BY JOHANNA BRICKMAN

ECODISTRICTS

An Opportunity for a More Comprehensive Approach to Sustainable Design

IN MANY RESPECTS, ECODISTRICTS CAN BE VIEWED AS THE NEXT ITERATION OF THE URBAN RENEWAL DISTRICTS THAT ARE NOW SO COMMON IN MANY COMMUNITIES.

A Mixed-Use district should place an emphasis on a variety of uses to include Offices, Entertainment, Housing and Workforce Housing, Retail, Civic, and green space.

I: INTRODUCTION

Even as the concept of sustainable design spreads, and tools like the USGBC's LEED rating system expand in acceptance and application, a movement is taking shape that is driving sustainable design toward a more holistic and systemic approach.

At a conceptual level, we have long been aware of the interconnectedness of things, and we have understood individual buildings to be part of a larger whole – a neighborhood, a larger district, a city and so forth. But for a variety of reasons, whether cost, complexity, political will or knowledge, that whole has rarely been the focus of sustainable design efforts. Instead, a building-by-building approach has ruled.

But eyes are now opening to the limits of that approach, due to the emergence of carbon neutrality as a building benchmark and because performance metrics have made clear that the building-by-building approach to sustainable design has thus far fallen short of achieving the desired environmental benefits.

And so an alternative approach is needed; an approach that views buildings not as individual entities but as interconnected structures capable of producing and sharing resources like water and energy. Indeed, it is only through such interconnectedness that carbon neutral design will be possible on an economically viable scale.

As is so often the case, nature provides us with a blueprint for what an interconnected system of buildings might look like. For example, in an ecosystem all plants, animals and micro-organisms in an area function together with all of the non-living physical factors of the environment, creating a unit of interdependent organisms that share the same habitat. As Janine Benyus explains, in the case of mature forests this interconnectedness manifests in canopy trees sharing CO_2 underground with the root systems of shaded undergrowth, or in differing plants utilizing roots of differing depth to store and share water as needed seasonally.

Similarly, buildings can be coupled to form an EcoDistrict, creating a system where the whole is able to outperform the individual.

II: WHAT IS AN ECODISTRICT

Rob Bennett, the founding Executive Director of the Portland + Oregon Sustainability Institute (POSI), and a former policy manager for the Clinton Climate Initiative, defines an EcoDistrict as "a neighborhood that generates all its energy from on-site renewables, collects and recycles rainwater and waste, and prioritizes pedestrian, bike, and transit access. It combines mixed use, mixed income development, neighborhood scale parks, schools, community centers and services, and enhanced IT infrastructure."

Portland's Pearl District, Denver's LoDo, and Salt Lake City's City Creek all serve as examples of neighborhoods where urban renewal efforts have spawned a slew of LEED-certified mixed-use buildings and other positive developments, including expanded retail opportunities, new mass-transit, and the development of parks and cultural venues. But these neighborhoods do not yet produce their own power or treat their water in a closed loop.

EcoDistricts, however, seek to do just that, leveraging not only new technology and new research but also growing political and economic will to push the boundaries of sustainable design.

To understand how significant this shift is, consider what might be the most prominent domestic example of a systemic approach to sustainable design: Greensburg, Kansas, a town that was all but destroyed by a category 5 tornado in 1999. There, following the tornado, the city council passed a resolution stating that all city buildings would be built to LEED Platinum standards, making it the first city in the nation to do so, and one of the few where the idea of "starting over," however unfortunate, became a reality.

Now, for communities where starting over isn't an option, EcoDistricts are providing a similar opportunity, using performance data from existing LEED certified buildings and the goal of carbon neutrality to expand the sustainable design frontier.

III: FROM VISION TO REALITY

EcoDistricts are being considered in a variety of locations, from college campuses to dense urban neighborhoods, and in many cases a single building project has served as the catalyst for exploring a systemic approach to sustainable design.

In Portland, Oregon, for example, the development of a hotel adjacent to the city's convention center recently sparked the exploration of incorporating an EcoDistrict into the surrounding Lloyd District, a neighborhood that features a variety of businesses; multi-family housing; two sports stadiums; limited greenways; and a number of public transportation options, including light rail and bus, as well as a new streetcar line.

Among the catalysts for this broader exploration are both the political and the physical.

Politically, the state of Oregon and the city of Portland have created entities to help foster both cross-jurisdictional development efforts and broader sustainable initiatives. For example, Oregon Solutions was formed to help address complex issues that require collaborative community governance, including efforts like EcoDistricts that require buy-in from governments, private landowners, developers, and business.

1) The proposed design for the Oregon Convention Center Headquarters Hotel has included means by which the future hotel could take advantage of or contribute to district-wide systems.

2) Food Waste from the district's hotels, the Oregon Convention Center, and the Rose Garden Arena can be tapped to create electricity in an Anaerobic Digestion facility, shown here at the south end of the Oregon Convention Center. Combined with distributed rooftop and building-integrated solar photovoltaic panels, these systems provide grid-tied renewable energy that exceeds what can be achieved by individual buildings. Add to that the future potential for avoiding peak energy demands through Vehicle-to-Grid charging, and the district would have the beginnings of a smart grid.e district's hotels, the Oregon Convention Center, and the Rose Garden Arena can be tapped to create electricity in an Anaerobic Digestion facility, shown here at the south end of the Oregon Convention Center. Combined with distributed rooftop and building-integrated solar photovoltaic panels, these systems provide grid-tied renewable energy that exceeds what can be achieved by individual buildings. Add to that the future potential for avoiding peak energy demands through Vehicle-to-Grid charging, and the district would have the beginnings of a smart grid.

Similar organizations can be found across the country, many of them being formed as communities confront significant economic and environmental challenges – and opportunities.

Indeed, it is the opportunity to transform (and to benefit economically from that transformation) that is driving much of the political will. Thus, just as cities like Portland, Denver, and Salt Lake City have seen their inner cities spring to life via existing urban renewal projects, so too there is hope that EcoDistricts will fuel further economic and physical renewal, coupled with true environmental benefit, including;

Improved Waste Management Solutions: Reducing landfill volumes and minimizing waste collection by using waste to generate electricity.

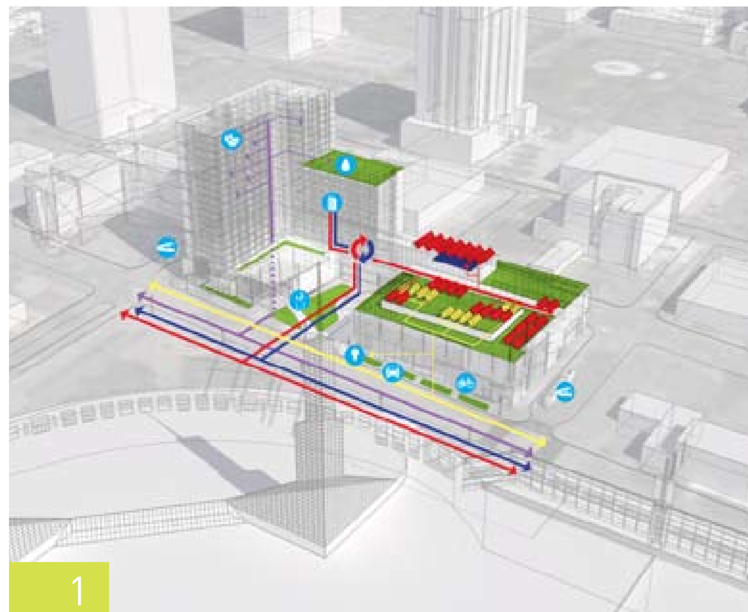
Reduced Carbon Footprint: District thermal systems minimize distributed use of natural gas to generate heating and cooling; decreased vehicle miles traveled due to 24/7 uses and services in district with intermodal transit; increased vegetation and wetland conditions sequester more CO_2 from the atmosphere.

Energy Efficiency: Reduced energy consumption achieves cost savings for district occupants; renewable energy utilized effectively to meet limited loads.

Water Efficiency: Drinking water not used for any use for which potable water is not required.

Stormwater Management, pollution reduction: 100% of stormwater filtered within the district, and either reused or infiltrated so as to recharge natural waterways and aquifers; wastewater treated 100% within the district, eliminating spills of untreated sewage to waterways.

Habitat: Open space planted with species providing shelter and food for avian and riparian species; creating connections across district via habitat corridors to natural areas.



3) Anaerobic Digestion creates waste heat in the production of electricity which is best captured for use in a thermal energy system. Other sources of thermal energy in the district include: the sewer, the Big Pipe project capturing stormwater, and distributed rooftop solar thermal panels.

4) An EcoDistrict can centralize expensive non-potable water use systems such as wastewater treatment, stormwater filtration and storage, and pumping for distribution. These costs can be prohibitive for individual private developers, but third party

IV: CONCLUSION

Achieving true carbon neutrality, as many municipalities and organizations are now mandating, isn't possible unless the built environment as a whole contributes to the solution. While further research and development on the individual building level will likely improve results, and must indeed continue, these efforts must be coupled with systemic approaches to sustainable design.

EcoDistricts provide a framework for such an approach, and in many communities policies are leading to their consideration and potentially to their adoption. What, ultimately, such a district will look like, or how exactly it will operate, is still being debated and considered – in fact they may be highly case-specific. What is more certain is that such districts are critical to achieving significant environmental change in the built environment.

EcoDistricts in Detail

By approaching sustainable design from a systemic perspective, EcoDistricts in essence tie all the buildings in a neighborhood together, creating economies of scale with respect to power generation, water reuse, transit, and so forth, the goal being to create neighborhoods that are truly self-sufficient with respect to water and energy and yet vibrant with regard to retail, culture, urban living, and outdoor space.

The components of such a district are as follows:

A: ON-SITE ENERGY GENERATION

On-site renewable energy generation has to date proven to be a significant hurdle to achieving carbon neutral design, especially in dense urban environments where surface area constraints limit effective solar collection and urban wind energy generation is not yet viable on a large scale or applicable to most locations and building types.

In light of these constraints, architects and engineers have begun to look to alternative power-generation resources, including food waste.

With the dense concentration of restaurants, residences, and offices in cities, food waste represents both an available and a relatively easy waste stream to source-separate and utilize on-site. In addition, food waste represents a land use burden and results in greenhouse gas emissions. As a result, many proposals for EcoDistricts have included waste-to-energy as part of an integrated system, whereby technology could capture either food waste in an anaerobic digestion cogeneration system or all municipal solid waste in a biogasification system to produce both electricity and heat.

Both systems operate on the same principle, whereby microorganisms break down biodegradable material in the absence of oxygen, producing both methane and carbon dioxide rich biogas suitable for energy production. That energy, in turn, would be distributed throughout the EcoDistrict via a Smart Grid, a system that is capable of not only augmenting the electricity produced via biogasification with electricity generated by privately owned or third-party owned photovoltaics, but a system that can also respond to varying user demand.

Of note, the biogasification system significantly reduces the volume and mass of the input materials, and the remaining solids (at least from anaerobic digestion) can be used as a nutrient-rich fertilizer, greatly reducing transportation needs and landfill waste.

B: DISTRICT THERMAL ENERGY

Waste heat generated by the composting and energy generation processes is also of use. Captured as an energy source, that heat can be used to generate hot water for the district, which in turn could be used in heat pumps ownership can make such systems attractive to a variety of district property owners.

5) Surface runoff in the public right-of-way can be managed in part through flow-through-planters incorporated into the streetscape, called Green Streets. Portland's Greater Green program already calls for the use of these Green Street facilities in new construction, which allows filtration to happen on a distributed basis, eliminating that volume's impact on combined sewers as the filtered water can be sent directly to the river or included in the district water reuse system.

throughout the EcoDistrict. Depending upon the demands of the district, heat transfer could be achieved for cooling as well through district chilled water.

Alternatively, an ambient loop could serve as either a heat source or heat sink, and additional heat could also be generated either via solar thermal panels or via waste heat mined from the sewer treatment process.

C: ON-SITE WASTEWATER TREATMENT

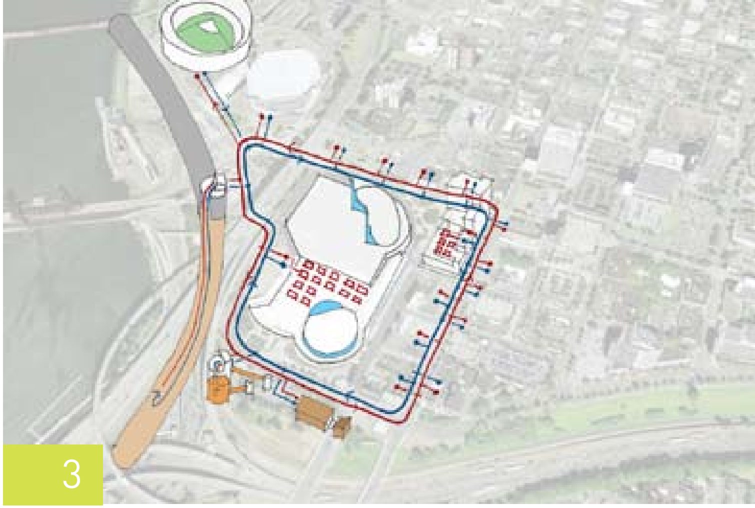
To date, on-site wastewater treatment has proven to be expensive and ineffective, requiring both significant initial investments and high maintenance costs to produce more treated, non-potable water than most buildings create demand for.

An EcoDistrict, however, makes on-site wastewater treatment scalable, spreading the cost of the system over more users and utilizing treated water for more uses. For example, excess non-potable water generated by the treatment facility could be used for functions such as park irrigation or facilities that do not themselves generate sufficient volumes of wastewater to be self-sufficient.

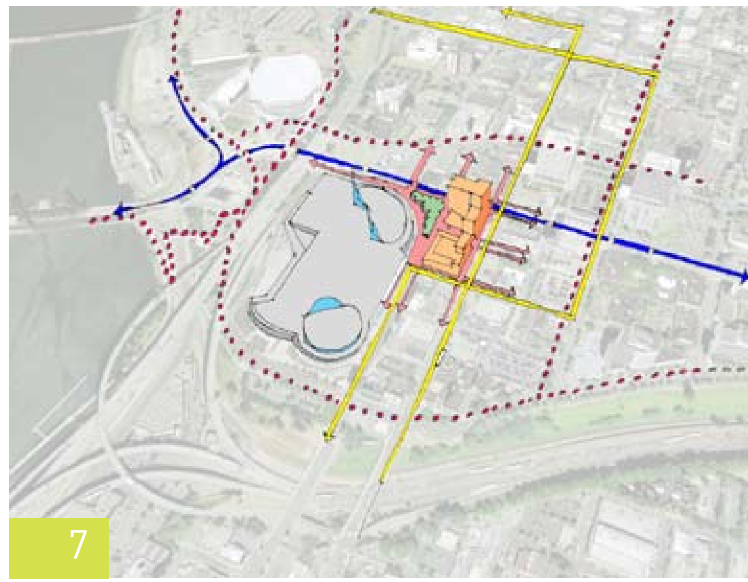
Moreover, by utilizing just one or two systems for wastewater treatment, an EcoDistrict also significantly reduces the energy necessary to support the pumping and redistribution of water, thus reducing energy demand.

EcoDistricts also help address water quality and water quantity with respect to runoff, issues that are especially challenging in dense urban environments that feature large impervious developed areas and significant pollution challenges.

Green infrastructure makes sense for tackling both problems. Codes and policies that encourage green roofs, pervious landscape, and onsite reuse and/or infiltration work hand-in-hand with strategies to distribute the



6) The district can reduce its stormwater impact by further extending the City's strong incentives for private developers to incorporate vegetated roofs and walls on their property.



7) The Lloyd EcoDistrict is located at the East Side nexus of public transportation with 3 Light Rail Lines, multiple bus lines, pedestrian and bicycle routes, and a soon-to-be completed Street Car line. The district has already been considering the creation of dedicated streets for pedestrians and bicycles—which would further reinforce the accessibility of the district.

filtration burden for street runoff to green streets.

With stormwater reuse, a similar benefit could be achieved by sharing the cost of storage, filtration, and pumping over a wide swath of occupants while maintaining the efficiency of providing such services to a smaller area.

In fact, there is already precedent for seeking to control water pollution and for placing the burden on developers to minimize pollutant contributions to waterways, and an EcoDistrict would simply make meeting those targets easier by providing the tools necessary to store and clean the water used in the development before it is infiltrated, reused or returned to rivers. Moreover, in communities facing a slew of water rights challenges, it is important to note that while the water used in an EcoDistrict is used more than once, it does ultimately return to the water table or waterways, preserving downstream flow. The goal is to use water efficiently and less frequently, not prevent it from flowing.

D: TRANSPORTATION

Transportation accounts for 30.2% of the carbon emissions of a conventional existing building, and 137% of a building designed to meet ASHRAE 90.1-2004. But locating green buildings in dense, urban locations, where citizens can access a variety of services within close proximity, reduces those transportation impacts significantly.

Thus, it follows that any EcoDistrict needs to provide for a diverse mix of uses. Ideally, it would also support a strong intermodal transportation system that links pedestrian, bicycle, bus, street-car and/or light rail to achieve ease of transportation within the district.

E: COMMUNITY

The same business/user diversity that reduces the need for transportation also tends to support a socially-diverse community with workforce housing and places for all residents to gather and share community space. Without this physical manifestation of community, residents are either not attracted to living in the district, or they are driven to leave their neighborhood to visit places that provide those needs. Ultimately, any district is viable only when social systems are supported and vibrant. That health drives successful development and the ongoing improvement of shared systems.

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