City of Seattle Outcome-Based Energy Code Pilot
Preservation Green Lab

Summary

In March 2009, the National Trust for Historic Preservation launched the Preservation Green Lab in partnership with the City of Seattle. The Green Lab is a programmatic field office that partners with cities nationwide on policy initiatives that support the reuse and sustainable retrofit of older and historic buildings in order to serve the broader goal of building sustainable cities and mitigating climate change.

The Preservation Green Lab serves as a resource for sustainable development policy, and helps local and state governments reduce GHG emissions associated with the operation of existing buildings, and transportation related emissions associated with irresponsible land use.

- **Policy development** –The Green Lab is partnering with selected municipalities, states and preservation partners throughout the country to create, document and disseminate innovative sustainable development policies which support the reuse of buildings in zoning ordinances, municipal plans, building and energy codes and "climate action plans."
- **Demonstration projects** – The Green Lab is identifying owners of existing buildings within partner cities who are committed to improving energy performance while respecting their buildings' character and architectural integrity, and will work with them to implement retrofits that demonstrate the Green Lab's policy initiatives.

What Does the Preservation Green Lab Do?

In its day-to-day work, the Preservation Green Lab is authoring and analyzing model policies, coordinating demonstration projects, disseminating policy roadmaps, and providing technical assistance to cities around the nation – all in an effort to encourage municipalities and states to fully consider appropriate reuse of the existing building stock. The Green Lab's work is currently focused in five areas:

1. **Energy Codes** – The Green Lab is pioneering a new energy code compliance framework – an "outcome-based energy code" – with focus on existing buildings, based on actual post-construction performance outcomes.
2. **District Energy** – The Green Lab is developing a toolbox of policies and other support tools that will help cities implement district energy systems in neighborhoods of existing and historic buildings with multiple owners.
3. **Life Cycle Analysis –** The Green Lab is completing a national study that quantifies the environmental advantages of reusing buildings, and we will be developing a suite of policy tools to support building reuse, and exploring projects to link this with the city of San Francisco green building code which includes specific mandates and incentives to discourage demolition
4. **Building Energy Retrofits –** In partnership with New Buildings Institute, the Green Lab is providing the research foundation for the Getting to 50 Project, which will make it easier for smaller building owners to retrofit their commercial structures.
5. **Density & Urban Vibrancy** – The Green Lab is developing metrics and policies on why and how to maintain an appropriate balance between reusing existing buildings and increasing neighborhood density through in-fill development.

Outcome Based Energy Codes

More than 40% of the nation's carbon emissions come from the operation of buildings, which makes reusing and improving the energy efficiency of older buildings an essential part of a sustainable future. However, energy codes that are prevalent today do a poor job of encouraging widespread energy retrofits and achieving desired results.

- Current codes are geared to new construction rather than to the individual strengths, weaknesses and opportunities presented by existing buildings
- Current codes can create challenges for existing buildings by prescribing changes that compromise their historic character and detract from their value.
- Code compliance is determined at permit time, with no post-construction accountability for actual performance. Without this feedback loop, recent data shows that both prescriptive codes and predictive models are in many cases not achieving expected outcomes.
- Current codes tend to trail rather than lead innovation. They don't allow for new, unproven approaches for load reduction or local renewable generation, and must constantly be revised to incorporate new learning and new technology.

The Preservation Green Lab has partnered with the City of Seattle and the New Buildings Institute to pioneer a new energy code compliance framework based on actual post-construction performance outcomes. Building owners will have the flexibility to pursue whatever retrofit strategies they deem appropriate to their individual buildings, but would be required to achieve and maintain an aggressive, pre-negotiated performance target. This flexibility will help local owners and tenants of smaller older buildings, owner-occupied businesses, and small entrepreneurial businesses, affordable housing agencies, etc. without compromising ambitious energy efficiency targets. This builds upon local requirements for mandatory annual reporting of actual energy consumption for existing buildings, legislation that the City of Seattle enacted in February 2010 and being implemented in its first phase this year. A third policy element linked to this effort is more extensive sub-metering requirements so that energy loads can be measured by tenant and by load type. Together, these policy elements will capture the combined effects of building design, building equipment commissioning, and tenant behavior, and serve as the foundation for large-scale uptake and market-driven innovations in energy retrofits.

Benefits

Seattle's pilot project was conceived in response to both the challenges of current energy codes, and to anticipated pressure on existing buildings as policy and market forces push buildings toward 'net zero'. From the perspective of the Green Lab, there is a particular urgency to create new solutions for smaller, older buildings, especially those whose character adds to the sustainability value of their neighborhoods and economic value to their owners, and that are often the home to small local businesses and local housing providers.

Smaller, older commercial, mixed-use and multi-family buildings have always played a unique role in incubating the small businesses that serve as engines of urban prosperity. A recent New York Times article about a new breed of local manufacturers in San Francisco and New York reveals that small-scale industry is popping up in cities all over the map, providing living-wage, skilled jobs, and keeping investments and consumer dollars in the local economy. It's noteworthy that these startups frequently locate in old buildings, which provide economic and social opportunity for entrepreneurs from all walks of life – and important employment opportunities contributing to the nation's economic recovery.

These places also serve as magnets to attract people to higher density urban living, resulting in reduced vehicle miles traveled by residents and less pressure for growth on urban fringes. There is evidence that the retention of our old urban buildings actually fosters many of the essential ingredients of attractive urban neighborhoods such as cultural and aesthetic value, human scale, and quite often commercial and residential layouts that attract locally-owned, diverse tenants and encourage interaction. They have also proved over the decades to be extremely adaptable, due to the quality of their materials, their high ceilings, thoughtful siting, thermal mass and natural daylight features.

How big is this opportunity? **The majority of our existing buildings are smaller than we realize** – 95% (by total number) are smaller than 50,000 square feet, 72% are smaller than 10,000 square feet, and more than half are smaller than 5,000 square feet.[1] We also have many buildings that have stood the test of time – almost 18% of buildings were built before 1946, and 30% were built before 1960 – and in general, the older the building stock in a community, the smaller the average building size. This is most evident in the traditional mixed-use "urban village" and "main street" neighborhoods that are driving the rejuvenation of so many American cities and towns. While the compact design and authentic character of these communities yields many sustainability benefits, the small size of their buildings can reduce the physical feasibility and economic viability of energy improvements to individual buildings. Importantly, the application of outcome-based code frameworks to older and smaller buildings will inform application to all buildings.

Each existing building presents a unique set of strengths and opportunities. Current codes were developed with new buildings in mind, and take a 'one size fits all' approach. Existing buildings are not blank slates and many energy saving design measures that make sense in new construction (such as under-slab insulation) are cost prohibitive or simply cannot be applied. The baseline assumptions of both prescriptive and modeled codes are often not appropriate, nor are they calibrated for how a building already performs.

Architectural character translates to economic value. Current energy codes can require changes that damage a building's character, yet many tenants are attracted to older buildings and are in fact willing to pay more for original windows and exposed interior bricks and beams. In order to maintain the economic value of their assets, owners of these buildings need to be able to employ alternative strategies for improving building performance that are not necessarily recognized by current codes. Windows are the most obvious example; original windows are highly valued by owners and tenants, but current codes incentivize window replacement and do not reflect the improvement that can be achieved through rehabilitation—caulking around the window opening on both interior and exterior, adding weather stripping to the window sash, and using a storm window or thermal panel.[2]

Many older buildings perform better than we think they do, and better than much of the newer building stock, due to a variety of passive properties ranging from thermal mass and operable windows to siting, established shade trees, and adjacencies with other buildings. Yet reuse of existing buildings is often ignored, or may be misunderstood in terms of its value and potential. A measured-outcome

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[1] Source: U.S. Energy Information Administration, *2003 Commercial Building Energy Consumption Survey*

[2] Up to 70% improvement in some studies: http://www.scribd.com/doc/35303527/Case-Study-Window-Restoration-Energy-Efficiency-for-110-Year-Old-Net-Zero-Home. A growing body of studies is demonstrating that a historic wood window that is properly maintained, weather stripped, and has a storm window can be just as energy efficient as a new window. An existing window and storm-window combination is in some cases more efficient than a new double-pane window unit alone because the air space between a historic window and the storm provides several inches of added insulation. For more information visit http://www.preservationnation.org/issues/weatherization/windows

regulatory framework would level the playing field, such that buildings that already perform well would be required to do less prescriptively and focus investment more effectively.

Owners will be able to optimize their return on investment. Many owners of smaller older buildings are hard-pressed to come up with the money to pursue aggressive retrofit measures, and are particularly reluctant to do so when codes force them to take a non-optimal approach in terms of the energy savings they believe they could achieve. The flexibility of an outcome-based approach will allow owners to focus investment in what are often the biggest areas for improvement—not fundamentally poor envelope design, but rather envelope maintenance, aging and inefficient equipment, and poor occupant practices (tenant behavior). At a larger scale, codes based on measured performance will allow owners of portfolios of buildings to focus more of their energy performance investment in the buildings where it is most needed and will have the greatest positive impact. At an even larger scale, this approach allows for a community's *aggregate private and public investment* to focus on the most leveraged investments across a district or an entire city.

Outcome based codes can put the value of onsite renewables and low-carbon district energy into the equation. The small size of older buildings can reduce the physical feasibility and economic viability of getting anywhere close to 'net zero' without the help of on-site or district-level clean energy generation. District energy represents an opportunity to invest in renewable energy solutions for buildings with limited space for new energy-saving devices, or for which there would be unacceptable architectural impacts. For older and historic buildings, connection to a district energy system also represents an opportunity to retain or install hydronic heating systems, and therefore reclaim and reuse valuable space taken up by boilers and furnaces, as well as to avoid (or rip out) unsightly ductwork and chases.

Two words: green jobs. Building reuse activities create more jobs than those associated with new construction. Every $1 million spent to rehabilitate a building, as opposed to new construction, results in $120,000 more dollars initially remaining in the community, five to nine more construction jobs created, and an average of 4.7 more new, permanent jobs.

Process & Roadmap

The City of Seattle's outcome-based energy code "roadmap" includes multiple steps that will lead to adoption of an alternative, voluntary energy code path for outcome-based compliance. The expectation is that an outcome-based code path will be part of a suite of energy performance policy tools that will eventually be used in concert. The work plan and associated tools include:

- **Benchmarking and disclosure** – Development of new mandates for annual benchmarking and reporting of energy consumption for existing buildings, a policy that the City of Seattle and several other US cities are pursuing in order to rate performance across their entire building stock, and focus policies and incentives accordingly. [3, 4] It would be difficult for any city to pursue an outcome-based code approach without a disclosure ordinance in place since it lays the foundation for assembling baseline benchmarking data needed to pick appropriate targets.
- **Participation in a regional working group** – A series of charettes sponsored by PGL, NBI and the Northwest Energy Efficiency Alliance. Participants included energy efficiency experts from NBI,

[3] Two states—California and Washington—and five major cities—Austin, New York, San Francisco, Seattle and Washington, DC—have enacted benchmarking and disclosure policies for privately owned buildings. Additionally, the New York City policy requires periodic energy audits and retro commissioning, while the Austin policy requires energy audits (and mandatory upgrades in some cases) for multifamily buildings.

[4] See: http://www.cityofseattle.net/dpd/GreenBuilding/OurProgram/PublicPolicyInitiatives/DPDP018682.asp

the cities of Vancouver and Seattle, NEEA[5], the Pacific Northwest National Laboratory (PNNL) of the US Department of Energy, Architecture 2030, and the Preservation Green Lab.[6]

- **Demonstration projects –** The Green Lab is directing a demonstration program, to guide at least two demonstration projects through the model compliance path process in order to expose policy challenges, and these in turn will inform the development of the model code demonstration ordinance.[7] The Green Lab has identified and evaluated more than 30 potential demonstration projects and is entering formal agreement with one, The Vulcan-owned Supply Laundry Building in South Lake Union, in early August 2011. A second project will be identified in August – among the possibilities are the historic Frye Apartments in Pioneer Square and the Pacific Science Center.
- **Development of a demonstration ordinance** – The Green Lab will develop a demonstration ordinance that will build on learning from the demonstration projects, and allow qualifying projects to follow an outcome-based compliance path. The ordinance will be developed during 2011-2012.
- **Sub-metering and measurement for each load type and each tenant** – Demonstration projects and the demonstration ordinance will inform development of requirements for performance disclosure, sub-metering and automated controls for new lighting and HVAC systems for the outcome-based path, so that building operations can be managed and monitored on a per-tenant, per-load basis. [8] We anticipate that these will be among the only mandatory components of an outcome-based code path.
- **Development of market tools** – The Green Lab's work includes assistance with green leases and green CCRs (for condos), which will allow landlords and ownership associations to incentivize and mandate appropriate energy consumption behavior on the part of their tenants. The Green Lab's complementary projects focused on technical retrofit tools will also support the outcome-based energy code by providing owners of smaller and older buildings with cost-effective retrofit strategies.
- **Influencing the national policy framework** – The work of our regional working group is informing the national conversation around outcome-based codes, as well as development of components of proposed compliance paths for such efforts as the new International Green Construction Code (IgCC).[9] The Green Lab is working with Seattle and NBI, and national partners including AIA, BOMA, and DOE, to draft an outcome-based energy code framework for the IgCC. Also, the Green Lab is a founding member of the Seattle 2030 District and the outcome-based energy code is being promoted as a benefit to 2030 District participants. This relationship is especially promising due to the recent selection of Seattle and the 2030 District as one of three national pilots for the White House's Better Buildings Challenge.[10]
- **Influencing Washington State Energy Code** – The Green Lab and City of Seattle will provide guidance to the State Building Code Council (SBCC) during the next revision cycle, starting in March 2012. The SBCC has expressed interest in adopting an outcome-based framework.
- **Codification** – The Green Lab and City of Seattle will draft energy code language to be incorporated during the next revision cycles of the Seattle Energy Code in 2013 and 2016.

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[5] See: http://www.neea.org
[6] See: http://www.architecture2030.org/
[7] See: http://www.preservationnation.org/issues/sustainability/green-lab/policy-innovation.html
[8] Sub-metering is the installation of metering devices to measure actual energy consumption after the primary utility energy meter. Sub-metering allows verification of energy usage for individual tenants, departments, pieces of equipment or other loads individually to account for their actual energy usage. The installation of sub-meters provides benefits to building owners and tenants, including measurement of actual energy performance (not estimated) that enables analysis of actual usage and costs, and energy management to reduce overall usage and utility costs.
[9] See: http://www.iccsafe.org/cs/igcc/pages/default.aspx
[10] See: http://www4.eere.energy.gov/challenge/

Key Issues

Our immediate challenges are specific to the demonstration program. We are identifying at least one additional demonstration project, and we are so far limited to commercial buildings with historic designation, or landmark status, due to provisions in the State Energy Code. However, the pool of such buildings that have near-term energy retrofits planned is quite small, and we would like to find a multi-family building and/or a non-designated, older building for consideration. This requires petitioning the SBCC and determining the legal parameters of the demonstration program.

This will also inform development of the demonstration ordinance, which must of course be approved by the Mayor and City Council, but first allowed by the State Building Code Council (SBCC), since we intend to test the outcome-based framework on a broad set of existing buildings, not just those that are designated and/or landmarked.

Development of the outcome-based energy code framework is challenging in that it seeks to alter the existing energy code model that has been in place for 40 years. Energy codes are revised in cycles – often three years – with incremental gains according to ever increasing requirements and/or stringency of process. The code enforcement mechanism has always been the authority of a jurisdiction to grant or deny a certificate of occupancy – either a building can be occupied or not, as per code compliance.

However, the outcome-based code framework shifts compliance and enforcement to extend beyond the certificate of occupancy, adding energy consumption factors – tenant behavior, and operations and maintenance – that cannot be regulated using the current method. Some energy code officials are concerned that increased design flexibility and code enforcement not based on certificate of occupancy will result in sub-standard buildings. Thus, the primary challenge to the outcome-based model is creating an enforcement mechanism that ensures building owners will still be held accountable to the *intended* performance requirements of state and local energy codes.

Such a substantial shift in the regulatory environment requires thorough testing of proposed alternatives and collaboration with stakeholders. The Green Lab and City of Seattle are testing enforcement mechanisms through the demonstration program and demonstration ordinance that will allow us to test the proposed framework on a greater number of projects. Our regional charrettes and collaborations with national partners have helped address both technical and process challenges. We are also working with national and regional partners to devise and test enforcement mechanisms for the International Green Construction Code (IgCC). This collaboration allows us to work with national leaders to identify opportunities and challenges for the Seattle development process.

The Seattle City Council can support this work by:

- Providing support to demonstration projects and development of the demonstration ordinance. Support may include providing visibility through Council communications and outreach efforts, encouraging DPD staff allocations for program support, and providing public quotes in support of the outcome-based code pilot and aligned strategies
- Assisting with the State Building Code Council as we enter the demonstration phase and seek to work with a broader range of projects
- Providing regional leadership and facilitating relationships with regional stakeholders, including utilities and agencies that may play a role in code enforcement mechanisms
- Helping promote Seattle's leadership role in national movement toward outcome-based regulatory model