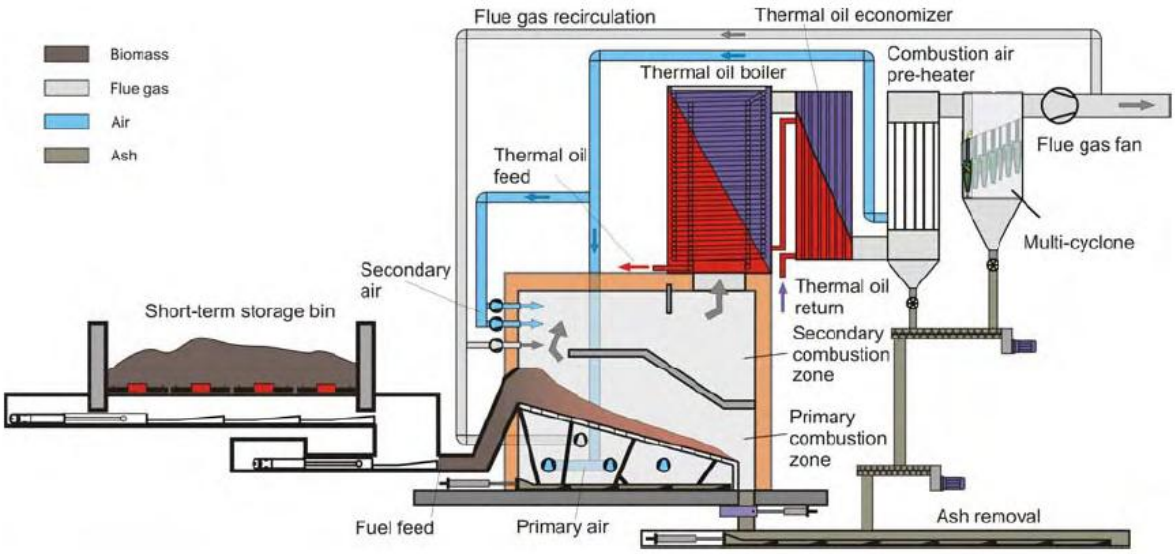


**Figure 4: Biomass Combustion CHP Plant Diagram**
Sardella, Mark PE. Local Energy 2004. Biomass-Fired District Energy: A Source of Economic Development and Energy Security. Prepared for: Natural Resources Conservation Service and US Department of Agriculture. Page 109

### *CHP Technology:*

The system uses a common combined heat and power (CHP) technology called Organic Rankine Cycle (ORC). The ORC generates about 80% of all electric power used throughout the world, including virtually all large-scale natural gas, biomass, and solar thermal facilities.[2] The ORC is fully compatible with viable, alternative energy sources in the Hillsboro area, including waste heat recovery, biomass, geothermal, and solar thermal. Biomass can be used for the production of electricity on small- to medium-size scaled power plants, but should be sourced as locally as possible to reduce transportation impacts.

The ORC is recommended because of the use of an organic, silicon-based, thermal oil with a liquid-vapor phase change, or boiling point, occurring at a lower temperature than water. This allows for a more efficient conversion of fuel to energy at lower temperatures and pressure. Biomass plants with ORC eliminate the problem of high specific investment costs for machinery, by eliminating the need for pressurized steam boilers. Another advantage is the long operational life of the machine due to the characteristics of the thermal oil which, unlike steam, is non-eroding and non-corroding to equipment. Because of the lower boiling point, the thermal oil allows Rankine cycle heat recovery from lower temperature sources, such as industrial waste heat, geothermal heat, and solar ponds.[3]

Waste heat, geothermal, and solar thermal heat sources vary in temperature from 50°F to 350°F. The ORC is therefore perfectly adapted for this kind of application. Hillsboro is located on a moderate geothermal zone, so system development is possible with further study. As stated above, the ORC requires no pressurized boiler (which decreases initial and personal costs) and requires no water treatment. The two-stage combustion achieves complete biomass combustion (minimum content of unburned biomass/charcoal in the ash) and lower emissions of CO, hydrocarbons, and NOx. Since the ORC process features a closed cycle, there is no loss of the thermal oil during normal operation. The process is fully automated, requiring only about three man-hours per week, which further reduces the operating costs of the CHP plant by a considerable amount.[4]

ORC-based fluidized-bed combustors can (if a flue-gas cleaning system is utilized as recommended) burn biomass fuel to meet the emission limits set by the Oregon Department of Environmental Quality.[5] Partial recovery of the remaining heat in the flue gas during cleaning further increases the total efficiency of the plant, which further reduces emissions (due to the reduced fuel input). It also improves the financial performance of the heating plant. One or two gas-fired boilers are used as peak-load boilers. The total nominal heating capacity of the boiler(s) depends on the size of the required back-up capacity. Since it is very unlikely that both installed biomass boilers will fail at the same time, back-up capacity is required only for the larger boiler and its heat-recovery unit.

Advantages of the ORC process are:

- Higher revenues due to sale of power (green credits and CO2 credits apply).
- Low-temperature and pressure levels reduce investment and operating costs.
- No specially trained personnel are needed (as would be required with a steam boiler).
- Higher electric production per unit of energy.
- High flexibility and efficiency at partial load.
- Long track record with solar and geothermal energy, and a 10-year track record for biomass-fired ORC units.

### *AmberGlen Energy Demand and Capacity Study:*

The energy analysis was aimed at determining the required heating/cooling capacity of the district CHP system (in BTU per hour), the total amount of heating/cooling (in BTU) that the system would need to deliver, and some general characteristics of how the heat would need to be delivered with respect to time and temperature. The energy demand study was based on the AmberGlen Concept Plan list of zoning types, their representative energy use intensities (EUI) per the nationally recognized Commercial Buildings Energy Consumption Survey (CBECS) database, and the proposed building square-footage and land area dedicated to the zoning types at full build out. Results show that within the fully developed AmberGlen area about 732 billion BTU of heating/ cooling would be needed annually. Based on the development plan, it is recommended that two locations be developed for a biomass/ natural gas CHP plant. The first will combine the energy demand of the OHSU West Campus and development to the east, and the second will serve development to the west, including the Central Park. This duality also reduces risks associated with bridging utilities across Bronson Creek.

The following information provides a summary overview of the development plan, energy use, and use within specific subareas analyzed for district energy system compatibility.

**Table 2: Summary of AmberGlen Development Plan**

| | Acres | Residential | | Office/Retail/Other | |
|---|---|---|---|---|---|
| | | Households | SF | Jobs | SF |
| Total | 600 (400 Developed) | 7,000 | 7,898,800 | 11,000 | 5,020,000 |
| Medium density transitional | 39 | 1,300 | 1,994,800 | NA | NA |
| Medium density urban | 78 | 3,300 | 3,683,000 | 1,000 | 425,000 |
| High density urban | 25 | 1,800 | 2,049,000 | 1,000 | 600,000 |
| Neighborhood center | 10 | 30 | 32,000 | 400 | 175,000 |
| Urban activity center | 6 | 130 | 140,000 | 600 | 260,000 |
| Office | 62 | NA | NA | 6,100 | 2,185,000 |
| OHSU West campus | 77 | NA | NA | 1,400 | 1,375,000 |

**Table 3: Use Type Energy Use Intensity***

| Use Type | Energy Use Intensity (kbtu/SF/yr) | | |
|---|---|---|---|
| | Total | Gas | Electric |
| Residential | 100 | 58 | 42 |
| Office | 92 | 42 | 50 |
| Retail | 73 | 30 | 43 |
| Civic / Assembly | 94 | 60 | 34 |
| Activity center | 200 | 140 | 60 |
| OSHU office | 92 | 42 | 50 |
| OHSU lab | 249 | 160 | 89 |

*EUI based on National CBECS Database, Energy Information Administration. EUI does not take into account building energy efficiencies, but provides a typical (or worst case) scenario to be improved upon.

**Table 4: Subarea Development Plan Mix**

| | 185th Corridor | Central Park Mixed-Use Neighborhood |
|---|---|---|
| Medium density Transitional | 40% | 60% |
| Medium density Urban | 25% | 75% |
| High density Urban | 0% | 100% |
| Neighborhood center | 50% | 50% |
| Urban activity center | 0% | 100% |
| Office | 40% | 60% |
| **OHSU West Campus** | | |
| Office | 25% | |
| Indoor lab | 20% | |
| Outdoor lab | 55% | |

**Table 5: Summary of Energy Use Per Opportunity Subarea**

| **Location** |
|---|
| AmberGlen total energy demand:<br>Building floor area: 12,918,800 sqft<br>Heat and cooling demand: 690.35 MMBTU per hour, 731,777.35 MMBTU/yr<br>Electric demand: 172,345 MWh/yr |
| Central Park mixed-use neighborhood (all development west of Bronson Creek)<br>Building floor area: 8,252,300 sqft<br>Annual natural gas demand: 473,755.60 MMBtu<br>Annual electric demand: 375,151.40 MMBtu<br>Annual natural gas GHG emissions*: 55,429,405.20 lbs CO2<br>Annual electric GHG emissions*: 97,856,021.68 lbs CO2 |
| OHSU West Campus<br>Building floor area: 1,375,000 sqft<br>Annual natural gas demand: 73,343.75 MMBtu<br>Annual electric demand: 60,787.50 MMBtu<br>Annual natural gas GHG emissions*: 8,581,218.75 lbs CO2<br>Annual electric GHG emissions*: 15,856,059.49 lbs CO2 |
| 185th Corridor (all development east of OHSU)<br>Building floor area: 3,291,500 sqft<br>Annual natural gas demand: 184,678.00 MMBtu<br>Annual electric demand: 152,105.00 MMBtu<br>Annual natural gas GHG emissions*: 21,607,326 lbs CO2<br>Annual electric GHG emissions*: 39,675,688.74 lbs CO2 |

*GHG Emission rates are based on PGE data: Electricity 0.89 lbs/kWh; Natural Gas 0.117 lbs/Kbtu

**185th Corridor/OHSU West Campus:**

The 185th Corridor and OHSU West Campus should be combined to require a base-load biomass CHP plant with a nominal heating and cooling capacity of 20.3 million BTU per hour, an electrical capacity of 1.5 megawatts, and an economizer with 4.2 million BTU per hour. A backup biomass boiler of 20.3 million BTU per hour/1.5 megawatts is also included. The system can easily accommodate low-temperature demand customers and relatively wet biomass. A gas-fired peak-load boiler of 82.9 million BTU per hour is also included, and is large enough to meet the peak load even when the base and back-up load boilers are out of service. It is possible for the base and peak load boilers to be fueled by natural gas and over time, install a back-up boiler fueled by biomass as the market for this fuel becomes more favorable.

The 185th Corridor/OHSU West Campus CHP configuration requires about 22,550 tons of wet fuel per year, producing 890 tons of ash. It produces 203 billion BTU per year of biomass-generated heating and cooling, and 5,966 megawatt-hours of electricity at an overall thermal efficiency of 88.9%. Rough order of magnitude cost is $27 million. The highest costs are for the network of pipes (pipes, trenching and backfilling, heat transfer stations) at $14 million. Costs for the biomass-fired furnace and boiler are approximately $10 million, followed by engineering and permitting costs at $2 million, biomass fuel costs at $500,000, labor costs at $36,000, and operating costs at $5,000. These numbers are typical industry-standard costs for system capacity and piping.

**Figure 5:**
Comparably sized biomass CHP plant with fuel storage, and administrative offices

**Tables and Calculations: 185th Corridor/OHSU West Campus District Energy System at Full Build-Out**

Connected Load Potential and Annual Heating/Cooling Demand

| Target Area | KBtu/hr | KBtu/hr |
|---|---|---|
| 185th Ave | 174,224.50 | 184,678,000 |
| OHSU West campus | 69,192.22 | 73,343,750 |
| **TOTAL** | **243,416.72** | **258,021,750** |

Connected Load Potential and Annual Electrical Demand

| Target Area | kWh/hr | kWh/hr |
|---|---|---|
| 185th Ave | 42,050 | 44,579,425 |
| OHSU West campus | 16,800 | 17,815,800 |
| **TOTAL** | **58,850** | **62,395,225** |

Heating/Cooling Demand and District System Contribution:

Heating/cooling demand: **258,021,750 KBtu/yr**
CHP heating/cooling contribution: **203,000,000 KBtu/yr**
Heating/cooling resultant: **55,021,750 KBtu/yr**

Supplementary Heating/Cooling Energy Production from Solar Thermal:

1 Solar thermal heating system (STHS) = 6 $m^2$ of PV
1 STHS = **9,964.50 KBtu/yr**
Resultant heating/cooling energy:
55,021 MMBtu/yr = 5,520 STHS = **33,120 $m^2$ panel**
Required panel area = 33,120 $m^2$; or **11,040 $ft^2$**

Electrical Demand and District System Contribution:

Electrical demand: **62,395,225 kWh/yr**
CHP electrical contribution: **5,966,000 kWh/yr**
Electrical resultant: **56,429,225 kWh/yr**

Supplementary PV energy production:

Hillsboro solar radiation = 3.16 kWh/$m^2$/day
Panel ac-dc conversion factor = 85%
Panel efficiency = 20%
Resultant electric energy: **56,429 MWh/yr or 154.6 MWh/day**
Required panel area = 154,600 kWh / 3.16 kWh / 85% / 20% = 287,788 $m^2$ panel area
Required panel area = 287,788 $m^2$; or **95,929 $ft^2$**

**Central Park Mixed Use Neighborhood:**

The Central Park opportunity area requires a base-load biomass CHP plant that is approximately twice the capacity of the current 185th Ave/OHSU West Campus plant, and requires a nominal heating capacity of 40.6 million BTU per hour, an electrical capacity of 3 megawatts, and an economizer with 8.4 million BTU per hour. A backup biomass boiler of 40.6 million BTU per hour or 3 megawatts is also included. A gas-fired peak-load boiler of 163.8 million BTU per hour is also included, and is large enough to meet the peak load even when the base and back-up load boilers are out of service. It is possible for the base and peak load boilers to be fueled by natural gas and over time, install a back-up boiler fueled by biomass as the market for this fuel becomes more favorable. The Central Park CHP configuration requires about 45,100 tons of wet fuel per year, producing 1,780 tons of ash. It produces 406 billion BTU per year of biomass-generated heat and 11,900 megawatt-hours of electricity at an overall thermal efficiency of 88.9%.

**Tables and Calculations: Central Park Mixed Use Neighborhood at Full Build-Out**

Connected Load Potential and Annual Heating/Cooling Demand

| Target Area | KBtu/hr | KBtu/yr |
|---|---|---|
| Central Park | 446,939.25 | 473,755,600 |

Connected Load Potential and Annual Electrical Demand

| Target Area | kWh/hr | kWh/hr |
|---|---|---|
| Central Park | 103,730 | 109,950,590 |

Heating/Cooling Demand and District System Contribution:

Heating/cooling demand: **473,755,600 KBtu/yr**
CHP heating/cooling contribution: **406,000,000 KBtu/yr**
Heating/cooling resultant: **67,755,600 KBtu/yr**

Supplementary heating/cooling energy production

1 Solar thermal heating system (STHS) = 6 $m^2$ of PV
1 STHS = **9,964.50 KBtu/yr**
Resultant heating/cooling energy: 67,755.6 MMBtu/yr = 6,800 STHS = **40,800 $m^2$ panel**
Required panel area = 40,800 $m^2$; or **13,600 $ft^2$**

Electrical Demand and District System Contribution:

Electrical demand: **109,950,590 kWh/yr**
Electrical contribution: **11,900,000 kWh/yr**
Electrical resultant: **98,050,590 kWh/yr**

Supplementary PV energy production

Hillsboro Solar Radiation = 3.16 kWh/$m^2$/day
Panel ac-dc conversion factor = 85%
Panel efficiency = 20%
Resultant electric energy: **98,050.6 MWh/yr or 268.6 MWh/day**
Required panel area = 268,600 kWh / 3.16 kWh / 85% / 20% = 500,000 $m^2$ panel area
Required panel area = 500,000 $m^2$; or **166,666 $ft^2$**

**Decentralized Solar Photovoltaic Solar Thermal Systems**

The district energy system above is integrated and encompasses a package of technologies that would support efficient and clean energy to AmberGlen. District systems are best described holistically – to show how each strategy satisfies portions of energy demand – rather than as isolated systems where their relative contribution or relevancy to serving the whole is unknown. However, it is important to note that different technologies can function alone and connect in a grid to other systems over time. This flexibility helps to complement complex, long-term or phased-development timelines and emerging early-stage governance structures.

A key concern for property owners is a perceived loss of control over building power and conditioning. Decentralized systems such as PV or solar thermal might provide a first step that eventually ties those systems in with a centralized CHP plant. These systems are attached to buildings giving property owners a sense of ownership, but are tied into a community micro-grid and connected to the larger power grid. These systems are like mini utility systems, but power is produced on individual buildings. Smart grid technology can also complement the system with a network of controls and meters that better manage energy supply and use. Hillsboro green tech and high-tech firms may become interested in partnering with AmberGlen to promote new technology or serve as a sponsor of greener solutions. For example, the American Recovery and Reinvestment Act (AMMA) is investing $4.5 billion in smart grid technology. A video on the progression of this technology in the U.S. can be viewed online.[6]

An example of decentralized district systems is the Community Power Project Flagstaff Pilot solar electric smart grid.[7] The National Renewable Energy Laboratory is also tracking examples of community-wide distributed energy systems.[8] One example is the Sonoma Mountain Village, located in Rohnert Park, California. Similar to AmberGlen, the community is sited on a 200-acre former business campus site that is being converted to a mixed-use development. The community chose to centralize their PV system into a 1.14 MW photovoltaic rooftop power plant.

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**MEMORANDUM**

DATE: May 31, 2011

TO: Colin Cooper, AICP
Current Planning Manager
CITY OF HILLSBORO

FROM: Bill Reid, Principal
JOHNSON REID, LLC

SUBJECT: Sustainable Infrastructure Systems Economic Factors

JOHNSON REID was retained by the City of Hillsboro to provide economic context for the planning of "sustainable" infrastructure systems for the AmberGlen Community Plan. The analysis provided in this memorandum is intended as an economic framework where we recommend the City begin to evaluate the economic and financial feasibility of specific, sustainable infrastructure systems identified as potentially feasible at AmberGlen from an engineering and design perspective.

The specific intent of this memorandum is to accomplish the following:

1. Define and discuss the economic/business case for sustainable infrastructure systems; and
2. Discuss the development economics of a potential combined heat and power (CHP) system. This system example is discussed in detail in terms of energy demand and capacity by Brightworks[1]. The CHP system serves as a useful example for stimulating discussion of economic and financial issues associated with provision of utilities.

As a land use and development economics consulting firm, JOHNSON REID does not provide expertise with regard to detailed financial due diligence of utility and infrastructure systems. As the firm's broader role in AmberGlen Community planning is the economic feasibility of land use forms, the specific focus of this analysis is from a land development perspective. We therefore explore sustainable infrastructure economics with regard to implications for existing and future property ownership and development as intended by the AmberGlen planning effort to date.

## Economic Concepts of Sustainability

The term "sustainable" has gained great currency over the past several years as a description of efforts to protect and enhance the natural environment by minimizing negative impacts caused by the built environment. Today, the term "sustainable" increasingly encompasses a broader range of issues better understood as "the greater good" with regard to environmental, social, and economic welfare. Given the evolution of the term to describe broader themes, the term is confusingly interchangeable with common terms that describe more narrow issues, such as "green" in describing vehicles or construction design, "organic" or "pesticide-free" with regard to food production, and "environmentally friendly" with regard to these issues and more.

From an economic perspective, we find it best to understand "sustainable" – particularly with regard to infrastructure systems – in the context of the Triple Bottom Line concept. Most notably conceived by business

[1] Brightworks for the City of Hillsboro, AmberGlen Community Plan Preliminary Exploration of District System Opportunities, June, 2011

management professor John Elkington,[2] the Triple Bottom Line or TBL is a conceptual accounting framework that goes beyond traditional measures of profit and return, encompassing three broad measures of benefit:

- Economic: The traditional "bottom line" for business, such as profit and investment return.
- Environmental: Minimized environmental impact(s), potentially in terms of small carbon footprint, natural/open space protected, etc.
- Social: Social well-being, potentially measured by variables such as income distribution gap reductions, education/training enhancement, or charitable giving.

This holistic measure of sustainable business practices, where "sustainable" implies optimization of all three bottom line measures, is now the most commonly recognized business measure of sustainability by the public and private sector.

For the purposes of this analysis, it is important to recognize that "sustainable" represents an accounting of business costs beyond traditional measures. In other words, a firm may be economically profitable but if it creates undesirable environmental or social impacts that are not factored into traditional financial measures, then it is not sustainable by the above definition.

The corollary of the above fact is that unaccounted environmental or social costs – "externalities" in economic parlance – are also potentially not being reflected in prices being charged for the good or service in question. Accordingly, a sustainable business will *not necessarily but very often* need to charge higher prices than a comparable firm that does not seek to minimize environmental and social costs, thereby maximizing the Triple Bottom Line.

It should also be noted that the Triple Bottom Line framework is not a formal accounting standard, nor is it universally adopted. The TBL is increasingly being used by international and domestic public agencies, as well as large domestic and international businesses. And despite its increasing use, the TBL is not formally structured for measurement, specifically the Environmental and Social bottom lines. For instance, there is no standard of measurement for environmental impact; some entities measure environmental bottom line in terms of dollars, others use relative index values, while still others utilize quantities such as acres of wetlands preserved, tons of carbon released into the environment, etc. Likewise, social measures also vary greatly from entity to entity: donations to non-profits, worker education enhancement, local poverty reduction, etc.

From all of the above, we draw the following conclusions for the City of Hillsboro regarding the economic value of sustainability as it plans infrastructure for the AmberGlen Community:

- Planned infrastructure systems have an increasingly prevalent measure of economic sustainability: the Triple Bottom Line.
- We recommend that future policy discussion for sustainable business practices, particularly including infrastructure systems, be framed in terms of the Triple Bottom Line as the concept evolves beyond prevalent use to a formal, measurable standard.
- We recommend the City seek a measure of consensus on a standard definition of "sustainable" regarding infrastructure and business practice within the AmberGlen Community.
- The economic cost of TBL conceptual accounting should be openly discussed as potentially, if not likely, more expensive than traditional business practice due to its accommodation of costs that go beyond traditional measures of firm financial performance.

[2] John Elkington, "Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development," California Management Review 36, no. 2 (1994): 90–100.

- Given higher potential costs, City discussion with stakeholders and project advisory groups should achieve agreement about what aspects of the Triple Bottom Line definition of sustainability are worthwhile addressing with sustainable systems, and what others are perhaps beyond the scope of AmberGlen planning or community sustainability goals.
- Agreement or consensus about the sustainability concept, its likely cost implications balanced with its benefits, and agreed-to priorities for sustainability for new infrastructure, concerns about costs can then more adequately be balanced with findings from a more detailed due diligence study of specific systems.

Economic Considerations for a Combined Heat & Power ("CHP") System

Economic & Engineering Due Diligence

Located within urbanized Hillsboro, Oregon, the AmberGlen Community planning area is already served by traditional infrastructure systems. The existing provision of necessary utilities and infrastructure naturally begs the question: What economic case can be made for a new infrastructure system(s) when there is existing, larger provision at lower likely costs?

Given the TBL sustainability framework, it should be generally recognized and expected that energy and other sustainable system provisions in AmberGlen may be more expensive as it accounts for costs beyond traditional service provision profit, O&M, and system debt service coverage. Beyond this factor, there are several benefits to new infrastructure systems for the business case. For future exploration of potential sustainable CHP systems, we would urge that the City of Hillsboro seek more detailed due diligence about the likely costs and benefits of such a system in AmberGlen.

The most thorough and straightforward framework for CHP system due diligence analysis available is that produced by the US Environmental Protection Agency Combined Heat & Power Partnership.[3] Specifically, the EPA has produced a formal guidebook for streamlining CHP project consideration, due diligence, and development/financing strategy.[4] A full review of EPA recommended guidelines is unnecessary at this stage of the AmberGlen Community planning process. However, we provide the following summary of EPA's recommended CHP planning framework for context of the current stages of AmberGlen planning as well as recommendations for later phases of systems planning:

1. System Qualification: Is the facility a good candidate for a CHP system? The first step in the greater due diligence process involves a basic inventory of current energy usage, rates, plans for system expansion, and district or individual user concerns about energy current and future energy costs. Basic collection of current and future likely heat/power usage and loads, specific uses, and other basic known existing information is then judged utilizing EPA recommended standards for CHP system candidacy criteria.
2. Level 1 Feasibility Analysis: A first, simple "payback" analysis of a potential CHP system. The Level 1 Feasibility Analysis identifies a likely, optimal system size based on power requirements, usage patterns, project/district size and development, district objectives, and the basic physical/engineering characteristics of the system given site(s) geographic considerations.
3. Level 2 Feasibility Analysis: A detailed engineering and financial feasibility analysis of a further-refined CHP system plan. The Level 2 analysis is the formal feasibility study that would ultimately determine project engineering and financial feasibility for definite system planning, budgeting, financing, and construction planning. The study will typically include significant sensitivity analysis of various system design and build-out permutations to optimize feasibility and reduce project risk. A recent,

[3] http://www.epa.gov/chp/index.html
[4] http://www.epa.gov/chp/project-development/index.html

oft-cited study[5] of CHP system feasibility in Northwest Portland is an example of such a Level 2 Analysis.

4. Procurement: Development of the planned CHP system meeting stated goals, timeframe, and financial requirements.
5. Operations & Maintenance: Operation of a financially-sustainable CHP system that delivers service cost and emissions reductions as planned.

Local System Financing Considerations

Although specific funding mechanisms for a potential CHP system in the AmberGlen Community are not yet possible to discuss in detail, economic feasibility issues at this planning stage make necessary to at least identify typical funding tools for such systems and economic implications for community planning at this stage, if any. The table on the following page provides a summary of identified, typical funding sources for CHP systems as identified by the US EPA, and Metro, as well as sustainable infrastructure public information sources. We underscore that the following are the most common local sources of financing. Federal and State programs also do exist, which are briefly discussed later and represent potentially significant development cost and risk mitigation tools.

Upon review of typical, local funding sources, we would note the following:

- CHP system development financing was more commonly documented for the instances of smaller systems, i.e. an individual power user seeking lower operations costs and reduced environmental impact.
- Alternatively, larger, multi-user utility districts were less of the focus for project financing information. Larger districts, typically with public involvement, would in fact have a wider variety of financial tools than a user-specific system or a smaller system serving a limited number of different users.
- The great majority of system development funding sources, almost all privately-sourced, would likely pose little to no risk to existing and future system users within the AmberGlen Community. Such funding sources – debt or equity – involve risk taken on by the project developer or primary system owner/user that sells power and heat to other users.
- Because a district-wide system or system(s) would be involved serving many different users over time, the system may seek public involvement or system ownership/operation. As a result, a wider selection of lower-cost tools are available for system development financing.
- However, such tools introduce greater system development risk to existing and future development interests either directly (LID establishment and/or SDCs), or indirectly via urban renewal resource allocation and opportunity cost for the district.

[5] Compass Resource Management Ltd. "Business Analysis for a Neighborhood Energy Utility in the North Pearl District." March 31, 2009.

**Typical Combined Heat & Power System Development Funding Sources**

| Source | Type | Financing Source | Description | Note(s) |
|---|---|---|---|---|
| **Private** | Internal Cash Flow | Debt | Expected heat and power service revenue secure debt financing. | Community development pace a primary risk. Lowest cost source likely. |
| | Commercial Debt | Debt | Credit rating and assets of developer, owner secure debt financing. | Careful developer screening would mitigate potential risk. |
| | | Debt and/or Equity | Vendor/operator of the system finances capital costs. | Capability to finance key capital requirements can be a vendor selection criterion. |
| | Project Financing | Debt | Expected financial performance of the system secures debt financing. | Independent debt coverage ratio/return requirements may make the source more expensive. |
| | 3rd Party Investor | Equity and/or Subordinated Debt | Equity or subordinated debt secured by investment interests. | Likely most-expensive financing source due to cost of equity relative to debt. |
| | Lease(s) | Capital/Operating Leases | CHP equipment/capital lease instead of financed purchase. | Potentially lower-cost financing option, possible requirement during developer screening process. |
| | Build-Own-Operate | Debt or equity | Independent operator owns and finances, selling energy to subscribers. | Lowest-risk and cost to district users, though power rate discount relative to existing must be demonstrable. |
| **Public** | Local Debt | Revenue Bonds/Urban Renewal | District general obligation bond financing of public improvements. | Second-lowest cost usually, though CHP system would require majority if not whole public ownership. |
| | | Project Bonds | Public debt secured by project service revenues. | Higher cost than revenue/district bond due to project revenue-secured and not general obligation bond. |
| | | Local Improvement District Debt | Debt secured by a local improvement district solely comprising beneficiaries of the infrastructure improvement. | A potential tool complimentary to other, more robust funding sources. Higher risk for district property owners. |
| | | System Development Charge(s) | Fees assessed on new development are earmarked for specific, public infrastructure improvement. | Public ownership of the utility would be required. SDCs, unless carefully determined, can negatively impact private development feasibility, thus posing risk to community buildout and utility revenue potential. |

Federal & State Incentives

CHP systems are now among the most common sustainable infrastructure systems developed and successfully operated based on district track records elsewhere. Because of increasing prevalence of CHP systems elsewhere in the country, perceived risk of system development by traditional, third-party private sector financing sources has gradually decreased enabling lower development cost as well. Further securing lower development cost and financing risk are the proliferation of federal CHP development incentives, as well as development of State of Oregon incentives over the last 5-10 years. The following is a brief summary of potential incentive sources that would serve to reduce overall CHP development risk, cost, and possible risks to existing and future development interest within the AmberGlen Community. The majority of Federal assistance potential is composed of tax incentives as several, recent funding mechanisms have expired and have not yet been reauthorized.

Federal Funding[6] Sources:

- Renewable Energy Production Incentive: Per-kWh based funding of qualified, renewable energy-producing facilities.

Federal Tax Incentives:

- CHP Investment Tax Credit: Federal tax credit for the first 15 megawatts (MW) of production capacity.
- Investment Tax Credit for Microturbines & Fuel Cells: Federal tax credit on 10% of microturbine costs and 30% of fuel cell expenditure, with no limits on expenditure in either case.
- Renewable Energy Production Tax Credit: 1.1 cents to 2.2 cents per kWh of qualifying renewable energy production.
- Bonus Depreciation: Accelerated depreciation for tax purposes on qualifying renewable energy capital facilities/equipment.
- Clean Renewable Energy Bonds: Bonds for qualifying renewable energy production that provide bondholder a tax credit in lieu of interest income.
- Qualified Energy Conservation Bonds: Although different IRS tax code provision and allowance, the "QECB" functions similarly to the CREBs cited above.

Oregon Incentives:

- Business Energy Tax Credit: A 50% tax credit for qualifying renewable energy generated by an Oregon business. The BETC is stated as expiring in July of 2012 however.
- Community Renewable Energy Feasibility Fund Program: Up to $50,000 grants for feasibility studies of qualifying renewable energy production.
- Energy Trust Large Scale Renewable Energy Program: Up to $40,000 in grant assistance for feasibility study of qualifying renewable energy production of up to 20 MW.
- Renewable Energy Systems Exemption: Property tax credit for property value increases due to renewable energy system equipment or connection. Not intended for producers of renewable energy. Expires in July of 2012.

[6] Other funding sources are cited by the EPA as recently utilized but not yet reauthorized. Those not currently active for project planning were not listed.

- Small Scale Energy Loan Program: Ultimately Federally funded, the loan program provides a range of $20,000 to $20 million for development of renewable energy production within the State or projects that stand to significantly benefit the State of Oregon.

It is important to note that in nearly all instances, the above funding sources and incentives have existed only since 2005. Therefore, in great measure, modern CHP system development has a far greater menu of incentives as well as sources of financing that past systems in the State of Oregon.

The result moving forward will likely be lower financial cost for a system at AmberGlen depending upon financial approach. In addition, an oft-cited older sustainable district system precedent elsewhere in the Metro region, Beaverton in the Round, is not indicative of potential system planning and financing in AmberGlen as a result of significant expansion of funding sources and perceived risk in such systems by the market. We would further note that the AmberGlen Community dwarfs the Beaverton in the Round development in total size and development capacity, thus providing a new district system with greater ability to spread any development risk across a much larger and diverse development area.