Roadmap To Zero Energy Public Buildings: Progress Report

June 2016

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About NEEP

NEEP was founded in 1996 as a non-profit whose mission is to serve the Northeast and Mid-Atlantic to accelerate energy efficiency as an essential part of demand-side solutions that enable a sustainable regional energy system. Our vision is that the region will fully embrace next generation energy efficiency as a core strategy to meet energy needs in a carbon-constrained world.

Introduction / Executive Summary

In May 2012 NEEP published a white paper entitled, "Roadmap to Zero Net Energy Public Buildings - Recommended Steps for the Northeast & Mid-Atlantic". This report informed readers that an increasing number of buildings within the building design and construction arena were beginning to meet a zero net energy benchmark. The report further illuminated that zero net energy buildings are imperative in meeting economic, environmental and energy system concerns. The "Roadmap" report concluded that the public sector should lead by example and act as an incubator for improved energy performance through zero net energy buildings. The report further laid out five critical next steps for public administrators to transform the zero net energy landscape. These steps included:

Step 1: Develop a "Path to Highest Performance" Information Campaign
Step 2: Promote the Continued Development of Exemplary Buildings
Step 3: Prioritize Measurement and Public Reporting of Building Energy Performance
Step 4: Implement Stretch Building Energy Codes
Step 5: Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments

This paper, "A Zero Energy Roadmap: Progress Report," takes a look back at the three years since the publication of NEEP's original white paper to summarize what has occurred within the region and beyond related to Zero Energy Buildings (ZEBs) and policies. In summary, we found both national awareness of zero energy standards, definitions, policies, initiatives and actual construction has grown and matured. The U.S. Department of Energy has promulgated a set of definitions that offers a much needed consensus definition of Zero Energy Buildings. Multiple federal agencies have rolled out zero energy programs, including the U.S. Army and NASA, as well as states such as California and Washington. In December 2015, Governor Raimondo of Rhode Island signed an executive order to task state agencies with reducing energy usage and greenhouse gas emissions across state facilities.

Within NEEP's region, most states have enacted at least one of the recommendations contained in the original report. Furthermore, several states in the region have enacted multiple recommendations. Noteworthy progress has been made on various fronts, though zero energy design and construction is still far from the norm. Some outstanding progress has been made on the municipal level, specifically in Cambridge, Mass. and Montpelier, Vt., both of which are moving toward zero energy communities. In addition, the public school sector has become a leader in both the region and nation in zero energy and resilient design and construction. This report delves into the policies, regulations and initiatives that support zero energy buildings, such as "stretch" energy codes, building energy performance, asset ratings and innovative financing mechanisms.

A Note on Terminology

NEEP's 2012 "Roadmap" report utilized the term, "Zero Net Energy." The terms "Zero Net Energy" or "Net Zero Energy" have become relatively common in energy efficient construction – the 'net' in Zero Net Energy indicating the net balance of a building's energy use coming out to zero. In that the use of "net" usually has to be explained and is not easily understood for those outside of the building science or policy realms, NEEP and others in this field have begun to drop the use of the word "net". In its recent publication "A Common Definition of Zero Energy Buildings," the U.S. Department of Energy concurs with this approach. This simplified term, we believe, is less technical and more precise and therefore will be more easily understood and accepted by designers, builders, and building owners. Thus, going forward, NEEP will use the term "Zero Energy Buildings" to describe those buildings that use no more energy than they self-generate.

Department of Energy "Zero Energy" Definitions

In September 2015, the U.S. Department of Energy promulgated a common definition of a Zero Energy Building. After an extensive stakeholder process, this important publication will provide clarity across the many sectors of building research, design and construction. The definition states that a Zero Energy Building is:

"[a]n energy-efficient building, where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy."

The definition also applies to communities, campuses and portfolios. The publication entitled **A Common Definition for Zero Energy Buildings** also provides guidelines for measurement and implementation, delving comprehensively into how to employ the definition for building projects.

It is expected that with a clear definition of a zero energy building, some of the uncertainty in the marketplace surrounding this construction ideology will be alleviated, and growth in the zero energy building sector will increase. The National Institute of Building Sciences partnered with DOE in the research and development of the definition and publication, and the American Institute of Architects, the U.S. Green Building Council and ASHRAE will all support the use of this definition with their members.

Note: For the purposes of this report, it is important to distinguish between *source energy* and *site energy*. *Source energy* is the total amount of energy consumed at the facility plus the energy required to get that energy to the site. *Site energy accounts for the amount of energy consumed at the facility only.*

Summary of Recommendations

Since the original publication in 2012, the zero energy buildings market has undergone many transformations. Some of these changes allow states to more easily pursue zero energy buildings in their communities. For instance, building energy codes are now being developed with consideration for zero energy facilities. Asset rating tools that were originally highlighted in the "Roadmap" have been continually improved upon in terms of accuracy, ease of use and cost.

Education / Promotion

The 2012 "Roadmap" emphasized the importance of education and promotion of zero energy construction practices for the design and construction communities, as well as the decision- makers in the public sector who oversee building construction and renovation. The main components of this include methods for examining how buildings compare to one another through mandatory asset rating and benchmarking programs, as well as technical training for design and construction teams on the best practices in zero energy construction.

In order to transform the building industry to zero energy, stakeholders should look to successful educational and promotional efforts; two noteworthy examples are Pacific Gas and Electric Company's (PG&E) Zero Net Energy Pilot Program and the U.S. DOE's Solar Decathlon. PG&E's Zero Net Energy Pilot Program includes workshops and educational series aimed at design professionals in California as they create the next generation of low and zero energy buildings[1]. This program also includes an annual design competition in partnership with the American Institute of Architects (AIA) which is open to a diverse group of stakeholders to learn best practices. The DOE's Solar Decathlon is a biennial competition for college students from all over the world to design a house that is affordable, energy efficient, powered by solar, and appeals to consumers[2]. The competition, which is open to the public, aims to empower and educate the next generation of architects and engineers while demonstrating that zero energy buildings are feasible now at a reasonable price: all homes entered into the competition must be built at a cost under $250,000.

Public Policy

Since the publication of the "Roadmap" report, some progress has been made in the efforts to raise the bar for zero energy construction standards through public policy. Municipal transparency ordinances requiring buildings to benchmark and disclose their energy usage have been passed in Boston and Cambridge, Massachusetts along with Montgomery County, Maryland, thereby bringing the total ordinances in the region to six. These are in addition to new policies in Connecticut, New York, and Rhode Island that encourage statewide public building benchmarking. More needs to be done to encourage public building benchmarking and asset rating in the remaining jurisdictions in order to provide the information needed to inform the decision-makers in the region. NEEP recommends that states enact requirements for public building benchmarking and asset ratings in order to give actionable insight into the energy performance of their buildings to pave the way to zero energy buildings.

The chart below indicates which cities, states and counties in the NEEP region have already enacted benchmarking and disclosure ordinances. NEEP's report, Building Energy Benchmarking and Disclosure Policies in the Northeast and Mid-Atlantic, offers further guidance for municipalities interested in enacting similar ordinances.

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[1] Pacific Gas & Electric. *PG&E Zero Net Energy (ZNE) Pilot Program.* Accessed: November, 2015. Available at: http://www.pge.com/en/myhome/saveenergymoney/rebates/zne/index.page

[2] United States Department of Energy. *Secretary of Energy Moniz Cuts Ribbon, Kicks Off Solar Decathlon 2015.* Accessed: November, 2015. Available at: http://energy.gov/articles/secretary-energy-moniz-cuts-ribbon-kicks-solar-decathlon-2015

City-Level Benchmarking and Disclosure Ordinances					
	New York, NY	Boston, MA	District of Columbia	Philadelphia, PA	Cambridge, MA
Ordinance	Local Law 84	Building Energy Reporting and Disclosure Ordinance	Clean and Affordable Energy Act of 2008 (Title V)	BILL NO. 120428-A	Building Energy Usage Disclosure Ordinance
Enacted	2009	2013	2008	2012	2014
Municipal	May 2010 10,000 sq. ft.+	All	October 2014 10,000 sq. ft.+	January 2012 10,000 sq. ft. +	December 2014 10,000 sq. ft. +
Municipal Data & Reports	2010 2011 2012	2012 2013	Data/Map	2013 Report and Data	2013 Data
Commercial	May 2011 50,000 sq. ft.+	Sept. 2014 50,000 sq. ft.+ AND May 2016 35,000 sq. ft.+	April 2013 100,000 sq. ft. + AND April 2014 50,000 sq. ft.+	November 2013 50,000 sq.ft.+ (Of commercial use)	May 2015 50,000 sq.ft.+ May 2016 25,000 sq.ft.+
Multi-Family	May 2011 50,000 sq. ft.+	May 2015 50k sq. ft.+ /50 Units+ AND May 2017 35k sq.ft.+ /30 units +	April 2013 100,000 sq. ft. + AND April 2014 50,000 sq. ft.+	March 2015 50,000 sq. ft.+	May 2015 50+ Units
Non-Compliance Penalty	$500 per quarter (limit $2,000 annually)	$35-$200/day (limit $3,000 annually)	$100/day Non-Compliance Penalty	$300 within first 30 days, $100 per day thereafter	Pending

State-Level Public Building Benchmarking and Disclosure Initiatives				
	New York	Connecticut	Rhode Island	Delaware
Statute or Regulation	Executive Order 88	Public Act 13-298	DOE funded grant (non-law)	Executive Order 18
Enacted	2012	2013	2012-2015	2010

County Level Benchmarking and Disclosure Initiatives	
	Montgomery County, MD
Statute or Regulation	BILL 2-14
Enacted	2014

Investment

Utility bills make up a significant portion of an average building's expenses; on average 22 percent of operating costs go towards energy and water bills[3]. Financing programs to reduce up-front costs of energy reduction projects are crucial to removing the perceived barriers that prevent many from lowering energy use and, thereby, utility costs to zero. States in the region should assist in creating an environment where public buildings have access to affordable sources of capital for energy efficiency projects through things like revolving loan funds. They should also support private-sector financing by providing credit enhancements such as loan loss reserves or interest rate buy-downs that reduce risk for lenders.

State Report Card – Current Regional Zero Energy Landscape

The original 2012 "Roadmap" report provided five recommended steps to unlock the market potential of zero energy construction. The following section contains two parts for each state. The first part, "Progress Towards Zero Energy Buildings," analyzes how each state has progressed in relation to the five critical next steps from the original report. The second part, "Actionable Next Steps," indicates where opportunities exist for states to improve. It is important to note that some states have enacted policies but have yet to put any actions into effect to develop ZEBs. Three years in, here is an update of where each state in the NEEP region stands in the implementation of these steps:

Step 1: Develop a "Path to Highest Performance" Information Campaign

Step 2: Promote the Continued Development of Exemplary Public Buildings

Step 3: Prioritize Measurement and Public Reporting of Building Energy Performance

Step 4: Implement Stretch Building Energy Codes

Step 5: Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy

[3] Rocky Mountain Institute. *Category Expenses by Building Type for Commercial Sector.* Accessed: December, 2015. Available at: http://www.rmi.org/RFGraph-commercial_building_category_expenses

State Report Card					
	Step 1	**Step 2**	**Step 3**	**Step 4**	**Step 5**
CT					
DC					
DE					
MA					
MD					
ME					
NH					
NJ					
NY					
PA					
RI					
VT					

Note: The following state analyses are designed in two parts. First, the Progress Towards Zero Energy Buildings sections show where considerable progress has been made in the public buildings sector. Then, the Actionable Next Steps sections indicates what the state has yet to accomplish or where progress has been made outside of the public buildings sector (i.e. residential).

Connecticut

Progress Towards Zero Energy Buildings

Step 3 – *Prioritize Measurement and Public Reporting of Building Energy Performance*: According to Connecticut general statute Sec. 16a-37t, beginning in 2014, the Department of Energy and Environmental Protection was required to benchmark energy usage of state owned buildings over 10,000 square feet. The state must also make this information available to the public. Utilities are also required to input energy data of nonresidential buildings into EPA's Energy Star Portfolio Manager for the most recent 36 months and make this information available to the public (Sec. 16-245ii).

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: The Connecticut Bond Commission approved $15 million of bond funding[4] to implement energy-saving retrofits at state buildings as a part of its "Lead by Example" initiative. Facilities owned by the state are eligible and must apply for funding of energy efficiency retrofits. This program is administered by the Connecticut Department of Energy and Environmental Protection, in partnership with the Department of Administrative Services and the Department of Construction Services.

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: Connecticut's Zero Energy Challenge Initiative (residential) as part of the Energize CT Residential New Construction program provides a competition for single and multi-family homes that are built to zero net energy standards. Participants can compete for cash prizes and media visibility, and have access to technical support from challenge sponsors (Energize CT and others). The aim of the program is to demonstrate that zero energy buildings are achievable today, and to transform the construction market to reflect this. In support of the zero energy challenge program, Connecticut's 2016-18 Conservation and Load Management Plan conveys a focus on moving the residential new construction market toward Zero Energy Homes through builder outreach and education, as well as by requiring the DOE's Zero Energy Ready Home Consolidated PV Ready Checklist for Tier 2 and Tier 3 HERS Ratings (HERS index of 60 or less).

Connecticut's Zero Energy Challenge is a great path forward for the residential market. However, the state needs to build upon this initiative and begin a similar program for commercial and public buildings and commercial to lead by example.

Step 4 – *Implement Stretch Building Energy Codes*

[4] Connecticut Department of Energy and Environmental Protection (DEEP). *Lead by Example for State Agencies.* Accessed: December, 2015. Available at: http://www.ct.gov/deep/cwp/view.asp?a=4120&Q=503868&tx=1

District of Columbia

Progress Towards Zero Energy Buildings

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*: Net Zero and Living Building Challenge Financial Study: A Cost Comparison Report for Buildings - This study investigated the anticipated cost differential between a set of three reference buildings designed to the LEED Platinum standard and those same three buildings conceptually designed for deep energy efficiency, zero energy, zero water and adherence to the Living Building Challenge.™

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: The District's Green Building Division promotes exemplary public buildings under the regulations of sustainable codes including the Green Building Act, Green Construction Code and Energy Conservation Code. The District leads the nation as the first jurisdiction in the country to adopt both the 2012 International Green Construction Code (IgCC) and 2012 International Energy Conservation Code (IECC) as mandatory codes, applicable to both public and private sector buildings.

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*: In 2008, The District passed the Clean and Affordable Energy Act of 2008. This enactment required public buildings in The District of at least 10,000 square feet to benchmark their energy usage.

Step 4 – *Implement Stretch Building Energy Codes*: The District's Green Construction Code, which was adopted in 2013, is based on an amended version of the 2012 version of the IgCC while allowing compliance through ASHRAE 189.1, LEED and other alternative paths.

Actionable Next Steps

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: Washington DC Property Assessed Clean Energy (PACE) Commercial financing program assists commercial (including institutional and multi-family) property owners finance their energy retrofit project. The program is administered by Urban Ingenuity on behalf of the District Department of Energy and Environment.

Delaware

Progress Towards Zero Energy Buildings

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*: **State Law** Title 16 Section 7602 c required establishing programs to promote the construction of zero energy homes. As of December 31, 2025, all new residential building construction in Delaware shall be zero energy capable. As of December 31, 2030, all new commercial building construction must also be zero energy capable.

The Delaware Sustainable Energy Utility (DESEU) and Vermont Energy Investment Corporation (VEIC) are partnering on a Zero Net Energy Manufactured Home Replacement (ZNE MH) pilot. Delaware's Division of Energy and Climate also recently joined a voluntary partnership with the U.S. Department of Energy in the Zero Energy Ready Homes program.

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*: Executive Order 18 establishes the requirement of all state owned and leased buildings to benchmark their energy usage. However, the order does not currently contain a requirement for reporting this information to the public. The executive order also establishes a plan and timetable to conduct energy audits of state facilities.

Delaware committed to DOE's Better Buildings Challenge in 2012 with eight million square feet of building space. The state has improved its energy usage by 17% percent compared to baseline 2008 and is on track to meet its goal of 20% reduction by 2022. As part of the state's participation in the challenge, Delaware has publicly shared complete portfolio data each year since 2012. The data is summarized and presented on the U.S. Department of Energy's website.

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: The DESEU does offer revolving loan fund options for cities, towns, counties, other governmental entities, schools, school districts and more. The purpose of these funds is to aid with the instillation of energy efficiency measures, renewable energy generation and greenhouse gas reductions. The program requires all applicants to undergo a third-party energy audit to justify the proposed upgrades. Loan amounts range from $10,000 to $1,000,000 per project. More information on the Revolving Loan Program can be found here.

Actionable Next Steps

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*

Step 4 – *Implement Stretch Building Energy Codes*

Massachusetts

Progress Towards Zero Energy Buildings

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*: Massachusetts Zero Net Energy Buildings (ZNEB) Task Force, made up of energy and building industry professionals, released Getting to Zero, a report of the Governor's Zero Net Energy Buildings (ZNEB) Task Force, in March 2009. This plan puts the state on track to Zero Energy Buildings by 2030.

Additionally, the City of Cambridge is working with NBI and ARUP on a municipal buildings assessment program. This includes using benchmarking data for a portfolio analysis of building energy end uses and recommendations for building improvements to be made to energy systems, accessibility, fire and life safety, public value and more. Furthermore, the program will identify buildings that are the best fits for transitioning to zero energy.

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: The Leading by Example (LBE) Program was established by Executive Order 484 in 2007. The overall goal of the program is to reduce the environmental impacts of state government operations. The program has set aggressive goals for energy consumption, greenhouse gas emissions and renewables. Massachusetts maintains a resource center of completed public building projects.

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*: MA DOER is currently working, with NEEP's assistance, on a building rating and labeling pilot project for commercial buildings. The Building Asset Rating (BAR) pilot provides a complete energy analysis of commercial buildings including each major energy consuming system (i.e. lighting, heating and cooling). Separately, two of the state's largest cities, Boston and Cambridge, require benchmarking and reporting of public buildings.

Step 4 – *Implement Stretch Building Energy Codes*: The Massachusetts Stretch Energy Code was added to the building code in 2009 and provided a more energy efficient alternative to the existing IECC energy provisions

Cambridge Net Zero Action Plan

In 2013, the City of Cambridge created the "Getting to Net Zero Task Force," a 13-member committee comprised of residents, community advocates, business and property owners, developers and local university representatives. The task force's goals included reducing energy use intensity of buildings, utilizing renewables and reducing carbon emissions. The task force developed its Net Zero Action Plan, a 25-year far-reaching and achievable plan with short and long term recommendations, which was adopted by Cambridge City Council in June of 2015.

A primary driver for the implementation of the plan was the city's concern over growth and the associated carbon emissions. The enacted Action Plan is anticipated to achieve a 70 percent reduction in carbon emissions by addressing energy efficiency in existing buildings, net zero new construction, energy supply, the establishment of a local carbon fund and engagement and capacity building. The plan dovetails with other key municipal initiatives including net zero schools, the Green Communities Act designation and a building energy disclosure ordinance, among others.

City of Cambridge - www.cambridgema.gov

that municipalities could choose to adopt. As the state has adopted the 2012 IECC energy code, the stretch code is still based on the less efficient 2009 IECC provisions until an update is passed.

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: Massachusetts created the Commonwealth Facility Fund for Energy Efficiency (CoFFEE) to promote energy efficiency upgrades throughout the state. The fund is a low-cost option for the implementation of energy and water conservation measures in state facilities. Some examples of projects include upgrades to lighting, HVAC, energy management systems and other efficiency improvements.

State Highlight: The Stretch Energy code, which provided about a 20 percent boost in efficiency for buildings in Massachusetts when first implemented in 2009, is voluntary until adopted by a local jurisdiction as a condition of qualifying for the state's Green Communities program. However, updating the stretch code in step with the state's new base code adoptions has not been a priority in recent years. Notably, Massachusetts has not followed any of the guidelines presented in the previous report (for example: become more stringent over time, incorporate outcome-based alternatives, include commissioning requirements, and address energy uses such as plug loads that go uncovered by energy codes). In fact, the state has fallen behind in even its adoption schedule for the baseline building energy code, which state law mandates must be adopted within one year of publication of the International Energy Conservation Code (IECC). In each of the last two code cycles, Massachusetts has missed that statutory deadline.

Maryland

Progress Towards Zero Energy Buildings

Step 2 – *Promote the Continued Development of Exemplary Public Buildings*: The Maryland Net Zero Energy Schools Program sets aside $9 million to design and construct three Net Zero Energy schools in the BGE service area. The Maryland Energy Administration is working closely with the Maryland Public School Construction Program to select projects and guide them through the design and construction processes. To date, two schools are in the design phase and a third is under construction. Progress of these developments can be tracked through the Maryland Zero Net Energy Schools Program Annual Report.

Step 4 – *Implement Stretch Building Energy Codes*: Maryland adopted the International Green Construction Code for all state buildings and, schools and community colleges. Local jurisdictions within the state may elect to adopt the IgCC; to date, both the city of Baltimore and Montgomery County have adopted.

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*

Step 3 – *Prioritize Measurement and Public Reporting of Building Energy Performance*

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*

Maine

Progress Towards Zero Energy Buildings

Currently there are no statewide zero energy building policies or initiatives within Maine, beyond the resolve mentioned below. The Maine Advanced Buildings program, administered by Efficiency Maine, offers incentives for new building construction that leads to 30-35 percent energy savings over the Maine Energy Code (2009 IECC).

Efficiency Maine also has a Business Program which offers prescriptive incentives for existing buildings to implement energy efficiency retrofits which are available to commercial, large multifamily, and municipal customers.

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*

Step 2 – *Promote the Continued Development of Exemplary Public Buildings*

Step 4 – *Implement Stretch Building Energy Codes*

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*: The State Legislature's 2009 Resolve, Chapter 134 LD 935, calls for the development of a rating system for building energy performance. Through this enactment, the Public Utilities Commission is directed to convene a stakeholder group and develop or select a standardized rating and reporting system for building energy performance as well as carbon performance. While this is progress forward, nothing further has been accomplished in Maine in regards to the resolve

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*

New Hampshire

Progress Towards Zero Energy Buildings

Step 2 – *Promote the Continued Development of Exemplary Public Buildings*: New Hampshire has been a leader in the development of high performance public school buildings. While there are no zero energy public schools in the state, there are 13 high performance schools that are on the path to becoming zero energy buildings. The state promotes the use of NE-CHPS for the design and construction of new and renovated schools.

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: The New Hampshire Municipal Energy Reduction Fund[5] is a revolving loan fund available to municipalities looking to make building energy efficiency improvements. The New Hampshire Public Utilities Commission awarded New Hampshire's Community Development Finance Authority (CDFA) $1.5 million to capitalize the fund and the loans to municipalities are structured on the projected energy savings of each project.

Keene, NH has independently adopted the International Green Construction Code (IgCC).

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*

Step 3 – *Prioritize Measurement and Public Reporting of Building Energy Performance*

Step 4 – *Implement Stretch Building Energy Codes*

New Jersey

Progress Towards Zero Energy Buildings

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: New Jersey does not have a statewide policy initiative for commercial or public zero energy buildings, nor are there any utility programs for zero energy commercial buildings. Resources in the form of incentives and financing exist for residential construction exceeding ENERGY STAR 3.0 toward zero ready and zero energy. Extensive resources exist for renewable energy installations. Various benchmarking programs and equipment incentives for commercial and municipal buildings are available. There are no references to zero energy buildings or zero energy in the 2011 State Energy Master Plan. There are several privately owned commercial buildings that are near or zero energy. State financing and incentive programs can be found on New Jersey's Clean Energy Program website.

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*

[5] New Hampshire Community Development Finance Authority. *Municipal Energy Reduction Fund Overview.* Accessed November 25, 2015. Available at: http://www.nhcdfa.org/energy-efficiency/for-municipalities-overview

Step 4 – *Implement Stretch Building Energy Codes*

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: New Jersey Natural Gas's SAVEGREEN Commercial On-Bill Repayment Program provides small- to mid-sized commercial, industrial and local government stakeholders with on-bill financing for project costs that go beyond the 70 percent cost incentive offered by the New Jersey Clean Energy Program. These project costs are then spread out on 36 bill payments over three years.

New York

Progress Towards Zero Energy Buildings

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*: The New York State Energy Research and Development Authority (NYSERDA), as part of its Reforming the Energy Vision (REV) process, has proposed developing a state-specific roadmap that identifies a sequence of key actions to increase the level of market adoption of and scalable, sustained engagement in deep energy savings projects. This process would convene a broad range of stakeholders to address commercial, residential, and multifamily sectors along with building energy codes[6].

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: NYSERDA maintains an online resource center[7] that includes case studies of state and municipal buildings that have been constructed beyond the energy code. These case studies detail the project specific efficiency measures included in the construction along with the incentives accessed through NYSERDA's New Construction Program. This publically available information can be used as a model for other public building construction projects in the state.

Step 4 – *Implement Stretch Building Energy Codes*: NYSERDA is currently working on its NYStretch program, which, upon its expected completion by 2018, would provide a stretch energy code for optional municipal adoption.

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: The New York Clean Energy Fund (CEF) is a 10-year commitment totaling $5 billion from 2016-2025. A few of the CEF goals that pertain to zero energy initiatives include reduction of greenhouse gas emissions, increasing statewide energy efficiency and renewable energy generation and to drive private investment in clean energy. Funding for the CEF will be provided through ratepayer bill charges that are already in place. Over the next 10 years, ratepayer funding will be replace by private sector market investment. For more information on this initiative and for updates on the status of the CEF, please click here.

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[6] New York State Energy Research and Development Authority. *Clean Energy Fund Information Supplement.* Accessed: December, 2015. Available at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={FC3FBD53-FBAC-41FB-A40E-3DA0A5E0866A}

[7] New York State Energy Research and Development Authority. *New Construction Program Case Studies.* Accessed: December, 2015. Available at: http://www.nyserda.ny.gov/About/Publications/Case-Studies-and-Features/NCP-Case-Studies

Development of a New York stretch energy code began in 2014 and remains under development. It is expected to be a local option code with a direct connection to a state zero net energy target.

Actionable Next Steps

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*

Pennsylvania

Progress Towards Zero Energy Buildings

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: The Pennsylvania Green Energy Loan Fund offers financing for existing buildings and new construction projects that result in a 25 percent reduction in energy consumption. These loans are available through Pennsylvania's Green Energy Loan Fund (GELF) for all buildings with the exception of single-family residential homes and generally offer low interest rates for terms that are consistent with the expected life of the improvements, usually up to 15 years. Loans can also be used for on-site renewable energy systems and on-site combined heat and power systems when combined with larger efficiency retrofits.

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*

Step 4 – *Implement Stretch Building Energy Codes*

Rhode Island

Progress Towards Zero Energy Buildings

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: On December 8, 2015, Rhode Island issued Executive Order 15-17 to establish a "Lead By Example" program for state facilities. The overall goal of

the program is to reduce energy consumption and greenhouse gas emissions associated with state facilities. The state set a goal to reduce agencies energy consumption by at least 10% below the baseline of fiscal year 2014.[8]

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*: As part of the Rhode Island Public Energy Partnership (RIPEP), 66 municipal buildings in the state were given asset scores using the DOE's Commercial Asset Score tool. Buildings that were included in this collaborative effort were also benchmarked in Energy Star's Portfolio Manager to provide municipal staff with actionable operational and asset information on their buildings in order to effectively target efficiency retrofits.

Step 4 – *Implement Stretch Building Energy Codes*: Executive Order 15-17[9] directed state officials and National Grid, the state's electric and gas utility, to establish the International Green Construction Code (or equivalent) as a voluntary aspirational energy code by 2017. The code will be publically available for use in state, municipal, or private construction projects.

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: In June of 2015, Rhode Island enacted legislation renaming the state's Clean Water Finance Agency. The legislation also expanded the role of the newly coined "Rhode Island Infrastructure Bank" to include the Efficient Buildings Fund which provides low cost financing for energy efficiency and renewable energy projects in public buildings around the state.

National Grid's 2016 SolarWise Rhode Island program helps residential, commercial and industrial customers reduce their energy use and compensates them for their output from their PV equipment. This program allows customers to receive a free energy efficiency evaluation and provides suggestions to improve the efficiency of the building. After the efficiency assessment, a Solar PV screening will take place to and customers will gain access to the online SolarWise Marketplace. This online tool will help customers find the best fit for PV at their location by allowing them to request and compare offers from independent solar installers. Customers are eligible for a bonus award through National Grid's RE Growth Program when a certain level of energy savings is obtained and a properly sized PV array is installed.

Rhode Island revised the 2012 IgCC to meet the state's needs. While Rhode Island was the first state to make the IgCC available for public buildings through 2010's Green Building Act, it may further deploy it as a stretch code following a similar model to Massachusetts' Green Communities program.

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[8] State of Rhode Island, Office of the Governor. *State Agencies to Lead by Example in Energy Efficiency and Clean Energy. Accessed: December 8, 2015. Available at:* http://www.governor.ri.gov/documents/orders/ExecOrder15-17.pdf

[9] State of Rhode Island, Office of the Governor. *State Agencies to Lead by Example in Energy Efficiency and Clean Energy.* Accessed: December 8, 2015. Available at: http://www.governor.ri.gov/documents/orders/ExecOrder15-17.pdf

Actionable Next Steps

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*: The Rhode Island Zero Net Energy Taskforce was established in the spring of 2015 to create a roadmap aimed at accelerating the zero energy building construction market in the state. As a part of the Governor's sustainability objectives, the task force will engage a diverse group of stakeholders to create a resource white paper to inform the state's policy makers, utilities, and builders. This document is due in the fall of 2016.

Vermont

Progress Towards Zero Energy Buildings

Step 1 – *Develop a "Path to Highest Performance" Information Campaign*: Vermont has set a transformative goal for all new construction to be net-zero by 2030. Efficiency Vermont, the nation's first non-profit statewide energy efficiency utility, is leading the state toward its zero energy goals. Efficiency Vermont provides technical assistance and financial incentives to help Vermont households and businesses reduce their energy use and costs with energy-efficient buildings, equipment, and lighting. The Triennial Plan 2015-2017, was developed to provide Vermonters with an overview of Efficiency Vermont's strategy through 2017.

Partnering with the New Buildings Institute, Efficiency Vermont hosted Net Zero Northeast, a conference in October 2014, including a workshop on community planning for net zero (see Zero Net Montpelier below).

Efficincy Vermont commissioned a Net Zero Energy Feasibility Study that examines the energy and financial implications of building to zero energy ready and zero energy standards compared to code for six new construction building types.

- Single family residential
- Duplex residential
- Quadplex residential
- Open office
- Closed office
- Office and light manufacturing
- Zero energy communities

EVT introduced a Net Zero Pilot Program for commercial new construction in 2014 and continued it as a full program tier in 2015. Over 20 projects have participated in the initiative, exploring the opportunity to set and build to a net zero goal. Five projects involved in the program were highlighted in a presentation at the 2016 Better Buildings by Design conference. Three were municipal projects – multi-use town buildings in Middlebury, Waterbury, and Waitsfield – that all involved several stages of local funding approval (bond votes).

Step 2 - *Promote the Continued Development of Exemplary Public Buildings*: Vermont's 2016 Comprehensive Energy Plan includes a State Agency Energy Plan that demonstrates Vermont's commitment to energy efficiency and overall energy usage reduction in state government operations. Funding and project support for efficiency projects is available through the State Energy Management Program. To meet the state's overall energy

reduction goals, state agencies should seek to reduce fuel consumption by 15 percent by 2030[10]. Technical assistance is available to state agencies through The Department of Buildings and General Services and Efficiency Vermont.

State government operations have already made significant improvements since The State Agency Energy Plan was published six years ago. Efficiency improvements made during this time include lighting upgrades, building controls improvements, and weatherization enhancements, amongst others. New funding mechanisms have been developed and agencies are using Energy Star Portfolio Manager to catalog energy usage and benchmark them against similar buildings across the country.

Step 4 – *Implement Stretch Building Energy Codes*: The passage of Act 89 in June 2013 paved the way for the development of a stretch energy code in Vermont that is voluntary for municipalities but mandatory for projects under Act 250. A stretch code for residential buildings was finalized and went into effect in December 2015. A commercial stretch code "guideline" remains under development, and is intended to be adopted for commercial Act 250 projects. In spring of 2016, the city of South Burlington adopted both stretch codes, incorporating the commercial when available, for all projects in its jurisdiction.

Step 5 – *Create a Revolving Loan Fund or Similar Mechanism to Provide Capital for Energy Investments*: Vermont has two revolving loan funds the first the State Resource Management Revolving Fund (SRMRF) is available for resource conservation measures. The other fund, the State Energy Revolving Fund (SERF), is available for energy efficiency improvements and the use of renewable resources (see The State Energy Management Program Revolving Funds Guidelines & Procedures for additional information). There is also Green Mountain Power Community Energy & Efficiency Development Fund (CEED) for efficiency and emerging technologies. The SRMRF has a goal of $4 million to invest in energy improvements. Since the start of the SRMRF in 2004 over two billion BTU's has been saved according to the BGS Energy Implementation Plan.

[10] State of Vermont, Public Service Department. *2016 Vermont Comprehensive Energy Plan.* Accessed January, 2016. Available at: https://outside.vermont.gov/sov/webservices/Shared%20Documents/2016CEP_Final.pdf

Zero Net Montpelier

Montpelier, the state capital of Vermont, in collaboration with community partners, utilities, the state credit union and renewable energy companies, are undertaking a "bold and audacious" plan to be the first zero net energy state capital in the nation. The initiative includes all the capital's energy needs, spanning public and private electric, heat and transportation, and will utilize energy efficiency techniques, renewables, hydroelectricity and biofuels to eliminate the use of fossil fuels and "offset any fossil fuels they do use by producing an equivalent amount of surplus renewable energy."

A variety of pilot projects offered primarily by Green Mountain Power and Efficiency Vermont form the basis of Net Zero Montpelier. Other primary partners including the Montpellier Energy Advisory Committee and Energy Action Network round out the offerings for different types of energy uses. The pilot actions include weatherization, electric vehicle charging stations, heat pumps, solar net metering, community energy dash boards, and addressing the energy needs of homes, municipal facilities and state buildings.

There is strong public and business support for Zero Net Montpelier. While the original plan called for 90 percent of the city's energy to come from renewables by 2050, the City Council enthusiastically voted on a resolution proposed by one member of council to accelerate the 90 percent goal to 2030.

Energy Action Network – www.eanvt.org
Vermont Energy and Climate Action Network – http://www.vecan.net/
City of Montpelier – www.montpelier-vt.org
Green Mountain Power – www.greenmountainpower.com/innovative/net-zero-montpelier
Montpelier Energy Advisory Committee – www.montpelier-vt.org/382/Energy-Advisory-Committee.html
Efficiency Vermont – www.efficiencyvermont.com

Actionable Next Steps

Step 3 - *Prioritize Measurement and Public Reporting of Building Energy Performance*

Conclusion - Next 10-15 Years

The Northeast and Mid-Atlantic regions have made significant progress since NEEP's initial report in advancing building energy efficiency on the road towards zero energy. The continued leadership of this region is important to demonstrate to the broader design and construction communities, as well as to policymakers, that zero energy building construction is achievable and affordable. Enacting public policy is a critical step, but more needs to be done beyond enacting policies. States must direct their energies to further develop these programs. Zero energy construction is the next logical step in the integration of today's readily available energy efficiency and renewable energy technologies. Additionally, to further aid with this initiative, states and local jurisdictions should act in a more collaborative manner by sharing resources, building on success and applying lessons learned from other communities to their own. More specifically, coordinating efforts in regard to stretch energy code adoption, zero energy task forces and roadmaps would be advantageous for the entire region.

Paving The Way Forward to Zero Energy Buildings

The following sections of this report offer updated guidance on the aforementioned subjects, as well as a new look on topics such as resiliency, financing and utility regulation and their impacts on the zero energy landscape.

Regulation - Building Codes Driving Zero Energy Buildings

Building energy codes set minimum standards for the energy characteristics of buildings. With regard to public buildings, and as stated in the original "Roadmap" report, energy codes establish the baseline against which high performance buildings are evaluated, gradually motivate the development of a zero energy capable workforce, and provide a more predictable and politically stable mechanism for addressing energy use than executive orders or other directives.

For commercial buildings, two sets of model energy codes and standards govern how buildings in the vast majority of the country, including the Northeast and Mid-Atlantic, are constructed: ASHRAE Standard 90.1 and the International Energy Conservation Code (IECC). Both ASHRAE 90.1 and the IECC, which are updated triennially, have driven building energy use downward in recent years with the newest versions of these codes and standards designed to save over 30 percent more energy than their predecessors a decade ago[11]. The energy codes community will have to maintain a similar pace to achieve the oft-cited 2030 target date for developing the first versions of ASHRAE 90.1 and IECC to require zero energy.

To accelerate the transition to zero energy design, construction and operations and to promote green building practices, advanced codes and standards were created that go beyond these base energy codes. ASHRAE Standard 189.1 and the International Green Construction Code (IgCC) build upon ASHRAE 90.1 and the IECC, respectively, to provide regulatory frameworks with which progressive jurisdictions can begin to pursue zero

[11] United States Department of Energy. *Saving Energy and Money with Building Energy Codes in the United States.* Accessed: December, 2015. Available at: http://energy.gov/sites/prod/files/2014/05/f15/saving_with_building_energy_codes.pdf

energy and green building policies. In 2014, it was announced that ASHRAE 189.1 and the IgCC would coalesce into a single standard, which promises to streamline national as well as regional efforts.

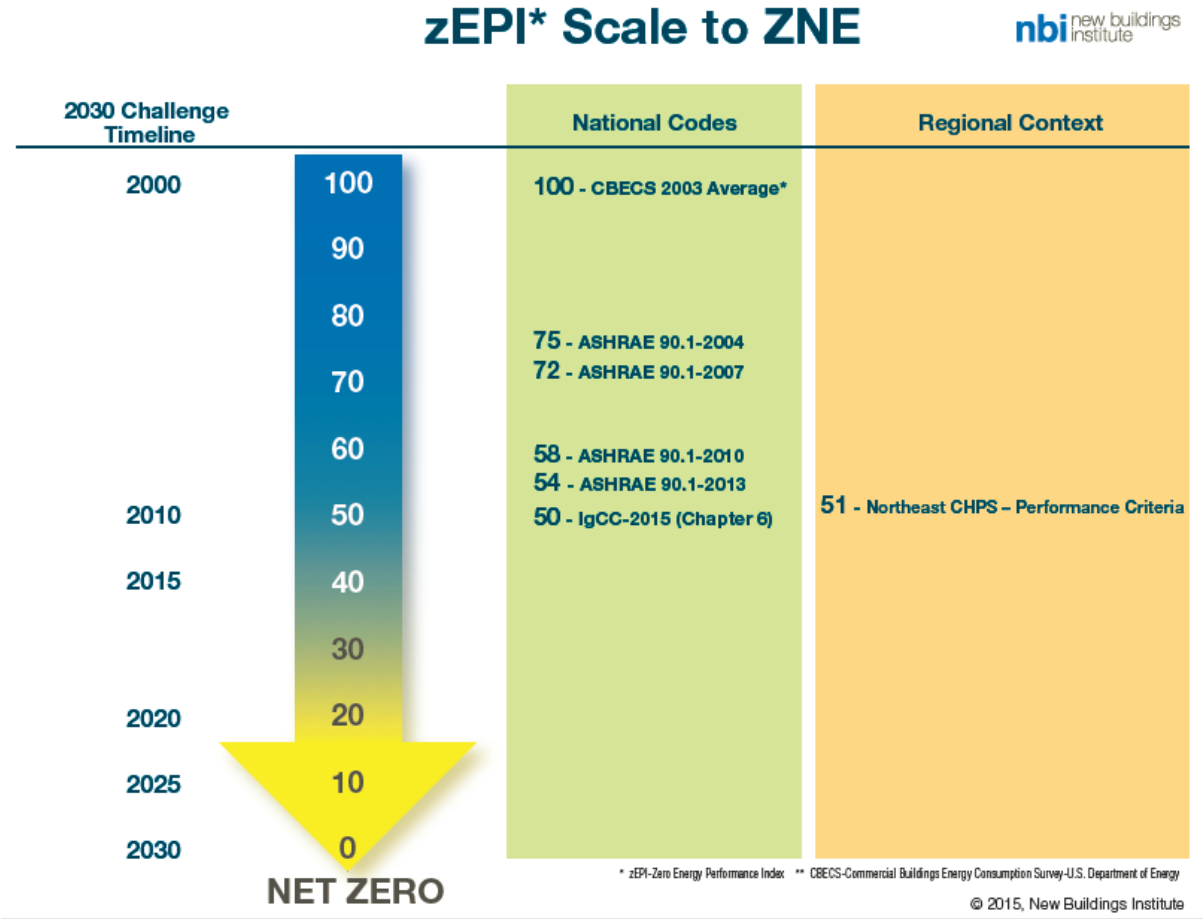

Figure 1: The Zero Energy Performance Index (zEPI) is used by the IgCC and provides a useful metric for the efficiency of various energy codes and standards relative to the eventual goal of zero energy. Source: New Buildings Institute

Prioritize Measurement and Reporting of Building Energy Performance

Asset Rating – A Tool for Private and Public Buildings

As stated in the original "Roadmap" report, all new public buildings should be required to obtain and disclose an asset rating, which assesses the energy performance of a building's energy features irrespective of its operations and allow for "apples-to-apples" comparison between buildings. New asset rating tools are being developed that enable building owners and investors to quickly identify and understand energy efficiency investment opportunities at a much lower cost.

The "Roadmap" identified three asset rating programs under development: U.S. DOE's Commercial Asset Score (DOE CAS), ASHRAE's Building Energy Quotient (bEQ), and the Massachusetts Building Asset Rating (BAR) pilot. While ASHRAE bEQ has not progressed substantially in the region over the past few years, the other two

programs have continued to improve the accuracy and usefulness of their auditing and reporting processes while also reducing the cost even further.

DOE Commercial Asset Score: Since our original report, DOE has made continual improvements to its CAS program including the launch of the first version of its CAS tool in 2014. DOE completed pilots in 2012 and 2013 which leveraged a sample of over 200 buildings to inform these improvements. Another modification was made in 2015 to the score itself, which was changed from a 100 point scale to a 10 point scale to avoid its confusion with the Energy Star Portfolio Manager score. In addition to this simple rating, the DOE CAS tool also provides typical information like building energy use intensity (EUI), end-use consumption breakdowns, and automatically generated energy asset upgrade recommendations.

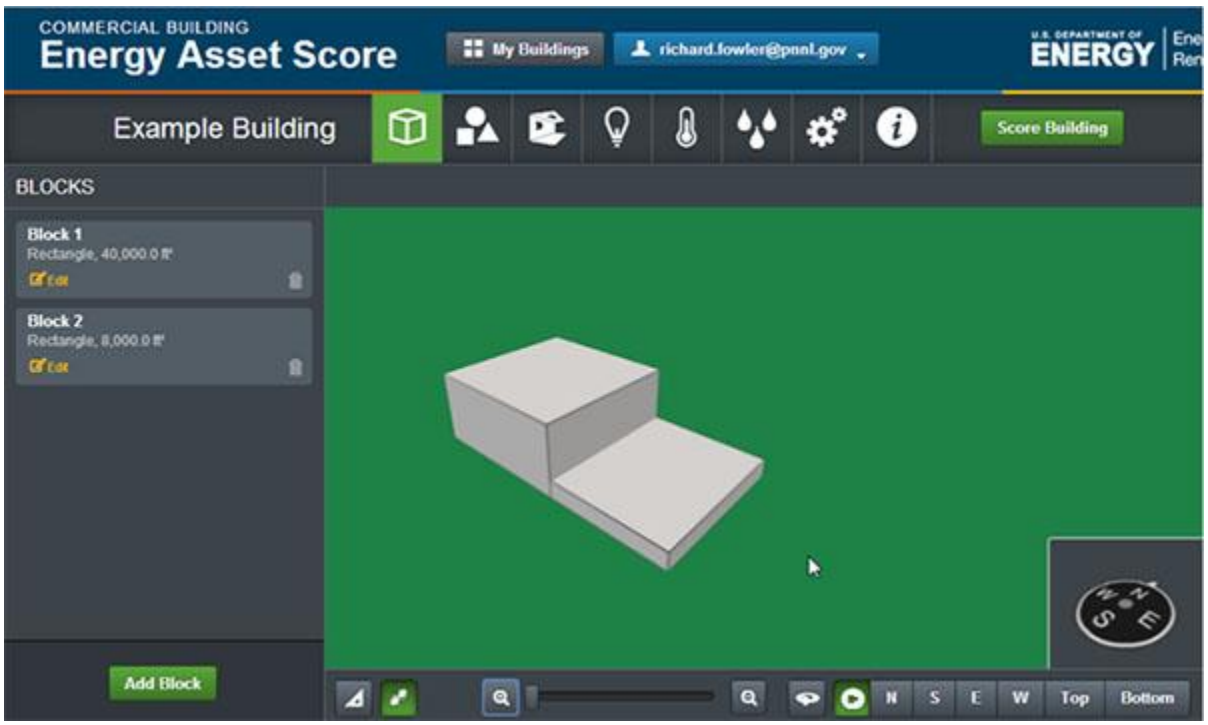

Figure 2: DOE's Commercial Asset Score tool is free to use and suitable for commercial as well as multi-family building applications

Mass. Building Asset Rating Pilot: Massachusetts is about to complete its three year BAR pilot, which was led by the Massachusetts Department of Energy Resources and NEEP. Instead of pursuing ASHRAE bEQ or another asset rating program as posited in our original report, Massachusetts instead developed its own protocols for asset rating audits and reports and allowed firms to develop their own proprietary solutions to meet these requirements. Over the first two years of the BAR pilot, these protocols were crafted and refined through two rounds of testing, with each property in the over 40 building sample scored by two to four different teams. Massachusetts is currently disseminating these results in the final year of the pilot and finalizing a report compiling the findings from the entire pilot. Perhaps most notably, the cost of the assessments decreased from

about $6,000 - $8,000 per building at the start of the pilot to about $4,000 - $5,000 by its completion, which constitutes a price of a quarter to a third of the typical cost for an ASHRAE Level 2 audit.[12]

Financing Zero Energy Buildings

Creating Funding Mechanisms to Provide Capital for Energy Investments

The incremental cost premium of zero energy building construction usually ranges from 5 to 19 percent,[13] which can be a significant hurdle for public entities with budgetary constraints that prioritize other basic services over energy efficiency. Today there is mounting evidence that zero energy buildings can actually be developed within the range of typical building costs for a given building type. There is a strong financial incentive to construct zero energy buildings because of the significant energy cost savings over the lifetime of the building. The Return on Investment (ROI) for zero energy construction averages 30 percent due to the savings in energy costs[14]. Financing is a useful mechanism for overcoming these higher initial costs of zero energy construction while often still achieving reduced net operating costs upon completion of construction.

The following are models that have proven successful in public sector building construction and renovation to improve energy performance on the path to zero energy:

Revolving Loan Funds: State and locally run revolving loan funds have proven to be a successful model for financing energy efficiency investments. A revolving loan fund is established to provide loans for energy projects where the repayments on those loans are then returned to the fund and used to make additional loans which expands the amount of funding available over time through the energy savings realized by each project.

State Highlight: Maryland's State Agency Loan Program provides loans to state agencies for cost-effective energy efficiency projects in state-owned buildings. Established in 1991, this program allows state agencies to pay from their fuel and utility budget based on the avoided energy costs of the project. These organizations pay zero interest with a one percent administration fee on energy upgrades which typically fall outside energy performance contracting projects. As loan repayments are made, more loans are then issued. Each fiscal year, the Maryland Energy Administration awards approximately $1 million in loans through this program.

On-Bill Financing: On-bill financing allows building owners to pay back the loan for an energy efficiency upgrade on their utility bills. The utility incurs the cost of the energy project and allows the customer to pay them back through monthly bills. The utility will often use the customer's past bill payment history to determine creditworthiness which can increase the number of loans completed in these programs. This is a straightforward method for the building operator who is able to see the net savings from the energy project right on the utility

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[12] Finlayson, I. Rose, K. & Dion, M. *Raising the BAR: Building Asset Ratings to Enhance Energy Assessments and Increase Efficiency Investments* [PDF Document]. Retrieved From: http://www.neep.org/sites/default/files/resources/ABx2014_Raising%20the%20BAR-BldgAssetRatings.pdf

[13] New Buildings Institute. *Net Zero and Living Building Challenge Financial Study: A Cost Comparison Report for Buildings in the District of Columbia. Accessed: December, 2015. Available at:* https://living-future.org/sites/default/files/reports/140411_DCReport_FINAL full cover.pdf

[14] Ibid.

bill. This option can be financially beneficial for the customer because the interest rate is usually lower on loans made with utility or rate-payer funding than those made with private capital.

On-Bill Repayment: On-bill repayment is another method of utilizing the utility bill as a means of paying for energy efficiency projects. On-bill repayment usually utilizes a third party funding source and allows the utility to distance themselves from the risks of lending money to customers. The order in which funds are distributed in the case of partial bill payment is one potential risk for third party funders in this model. Usually the utility will put partial repayment funds towards gas and electric expenses before paying back the lender. This adds a level of risk for investors that state and local governments can help address by establishing loan loss reserves.

Public Bonding: Public bonds are a popular method for financing energy projects in the public sector because they are a low cost source of capital, and projects can be bundled together into larger issuances for investors. These bonds enable public entities to finance projects at a significantly lower cost because there is often a lower tax liability for returns on these projects for investors. This lower tax liability allows them to provide capital at a lower interest rate for the bond issuer.

Qualified Energy Conservation Bonds (QECBs): QECBs are bonds that enable qualified state, tribal, and local government issuers to borrow money at low interest rates for energy conservation projects. The borrowing costs on these bonds are subsidized by the U.S. Department of the Treasury. These bonds can be issued as tax credit bonds where investors receive federal tax credits instead of interest payments but most have been issued as direct subsidy bonds where investors receive direct interest payments from the Treasury because of the lack of demand for tax credit bonds.

Energy Services Performance Contracting: Energy Services Performance Contracts (ESPCs) are a method of financing that enables a third party Energy Services Company (ESCO) to implement and monitor energy projects in a building while guaranteeing certain savings to the building owner. This provides an option for public entities that is usually budget neutral and incentivizes the ESCO to work together with the building operators to ensure savings are being realized so they can increase their return on investment. Public facilities are especially well suited for ESPCs because of their ability to enter into longer-term financing agreements with payback over 10-20 years. These long-term agreements enable deeper retrofit projects to bring buildings closer to zero energy usage where many commercial ESPCs are limited to much shorter payback periods where only the most cost-effective measures are implemented.

Tax Exempt Lease Purchase Agreements: Tax exempt lease purchase agreements are an attractive method of financing energy projects for public entities because they enable the payments for the project to come out of money set aside in the annual utility budget. These agreements enable the public organization to lease the assets involved in the project for a period of time and takeover ownership at the end of the lease agreement. These agreements usually also have lower interest rates because of their tax exempt status.

How Can State and Local Governments Support Energy Efficiency Financing?

Loan Loss Reserves are a popular form of credit enhancement used by state and local governments seeking to give more people access to affordable capital. Loan loss reserves lower the risk for lenders by providing a pool of funds that covers a portion of the total loan portfolio and can be drawn upon in the event of non-payment.

Often, these reserves are set at levels above the expected losses for the loan portfolio to ensure a manageable level of risk for the capital provider. These pools allow a relatively small amount of public dollars to be leveraged to secure a larger amount of investment into projects that may not otherwise meet the requirements of traditional lending practices.

Interest Rate Buy-Downs enable state and local governments to assist in lowering the interest rate on loans for their constituents in order to make financing more attractive. These buy-downs typically take the form of an up-front payment to the lender of an amount that reduces the rate of interest the borrower will pay over the lifetime of the loan. These programs are especially useful for building interest in new energy efficiency programs and encouraging deeper retrofits that might be left off the table at higher interest rates.

Utility Regulation

In NEEP's original report, we called out the significant role that electric and gas utilities and other administrators of ratepayer-funded energy efficiency programs play in advancing zero energy buildings. Indeed, in the intervening time frame, several program administrators in NEEP states have launched initiatives to promote ZEBs. Massachusetts' latest three-year (2016-18) coordinated energy efficiency plan, for example, notes that zero energy buildings can drive both resource acquisition and market transformation for energy efficient products and services, and includes an increased focus on research and development, as well as outreach and education to the building community. In addition, the plan also states that "the PAs will continue to provide, as they have historically, technical and modeling assistance and incentives for all the efficiency measures towards Net Zero Ready that are cost-effective through the Whole Building Path of the New Construction Program efficient construction practices."[15]

However, NEEP also pointed out that, in order for states to fully realize the potential of zero energy buildings, state utility regulators need to provide an appropriate framework for utilities to deliver these programs, including:

- ✓ Appropriate budget levels to maximize new construction and retrofit program opportunities;
- ✓ Appropriate incentives to motivate program gains in the area of ZEBs;
- ✓ Revenue decoupling to sever the link between utility volumetric sales of energy and utility cost recovery;
- ✓ Regulations to foster on-site renewable energy, including those enabling net-metering and removing disincentives to grid interconnection;
- ✓ Direct marketing to the municipal customer sector, as opposed to including them in small commercial business categories for outreach and support.

As noted in our original report, while the recommendations in this section are applicable to both public and private sector buildings, they are most important – and salient to this document – for public buildings, for several reasons. Most notably, states and municipalities cannot effectively access the tax incentives available to

[15] Massachusetts Department of Public Utilities. *2016-2018 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Plan.* Accessed: November, 2015. Available at: http://ma-eeac.org/wordpress/wp-content/uploads/Exhibit-1-Gas-and-Electric-PAs-Plan-2016-2018-with-App-except-App-U.pdf

private-sector builders and owners, which makes efficiency programs critical to the ability to overcome the many financial hurdles to developing zero energy buildings.

NEEP's annual Regional Roundup of Energy Efficiency Policy in the Northeast and Mid-Atlantic States provides a general overview of most of these policy elements, with the exception of those entailing renewable energy regulations, such as net metering and grid interconnection. Two recent policy developments provide some examples of how states may address these topics. The first is from Vermont, which has developed an expedited registration process for buildings with net-metered photovoltaic systems with a capacity of 15 Kw or less. Per the Clean Energy States Alliance/U.S. Department of Energy "Sunshot Report," the effort is aimed at lowering "soft" costs, i.e., non-hardware costs, of interconnection.

> *"The authority to issue permits for PV installations is centralized through the Vermont Public Service Board. After submittal of a smallscale PV registration application, the local utility has ten days to object to the permit issuance. If the utility does not object, a permit, known as a Certificate of Public Good, is automatically deemed issued to the applicant on the eleventh day. Other participating states have learned about Vermont's small-scale solar registration and interconnection approval process."*

The second is New York, where, as part of the state's landmark "Reforming the Energy Vision" proceeding, the Public Service Commission has issued an order to address system interconnection issues and streamline the process.

In its "Order Adopting Regulatory Policy Framework and Implementation Plan," the Commission noted that it was dividing the process into two phases – the first aimed at "streamlining the approval process for smaller distributed generation projects, such as residential solar," and the second "oriented toward a comprehensive ability to integrate interconnection processes into system planning and operation."[16]

Utilities will be required to use online portals and other automated functionality, "integrated with grid optimization planning," at the time of their filing of their Distributed System Implementation Plans (DSIP), which is procedurally scheduled for June 30, 2016. The goal, according to the Commission's order, is for the utilities to develop capabilities that will "result in economically desirable DER [distributed energy resources] projects having ready access to interconnection approval, and potential market participants having ready access to information to assess the viability of a project from a system interconnection standpoint."

In a separate PSC staff guidance white paper on ratemaking and utility business models,[17] direction was also provided on how to assure that "utilities … develop capabilities that will allow them to process more interconnection requests in a timely manner," particularly for smaller (50 kW or smaller) distributed generation projects. One metric for utility incentives will be an increase in interconnection approvals by 20 percent from year to year.

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[16] State of New York, Public Service Commission. *Order Adopting Regulatory Policy Framework and Implementation Plan.* (pp. 92-93). Accessed: December, 2015. Available at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={0B599D87-445B-4197-9815-24C27623A6A0}

[17] Ibid (p. 61).

For larger DG projects, i.e., those greater than 50 kW, the metric for utilities will be tied to "workable solutions rather than simply identifying obstacles," adding that the utilities "should have an incentive to help produce solutions."

In summary, in their initial Distributed System Implementation Plans, utilities will need to:[18]

- Explain how the utility interconnection process complies with the [Commission's] Order.
- Describe the process for interconnecting DERs and the capability to improve this process through an online portal.
    - Provide a status of current efforts and future plans.
    - Indicate how this function will be integrated into the planning process improvements and monitored to measure the effectiveness of the interconnection process.
- Describe plans for optimization of planning by modeling system impacts of DER, risk assessments, and resiliency.

While a great many issues contemplated in New York's landmark REV proceeding still need to be worked out, Commission guidance on interconnection can provide a helpful model for other state's needing to address issues such as interconnection to create a framework for accelerating the construction of zero energy buildings.

Resiliency

A community's ability to respond after a natural disaster is key to minimize the negative impacts of the event. Today more than ever there is an increased focus, especially in coastal regions, on a community's ability to adapt to unfavorable circumstances such as those presented by natural disasters. *Community* or *coastal resilience* reflects the ability of a community to "bounce back" after dangerous natural events such as hurricanes, coastal storms, and flooding – as opposed to simply reacting to its perils[19]. Maintaining a proactive rather than reactive approach can save lives, reduce economic burdens, limit power outages and more.

Communities across the NEEP region, such as New York City, parts of upstate New York, New Jersey and Vermont, have been recently devastated by the effects of hurricanes or other severe weather. In 2012, Hurricane Sandy struck the eastern seaboard causing a massive storm surge which severely damaged the building stock in New York City. Approximately 20,000 buildings sustained structural damage or were without power two weeks following the storm. This resulted in an influx of people seeking refuge in city shelters, with nearly 7,000 reported occupants at its peak[20]. One year earlier in Vermont, Tropical Storm Irene led to

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[18] State of New York, Department of Public Service. *Case 14-M-0101-Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision.* (p. 19). Accessed: December, 2015. Available at: http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={F3793BB0-0F01-4144-BA94-01D5CFAC6B63}.

[19] National Oceanic and Atmospheric Administration. *What is Resilience?.* Accessed: November, 2015 Available at: http://oceanservice.noaa.gov/facts/resilience.html

[20] New York City Special Initiative for Rebuilding and Resiliency. *What happened during Sandy and why?*. Accessed: November, 2015. Available at: http://www.nyc.gov/html/sirr/html/about/sandy.shtml

widespread power outages and significant damage to infrastructure such as roadways and bridges. Following these major disasters, resilient structures became a focal point for future construction.

Improving resiliency is a worthy endeavor on its own, but for schools and public buildings with strict budget constraints, making these types of improvements can be challenging. Linking energy efficient improvements with resilient features provides a worthwhile option for long-term savings. To provide an example of a resilient and energy efficient feature, we look to New York City in the subsequent days following Hurricane Sandy's landfall. Many critical facilities in the city were unable to function properly due to flooding. However, some buildings maintained their services due to their use of Combined Heat and Power (CHP) technology. CHP allowed a small number of hospitals, colleges, public service facilities and residential buildings to maintain their power throughout the storm[21]. CHP, also known as a cogeneration system, is an integrated energy system that allows for onsite power generation and can be used for heating/cooling purposes. Localized cogeneration systems, such as CHP, are energy efficient, environmentally friendly, and reliable systems for producing power.

Additional examples of the linkage between energy efficiency and resiliency include:

- Enhanced building envelope
- Natural ventilation
- Daylighting
- Water management
- Joint use of facilities

Hurricanes, however, are not the only natural threat to states in the Northeast and Mid-Atlantic regions. Impacts of major snowstorms have been felt throughout the region, especially during the winter of 2014-2015. Buffalo, N.Y. and the surrounding area received an unprecedented snowfall event in 2014. From November 17-20, some areas received nearly seven feet of snow[22]. As a result, numerous roadways were shutdown, power outages were reported and communities were left in danger while cleanup efforts were underway. While it is impossible to prevent future events of this magnitude from occurring, it is entirely possible to minimize the negative impacts it has on our community's by improving the resiliency of our buildings.

Furthermore, energy efficiency improvements help reduce the negative impacts of climate change. The link between climate change and the severity of natural disasters has been well documented, which makes the case for energy efficient and resilient design even stronger.

Resilient Schools: Southeastern Regional Vocational Technical High School, a Collaborative for High Performance Schools (CHPS) Verified school located in South Easton, Mass., provides a prime example of how to improve the resiliency and energy efficiency of these important community facilities. Recent upgrades to their energy supply system include installation of an on-campus tri-generation power plant, which, in addition to reducing their

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[21] Chittum, Anna; American Council for an Energy-Efficient Economy. *How CHP Stepped Up When the Power Went Out During Hurricane Sandy.* Accessed: November, 2015. Available at: http://aceee.org/blog/2012/12/how-chp-stepped-when-power-went-out-d

[22] National Oceanic and Atmospheric Administration, National Weather Service. *Lake Effect Snow Summary: November 17-19, 2014. Accessed: December, 2015. Available at:* http://www.weather.gov/buf/lake1415_stormb.html

monthly energy costs by $16,000, allows the school to retain power even when the surrounding area may be without. The inclusion of the tri-generation plant means the school is able to provide shelter, warmth and food for local residents during times of need.

Regional Resiliency Resources:

New York City - A Stronger More Resilient New York City

Boston - Building Resilience in Boston

National – Resilient Design Institute

Zero Energy Initiatives Outside the NEEP Region

NOTE: The following content highlights initiatives and policies that contribute to the progress of zero energy buildings through information and education, regulation, measurement and reporting, finance, utilities and resiliency. The last appendix highlights federal zero energy programs and exemplary state initiatives outside the NEEP region.

California – Zero Energy Mandates

The California Energy Code offers an alternative framework to those formulated by the International Code Council and ASHRAE for pushing toward zero energy construction. As set forth by the State Public Utility Commission's 2008 Strategic Plan, the California Energy Code is mandated to reach zero energy for residential new construction by 2020 and for commercial buildings by 2030. California is going even further to promote zero energy in its public buildings. Governor Brown issued an executive order that, by 2025, all new state buildings shall be constructed as zero energy facilities and State agencies shall achieve zero energy performance in at least half of their existing buildings. Within the NEEP region, the District of Columbia is considering tailoring its future code adoptions toward required zero energy buildings.

California Zero Energy Action Plan

California Senate Bill 1389 of 2002 requires that the California Energy Commission, "develop energy policies that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety." As required, the Commission adopts an Integrated Energy Policy Report every two years and an update every other year. In 2007 the Integrated Energy Policy Report included zero net energy goals for new construction. That report was followed in 2008 by the California Public Utilities Commission Strategic Plan outlining the energy goals and efficiency strategies for the residential and commercial sectors. **The goal is that 100 percent of all new residential buildings will be zero net energy by 2020, all new commercial buildings zero net energy by 2030 and 50 percent of existing commercial buildings by 2030**. Other plans were created for measures associated with zero net energy buildings such as HVAC, codes and later lighting to name a few. The state will provide technical assistance and incentives through various residential and commercial programs.

California will also demonstrate leadership in state buildings per Governor Brown's Executive order B-18-12 which requires comprehensive green high performance measure for all existing and new state buildings. Measures related to zero net energy buildings include:

- All new state buildings and major renovations beginning design after 2025 be constructed as Zero Net Energy facilities with an interim target for 50 percent of new facilities beginning design after 2020 to be Zero Net Energy;[23]
- State agencies shall also take measures toward achieving zero net energy for 50 percent of the square footage of existing state-owned buildings area by 2025.[24]

Other provisions of the Order call for the reduction of greenhouse gas across the entire inventory of state buildings, reduction of grid based energy, participation in gird response programs, and use of onsite power generation through clean and renewable sources.

California Public Utilities Commission – www.cpuc.ca.gov

Integrated Energy Policy Reports – www.energy.ca.gov

California Zero Net Energy – www.californiaznehomes.com

Executive Order B-18-12 – www.ca.gov

Stretch Codes

Like California, several states in the region require public buildings to achieve additional energy savings beyond the base building energy code. Stretch energy codes, which are currently in use in Massachusetts, Vermont, and the District of Columbia and under development in New York and Rhode Island, provide an avenue for jurisdictions interested in saving additional energy and money to require their buildings to be more efficient—typically 10-20 percent—than the minimum code-mandated level. While some states incentivize municipalities to adopt a stretch energy code, other states have incorporated such codes into their rules and regulations to make them an outright requirement. (See State Progress Report for State Stretch Code Information)

National / Federal Zero Energy Initiatives

Executive Order 13693, titled "Planning for Federal Sustainability in the Next Decade," was issued by the Obama Administration on March 19, 2015. The order requires that at least 15 percent of existing federal buildings and leases meet Energy Efficiency Guiding Principles by 2015 and that annual progress be made toward 100 percent conformance for all federal buildings, with a goal of all new federal buildings achieving zero energy by 2030 and all buildings designed for zero energy starting in 2020.

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[23] California Office of Governor. *Executive order B-18-12*. Accessed: December, 2015. Available at: https://www.gov.ca.gov/news.php?id=17508

[24] Ibid.

The Energy Efficiency Guiding Principles as stated in EO 13514 are:

1. Employ integrated design principles (new construction)/Employ integrated assessment, operation, and management principles (existing buildings);
2. Optimize energy performance;
3. Protect and conserve water;
4. Enhance indoor environmental quality;
5. Reduce environmental impact of materials.

"Zero-net-energy building" is defined in Executive Order 13514 (previous to EO 13693) as "a building that is designed, constructed, and operated to require a greatly reduced quantity of energy to operate, meet the balance of energy needs from sources of energy that do not produce greenhouse gases, and therefore result in no net emissions of greenhouse gases and be economically viable".

Other federal agencies with zero energy initiatives:

NASA Ames Sustainably Base - https://www.nasa.gov/centers/ames/home/index.html

NREL Research Support Facility (first and largest Zero net energy building) - www.nrel.gov/sustainable_nrel/rsf.html

US Army Net Zero – Energy, Water, Waste - http://www.asaie.army.mil/Public/ES/netzero/

GSA NetZero Energy - www.gsa.gov

US EPA MOU on EO 13514 - http://www.epa.gov/greeningepa/practices/eo13514.htm

Washington State

Similar to California, Washington's legislature passed and Governor Inslee signed RCW 19.27A.160, which instructs the Washington State Building Code Council (SBCC) to develop residential and commercial energy codes that achieve a 70 percent reduction in building energy use by 2030 compared to the 2006 Washington State Energy Code (WSEC). Also, RCW 19.27A.170 requires commercial building to energy disclosure at the time of sale, lease, or when they are refinanced. The provision also pertains to including public agency buildings. RCW 19.27A.020 contains a broader goal of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031. A roadmap developed by the New Buildings Institute, recommends initiatives to reach the legislative goal.

Resources

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