



2011
AIAS / AIA COTE
RESEARCH
FELLOWSHIP

Deep Green Renovation: Broad Scale Strategies for Achieving Deep Energy Savings in Existing Buildings

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2011 AIAS / AIA Committee on the Environment Research Fellowship Recipient

Table of Contents

Acknowledgements

Executive Summary

Synthesis Report

Introduction

Adapting vs. Building New

Retrofitting the Existing Building Stock

Deep Green Renovation

Definition

Deep, Integrated Approach

Advantages to Deep Retrofits

Barriers and Challenges to Deep Retrofits

Broadening the Scope and Scale of Retrofits

The Need for a Broader Scale

Sustainability Initiative Programs

Comparison and Range of Methods

Conclusion

Program Comparison Chart

Program Case Studies

Living City Block

Seattle 2030 District

Portland Sustainability Institute EcoDistricts

Chicago Climate Action Plan

U.S. DOE Commercial Buildings Partnership

Appendix

Additional Resources

Acknowledgements

This report was made possible through a student research fellowship supported by the AIA, AIAS, and the AIA Committee on the Environment (COTE). I wish to extend my gratitude to the COTE advisors who oversaw the development of this project, including Alexis Karolides, Emily Rauch, and Dave Miller, as well as to Kelly Pickard at the AIA. I also wish to thank John Quale at the University of Virginia and Rob Pena at the University of Washington for their indispensable guidance and feedback, and everyone at the UW Integrated Design Lab, including Joel Loveland and Aaron Helmers, for assisting me in the early stages of this research. This report would not have been possible without the assistance and cooperation of the various people who agreed to be interviewed for the project—I appreciate your time and thank you for your contribution.

Executive Summary

The building sector is the largest contributor to climate change in the United States, responsible for almost 50% of the energy consumption and 40% of the carbon dioxide emissions in the United States.¹ In an effort to curb the building sector's impact on climate change, considerable focus has been placed on the design and construction of new "green" buildings. However, until recently, there has been little emphasis on how to improve, adapt, and reuse our existing building stock. In order to dramatically reduce carbon emissions and energy use to a point that can reverse the impacts of global climate change, the energy use of existing buildings must be addressed. While much of the existing building stock was not designed with energy efficiency in mind, retrofits can provide significant and necessary reductions in energy use and carbon emissions. In order to reduce energy use of existing buildings to a point that will curb the impacts of global climate change, the rate of retrofits must be drastically increased and the buildings that are retrofitted must achieve greater savings.²

Deep green retrofits are the key to reducing carbon emissions and energy consumption generated by the building sector. Deep retrofits are defined as building renovations focused specifically on improving energy efficiency that result in 50% energy cost savings over that building's baseline energy use as measured prior to the renovation.³ The typical approach to building retrofits is to "pick the low-hanging fruit," a process that involves doing the most cost-effective, minimally invasive measures that tend to have quick payback period, and tend to yield savings of around 20%. In order to see savings as high as 50% that have higher potential for reducing carbon emissions, a wide range of integrated energy efficiency measures must be implemented that address multiple factors impacting energy use in a building.⁴

Deep green renovations offer a number of advantages including reducing building energy consumption decreasing carbon emissions, and reducing building operating costs. Moreover, buildings that have undergone energy-efficiency renovations command higher rental rates and sale prices, and attract more tenants resulting in higher occupancy rates.⁵ Despite these advantages, a

¹ "2010 Buildings Energy Data Book" (U.S. Department of Energy, March 2011), <http://buildingsdatabook.eren.doe.gov/ChapterIntro1.aspx>.

² Patrice Frey, *Building Reuse: Finding a Place on American Climate Policy Agendas* (National Trust for Historic Preservation, September 2008).

³ Victor Olgay and Cherlyn Seruto, "RMI: Whole-Building Retrofits: A Gateway to Climate Stabilization," *ASHRAE Transactions* 116, no. 2 (2010).

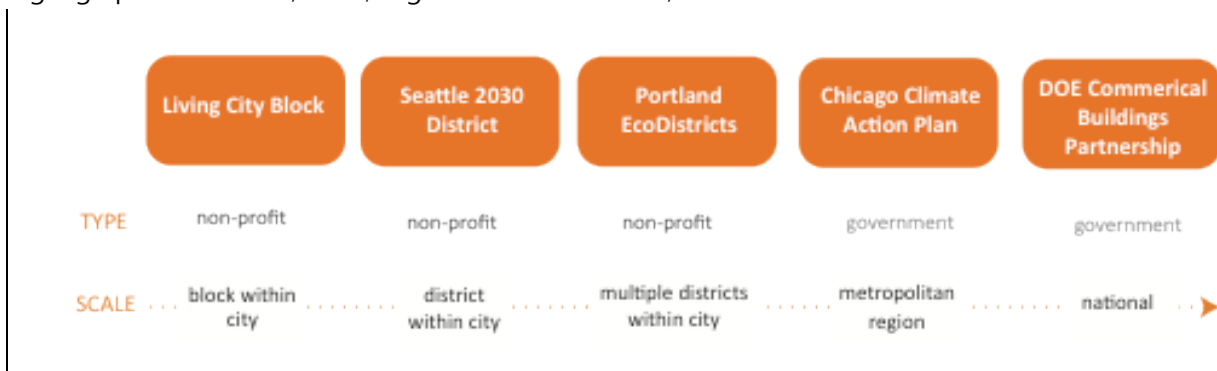
⁴ Dennis Landsberg et al., *Energy Efficiency Guide for Existing Commercial Buildings: The Business Case for Building Owners and Managers* (American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE), 2009).

⁵ *Existing Building Renewal: Deep Energy Renovation: Planning Workshop Summary Report* (Northwest Energy Efficiency Alliance, September 2010).

number of barriers and challenges prevent building owners from pursuing deep retrofits. One of the most significant barriers is financial, as deep energy retrofits require substantial capital investment and most building owners are unable or unwilling to invest the money required for a retrofit, particularly when the payback period is long. Another significant barrier is the lack of knowledge and technical expertise needed for design teams to successfully implement deep, integrated energy efficiency measures into renovation projects.⁶

In order to dramatically reduce energy consumption and curb carbon emissions in the United States, building retrofits must not only be more extensive, but also must occur on a broader scale. The numerous challenges involved in doing deep green retrofits has led to a relative lack of widespread success thus far in achieving retrofits on a broad scale. Broad-scale incentive programs and sustainability initiatives offer the opportunity to achieve retrofits on a deeper and wider scale. Such programs can allow building owners to achieve deeper savings through access to additional resources, technical expertise, and financing mechanisms, among other strategies and are able to focus on achieving deep retrofits on a broad scale by setting performance goals for a collection of buildings in a neighborhood, district, or city.

To examine the capacity for larger scale sustainability initiative programs to achieve retrofits on a deeper and broader scale, five case studies were developed on different programs, each operating at different scales and each aimed at improving energy efficiency in existing buildings. The programs investigated in this report are Living City Block, the Seattle 2030 District, Portland Sustainability EcoDistricts, the Chicago Climate Action Plan, and the U.S. DOE Commercial Buildings Partnership Program. These particular programs were chosen in order to achieve diversity in terms of geographical location, scale, organizational structure, and methods.



The case studies examine the organizational structure, goals, strategies, financing mechanisms, and current status of each program in an effort to identify common strategies being used to overcome the barriers of deep energy retrofits. Common strategies identified across scales include collaboration between key stakeholders, aggregation of building owners within a district, providing technical

⁶ Ibid.

assistance and sharing of best practices, incorporation of building retrofits into a broader sustainability vision, and the development a scalable framework to allow for replication. By developing these strategies to target the widespread implementation of deep, integrated energy efficiency measures, broad-scale sustainability programs are an important component of accelerating the rate and depth of energy efficiency renovations in addition to offering a number of opportunities for architects to be the lead on deep retrofit projects. It is only through the increased scale and scope of existing building renewal that energy use and carbon emissions from the building sector can be lowered to a degree that will curb the impacts of climate change within the United States.

Synthesis Report

Introduction

Adapting vs. Building New

The building sector is the largest contributor to climate change in the United States, responsible for almost 50% of the energy consumption and 40% of the carbon dioxide emissions in the United States. Energy use by the building sector is equal to that of industry and transportation combined and is expected to grow at a faster rate than that of industry and transportation.⁷ In an effort to curb the building sector's impact on climate change, considerable focus has been placed on the design and construction of new "green" buildings. However, there has been little emphasis on how to improve, adapt, and reuse our existing building stock. In order to dramatically reduce carbon emissions and energy use to a point that can reverse the impacts of global climate change, the energy use of existing buildings must decrease significantly. While much of the existing building stock was not designed with energy efficiency in mind, retrofits can provide significant and necessary reductions in energy use and carbon emissions.⁸

Adapting existing buildings as opposed to building new has been shown to save embodied energy, avoid environmental impacts over a building life cycle and avoids generating waste from building demolition. However, many existing buildings are poor performers when it comes to energy efficiency, primarily due to general operational inefficiency and heat loss through windows. Deep green renovation can drastically improve the performance of existing buildings while using less embodied energy over a building life cycle than new construction.⁹

Retrofitting the Existing Building Stock

Reducing energy use and carbon emissions in the building sector is a primary component of reducing overall energy consumption and CO₂ emissions in the United States. With over 75% of the predicted US building stock in 2035 comprised of new or renovated buildings, there is a tremendous opportunity to improve energy performance not only in new construction projects, but also in existing buildings through deep green renovations.¹⁰ Architecture 2030, a leading national nonprofit organization working to decrease greenhouse gas emissions by the building sector, has put forth the challenge to reduce energy consumption in existing buildings by 50% by the year 2030, a level

⁷ "2010 Buildings Energy Data Book." U.S. Department of Energy.

⁸ Frey, *Building Reuse: Finding a Place on American Climate Policy Agendas*.

⁹ Ibid.

¹⁰ "Architecture 2030: A Historic Opportunity," *Architecture 2030*, 2011, http://architecture2030.org/the_solution/buildings_solution_how.

necessary to slow and reverse the impacts of climate change.¹¹ The 2030 Challenge been widely adopted across the architecture and building community in the United States.

However, despite the increased recognition of the importance of sustainable design, there has been little measurable progress in increasing the efficiency of existing commercial buildings. According to the U.S. Department of Energy, the U.S. commercial building stock is no more efficient than it was 25 years ago. The current rate of building retrofits in the United States is around 2.2%, or 2 billion square feet a year.¹² In order to meet the performance targets set by Architecture 2030 and curb the impacts of global climate change, the rate of retrofits must be drastically increased and the buildings that are retrofitted must achieve greater savings. In order to see dramatic reductions in energy consumption in the US, “we need to rebuild with deep comprehensive retrofits that cost effectively reduce energy use by 50% or more” and “for retrofits to achieve their potential in carbon emissions reductions, design teams must design deeper building retrofits that save more energy.”¹³ Increasing both the depth and the breadth of existing building renovations is imperative in reducing the energy consumption and carbon emissions generated by the building industry.

¹¹ “Architecture 2030: The 2030 Challenge,” *Architecture 2030*, 2011, http://architecture2030.org/2030_challenge/the_2030_challenge.

¹² Olgay and Seruto, “RMI: Whole-Building Retrofits: A Gateway to Climate Stabilization.”

¹³ *Ibid.*

Deep Green Renovation

Definition

Deep green retrofits are the key to reducing carbon emissions and energy consumption generated by the building sector. Deep retrofits are defined as building renovations focused specifically on improving energy efficiency that result in 50% energy cost savings over that building's baseline energy use as measured prior to the renovation.¹⁴

Deep, Integrated Approach

The typical approach to building retrofits is to “pick the low-hanging fruit,” a process that involves doing the most cost effective, minimally invasive measures that tend to have quick payback periods. These renovations, which typically consist of lighting retrofits or simple HVAC replacements, tend to yield savings of up to 20%. However, in order to see savings as high as 50% that have higher potential for reducing carbon emissions, a wide range of integrated energy efficiency measures must be implemented that address multiple factors impacting energy use in a building. These measures include upgrades to the building envelope, mechanical systems, lighting and electrical systems, system controls, and changes in tenant behavior. Rather than being considered individually, these measures must be integrated into a comprehensive package in which each measure is evaluated in conjunction with other proposed measures to achieve the most effective overall approach to energy efficiency.¹⁵

Advantages to Deep Retrofits

In addition to reducing building energy consumption and decreasing carbon emissions, deep green renovations offer a number of advantages that can be an important component in motivating building owners and managers to pursue retrofits. Retrofits aimed at energy efficiency can reduce operating costs of buildings leading to a substantially lower utility bill. Buildings that have undergone renovation also tend to command higher rent prices, see higher occupancy rates, higher sale prices, and are able to attract more tenants, particularly sustainability-minded clients.¹⁶

Barriers and Challenges to Deep Retrofits

Despite the number of advantages to deep green renovations, many challenges and barriers make the process difficult for most building owners to pursue. One of the most significant barriers is financial. Deep energy retrofits require substantial capital investment, and most building owners are

¹⁴ Ibid.

¹⁵ Landsberg et al., *Energy Efficiency Guide for Existing Commercial Buildings: The Business Case for Building Owners and Managers*.

¹⁶ *Existing Building Renewal: Deep Energy Renovation: Planning Workshop Summary Report*. Northwest Energy Efficiency Alliance.

unable or unwilling to invest the money required for a retrofit, particularly when the payback period is long. While a number of tax credits and incentives exist for building retrofits depending on building type and location, many building owners are unaware of these opportunities. Traditional lease structures also impact the financial incentives to invest in retrofits as rapid rates of owner and tenant turnover have led most building owners to think in relatively short time frames, thus making “low hanging fruit” improvements with short payback periods more attractive than deep energy improvements that have longer payback periods, despite the significantly higher long-term cost savings. Without a clear business case, many building owners lack the incentive or motivation to pursue deep retrofits.¹⁷

Communicating the value of deep, integrated energy efficiency measures to building owners is a critical component in convincing owners to pursue deep retrofits, but is made difficult by the lack of common vocabulary, shared knowledge, collaboration between key stakeholders involved in the retrofit process. Moreover, design teams often lack the technical expertise and skill set to implement deep, integrated energy efficiency measures into renovation projects.¹⁸

Broadening the Scope & Scale of Retrofits

The Need for a Broader Scale

In order to dramatically reduce energy consumption and curb carbon emissions in the United States, building retrofits must not only be deeper, but also must occur on a broader scale. The numerous challenges involved in doing deep green retrofits has led to a relative lack of widespread success thus far in achieving retrofits on a broad scale. Despite the increasing interest in adaptive reuse and building preservation as a strategy for sustainability, small-scale individual efforts have yielded little success so far in motivating broad scale change. While there have been a number of successful projects yielding significant energy savings (see *NEEA Study: Examples of Deep Energy Savings in Existing Buildings*)¹⁹, such projects are not occurring at a rapid enough rate to mark a significant impact on reducing emissions. Broad scale incentive programs and sustainability initiatives offer the opportunity to achieve retrofits on a broader scale.

¹⁷ Ibid.

¹⁸ Ibid.

¹⁹ New Buildings Institute, *NEEA Study: Examples of Deep Energy Savings in Existing Buildings* (Northwest Energy Efficiency Alliance, July 2011).

Becoming involved in larger initiative programs can help building owners and design teams overcome some of the barriers that often prevent projects from achieving maximum energy use savings. Incentive programs and large scale sustainability initiatives can allow building owners to achieve deeper savings through access to additional resources, technical expertise, and financing mechanisms, among other strategies. Such programs also focus on achieving deep retrofits on a broad scale by setting performance goals for a collection of buildings in a neighborhood, district, or city.

Sustainability Initiative Programs

In order to examine the capacity for larger scale sustainability initiative programs to achieve retrofits on a both a deeper and broader scale, five case studies were conducted on different sustainability initiative programs, each aimed at improving energy efficiency in existing buildings. These case studies examine the organizational structure, goals, strategies, financing mechanisms, and current status of each program in an effort to identify common strategies being used to overcome the barriers of deep energy retrofits. While not a comprehensive look at every program working toward the goal of increasing the depth and breadth of existing building renewals, these case studies are intended to be representational of the various scales, program types, financing mechanisms, and strategies being used.

The five programs investigated—Living City Block, Portland Sustainability Institute EcoDistricts, the Seattle 2030 District, the Chicago Climate Action Plan, and the U.S. DOE Commercial Buildings Partnership—have each identified improving energy efficiency in buildings as a critical component in creating more sustainable, resilient communities. While specific performance targets differ from program to program, all aim to achieve between 30-50% energy savings in existing buildings using a variety of strategies and methods appropriate to their scale and scope of work. Information was gathered through telephone interviews with individuals directly involved with the operations and organization of the program as well as through written materials published by each program. Based on the information gathered through these case studies, this section investigates the common strategies and methods used to achieve deep energy efficiency retrofits on a broad scale.

Comparison and Range of Methods -

	Living City Block	Seattle 2030 District	Portland EcoDistricts	Chicago Climate Action Plan	DOE Commercial Buildings Partnership
Collaboration	X	X	X	X	X
Community Organizing	X		X		
Aggregation Model	X	X	X		
Benchmarking	X	X	X	X	X
Technical Assistance					X
Broad Sustainability Vision	X		X	X	
Scalable Framework	X	X	X		X
Publication of Toolkits			X		X

Collaboration Regardless of the scale and scope of the initiative, each program has identified the importance of collaboration in developing strategies for achieving ambitious performance targets. Collaboration amongst key stakeholders is a critical component in developing an organizational framework that considers all perspectives, in setting performance targets appropriate to the program, and in developing and implementing strategies for deep retrofits and other sustainability initiatives. A collaborative approach is advantageous to all members involved. Building owners benefit from the broad range design and technical expertise, while architecture, engineering, and energy firms gain an opportunity to sell their services to prospective customers. Involving local government and other community groups broadens the scope and awareness of energy efficiency within a neighborhood or city and brings in additional areas of expertise.

- The **Seattle 2030 District** utilizes strategic partnerships between building owners, professional stakeholders, and community stakeholders as a key strategy in developing the framework for the district and defining strategies that consider the perspectives and capitalize on the expertise of all members involved.
- The **Chicago Climate Action Plan's** Retrofit Steering Committee brings together stakeholders from the city government, utilities, energy companies, and building owners to develop strategies for implementing retrofits on a broad scale. Collaboration also allows for the sharing of best practices and lessons learned, and technical expertise amongst stakeholders.

- The **DOE Commercial Buildings Partnership** relies on partnership between building owners, design teams, and technical experts to develop the most cost-effective package of integrated energy efficiency measures for each project that can also be replicated throughout the owner's entire building portfolio.

Community Organizing Community organizing work is often necessary to reach out to building owners within a district or city and to involve owners in setting goals and strategies for the programs.

- **Living City Block** relies on community organizing work to make initial contact with building owners and businesses within the block area and organizes community events such as workshops, charettes, and work groups to determine what the issues are most important to community members and to develop strategies for achieving those visions.
- **Portland EcoDistricts** identify community engagement as a critical step in developing an organizational structure and framework for each EcoDistrict, as the program relies on an aggregation of buildings owners to achieve broad scale sustainability throughout the neighborhood.

Aggregation Model Aggregating building owners under a common goal to achieve deep energy efficiency is important in broadening the scale of deep green retrofits as developing and implementing retrofit strategies one building at a time will not yield the impact necessary to reduce carbon emissions. A district-wide approach allows for the development of strategies appropriate to an entire group of buildings and allows for energy performance to be calculated and measured in aggregate, which can allow for a more flexible approach capable of adapting to a variety of existing building conditions. Aggregating buildings also offers opportunities for district-wide resource sharing which can yield significant energy savings.

- The **Seattle 2030 District** hopes to capitalize on opportunities for district energy and district wide heat through Seattle's existing district utility, Seattle Steam.
- **Portland EcoDistricts** is in the process of implementing district energy in at least one of its pilot projects and sees district energy as a critical component reducing energy use and carbon emissions. Gathering as a district also provides resources and services to members that an individual might not ordinarily have access to.
- **Living City Block** works to aggregate otherwise unrelated building, residence, and business owners into a consortium capable of achieving goals that an individual building owner could

not do alone. Gathering building owners into an association allows Living City Block to create a single point of contact customer to contract with the organization's partners to implement upgrades and to create opportunities of economies of scale on both the implementation and finance side.

Benchmarking In order to set appropriate performance targets and develop a strategic plan for implementing building retrofits, it is critical to benchmark the current performance of existing buildings.

- The **Seattle 2030 District** works with building owner to benchmark energy use using tools such as Energy Star, which allows building owners and managers to measure and track performance as energy efficiency measures are implemented. Benchmarking energy use also allows for programs to prioritize retrofit work by identifying buildings and areas with the highest energy use that are most in need of upgrades.
- The **Chicago Climate Action Plan** has measured energy use per square foot per block throughout the entire Chicago metropolitan region and is using this data to develop a strategic plan for identifying and implementing retrofit projects.

Offering Technical Assistance One of the primary barriers in achieving deep retrofits is the lack of technical knowledge in the design and construction teams. In contrast to low-hanging fruit retrofits that focus on simple measures considered individually, deep retrofits require the careful integration of a number of energy efficiency measures in order to achieve maximum energy saving potential. Many initiative programs work to provide technical assistance to building owners and design teams in order to allow for the successful implementation of deep, integrated energy efficiency measures in retrofit projects.

- The **DOE Commercial Buildings Partnership** offers direct technical assistance in implementing retrofits as both public and private sector technical experts provide support and assistance to building owners and their design teams throughout the life of the project, from design, to construction, and through performance verification and reporting.
- The **Seattle 2030 District** works to facilitate partnerships between building owners and the design teams, energy service providers, and energy efficiency experts that can provide the technical support and knowledge of best practices necessary to achieve deep saving in a retrofit project.

Identifying Financing Mechanisms Financial barriers are one of the primary challenges in achieving deep retrofits. While none of the initiative programs investigated provide direct funding for the implementation of retrofits, most assist building owners in identifying financing mechanisms appropriate to their building location, type, and scale.

Broad Sustainability Vision Setting performance targets for energy use in buildings is only a component of developing a broader vision of sustainable communities. While all programs investigated in this report have are targeting energy efficiency in buildings, several operate under a framework of larger sustainability goals that go beyond the scale of the individual building.

- **Living City Block** targets block-wide sustainable infrastructure projects, including transportation, green streets, and community agriculture, as well as focusing on economic and social sustainability in an effort to create a thriving, resilient neighborhood.
- **Portland EcoDistricts** aims to integrate building, infrastructure, and social systems at a neighborhood scale in order to achieve the aggressive performance targets and to develop a model for a sustainable neighborhood.
- The **Chicago Climate Action Plan** has identified four sustainability strategies in addition to creating more energy efficient buildings, including developing clean and renewable energy sources, improving transportation options, reducing waste and industrial pollution, and adapting to change, that together work to meet the plan's aggressive performance goals and aim to broaden the scope of the Climate Action Plan beyond energy use in buildings to encompass a more holistic vision of a sustainable city.

Developing a Scalable Framework to Enable Replication Developing organizational frameworks and retrofit strategies that can be replicated to other areas is a key strategy for achieving deep retrofits on a broad scale. A number of programs consider themselves as just a seed of what they hope to be a much larger push towards retrofits, and hope to demonstrate success at a small scale that could be implemented at a larger scale.

- The **Seattle 2030 District** has developed its organizational structure, and performance targets to allow for replication to other cities and has so far exported the 2030 District concept to Cleveland.
- **Portland EcoDistricts** is using pilot districts to test strategies

- **Living City Block** intends to take the most successful projects and strategies from the pilot EcoDistricts and scale them up throughout the city of Portland and to export the EcoDistrict concept to other cities in the U.S. PoSI is working with each of these cities to apply and adapt the EcoDistrict concept, framework, and toolkits to each particular place. PoSI hopes to create a network among all EcoDistricts in the nation to maintain a strong connection and facilitate the sharing of information and best practices.

Publication of Toolkits based on Best Practices Publishing toolkits based on best practices and strategies used to achieve energy performance goals

- The **DOE Commercial Buildings Partnership Program** is in the process of publishing a comprehensive series of toolkits aimed at architects, engineers, and building owners and managers to “help drive market replication of project technologies and strategies.”²⁰ Toolkits are informed by data and lessons learned from the energy saving strategies used in CBP projects.
- **Portland EcoDistricts** has developed a framework and implementation toolkit that includes strategies for assessment, governance, finance, and multiple policy support that allow for the replication of EcoDistricts to other cities in the U.S.

Conclusion

While each of the programs investigated are in early stages, all have developed a solid framework from which to begin implementing deep retrofits on a broad scale. Through common strategies including aggregation of building owners, collaboration between key stakeholders, and the development a scalable framework to allow for replication, each program has developed an organizational structure and set of strategies appropriate to its scale and scope. Certain strategies, like community organizing and employing an aggregation model appear to be more applicable to smaller-scale programs like that focus on a collection of buildings within a district or neighborhood, while other strategies, like incorporating building retrofits into a broader sustainability vision, can be employed regardless of the scale scope of the program. A strategy used by each of the five programs investigated is collaboration, indicating the importance of involving a diversity of stakeholders and a broad range of experts in developing the framework and implementation for a successful initiative program.

²⁰U.S. Department of Energy, “Commercial Building Initiative: Commercial Building Partnerships”, 2011, http://www1.eere.energy.gov/buildings/commercial_initiative/building_partnerships.html.

In addition to increasing the depth and breadth of retrofits, broad-scale initiative programs offer a number of opportunities for architects to be the on lead deep retrofit projects. In a number of cases, architects are involved in the actual organization and structure of the program (including development of goals, strategies) and a number of programs consider architects as key collaborators, particularly due to the broad vision they can lend to projects and ability to work as a team leader with building owners, engineers, and technical experts. Moreover, initiative programs can facilitate interactions between building owners and potential design team can spur the rate at which retrofits occur, thereby increasing the number of potential projects for architects and design teams.

Through strategic collaboration and sharing of best practices and strategies for the most effective implementation of deep, integrated energy efficiency measures, broad-scale sustainability programs are an important component of accelerating the rate and depth of energy efficiency renovations. It is only through the increased scale and scope of existing building renewal that energy use and carbon emissions from the building sector can be lowered to a degree that will curb the impacts of climate change within the United States.

Program Comparison Chart

	Living City Block	Seattle 2030 District	Portland EcoDistricts	Chicago Climate Action Plan	DOE Commercial Buildings Partnership
YEAR FOUNDED	2010	2010	2009	2008	2008
LOCATION	Denver, CO Brooklyn, NY	Seattle, WA	Portland, OR	Chicago, IL	Various locations throughout U.S.
PROGRAM TYPE	Nonprofit	Nonprofit	Nonprofit	City government	Federal government
PROGRAM SCOPE	Block within city	Single district within city	Multiple districts within city	Metropolitan region	National
PROJECT TYPE & SCALE	Small scale commercial buildings Neighborhood scale infrastructure	Medium-large scale commercial buildings	All scales of commercial & residential buildings Neighborhood-scale infrastructure	All scales of commercial, residential, & industrial buildings	Medium-large scale commercial buildings
PERFORMANCE TARGETS	50% reduction in energy use in existing buildings <i>(in aggregate)</i>	50% reduction of energy use in existing buildings by 2030 <i>(in aggregate)</i>	To be determined	25% reduction in CO2 emissions by 2020; 80% reduction by 2050 <i>(in aggregate for City of Chicago)</i>	30% savings over ASHRAE Standard 90.1- 2007 for existing buildings
LONG TERM GOALS	Create more resilient urban environments Develop new paradigm for retrofitting existing city neighborhoods	Create high performance building district Develop replicable model Make the business case for deep retrofits	Create sustainable neighborhoods Allow for replication of EcoDistrict concept to other cities	Curb impacts of climate change within Chicago metropolitan region	Develop strategies to allow for replication of best practices across building portfolios
STRATEGIES	Collaboration Community Organizing Aggregation Model Benchmarking Broad Sustainability Vision Scalable Framework	Collaboration Aggregation Model Benchmarking Scalable Framework	Collaboration Community Organizing Aggregation Model Benchmarking Broad Sustainability Vision Scalable Framework Publication of Toolkits	Collaboration Benchmarking Broad Sustainability Vision	Collaboration Benchmarking Technical Assistance Scalable Framework Publication of Toolkits

Case Study: Living City Block

Summary

Location: Denver, CO and Brooklyn, NY

Year Founded: 2010

Program Type: Nonprofit

Program Scope: Block within city

Project Type & Scale: Small-scale commercial buildings, Neighborhood-scale infrastructure

Performance Targets: 50% reduction in energy use in aggregate for exiting buildings

Long Term Goals: Create more sustainable, thriving, and resilient urban environments; develop new paradigm for retrofitting existing city neighborhoods

Strategies: Collaboration, community organizing, aggregation model, benchmarking, broad sustainability vision, develop a scalable framework to enable replication

Background

Living City Block (LCB) is a nonprofit organization that spun out of the nonprofit research organization Rocky Mountain Institute in January 2010. Setting itself apart from larger scale sustainable cities initiatives, LCB targets a much smaller scale and aims to “create a replicable, exportable, scalable and economically viable framework for the resource efficient regeneration of existing cities, one block at a time.”²¹ The organization identifies an area to become a “living city block” and partners with community members, building owners and managers, academic groups, local government, technical experts, and community organizations to identify the strategies that will transform the selected area into a “resilient, regenerative, urban center” through a multi-phase redevelopment process. Retrofitting existing buildings within the selected to become more energy, water, and resource efficient is the cornerstone of this process. The program began with a two-block area of historic downtown Denver and has expanded to include an eight-block area in Brooklyn, New York.

Goals

Living City Block intends to broaden the notion of sustainability beyond energy efficiency and strives to foster sustainable community development in order to make cities more desirable and livable environments. By working one block at a time, the organization’s long-term goal is to “create regenerative and resilient cities that are culturally thriving, energy and resource super-efficient, and

²¹ “Living City Block,” *Living City Block*, 2012, <http://www.livingcityblock.org/>.

economically sustainable.” Improving energy efficiency existing buildings is a key component of this goal, as LCB aims to “create a new paradigm for retrofitting existing city neighborhoods.”²²

Living City Block’s founder Llewellyn Wells says that specific energy saving targets are still being set, but savings of 40%-50% over current actual use are expected for Denver through implementation of energy efficiency measures and long term behavior change mechanisms. Targets might be more aggressive in Brooklyn, where the higher energy prices allow for a shorter payback period on more intensive energy saving measures. In completing deep retrofits across a broad scale, LCB aims to prove the business case for retrofits, convincing building owners that retrofits make sense financially and that there are “clear pathways to financing that work.” Wells argues that the strategy for beginning work on a building or group of buildings is “through the angle and mechanisms of energy efficiency because there are strong business case and economic arguments for why you should do that work.”²³

Strategies

Collaboration Living City Block relies on strategic partnerships and collaboration to achieve its goals. In addition to partnering with community members and building owners within the designated living city block area, the organization collaborates with technical experts, architecture, engineering, and planning firms, local government and city organizations, students and professors from local universities, sustainability groups, city parks and planning departments, various transportation departments, and other NGOs and community organizations in the area. These partners are crucial in allowing LCB to understand and baseline the block and to develop the framework for the redevelopment plan. Commercial partners such as McKinstry Engineering, United Technology Corporation, General Electric, and AT&T among others provide technical assistance and architecture and planning firms contribute to much of the analysis work. The Denver Project received a three-year DOE CBP technical assistance award to hire outside energy engineering and analysis firms, administered through NREL.

Community Organizing Living City Block works with community members and building owners to develop the framework for the redevelopment of the block(s). The organization relies on “old-fashioned community organizing work” to make initial contact with building owners and businesses within the block area and get them involved.²⁴ LCB organizes community events such as workshops, charettes, and work groups to determine what the issues are most important to community members and to develop strategies for achieving those visions.

²² Ibid.

²³ Llewellyn Wells, Telephone interview by author, October 20, 2011.

²⁴ Ibid.

Aggregation Model Living City Block works to aggregate otherwise unrelated building, residence, and business owners into a consortium capable of achieving goals that an individual building owner could not do alone. LCB is working to develop a building owner's association, similar to a homeowner's association contractual agreement, bringing together the various business owners and utility account owners into a separate 501c3 organization. Building owners in the association will be able to contract with LCB to deliver upgrades to buildings with all of LCB's outside partners. The association creates, "a single point of contact customer out of what were a whole lot of disaggregated, very difficult to get at smaller customers to create opportunities of economies of scale both on the implementation side and on the finance side."²⁵ While 100% participation of building owners on the block is not required, a critical mass of square footage, number of buildings, and building owners participating in the block is necessary for the aggregation model to be successful.

Broad Sustainability Vision Living City Block targets larger sustainable infrastructure projects beyond the scale of the individual building, including transportation, green streets, and community agriculture in an effort to create a vibrant, resilient neighborhood. Through implementation of these projects and a focus on economic and social sustainability in addition to resource efficiency, LCB aims to create more "develop a thriving urban community, one in which people of all ages and types chose to live, work, and play."²⁶

Developing a Scalable Framework to Enable Replication Living City Block works at the scale of a block in order to successfully aggregate building owners. Wells says, "if we're going to aggregate building owners, we knew we couldn't take on too large of an area to begin with because this would be hard enough to get a couple of blocks of building owners to come together and agree to do something." The intention is to begin in a smaller area and "plan it so it could spider-wed or trickle out from that smaller area to include more buildings and a larger area over time."²⁷

Financing

Living City block is a 501c3 nonprofit organization funded through philanthropy, government grants, and corporate sponsorships. Actual implementation work is commercially funded as building owners invest their own capital to improve their buildings. Operating similarly to an energy service company (ESCO) model, Living City Block manages the energy and utility contracts for the aggregation of buildings, acquires the financing to pay for the upgrades, and controls the savings from the energy efficiency upgrades. The delta between the old utility account numbers and the lower, newer ones is

²⁵ Ibid.

²⁶ "Living City Block."

²⁷ Wells, interview.

used to pay back the financing package. Block-wide measures, such as street improvements are funded by the city.

Living City Block is working to develop a business and finance model to “ensure that financial markets will provide competitive financing for energy efficiency and renewable energy.”²⁸ To achieve this, the program will package equity and debt financing in unique ways and serve as a 3rd party aggregator for block-wide consortiums. By attracting energy “investors” through the aggregation of building square footage, the program will create returns acceptable to all parties. LCB will provide finance and energy account management services for shared utility rebates and tax credits.

Living City Block Denver was awarded a three-year \$600,000 technical assistance award through the USDOE Commercial Building Partnership program, through which outside energy engineering and analysis firms were hired to determine packages of deep energy efficiency measures.

Involvement of Architects

Architecture, engineering, and planning design teams are expected to be deeply involved in the retrofit projects completed by Living City Block. Wells cites the need for design teams to be involved in a project from an early stage to most successfully determine what the energy efficiency needs and opportunities of a project are, based on the analysis of the existing building. An architecture firm in Denver has helped to establish a neighborhood planning program to identify goals and opportunities and to work with community members to determine their vision for their neighborhood.

Challenges & Lessons Learned

Working on one block at a time has allowed LCB to develop and refine its strategies in one place before moving on to the next location. Wells says that the Brooklyn project was able to move much quicker because “we had learned a lot in Denver so a lot of the lessons learned were able to transfer more quickly in Brooklyn.”²⁹

Status & Next Steps

Both the Denver and Brooklyn projects are in relatively early stages of planning and implementation. Living City Block Denver was launched in Summer 2010 with 16 different buildings, 40 business

²⁸ “Living City Block.”

²⁹ Wells, interview.

owners comprising 750,000sf of aggregated building space. As of November 2010, the Denver project is in the process of finalizing cost estimates on the recommended implementation work in order to continue developing a financing. The Denver project is also in the process of setting up the governance structure for the building owners association. The Brooklyn project was launched in 2011 and consists of an 8-block area in the Gowanus neighborhood. Having benefitted from various lessons learned in Denver, the Brooklyn project is moving along rapidly and is currently at the same stage as the Denver project. Both cities have a pilot building project intended to act as the "driving foundational building project" that can demonstrate the advantages of deep energy retrofits. Both projects are expected to break ground in mid-2012.

Living City Block has established a 6-10 year commitment in each community due to the lengthy community organizing, pre-design, analysis, and financing process that must occur before actual implementation work has begun. Wells estimates this initial phase to be a 3-4 year process after which construction will begin. Wells also cites the need for performance measurement and verification once the retrofitted buildings are in use in order to show occupants how to maximize energy savings.

Replication to other cities and expansion beyond the scale of the block remain the long-term goals of Living City Block. The intention of the two pilot projects in Denver and Brooklyn is to "prove the case for one-block-at-a-time improvement" and "serve as proof of concept replicable throughout the city, United States, and in large urban centers around the world."³⁰

Resources

Living City Block Website:

<http://www.livingcityblock.org/>

Contact:

Llewellyn Wells, President and Founder, Living City Block

³⁰ "Living City Block."

Case Study: Seattle 2030 District

Summary

Location: Seattle, WA

Year Founded: 2010

Program Type: Nonprofit

Program Scope: Single district within city

Project Type & Scale: Medium-large scale commercial office buildings

Performance Targets: 50% reduction of energy use in existing buildings by 2030 (in aggregate)

Long Term Goals: Create a high performance building district in downtown Seattle; develop replicable model other cities can use to create high performance building districts; make the business case for deep retrofits

Strategies: Collaboration, aggregation model, benchmarking, replication

Background

The Seattle 2030 District is a public-private collaboration that has engaged various stakeholders and community members in an effort to create a high-performance building district in downtown Seattle. The district involves a diverse range of members, including building owners and managers, architecture firms, engineering firms, energy service providers, local government, utilities, NGOs, energy and sustainability consulting groups, and community interest groups. The Seattle 2030 District has focused its efforts on privately owned, medium to large commercial office buildings within a defined region in downtown Seattle. It is structured as independent nonprofit organization with a 21-member board of directors representative of the larger group of members, including 10 property owners and managers.

Seattle architect Brian Geller founded the district in 2010 after learning about the *De-Carbonization Plan for Chicago*, a study developed and conducted by Chicago architecture firm Adrian Smith + Gordon Gill. The De-Carbonization Plan examined strategies for resource sharing in commercial buildings in Chicago's Central Loop and was based on the idea that a collection of buildings could go farther to reduce carbon emissions than a single building could do individually (see Chicago Climate Action Plan case study for further information). Geller believed that the idea was applicable to Seattle as a number of features, including a compact downtown, a small number of building owners controlling a majority of the property, and an existing district energy system, made Seattle an ideal place to explore opportunities for district-wide resource sharing. Multiple energy saving initiatives were already underway in Seattle, but all operated separately from one another. The 2030 District provided the chance to unite these various efforts under a common set of goals.

The Seattle 2030 District consists of three types of stakeholders or members: property owners and managers, professional stakeholders, and community stakeholders. New members sign a commitment letter that varies by type of stakeholder, outlining their expectations and role within the district. Property owners and managers commit to benchmark and share their energy use, water use, and transportation data, share their best practices and challenges, and use 2030 performance goals as targets for energy audits. Only building owners of new construction projects commit to meeting specific performance goals—owners of existing buildings do not have to do so to become a member. Professional stakeholders are representatives of for-profit organizations—including architecture and engineering firms—that have services to sell in the district. Professional stakeholders commit to providing an in-kind contribution of time for support to the district, either to consult on a building project or to assist in 2030 District operations. Professional stakeholders benefit from membership in the district because, according to Geller, “if we do manage to move a large number of buildings towards our targets we create a lot of work for them.”³¹ Community stakeholders function much in the same way as professional stakeholders, but are entities—like nonprofit organizations and NGOs—that are not trying to sell a service. In their commitment letters, community stakeholders are asked to specify how they wish to contribute to the district, be it through technical support, advocacy, or any other mode of involvement.

Goals

The district’s mission is to create a high performance building district in downtown Seattle that “aims to dramatically reduce environmental impacts of building construction and operations, while increasing Seattle’s competitiveness in the business environment and owner’s return on investment.”³² The 2030 District has adopted the performance goals set by Architecture 2030, and aims to reduce aggregate energy use in existing buildings within the district by 50% below the national average by the year 2030. The District also aims to develop a working model that other cities and regions can use to reduce their emissions and environmental impacts, and to make the business case for deep energy retrofits.

Strategies

Collaboration Strategic partnerships and collaboration are the primary strategies by which the Seattle 2030 District hopes to achieve its performance goals. This collaboration between stakeholders is intended to allow the district to develop “realistic, measurable, and innovative strategies and solutions

³¹ Brian Geller, Telephone interview by author, November 7, 2011.

³² “Seattle 2030 District”, 2011, <http://www.2030district.org/seattle/>.

to improve building energy performance” that considers the perspectives and concerns of all stakeholders involved.³³ Collaboration also allows for the sharing of information and best practices among stakeholders as each type of stakeholder in the 2030 District commit to sharing their best practices, lessons learned, technical expertise, and consulting services to other members of the district.

Benchmarking The 2030 District works with building owners to benchmark current energy use using Energy Star in order to establish a target of 50% reduction from the national average for that particular building type. This information is shared with auditors to use as a target for their building audits and to establish a strategy for how to reach that specific performance target.

Aggregation Model The district does not mandate that individual existing buildings reach the 2030 performance goals, but rather calculates and measures energy performance in aggregate over the entire district. Measuring the group in aggregate allows for a more flexible approach capable of moving the market more effectively. The 2030 District also hopes to capitalize on opportunities for district energy and district-wide heat. Seattle already has a district energy provider, Seattle Steam, that a number of the buildings in the district currently use. While the 2030 District is not involved in the actual implementation of the retrofits, it acts as a convener to facilitate conversations and meetings between the right groups of people to make sure the appropriate goals are being set and the proper strategies being used to reach those goals. Gathering as a district also provides resources and services to members that an individual might not ordinarily have access to.

Replication The organizational structure and goals of the Seattle 2030 District were developed to allow for replication to other cities. Geller explains, “the replication part of is that we’ve got our goals set, how to measure the goals, how to set the benchmarks, and then what mix of public and private people you need to have around the table to make it work. That’s really what we’re trying to get other places to replicate so that they don’t reinvent the wheel of the whole.”³⁴

Financing

The Seattle 2030 District is a nonprofit organization and receives funding through philanthropy and grants. The district is not directly involved in the financing of particular building projects and is leaving it up to the individual building owner to determine the best financing mechanism for their project. The district has identified a number of financing opportunities for various types of buildings, and is working to inform building owners of the multiple financing options applicable to their project.

³³ Ibid.

³⁴ Geller, interview.

Involvement of Architects

The district includes many architects and architecture firms as members that have been involved in developing the goals and strategies of the organization. Geller, himself an architect, has identified the importance of having architects involved in the process to become a collaborator and team leader of projects as they can bring the ability to coordinate everyone involved and to carry a broader vision of individual project goals.

Challenges and Lessons Learned

Geller considers the major lesson learned to be the importance of clarifying common goals. The national standards of the 2030 Challenge were specifically chosen as the performance goals for the district to avoid a lengthy debate period, though it still took several months to decide if those goals were appropriate and how to measure them. Geller says that he has seen a number of other cities “spin their wheels” trying to establish performance goals, particularly when with climate action plans are used as the basis for goal setting. Because climate action plans are dependent on a government that has the potential to change, Gellar says that “having a non-government based goal set that everyone agrees to is the most important thing” to getting an initiative program going.³⁵

Status & Next Steps

The Seattle 2030 District currently has over 50 committee members and has established a board of directors to help accelerate the planning process. All participating buildings within the district have been benchmarked for their current energy use. Through consultation with various technical experts, the district has developed a “roadmap” for retrofits that outlines an integrated approach to deep green renovation that it will use to guide retrofit projects within the district.

The 2030 District has compiled a series of case studies on buildings within the district that have achieved or are close to achieving a 50% reduction in energy use from the national average for their building type. The case studies are intended to show other building owners that the aggressive energy saving targets are achievable and that buildings within the city are already reaching them. In addition to these case studies, the district is planning to do several pilot projects that can help to demonstrate the possibilities and advantages of deep energy retrofits.

The 2030 District hopes to replicate its basic framework and goals to other cities while allowing for more flexibility in terms of technical solutions and organization structure. The 2030 District has been

³⁵ Ibid.

successful in this endeavor, as the district has already been replicated in Cleveland and is awaiting replication in a number of other cities across the United States.

Resources

Seattle 2030 Website:

<http://www.2030district.org/seattle/>

Contact:

Brian Geller, Founder & Executive Director, Seattle 2030 District

Case Study: Portland Sustainability Institute EcoDistricts

Summary

Location: Portland, OR

Year Founded: 2009

Program Type: Nonprofit

Scope: Multiple districts within city

Project Type & Scale: All scales of commercial and residential buildings; Neighborhood-scale infrastructure

Performance Targets: To be determined; PoSI is in the process of establishing targets for nine performance areas (six environmental and three social)

Long Term Goals: Create sustainable neighborhoods, allow for replication of the EcoDistrict concept to other cities

Strategies: Collaboration, community organizing, aggregation model, benchmarking, broad sustainability vision, replication, publication of toolkits

Background

EcoDistricts is a program of the Portland Sustainability Institute (PoSI), a nonprofit organization founded by Portland Mayor Sam Adams in 2009. The idea for the EcoDistricts program came out of a collective vision from the city's prominent green building community to move beyond what had already been achieved at a building scale and work towards the development of sustainable

neighborhoods. PoSI was tasked with developing the EcoDistrict concept and an implementation strategy.

Portland has long since been a leader in high performance green buildings, and has many sustainability initiatives in place. The EcoDistricts concept weaves together many of these programs into a collective effort under the assumption that an aggregation of programs can achieve more than one program can individually. The hope is to develop deeply sustainable neighborhoods through a broad approach that includes the construction of new high performance buildings, retrofitting existing buildings to be more energy efficient, sustainably managing storm water and drinking water, and other integrated infrastructure projects.

An EcoDistrict is a neighborhood or district that aggregates around a common commitment to “accelerate neighborhood-scale sustainability” in the city through the achievement of “ambitious sustainability performance goals.”³⁶ The EcoDistricts initiative aims to remove barriers in implementing common strategies for neighborhood wide sustainability—energy and water management systems, green streets, resource conservation, building retrofits, among others—through the engagement of community stakeholders and the development of a implementation and enabling plan. Working at the neighborhood scale has allowed each EcoDistrict to develop an individual sense of identity and community that has helped to generate interest in the program. While small enough to be manageable, the district scale is also large enough to have a critical diversity of stakeholders and building types. PoSI has established five pilot EcoDistricts within Portland (South of Market, Lloyd, Gateway, Foster Green, and South Waterfront), each of which consists of a different makeup of building types and scales. Through these pilot projects, PoSI hopes to create replicable and scalable strategies to achieving integrated sustainable development.

While the EcoDistrict projects encompass a much broader scale than the building and plan to tackle sustainable infrastructure projects that impact the entire neighborhood, energy efficiency retrofits are a key component of the overall sustainable development strategy. It is expected that the first significant projects each of these districts implements will be retrofit programs. The Gateway and Lloyd EcoDistricts have both gone through planning and assessment work and are in the process of identifying projects for renovation. The type of retrofit program will depend on the makeup of the district, as the Gateway EcoDistrict will be focused primarily on residential retrofits, whereas the Lloyd EcoDistrict have a commercial retrofit program. Both retrofit programs are intended to take integrated approaches to retrofits, incorporating water use, waste consumption, and transportation in addition to energy use targets.

³⁶ “EcoDistricts,” *Portland Sustainability Institute*, 2011, <http://www.pdxinstitute.org/index.php/ecodistricts>.

Goals

PoSI is in the process of establishing a set of broad-ranging performance goals that each of the pilot districts will agree to meet. The organization has nine categories of performance (six environmental and three social) that each pilot district can adapt to their own specific goals and needs. Individual EcoDistricts will also be able to add performance goals as they see fit.

The long-term vision of EcoDistricts is to take the most successful projects and strategies from the pilot EcoDistricts and scale them up throughout the city of Portland, although the intent is not to create independent EcoDistricts in each of Portland's 95 neighborhoods. Significant interest in the program has been generated and PoSI has begun to export the EcoDistrict concept to other cities in the U.S. PoSI is working with each of these cities to apply and adapt the EcoDistrict concept, framework, and toolkits to each particular place. PoSI hopes to create a network among all EcoDistricts in the nation to maintain a strong connection and facilitate the sharing of information and best practices.

Strategies

Collaboration PoSI has led the development and planning stages of each EcoDistrict and has worked to establish governance structures in each of the districts made up of various stakeholders representative. Currently, each EcoDistrict has its own governing board or steering committee of approximately 10-20 stakeholders and the hope is for each district to become its own independent organization. The governing board of each EcoDistrict relies on a collaboration of diverse stakeholders representative of the district in order to establish specific goals, identify potential projects, and begin the implementation of projects. The make-up of the steering committee is representative of the character of each district. For example, The South of Market EcoDistrict includes Portland State University's campus, so the university is one of the primary stakeholders along with other large property owners. The Gateway EcoDistrict, on the other hand, consists of a diverse mix of stakeholders, including a large health care institution, large and small business owners, residents, and a school district.

Community Organizing Engaging the community is a critical step in developing an organizational structure and framework for each pilot EcoDistrict, as the program relies on an aggregation of buildings owners to achieve broad scale sustainability throughout the neighborhood. Through community outreach and workshops, each EcoDistrict works to develop priorities for sustainable infrastructure projects most appropriate to that neighborhood.

Aggregation Model The EcoDistricts program works to aggregate all building owners within a neighborhood to develop broad, integrated approaches to sustainability. When working at the scale of a neighborhood, aggregating a critical mass of building owners is necessary to see broad implementation through the district. Aggregating building owners into a common effort and developing energy efficiency strategies that target a group of buildings in a neighborhood rather than the individual building also provides opportunities for district-wide resource sharing. PoSI sees the implementation of district-wide energy systems as a key component of significantly reducing energy use and carbon emissions, citing the success of district energy projects around the world as precedents. The Lloyd District is currently in the process of implementing district energy and PoSI hopes that it will spread to other districts. Although the implementation of district energy was initially seen as a large-scale complex infrastructure project, it's looking to be one of the early successes of the EcoDistrict program.

Broad Sustainability Vision The EcoDistricts program aims to successfully integrate building, infrastructure, and social systems at a neighborhood scale in order to achieve the aggressive performance targets set by the city's Climate Action Plan, the Portland Plan, and the Metro Comprehensive Plan. PoSI realized that these goals could not be achieved through sustainable building efforts alone, and saw a need to expand the scope to encompass larger sustainability strategies. Working at a district scale allows the program work faster to implement and refine the integration of systems at a manageable scale that would be more difficult to do at a citywide scale.

Replication & Publication of Toolkits PoSI sees the district scale as a building block from which to create sustainable cities and has developed a framework and implementation toolkit that includes strategies for assessment, governance, finance, and multiple policy support. This framework, refined and developed over a two-year period, has been implemented in each pilot EcoDistrict in order to accelerate the planning and implementation processes. These toolkits will also help to promote the widespread adoption of EcoDistricts to other cities in the U.S.

Involvement of Architects

A considerable amount of the leadership in the concept development and implementation of EcoDistricts has come from the architecture community. Architects who have urban planning skills have brought a sensibility for how a building can relate to a larger neighborhood—the key concept behind EcoDistricts, Naomi Cole, the program manager for the EcoDistricts program, who has experience working for architecture firms, remarks that, “There’s a huge opportunity for leadership around understanding how a building touches down to the ground—that human scale and how it relates to the neighborhood. So I think it’s a huge opportunity for architects to think about how their buildings are actually impacting a neighborhood and a broader community.” Cole also sees well-

designed, high performance buildings, as catalysts for the creation of EcoDistricts, particularly if buildings begin to reach out beyond their own property boundaries to establish a collective approach to energy, water, and waste management.³⁷

Financing

PoSI is a nonprofit organization with funds coming from contributions, grants, and loans. PoSI received \$175,000 in initial funding from the Portland City Council to develop the EcoDistrict concept at the time of the organization's founding in 2009. Portland Development Commission has continued to help fund the organization through \$742,000 in pilot grants to continue the development of the EcoDistricts framework.

The financing mechanism for the retrofit work and other sustainable development projects is still being determined and will vary by district. PoSI will not fund the actual project implementation, but will be deeply involved in identifying financing mechanisms appropriate to each district. The organization is hoping to take advantage of the emerging commercial PACE financing model in the Lloyd District, a primarily commercial neighborhood. Retrofits in the primarily residential Gateway district are likely to emerge from a packaging of a range of different existing program that provide financing options and incentives for home retrofits. These existing programs include the nonprofit Community Energy Project, Clean Energy Works (on-bill financing), the Energy Trust of Oregon's energy efficiency program, and Solarize Portland, a program that utilizes bulk purchasing of solar panels.

Challenges & Lessons Learned

Engaging the community and aggregating stakeholders towards a common goal was one of the biggest and most unexpected challenges the EcoDistricts program faced in its early stages. PoSI did not anticipate the level of community organizing work that would be required to convince community members of the value proposition of EcoDistricts specific to their neighborhood. However, the organization also sees the time and effort spent on community outreach as of the biggest successes and lessons learned of the program, having now established strong leadership in each district. The organization considers the biggest lesson learned thus far to be the importance of getting the engagement process right. Naomi Cole states that, "if you don't get the [the engagement process done right or if you don't take the time to do it, every decision and step along the way is going to be a pain-staking process because people aren't there—they don't quite get it."³⁸

³⁷ Naomi Cole, Telephone interview by author, November 18, 2011.

³⁸ Ibid.

Status & Next Steps

The five pilot EcoDistricts are in an early implementation stage having gone through over three years of planning. For the first year and a half of the program, PoSI worked to develop the EcoDistrict concept and framework before bringing it to the specific pilot districts. The organization worked with each district for another year and a half to organize stakeholders and go through a rigorous assessment process to set baselines, identify the most high impact projects for each district, and to develop an implementation plan specific to each place. The Gateway EcoDistrict is expected to be the first district to begin physical implementation work, with the first round of building retrofits expected to begin in Summer 2012. PoSI is also working with several districts to develop integrated infrastructure master plans that aim to achieve higher performance through integrated district energy, water, and waste systems.

Mayor Sam Adams is still deeply involved in the project, and through his role on PoSI's Board of Directors, has helped to promote the EcoDistrict concept worldwide to expand international partnerships. Since 2009, PoSI has held an annual multi-day EcoDistricts Summit that brings together leaders in sustainable development around the world to share best practices and further develop and promote the EcoDistrict concept.

Resources

Portland EcoDistricts website:

<http://www.pdxinstitute.org/index.php/ecodistricts>

Contact:

Naomi Cole, Program Manager, Portland Sustainability Institute

Case Study: Chicago Climate Action Plan

Summary

Location: Chicago, IL

Year Founded: 2008

Program type: city government

Scope: Metropolitan region

Project type & scale: All scales of commercial, residential, and industrial buildings

Performance Targets: 25% reduction in CO₂ emissions by 2020; 80% reduction by 2050 in aggregate for City of Chicago

Long Term Goals: Curb impacts of climate change within Chicago metropolitan region

Strategies: Collaboration, benchmarking, broad sustainability vision

Background

The Chicago Climate Action Plan (CCAP) was launched by the City of Chicago in September 2008 as a large scale, comprehensive effort to reduce greenhouse gas emissions within the Chicago metropolitan region. Grounding the plan in research was a critical step, and prior to setting any goals, the city completed an in-depth analysis on the global and Chicago-area impacts of climate change and commissioned an emissions inventory for the Chicago region. The emissions inventory, prepared by the Center for Neighborhood Technology, found that in the greater Chicago Region, 60% of emissions were coming from buildings, 20% from transportation, and 10% from waste and industrial processes. Based on these findings, a set of goals and mitigation strategies was developed to drastically reduce emissions and the impact of climate change in the region. The city developed the CCAP, a road map of 5 strategies (energy efficient buildings, clean and renewable energy sources, improved transportation options, reduced waste and industrial pollution, and adaptation) that together aim to significantly reduce the city's carbon emissions. The plan has brought together the City of Chicago, researchers, non-profit organizations, community and environmental groups, and corporate partners in a collective effort to mitigate Chicago's contribution to climate change.

"Energy efficient buildings" is the primary strategy outlined in the CCAP, as energy use in buildings is currently a source of 70% of the carbon emissions in the city of Chicago and 60% of emissions in the metropolitan region. Chicago has over 23,00 commercial, institutional, and industrial buildings and over a million residential buildings. It is estimated that improving the energy performance of this existing building stock could account for 30% of total Chicago greenhouse gas reductions by 2020. The "energy efficient buildings" strategy outlines eight actions that will work together to achieve this target, including retrofitting commercial and institutional buildings, retrofitting residential buildings,

trading in appliances, conserving water, updating city energy codes, establishing new guidelines for renovations, cooling with trees and green roofs, and taking easy steps.

In 2009, the CCAP formed the Chicago Retrofit Steering Committee to focus on the first two actions of the energy efficient buildings strategy: retrofitting commercial and industrial buildings and retrofitting residential buildings. The Steering Committee is comprised of a number of public and private sector stakeholders including the City of Chicago, consulting firm Booz & Co, utility companies ComEd, Peoples Gas, and NiCor, the Community and Economic Development Association of Cook County, the Northern Illinois Energy Project, the Illinois Science and Technology Coalition, the Illinois Department of Commerce and Economic Opportunity, and the Chicago Metropolitan Agency for Planning. A retrofit program director helps organize these stakeholders to coordinate and collaborate towards a common goal. The Steering Committee is working to develop a comprehensive retrofit implementation plan, to develop financing tools for all building sectors, and to establish an online information system (energyimpactillinois.com) intended to connect home and building owners to financing options and vendors to implement energy efficiency work.

Retrofits counted toward the CCAP targets encompass everything from lighting upgrades to more holistic weatherization projects, resulting in energy use savings of 10-30% based on the specific energy savings measures employed. In addition to these smaller scale efforts, a number of deep retrofits have been completed on large commercial buildings, including the Sears Tower and the Richard J. Daley Center. The Daley Center, one of the most successful retrofit projects completed under the CCAP with funding from the Clinton Climate Initiative, resulted in a 54% decrease in energy use and a 62% decrease in water consumption.

Actual retrofit implementation is done through a number of existing programs in the City, each targeted at different building sectors using a variety of financing mechanism. The Chicago Climate Action Plan and the Retrofit Steering Committee are working to inform residents and building owners about programs and financing mechanisms that exist and point building owners to contractors that complete the actual retrofit work.

Goals

Through the Climate Action Plan, the city of Chicago hopes to reduce carbon emissions 25% by 2020 and 80% by 2040 over 1990 greenhouse gas levels. Through actions taken in all five mitigation strategies, this represents a reduction in greenhouse gas emissions of 15.1 million metric tons of CO₂ equivalent by 2020.

The energy efficient buildings strategy accounts for 30% of total Chicago greenhouse gas reductions, or 4.6 MMTCO₂E by 2020. In line with these greenhouse gas reduction targets, the CCAP hopes to retrofit 9,200 commercial and industrial buildings at a 30% energy use reduction rate, representing 1.3 MMTCO₂E reductions in emissions, and 400,000 of the 1 million residential housing units in Chicago also at a 30% rate, representing a potential greenhouse gas emissions reduction of 1.44 M MMTCO₂E by 2020.

Strategies

Collaboration From its conception, the CCAP has relied on a collaboration of leaders from business, civic, environmental, foundation, and nonprofit organizations throughout the city to develop the plan and provide input on the input on plan's emissions reductions goals. The Retrofit Steering Committee utilizes this approach as well, and has brought together a number of public and private sector stakeholders to develop and implement a comprehensive retrofit plan.

Benchmarking & Prioritizing Buildings for Retrofits At this point, the Steering Committee does not identify individual buildings for retrofits, and instead focuses on reaching out to home and building owners to take advantage of the retrofit program. This approach might change, however, as the CCAP, working with the consulting firm Accenture, has completed an analysis of building energy use by census tract to identify several potential energy efficiency target zones throughout the city. The study calculated energy use per square foot per block for the entire city, and tiered low, medium, and high energy use per building per block in the city to identify the most energy inefficient buildings in the city that are most in need of retrofits. The CCAP is also focused on identifying buildings for retrofits in low-income areas, where home and business owners would benefit the most from decreased energy costs. In addition to these factors, identifying areas in the city with urban heat island effect and areas with existing green infrastructure and initiatives will help the city prioritize what buildings should be targeted for retrofits.

Broad Sustainability Vision Each of the five strategies of the Climate Action Plan are intended to complement each other and work together to reach greenhouse gas reduction goals. The diversity of actions, including conserving water, developing clean and renewable energy sources, improving transportation options, reducing waste and industrial pollution, and adapting to change, have broadens the scope of the Climate Action Plan beyond energy use in buildings to encompass a more holistic vision of a sustainable city.

Financing

The CCAP works with a variety of partners and has received grants from various sustainability-minded foundations in Chicago as well as state and government grants to help leverage funds for the retrofit work. A portion of funding directed towards retrofit work comes from the Illinois Energy Efficiency Portfolio Standard, a bill that collects taxpayer fees into a fund that the utilities spend towards residential and commercial, and industrial energy efficiency programs. Settlement money from a lawsuit against a Chicago area utility has also been used to fund a significant amount of the energy efficiency and retrofit work. The CCAP retrofit initiative also works with existing energy efficiency incentives, including ones through the utilities, to help identify funds for implementation work.

Involvement of Architects

The CCAP's collaboration of partners from various fields has provided a number of opportunities for architects to become involved in the planning and development of strategies to meet the plan's performance targets. Acting as a key consultant in the energy efficient buildings strategy, Chicago-based Architecture firm Adrian Smith & Gordon Gill developed the "De-Carbonization Plan for Chicago" which outlines a methodology for meeting the CCAP's emissions reductions goals within Chicago's Central Loop.

Challenges & Lessons Learned

The CCAP is a city-government sponsored program, which despite its advantages in terms of reaching a broad area and establishing a wide range of partnerships has presented several challenges. According to Olivia Cohn, who works on performance metrics for the CCAP, teaching out to residents to inform them about energy efficiency and retrofit programs has been difficult to do, as residents have "a tendency not to trust the city government." To help reach out to more people and inform them about the program, the CCAP has partnered with a number of groups that people are more likely to trust, including religious organizations and community block organizations so that "it's not just the city government walking up to the door."³⁹

Changeover in administration has not presented a major problem for the goals of the plan as both former Mayor Richard Daley (who initiated the plan) and the current mayor, Rahm Emanuel, consider energy efficiency to be a top priority. However, the changeover will likely result in a restructuring of the CCAP as the current Department of the Environment is being eliminated due to budget constraints.

³⁹ Olivia Cohn, Telephone interview by author, November 15, 2011.

Status & Next Steps

Since 2009, more than 13,000 residences and 390 businesses have been retrofitted under the CCAP, resulting in approximate energy savings of 21%--a rate expected to increase to 30% rate in future years after the implementation of several lessons learned in the initial phase of retrofits. The energy efficient buildings strategy alone has resulted in a .33 MMTCO₂E reduction in emissions. In its first two years the CCAP has achieved 8% toward the 2020 goal of a reduction of 15.1 million metric tons of CO₂ equivalent based on actions taken from all five mitigation strategies. The rate of savings is expected to increase once the clean and renewable energy strategy sees more market up-take. Based on consultation with a number of data owners, the CCAP appears to be on track for meeting its 2020 targets.

At this point, the CCAP has approximately \$900 million in public and private funds dedicated to improving energy efficiency in the region based on the comprehensive retrofit plan and to simplify the retrofit process to accelerate market transformation.

Resources

Chicago Climate Action Plan Website:

<http://www.chicagoclimateaction.org/>

Contacts:

Olivia Cohn, Performance Metrics, Chicago Climate Action Plan

Tom Jacks, Retrofit Steering Committee, Chicago Climate Action Plan

Case Study: DOE Commercial Buildings Partnership

Summary

Location: Various locations throughout United States

Year Founded: 2008

Program Type: Federal government

Program Scope: National

Project Type & Scale: Medium-large scale commercial buildings

Performance Targets: 30% savings over ASHRAE Standard 90.1-2007 for existing buildings

Long Term Goals: Develop strategies to allow for replication of best practices across owner's building portfolio

Strategies: Collaboration, benchmarking, technical assistance, replication, publication of toolkits

Background

The Commercial Buildings Partnership (CBP) Program is a public-private, cost-shared initiative sponsored by the United States Department of Energy (DOE). The program organizes collaborations between private building owners, representatives and technical experts from the DOE national laboratories, and other private sector experts. Together, the teams explore energy-savings measures to apply to specific commercial building projects. The CBP is aimed at increasing energy efficiency in both new and existing buildings and focuses on all types and scales of nonresidential buildings, including retail stores, grocery stores, university buildings, housing development, storage facilities, and office buildings.

The program consists of two currently ongoing phases, designated as CBP-1 and CBP-2, that differ slightly in structure and funding mechanisms. In CBP-1 the first phase of the program initiated in 2008, technical experts from the national laboratories work with approximately 18 corporations, known as "partners" that each hold large portfolios of buildings. Working directly with experts from National Renewable Energy Laboratory (NREL) or Pacific Northwest National Laboratory (PNNL), these selected building owners have a choice to retrofit an existing building in their portfolio, work on a new construction project, or do both. In 2010, the DOE received funding through the American Recovery and Reinvestment Act (ARRA) to begin a new phase of the program, designated as CBP-2. A call for solicitations was put out to potential partners who proposed potential building projects—either new construction or retrofits of existing building. Outside technical contractors are hired by the national labs to provide the technical assistance the labs provided directly in CBP-1.

In each both phases of the program, partners sign letters of intent to participate in the program, demonstrating their willingness to meet the aggressive energy saving targets in their building projects and their intent to replicate successful energy efficiency measures and technologies throughout their building portfolios.

Goals

The mission of the Commercial Buildings Program is to accelerate the rate of and increase the scale energy efficiency projects in the United States by “demonstrating low-energy technologies and strategies in commercial buildings.”⁴⁰ CBP has set specific energy saving targets for each new and retrofit building project completed under the program. Retrofit projects completed under CBP-1 are aim to consume 30% less energy than either ANSI/ASHRAE/IES Standard 90.1-2004 or current energy consumption, and new construction projects aim to save 50% over 90.1-2004. In CBP-2, new construction projects aim to consume 50% less energy over 90.1-2007 and retrofit projects aim to save 30% over 90.1-2007. The DOE determined these specific targets in the early stages of the program, prior to the selection of any specific building projects.

Actual savings depend highly on the building project. While there are no current plans to increase the energy saving targets for retrofit projects beyond 30%, anticipated and modeled savings for some retrofit projects have shown potential savings of up to 45%. The long-term goal of the CBP program is to develop replicable energy saving strategies (through the “showcase” projects done with the CBP) that building owners can apply throughout their building portfolios.

Strategies

Collaboration The collaboration of building owners and technical experts is intended to allow for the exploration of energy-saving strategies and ideas that “could be too expensive or technologically challenging to tackle without the resources and technical expertise available through CBP.” Experts from the DOE national laboratories use their knowledge and familiarity with the building technology industry to work with partners and their design teams to explore both cost effective and readily available energy saving technologies as well as more cutting edge strategies aimed at achieving deeper energy savings. Achievements in the implementation of newer, deep energy saving technologies are intended to “spur development of next-generation commercial buildings by demonstrating what is possible and by creating market demand for pioneering technologies.”⁴¹

Technical Assistance Both public and private sector technical experts provide support and assistance throughout the life of the project, from design, to construction, and through performance verification and reporting. Technical teams from the national laboratories work with building owners and their design teams to identify appropriate energy efficient technologies for all building systems and use energy modeling to determine the most economical, effective and integrated approach for energy saving. Once design and construction is complete, DOE teams are also involved in collecting building performance data, monitoring and verification of energy saving systems, and data analysis.

⁴⁰ U.S. Department of Energy, “Commercial Building Initiative: Commercial Building Partnerships.”

⁴¹ Ibid.

Replication Experts from the national labs work with building owners to replicate energy efficiency strategies throughout their larger building portfolios, where applicable. By selecting building owners who are dominant in their industry, the hope is that these corporations will provide leadership in advancing energy efficiency efforts throughout the commercial building sector. Moreover, both public and private sector technical experts are able to incorporate innovations and lessons learned from CBP projects into the broader marketplace as well as take advantage of published business and technical information about CBP projects for use in non-CBP work, thus increasing the speed at which the new technologies are becoming standards.

Publication of Toolkits The CBP is in the process of publishing a comprehensive series of toolkits aimed at architects, engineers, and building owners and managers to “help drive market replication of project technologies and strategies.”⁴² Toolkits are informed by data and lessons learned from the energy saving strategies used in CBP projects.

Financing

Both CBP-1 and CBP-2 are set up as shared-cost initiatives. Building owners are responsible for all construction and building operating costs, and work with their own design team. The DOE funds all technical assistance provided by the national laboratories and outside contractors hired by the national labs. Technical expertise in CBP-2 is funded through the American Recovery and Reinvestment Act of 2009 (ARRA). Providing financing to the building owner for the actual design and construction of the project is not a primary component of the CBP program, although the program will make owners aware of outside funding opportunities or incentives if they are known and applicable to the project.

Involvement of Architects

Partners work with their design teams as they normally would—many partners are large corporations who have in-house design teams or have consulting design teams. Experts provided by the CBP work with these design teams and the building owners to provide energy modeling, expertise, and technical assistance on potential energy saving measures. Michael Baechler, the program manager for the CBP projects at the PNNL, says, “...we try to introduce design approaches and design tools to the design team. The partner makes the selection in terms of what measures they’re willing to pay for

⁴² Ibid.

and adopt. We try to hit those efficiency goals but stay within the business criteria of the partner...we see our goal as trying to both educating the design team, exposing them to these advanced models, and also learning from the design teams."⁴³ While the CBP only provides technical assistance on one to two projects for each partner, partners typically continue to use the same design teams for future building projects. The hope is that these design teams will incorporate successful energy saving measures learned from CBP projects into future projects in the owner's building portfolio. Moreover, technical experts from the labs rely on the partners' design team to understand the nuances of the design process that a particular owner or corporation wants to follow.

Challenges & Lessons Learned

Baechler cites the economic downturn as the biggest challenge the program has faced thus far as the solicitation for CBP2 just prior to the hit on commercial real estate in 2009. Baechler says, "...a lot of our partners, even really big name brand organizations that have lots of buildings—lots of public buildings that you see every day—they just didn't want to build anything for a long time. The economy just really slowed them down." Despite financial challenges, Baechler explains that the partners involved in the CBP program "for the most part wanted to be doing what we were doing. They saw highly aggressive energy efficient buildings as a good thing... they were willing even to invest more in energy efficiency than they might otherwise have been so if anything maybe the bias went the other way."⁴⁴

Incorporating packages of energy efficiency measures within the partners' business criteria has also been a challenge. Since many of the partners are large corporations with branding criteria that extends into the layout and appearance of their buildings, technical experts have to work around tight constraints on particular projects to work around the process, branding, and economic criteria of partners. In most cases however, national lab reps have been successful in finding packages that worked through collaboration with partners and their design teams. When speaking of lessons learned from working with design teams to overcome particular constraints, Baechler says that "I think the key lesson learned was that to be most successful it's about integration and bringing the advanced modeling capabilities and the familiarity with energy efficiency of the national lab and putting that on the table along with what the design team has to offer, and remember that the partner, the owner of the building is a part of that design team, and what they have to offer in terms of organizational changes they can make and priorities they can set—its really working that through that as a team that brought us our most successful results."⁴⁵

⁴³ Michael Baechler, Telephone interview by author, November 7, 2011.

⁴⁴ Ibid.

⁴⁵ Ibid.

Status & Next Steps

CBP projects are competitively selected, with one round of selections in 2008 and another in 2010—the latter through a solicitation funded by the American Recovery and Reinvestment Act. The CBP currently has 42 partners that represent some of the largest building owners and operators in the United States. 27 new construction projects and 27 retrofits projects are currently underway, representing approximately 8.3 million ft² of commercial real estate across a diverse spectrum of commercial building types and scales. Moreover, partners have committed to integrating the energy efficiency technologies and strategies from their CBP projects throughout their building portfolios, representing almost 4 billion ft² of additional commercial real estate in the United States.⁴⁶

A typical project takes about five years from a length pre-design period, through design, construction, and measurement and verification. The 54 projects currently underway are each at various points along that process. Once these initial “showcase” buildings have been completed, the focus will shift to developing replicable strategies that owners can use across their building portfolios. Baechler says, “I would hope is that whether 10 years out or 20 years out, these measures are replicated across these portfolios and then these same companies become leaders within their industries and that we see their industries also adopting these technologies. That’s going to be a longer-term goal of course, because we don’t have direct impact on their other industry colleague’s portfolios like we do with our partners, but hopefully that’s the way the momentum goes. Replication is the name of the game.”⁴⁷

Resources

U.S. DOE Commercial Buildings Partnership Program Website:

http://www1.eere.energy.gov/buildings/commercial_initiative/building_partnerships.html

Contact:

Michael Baechler, Senior Program Manager, Pacific Northwest National Laboratory (PNNL)

⁴⁶ “Commercial Building Partnerships Factsheet” (U.S. Department of Energy, July 2011).

⁴⁷ Baechler, interview.

Appendix: Additional Resources

Retrofit Research Initiatives

The following organizations are deeply involved in researching strategies used to achieve up to 50% energy savings in existing building retrofits and offer a number of resources and publications on deep energy retrofits.

Better Bricks/Northwest Energy Efficiency Alliance (NEEA) Existing Building Renewal Initiative

The Northwest Energy Efficiency Alliance has launched an Existing Building Renewal Initiative to motivate and assist building owners in the Pacific Northwest region to “conduct deep, whole building energy efficiency retrofits” on existing buildings. NEEA commissioned the reports “Deep Savings in Existing Buildings” and “A Search for Deep Energy Savings” which include case studies on deep energy retrofits in the Northwest. Both studies were conducted by the New Buildings Institute (NBI) and are available on the NEEA Existing Building Renewal Initiative website.

<http://www.betterbricks.com/design-construction/existing-building-renewal-initiative>

New Buildings Institute (NBI)

The New Buildings Institute has compiled a database of buildings in the United States that have achieved 50% energy savings over current code requirements. In addition to new construction projects, the database includes a number of retrofit projects.

<http://www.newbuildings.org/advanced-design/getting-50-beyond>

Rocky Mountain Institute (RMI) Retrofit Depot

RMI’s Retrofit Depot offers a comprehensive resource on deep energy retrofits, including case studies on successful deep retrofit projects, an explanation of the retrofit process, and a database of resources and tools for building owners and design teams.

<http://retrofitdepot.org>

Preservation Green Lab (PGL)

The Preservation Green Lab was established as a part of the National Trust for Historic Preservation’s Sustainability Initiative to develop and promote policy that support to the reuse and retrofitting of existing buildings in the context of city and state sustainability initiatives. The PGL website includes a number resources and case studies on policy innovation and best practices.

<http://www.preservationnation.org/issues/sustainability/green-lab/>

| **U.S. DOE Commercial Building Initiative [Advanced Energy Retrofit guides](#)**

The U.S. DOE Commercial Buildings Initiative, working with the Pacific Northwest National Laboratory, is in the process of developing a series of Advanced Energy Retrofit guides, each focused on a different building type. The guides, aimed at building owners and design teams, are intended to provide recommendations for selecting and implementing energy efficiency strategies specific to that building type and location.

| Advanced Energy Retrofit Guide for Office Buildings

http://apps1.eere.energy.gov/buildings/commercial_initiative/resource_database/detail.cfm?p=5

| [37](#)

| Advanced Energy Retrofit Guide for Retail Buildings

http://apps1.eere.energy.gov/buildings/commercial_initiative/resource_database/detail.cfm?p=5

| [38](#)

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http://architecture2030.org/2030_challenge/the_2030_challenge.

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"EcoDistricts." *Portland Sustainability Institute*, 2011.
<http://www.pdxinstitute.org/index.php/ecodistricts>.

Existing Building Renewal: Deep Energy Renovation: Planning Workshop Summary Report. Northwest Energy Efficiency Alliance, September 2010.

Frey, Patrice. *Building Reuse: Finding a Place on American Climate Policy Agendas*. National Trust for Historic Preservation, September 2008.

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