The Massachusetts Green Bank Opportunity and Business Plan

Prepared by the Coalition for Green Capital
With Support from the John Merck Fund

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Executive Summary

Massachusetts is a clean energy leader, and has implemented aggressive targets and subsidy policies to support deployment of renewable energy and energy efficiency. However, vast potential for economic clean energy deployment remains untapped, and many energy users are unable to access clean energy today. A Green Bank, modeled on those of neighboring states, could be formed in Massachusetts to unlock this potential, using limited public capital cost-effectively to catalyze private investment to fill market gaps. The Green Bank could work in concert with the vast set of existing programs and policies, maximizing the impact of public funds. The Green Bank could be formed as a non-profit corporation, designated by the state to serve as the Green Bank. It could either be operated independently, or by the Massachusetts Clean Energy Center (MassCEC).

Though Massachusetts has been a national leader in energy efficiency, there are nevertheless many untapped clean energy market opportunities in the Commonwealth. There are potentially $45 billion in economically viable renewable investments alone in the state. The market potential of building efficiency is also considerable and well beyond what has been realized through existing subsidies. Wider clean energy deployment and increased consumer savings can be achieved with innovative financing techniques and increased private sector engagement. Products and programs designed to catalyze private investment into specific underserved markets, like low-to-moderate income households, can make clean energy more accessible and affordable to all Massachusetts citizens.

The formation of a Green Bank is an effective means of unlocking market potential, driving more investment and private activity across in targeted market segments not currently served by the private sector and government programs. Green Banks, like those in Connecticut and New York, are purpose-built finance entities with balance sheets and flexibility to deploy public capital through financing that is repaid to the Green Bank. Green Banks use financing techniques to pair public capital with private investment, driving up to 10 private dollars of investment per public dollar deployed. A Massachusetts Green Bank would provide a platform for a more focused, market-oriented approach to clean energy investment in the state. A Massachusetts Green Bank would offer various clean energy financing products and engage in market development activities across a range of market sectors to fill existing gaps.

A Massachusetts Green Bank should be created with legislation that outlines criteria to designate a private non-profit as the Commonwealth's official Green Bank. This non-profit pathway would allow the Green Bank to access philanthropic dollars, to become operational quickly, and operate as a more responsive market participant. The new non-profit could be operated independently, following the model of the Montgomery County, Maryland Green Bank. Or it could be operated by the MassCEC, given its existing role in funding clean energy market deployment. The legislation should also designate public funds to be made available to capitalize the non-profit Green Bank. The Green Bank would also seek to raise funds from non-state sources, such as philanthropic and mission-driven investment.

Initial products offered by the Massachusetts Green Bank could include a small-to-medium commercial solar financing product and commercial whole-building efficiency credit enhancement, both of which could be modified to encourage participation in the new PACE program. The Green Bank could also support investment in solar for low-to-moderate income households, with products like a credit enhancement to encourage community solar projects that target those communities. Depending on capital available to the Green Bank, it could also operate a market-responsive RFP for larger grid-tied projects, similar to the structure used by the New York Green Bank.

These financing products would be combined with all applicable rebates and incentives already available, which would increase the value proposition for consumers and drive uptake in the programs. The Green Bank could also create a website that serves as a central resource for clean energy information and resources in the Commonwealth. Learning curves and complex public programs can hinder adoption, so a streamlined website that allows users to understand all financing and rebates available, like EnergizeCT in Connecticut, could address this barrier.

The Massachusetts Green Bank would be built as a nimble, market-oriented, mission-driven clean energy financing entity, with a lean staff and start-up approach. It would work in partnership with existing market actors to drive clean energy market development, private activity, and consumer savings by filling market gaps and de-risking private investment. The impact of this institution would be all the more valuable as the Massachusetts clean energy market introduces changes such as the new SMART and PACE programs.

About the Coalition for Green Capital

The Coalition for Green Capital (CGC), a 501(c)(3) non-profit, is the nation's leading, advocate, expert and consultant on the topic of Green Banks, dedicated finance entities that use public-purpose dollars to drive greater private investment in clean energy deployment. CGC works directly with state governments and other partners to identify ways for public capital to stimulate private investment in mature clean energy technologies and accelerate the growth of clean energy markets. CGC often works with government to help create the institution, assessing various legal options to institutional creation and financial options for green bank capitalization. CGC also works with states to implement innovative clean energy finance and market development mechanisms through existing public institutions.

About this Report

This report was authored with support from the John Merck Fund. The goal of this report is to determine the need, viability and pathway for a Green Bank to be formed in Massachusetts. It is meant to elucidate clean energy market conditions in Massachusetts, specifically with regard to financing clean energy projects, and to identify various market gaps and needs that could be filled with a Green Bank. This report is also meant to provide clarity to the many market actors and stakeholders in Massachusetts that are interested in the creation of a Massachusetts Green Bank. This report provides Green Bank case studies, conceptual models, and various recommendations for the creation and operation of a potential Green Bank in Massachusetts.

Table of Contents

List of Tables

List of Figures

Massachusetts Energy Market & Clean Energy Policy

Massachusetts' energy needs are primarily met with natural gas and oil-based products. Natural gas-fired generation, both in and out of state, accounts for the majority of electricity consumption. Building heat is supplied by natural gas and fuel oil. And gasoline powers the Commonwealth's transportation sector. As a result, today, Massachusetts is highly dependent on carbon-emitting fossil fuels, all of which must be imported because the Commonwealth does not produce its own gas or oil. In addition, electricity and natural gas prices are above the national average. Massachusetts has taken steps to support clean energy deployment, but has a complicated and changing policy and program landscape.

Energy Sources

Most of the energy consumed in Massachusetts is sourced from fossil fuels. Of all electricity generated in Massachusetts in 2015, 66% was from natural gas, 16% was from nuclear, 7% was from coal, 2.6% was from hydroelectric, while wind was 0.7% and solar was 1.4%.[1] The electricity Massachusetts imports from other states in the region has a very similar mix, with most of the electricity being generated from natural gas.[2] 50% of Massachusetts residents use natural gas to heat their homes, with 35% using other fossil fuel-based products and 15% using electricity. Of the Commonwealth's carbon dioxide emissions by sector in 2014, 39% of the Commonwealth's carbon emissions came from transportation in 2014, with 26% residential buildings, 19% from commercial buildings, and 13% from industrial uses.[3] Statewide sectoral consumption of energy across sectors is 30.9% transportation, 30.0% residential, 28.0% commercial, and 11.1% industrial.[4] Massachusetts has the 32nd highest total emissions of all the states in the country. Massachusetts has higher emissions than all the states in its region, with the exception of New York.[5]

The figures below break down the energy consumption by type and by sector—one can see the outsized role played by natural gas in electricity generation, and on-site consumption in the residential, commercial, and industrial sectors.

Figure 1: Massachusetts Energy Consumption Estimates 2015[6]

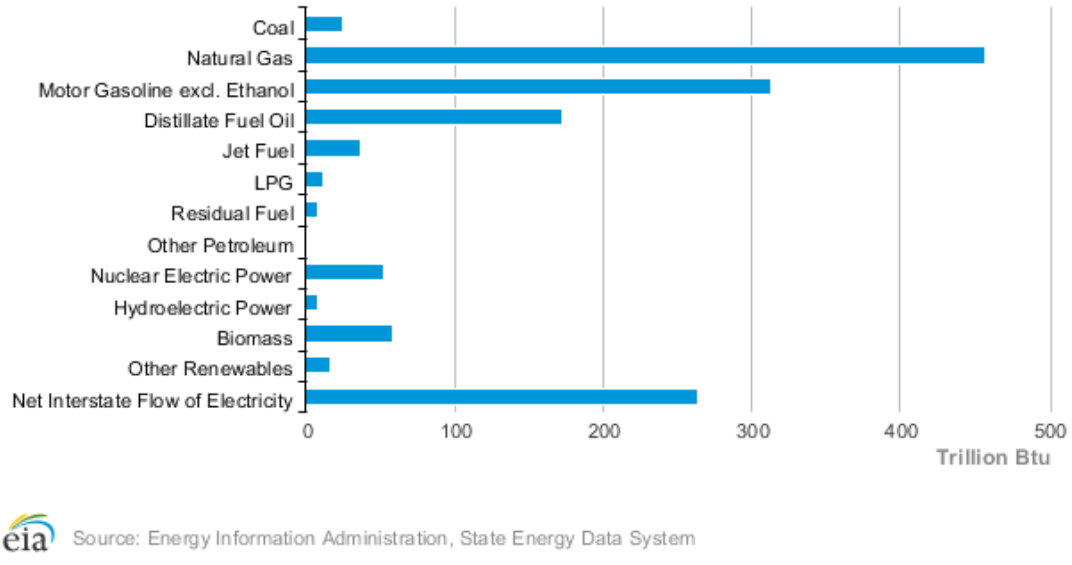
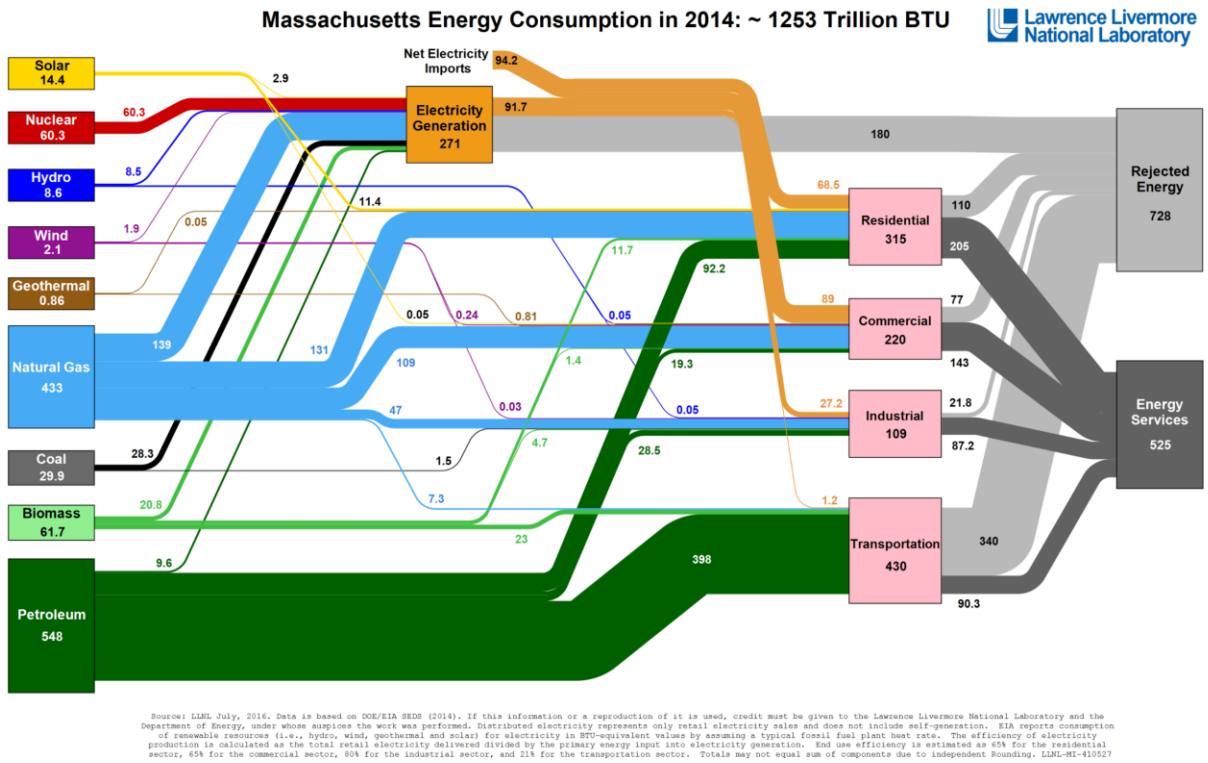


Figure 2: Massachusetts Energy Use in 2014[7]



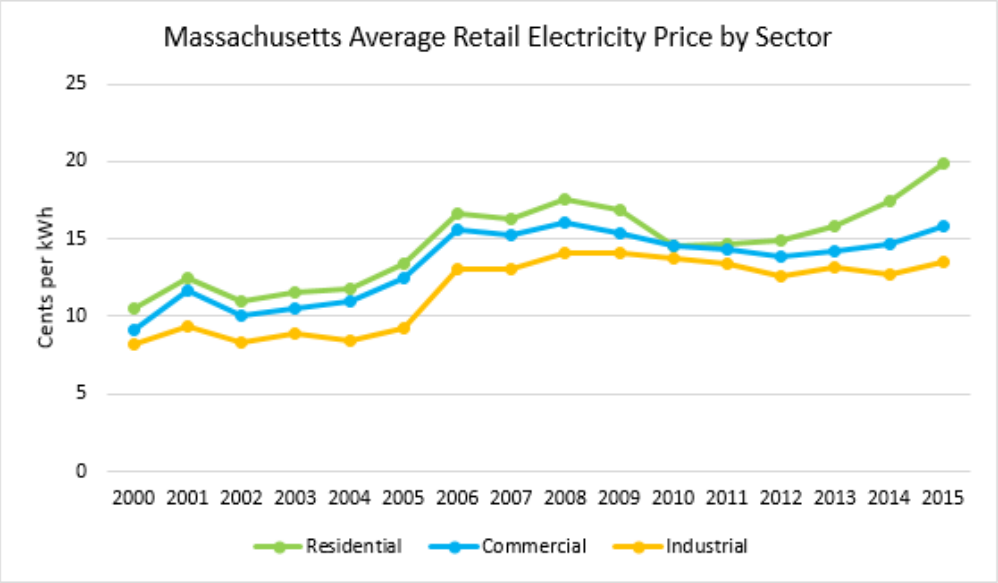
Energy Costs

Massachusetts is a high-priced energy state, with the 8th highest prices for natural gas and the 4th highest prices for electricity in the country. In June of 2017, Massachusetts's average residential electricity prices were above the national average by 53%, while the Commonwealth's average commercial price was above the national average by about 45%. The average industrial price was 98% above the national average.[8] In the last 15 years, the average price of electricity has essentially doubled, rising from around 10 cents per kWh to nearly 20 cents per kWh.

Table 1: Massachusetts Electricity Prices by Sector in 2017 in cents per kWh[9]

	Residential	Commercial	Industrial
Massachusetts	19.84	15.15	13.34
U.S. Avg.	12.90	10.48	6.74

Figure 3: Massachusetts Average Retail Electricity Prices by Sector 2000-2015[10]



Natural gas prices in Massachusetts are currently 25%, 31% and 113% above the national average price in the residential, commercial and industrial sectors, respectively.[11]

Table 2: Average US and Massachusetts Natural Gas Prices in 2017 in $/Mcf[12]

	Residential	Commercial	Industrial
Massachusetts	12.57	9.47	7.49
U.S. Avg.	10.07	7.25	3.51

Policy and Program Landscape

Massachusetts has a wide array of policies that support clean energy, which are managed are promulgated by a small group of state institutions. The Department of Energy Resources (DOER) is the state energy office, and manages many of the Commonwealths' energy policies. The Massachusetts Clean Energy Center (MassCEC) is a quasi-public entity that supports clean energy development. Utilities or utility program administrators—such as Eversource, National Grid, and Berkshire Gas—run efficiency incentive programs to reach efficiency goals mandated by the Department of Public Utilities. Mass Save is an umbrella program created by utilities that includes many (but not all) of the energy efficiency incentive programs in the Commonwealth.

Massachusetts has a Renewable Portfolio Standard (RPS) that mandates 15% of electricity sales come from renewable sources by 2020, and mandates an additional 1% of sales each year after 2020. The RPS also includes a required in-state solar photovoltaic generation capacity of 1,600 MW by 2020, which equates to around 3% of total retail sales of electricity.[13] To comply with the RPS, utilities and electricity suppliers must possess renewable energy certificates (RECs) produced by eligible technologies.[14] Historically, the Commonwealth required all electricity suppliers to comply with the RPS by securing RECs

and solar carve-out renewable energy certificates (SRECs) in the appropriate amounts. Each RECs and SRECs had market price that facilitated the sale and purchase of excess RECs and SRECs. The new Solar Massachusetts Renewable Target (SMART) program will change the way the solar capacity target is met by instituting a feed-in tariff model in place of the SREC market.[15]

Massachusetts recently introduced a target of 200 MWh of storage by 2020.[16] Massachusetts also has net metering, efficiency targets for state buildings, and tax benefits for renewable energy project owners.[17] Massachusetts recently passed Property-Assessed Clean Energy (PACE) enabling legislation, which allows commercial building owners to finance clean energy upgrades by placing a lien on the property and repaying the financing through their property tax bills.[18] The Department of Energy Resources (DOER) is the state energy office and manages the RPS, the storage target, and the transition to SMART. DOER also co-administers the new PACE program with Mass Development, the Commonwealth's economic and development finance agency.

In addition to these policies, Massachusetts has a large number of incentive programs that support efficiency and renewable energy technologies, mostly provided by utilities and their affiliated programs. There are a large number of entities that sell electricity and natural gas to Massachusetts customers, and nearly all of them offer some form of rebate or subsidy for energy efficiency technologies either directly or indirectly through an affiliated program. The specific technologies, form of financial support, and market sectors served vary on an institution-by-institution basis.

Mass Save is unique among these rebate programs—it was jointly created by the electric and gas utilities in Massachusetts to serve as an umbrella program to offer rebates for energy efficiency projects. It provides a range of incentives and rebates, building energy audits, and various educational materials and resources on the subject of building energy efficiency.[19]

MassCEC is a clean energy-focused quasi-public organization, offers a wide range of support for clean energy companies, technologies, and projects. MassCEC offers incentives for efficiency, wind, hydropower, anaerobic digesters, and other technologies.[20]

Though there are many incentive programs throughout the Commonwealth, there are only a few financing programs. MassCEC runs the Mass Solar Loan program for residential solar projects, offering interest rate buy downs for participating private lenders. Mass Save runs the HEAT Loan program and the Financing for Business program for residential and commercial efficiency projects respectively. Through those programs, Mass Save buys down the interest rate or pre-pays scheduled interest payments to participating lenders on behalf of the borrowers. For all these programs, the rates participating lenders are allowed to charge are determined in advance. Across these programs, public funds are primarily used to provide incentive payments and credit enhancements to lenders—public capital is not used directly for project financing. Detailed information on the programs and policies in Massachusetts is available in the Appendix.

Clean Energy Penetration & Potential

Though Massachusetts has made strides deploying clean energy, the current installed capacity is only a small share of what is currently economically viable.

Clean Energy Deployment Today

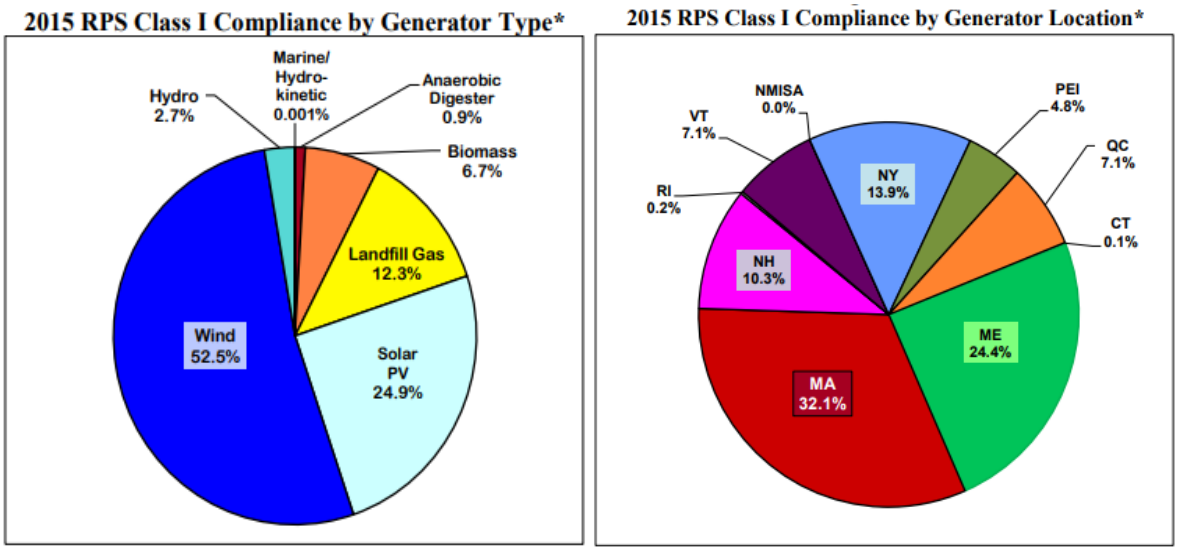
Table 3: Renewable Energy Installed Capacity by Technology in 2017[21]

Technologies	Installed Capacity
Solar	1699 MW
Wind	115 MW
CHP	483 MW
Biogas	34 Projects

A range of renewable generation technologies have been deployed in Massachusetts, but solar power has by far the greatest installed capacity. Currently nearly 1.7 GW of solar has been installed, and Massachusetts had the 7th most solar of any state as of the end of 2016. Of the installed solar capacity, 70% was distributed and 30% was utility scale in 2015. Of the distributed solar capacity in 2015, 30% were residential systems and 70% were installed on commercial and industrial properties.[22]

More broadly, of the RECs used to comply with the Massachusetts RPS in 2015, 67.1% came from out of state, while 32.1% came from in-state renewable generation. Of the RECs used for compliance in 2015, 53% were wind, and 25% were solar.[23]

Figure 4: Massachusetts RECs by Technology and Location in 2015[24]



* Includes the Solar Carve-Outs, all SRECs & SREC-IIs.

In the period of 2010 through 2016, Mass Save spent $2.9 billion on electricity efficiency through incentive programs, and has achieved 7,879 GWh of total first-year savings in that period, or 85,978 GWh in lifetime savings. In the same period, Mass Save spent $1.0 billion on gas efficiency through incentive programs, and has achieved 1.551 trillion BTUs of total first-year savings, or 21.0 trillion BTUs in lifetime savings.[25]

Clean Energy Potential

Massachusetts' clean energy market potential is well above its current deployment of clean energy. Below are estimates of the economically viable clean energy potential in Massachusetts on an energy and dollar investment basis. This approach highlights the economic potential (or Serviceable Addressable Market) of the clean energy market by focusing on commercially proven technologies in feasible market segments. The estimates of economic potential in this section are based on existing technical analyses, which can produce varying results, depending on methodologies used and the assumptions made.[i]

Table 4: Renewable Energy Investment Potentials by Technology[26]

Technologies[ii]	Savings, Capacity & Project Potentials	Investment Potential ($M)
Solar (Distributed)[iii]	4,490 - 11,750 MW	$2,471 - $6,460
Solar (Utility)	5 - 85 MW	$1,149 - $21,265
Wind (Onshore)[iv]	260 - 1,170 MW	$444 - $2,000
Wind (Offshore)[27]	4,000 - 55,000 MW	$1,000 - $13,750
CHP[28]	343 MW	$520
Biogas[29]	98 Projects	$294
Geothermal Heat Pumps[v]	33,177 Projects	$920
TOTAL	**-**	**$6,799 - $45,210**

This market sizing assessment provides a reasonable estimate of the economically viable clean energy potential, based on available technical market research. This estimate can help policymakers and market

[i] Sources include the National Renewable Energy Laboratory (NREL), the Lawrence Berkeley National Laboratory (LBNL), the Department of Energy (DOE), Windpower Intelligence, Rutgers University, the U.S. Energy Information Administration (EIA), American Biogas Council, the American Wind Energy Association (AWEA), the Solar Energy Industries Association (SEIA), Massachusetts Department of Energy Resources (DOER), the Massachusetts Clean Energy Center (MassCEC), Cadmus, Electric Power Research Institute (EPRI), and the Massachusetts Energy Efficiency Advisory Council (EEAC).

[ii] This table is not comprehensive—there may be other clean energy technologies that have attractive and untapped market potential in Massachusetts.

[iii] According to NREL estimates, the market potential for solar is very large in Massachusetts. While NREL's estimates are reported in full as capacity potentials in this table, for the sake of conservatism only 25% of calculated investment potentials are reported in this table.

[iv] This only includes onshore wind potential at 80m height.

[v] This only includes residential applications of heat pumps. There are attractive opportunities for geothermal heat pumps in commercial applications that were not accounted for due to lack of data.

participants understand the range and scale of investment opportunities in Massachusetts' clean energy markets. This assessment is not meant to precisely calculate or identify one single "correct" figure for clean energy potential, or to indicate a recommended fuel mix. It should not be read as a technical analysis on par with those produced by energy engineering firms or government agencies.

Energy efficiency potential studies vary widely in their methodologies and in their calculated estimates of efficiency potential in Massachusetts. Estimates range from 122.2 trillion BTUs of savings in residential and commercial sectors through 2040 to 28.2 trillion BTUs across all sectors in the 2016-2018 period.[30] These studies are very conservative, yet they nevertheless suggest that there is a large potential for energy efficiency in the Commonwealth. It is also worth noting that the studies do not include estimates of the investment necessary to achieve the estimated energy savings, or do not do so from the perspective of the building owner or investor. More information on energy efficiency potential studies conducted in Massachusetts is available in the Appendix.

The Need for Increased Clean Energy Investment

Massachusetts has clean energy targets, and spends large sums of public money to support deployment. The Commonwealth also has an enormous market potential. However, the current set of programs and current level of private activity is sufficient to meaningfully penetrate this market. Though there are pockets of strong market and investment activity, there are many other gaps left unserved. Financing from public and private sources, which can eliminate the barrier of upfront costs of adoption, is critical to building out clean energy that can serve all Massachusetts citizens and businesses. Increased clean energy investment can support economic growth, save money for energy users, preserve public capital, and lower emissions.

Financing & Current Market Activity

Much of the market activity in residential and commercial efficiency in Massachusetts results from ratepayer-funded rebates for efficiency. Yet many of the easiest opportunities for inexpensive and simple energy-saving building upgrades have already been seized as a result of the active and generous utility efficiency programs.[31]

Some homeowners are making more ambitious investments in efficiency with the Mass Save HEAT Loan program, and in solar with the MassCEC Solar Loan program and private solar companies such as Tesla (formerly SolarCity) and Sungage.[32] There are high levels of uptake in the Solar Loan and the HEAT Loan programs. Private entry and activity in the clean energy lending space may be inhibited by the existence of government and utility-subsidized lending programs. Conversations with market participants suggested that these programs (and their previous iterations) have crowded out businesses active in or interested in entering this space, and subsidized capital may preventing price discovery for clean energy capital.[33]

Commercial and industrial building owners in Massachusetts also have access to rebates for building energy upgrades. Efficiency professionals work closely with utilities and utility efficiency programs to implemented discounted efficiency upgrades in C&I buildings of all sizes and market segments. There is an active group of solar developers and lenders servicing large C&I buildings with solar projects financed

through power purchase agreements (PPAs). Smaller C&I buildings have a harder time finding attractive financing for solar.[34]

The municipal, university, school, and hospital (MUSH) market is among the most active clean energy market segments in Massachusetts. Much of the clean energy projects in the MUSH market segment is performed by private energy services companies (ESCOs), which install both efficiency measures and renewable energy systems. Municipal buildings, including many schools, have access to inexpensive bond capital and use it to finance whole-building energy retrofits and rooftop solar. Tax-exempt lease purchases are another common model of financing in this market segment. Most of the solar projects in the MUSH market are financed with PPAs.[35]

The Massachusetts clean energy market is in flux. The new PACE program, the new SMART program that will essentially create a feed-in tariff for solar, new storage targets, and a new iteration of the Mass Solar Loan product may change the market landscape or create new gaps and new opportunities for clean energy market activity.

Financing & Investment Needs

Extensive program and policy research and numerous conversations with market stakeholders were undertaken to identify financing gaps and needs in Massachusetts' clean energy market. Interviews were conducted with project developers, contractors, program managers, lenders, investors, policymakers, NGOs, and regulators. The analysis focused on understanding the current energy landscape, and the process for identifying, financing and developing clean energy projects. Discussions also centered on identifying gaps, opportunities and underserved market segments. The economically viable market potential for clean energy projects in Massachusetts is large, and market penetration could be much higher.

Of particular interest are distributed clean energy projects such as distributed solar projects and building efficiency, as they are more heterogeneous and rely on mostly local and regional market actors. Stakeholder interviews focused on these markets in particular, in an effort to understand why investment levels are below their potential, and what market gaps and failures might be preventing growth. Through the interview process, Massachusetts stakeholders identified several key market segments that are underdeveloped and have difficulty implementing clean energy projects. These markets include:

- Small-to-Medium-Sized Commercial and Industrial solar projects
- Small-to-Medium-Sized Commercial and Industrial energy efficiency whole building retrofits
- Non-profits (such as hospitals and schools)
- Low-income community solar
- Whole-building turnkey Efficiency Financing
- Financing options for Micro-hydro, Anaerobic Digesters, Fuel Cells, Storage, Microgrids

Beyond these specific market segments, other aspects of the broader clean energy market in Massachusetts that may limit market development include: information gaps, market complexity, difficulties with grid interconnections, and subsidized lending programs inhibiting price discovery and private activity.

Stakeholders also identified several markets that can presently access clean energy financing with more ease: municipal buildings (via bonds and energy services companies), MUSH-market buildings (through energy services companies); high income residential solar in urban areas (through the national and local solar installers); utility-scale wind (through large project developers and large capital providers); and efficiency in large, credit-rated commercial buildings (through energy services companies).

Specific Financing Gaps for Massachusetts

Solar and Efficiency in Small-to-Medium Commercial and Nonprofit Buildings

The single family residential and large commercial market segments in Massachusetts are served by solar installers and developers, and building owners in both segments, as well as developers, have access to affordable financing for solar projects.[vi] Small-to-medium commercial buildings are the market segment between single family residential and large commercial and in Massachusetts have much less access to installation services and financing for those services.[36]

Single family residential projects tend to be in the range of 5-20 kW, and are installed and financed by national installers (such as Vivint and Tesla), or by local or regional installers that use third party financing subsidized by the Mass Solar Loan program. Solar projects in larger commercial buildings, projects approximately in the range of 200 kW to 5 MW, are performed by commercial solar development companies (such as Borego and Nexamp), and financed by some combination of in-house capital and third party lending partners.[37]

Small and medium commercial solar projects, projects approximately in the range of 25 to 200 kW, are generally not served by residential solar installers or large commercial solar developers, and do not benefit from access to the sources of capital those segments use. Another challenge faced by small and medium businesses is insufficient tax liability to fully monetize the solar tax incentives.[38]

There is an opportunity in this market segment to either create a solar financing product or credit enhancement that encourages private entry into this market gap.

In the efficiency market, commercial buildings of all sizes get assistance directly from utilities or from utility-affiliated contractors depending on their size and service territory. Much of the efficiency programs are geared toward single-measure upgrades. Mass Save provides 0% financing for multi-measure commercial efficiency projects, but the program is not well used. Owners of small-to-medium commercial buildings may not have the time or expertise necessary to seek out and take advantage of subsidies for individual measures or to bundle multiple efficiency measures together and use Mass Save financing to pay for them.[39]

There is an opportunity in this market for a whole-building efficiency retrofit financing product to integrate multiple measures (and any relevant subsidies) into a single turnkey financing to serve small and medium commercial buildings.

[vi] It is worth noting that the transition in the solar market structure away from high-value SRECs toward a feed-in tariff model may change the economics of and viable financing structures of solar projects in these market segments in the near future.

There is also an opportunity to create a single integrated solar and efficiency financing product to serve small and medium commercial buildings. The newly formed PACE financing mechanism will likely facilitate the integrated financing of solar and efficiency projects in medium sized commercial buildings. However some smaller commercial and non-profit buildings may PACE is most suitable for projects with a minimum total install cost on $100,000.[40]

Solar and Efficiency in Nonprofit Buildings

Nonprofit buildings, much like small-to-medium commercial buildings, are an underserved market segment for whole-building efficiency and solar projects. Nonprofit buildings are often in a similar size range as small-to-medium commercial buildings, and are unable to directly monetize solar tax incentives. Nonprofits may have income, debt, and ownership structures that differ from those of commercial buildings, which may make solar and efficiency upgrades more difficult to finance.

There is also an opportunity to create a single integrated solar and efficiency financing product to serve non-profit buildings. Nonprofit buildings are also eligible for PACE financing, so an integrated solar and efficiency financing product designed for the small-to-medium commercial buildings may also be applicable to non-profit buildings.

Community Solar for Low-to-Moderate Income Households

Several solar developers active in Massachusetts that install and finance solar in residential and commercial buildings under the PPA third-party ownership model also offer community solar installation and financing products.[41] Those community solar products work in a similar fashion—the company owns the solar project and monetizes the various tax credits and other incentives and offers electricity or net metered credits to customers at a modest discount to the utility rates they would otherwise pay. These community solar products serve the market segment that is interested in solar but has a roof unsuitable for solar or lives in a multi-unit residential building.

While some low and moderate income homeowners have access to solar and solar financing through the Mass Solar Loan program of MassCEC, the low and moderate income households that do not have suitable roofs for solar, or that live in multi-unit buildings are unable to access the benefits of solar electricity through community solar structures. The existing community solar products are not geared toward low to moderate income customers.[42] There is an opportunity to create community solar structures that serve the low-to-moderate income households.

Financing for Distributed Clean Energy Projects in Commercial Applications

Newer clean energy technologies—such as anaerobic digesters, fuel cells, micro-hydro, storage, and microgrids—have become or are becoming economically viable for commercial applications but there is a general lack of financing options for these technologies at the commercial scale in Massachusetts. Government and utility programs may provide incentives that defray predevelopment costs or a portion of installation costs, but do not provide financing. Private lenders may not be familiar with the relatively new technologies and may be unwilling to undertake the research and legwork necessary to invest. There is an opportunity to create a program or pool of capital devoted to financing or providing credit enhancements for the private sector to finance these new technologies in Massachusetts.

Whole-Building Turnkey Efficiency Financing

There are a multitude of energy efficiency incentives in Massachusetts for a range of building-types. Many of the incentives are technology-specific single measure incentives, such as rebates for efficient lighting or heating technologies. As many of the most obvious and easy efficiency upgrades are undertaken, there are fewer opportunities for attractive single-measure upgrades. There is an opportunity for financing to supplement these incentives by providing a means to combine multiple measures into a single project and thereby achieve deeper savings. Financing whole-building efficiency projects would eliminate upfront costs. Multiple efficiency measures together could produce a stream of savings large enough to pay for the financing of the project and provide net savings to the building owner.

While the whole-building approach is already used by ESCOs in the Massachusetts MUSH market, there are opportunities to apply the approach in the commercial, and residential single family and multifamily sectors. There is an opportunity to create turnkey financing products to serve these sectors such that all relevant incentives are wrapped into the financed project, and that the customer and contractor experiences are as seamless and simple as possible. Layering financing on top of the wide array efficiency incentives will allow deeper efficiency gains. There is also an opportunity to integrate solar and efficiency projects into a single financing.

The Green Bank Opportunity in Massachusetts

Market potential is high, penetration is low, and the Commonwealth's primary approaches to supporting clean energy are through mandates and rebates. Together these can set the table for demand and market growth, but don't necessarily provide the tools for robust private sector activity and investment. To address this need in a focused, and market-oriented way that drives private investment, the Commonwealth should establish a Green Bank financing entity similar to those used in neighboring states.

Today, there are a variety of incentives for efficiency and renewable energy technologies in Massachusetts. There is private market activity in some market segments, such as MUSH and large C&I. Some segments, such as residential efficiency, are either dominated by rebate programs or subsidized lending programs. Yet there are a several market segments that are not served by the private sector that do not have access to attractive financing. And many of the most attractive single-measure efficiency upgrades, such as lighting and HVAC equipment, have already been made in Massachusetts as a result of the active utility efficiency program ecosystem.

There is an opportunity to drive more clean energy deployment by creating more independent private sector activity and investment in clean energy. Clean energy deployment in Massachusetts can rise to higher levels if consumers are able to take advantage of turnkey financing products to implement deeper, more ambitious cash-flow positive energy upgrades without upfront costs. Turnkey financing products created with a strong customer (and contractor) focus make it easy and quick to finance more ambitious clean energy projects and build scale. Sourcing the capital for these turnkey financing products from local lenders, whenever possible, provides a deep and efficient flow of capital into the clean energy space, and drives local economic development. Financing can allow underserved segments to realize greater consumer savings and can make clean energy more attractive from the consumer and investor perspective.

A Green Bank will allow Massachusetts to take full advantage of the opportunity to leverage more clean energy financing in the market. A Massachusetts Green Bank would increase clean energy access and customer savings through innovative financing techniques, increase private activity and investment in clean energy through its market development activities, and have a deeper impact on outcomes.

The Green Bank model has been widely adopted throughout New England, and increasingly the rest of the world. Green Banks have collectively achieved impressive results. The Green Banks represented in the Green Bank Network have mobilized $29 billion in public and private clean energy investment.[43] The New York Green Bank alone has mobilized a total of $1.4 billion clean energy investment with only $409 million of its own capital,[44] and has achieved financial self-sufficiency with the returns from its investing activities.[45] The Connecticut Green Bank has mobilized more than $1 billion in public and private clean energy investment, with only $200 million of its own project investment.[46] There is now an opportunity to generate similar outcomes with a Massachusetts Green Bank.

What is a Green Bank

A Green Bank is a public, quasi-public or non-profit institution that finances the deployment of renewable energy, energy efficiency, and other clean energy and green infrastructure projects in partnership with private lenders. They provide funds to cover the sizable upfront costs of clean energy adoption or construction, and are then repaid through a range of financing mechanisms. Green Banks are typically capitalized with public funds, which are then used to offer loans, leases, credit enhancements and other financing services to drive in more private and total investment into target markets. The goal of a Green Bank is to accelerate the deployment of clean energy by removing the upfront cost of adoption, leveraging greater private investment in clean energy, and increasing the efficiency of public dollars.

Through Green Banks, consumers and businesses can install clean energy technologies with little to no upfront cost while reducing energy costs. And because public dollars are used for lending, rather than subsidies, all public dollars are preserved through loan repayment. For a number of reasons, economically viable, low-risk clean energy projects are often unable to access affordable private financing. Green Bank financing methods “crowd-in” private capital to fill financing gaps by reducing real and perceived risk, and allowing private investors the chance to learn about a new market opportunity with the security of government partnership. As private lenders gain experience and information about the processes, risks and addressable market size in clean energy, they can become increasingly comfortable and confident lending into these markets. Green Banks have shown that with experience and data, private investors are eager to enter clean energy markets at scale, ultimately without any Green Bank support.

In addition to attracting capital in innovative ways, Green Banks ensure there is demand for that capital and clean energy solutions. With an equal focus on market development and demand generation, Green Banks don’t merely make money available to the market. Green Banks bridge the gap between capital supply and market demand by developing holistic, turn-key products and delivery pathways the enable broader clean energy adoption. This is implemented in partnership with existing rebate programs.

Green Bank Principles

Green Banks around the world have been implemented in different ways, with varying organization structures and objectives. However, they are all tied together by a common set of guiding principles:

- *Drive more private investment using limited public resources* - The goal of all Green Banks is to drive more private investment with public funds. This is achieved through a number of financing approaches, but all Green Banks aim to stimulate more private clean energy investment. This approach is driven by the fact that achieving climate-related goals requires more investment than the public sector can reasonably be responsible for. Private investment can also be a catalyst for economic growth. Private investment is essential, and Green Banks aim to drive that investment.

- *Provide financing for underserved market sectors and segments* – Green Banks do not offer subsidies or rebates. They provide financing with the goal of being self-sustaining and to build markets that are not reliant on subsidies. However, Green Banks only support financing for segments of the clean energy markets that aren't already adequately served by private markets. For example, small-to-medium businesses without a credit rating or low-to-moderate income households often struggle to get financing to upgrade the efficiency of their buildings or homes and are a good Green Bank target.

- *Be market-oriented and aim to increase consumer protection, information transparency, and ease of adoption* - Green Banks aim to build robust and efficient markets for clean energy solutions. They seek to create markets where ample supply of capital and technology solutions meet sustained and growing demand from informed consumers. This means Green Banks take on a number of activities that support the delivery of financing, like increasing information transparency and standardizing documents/processes.

- *Be steadfast in the face of changing political landscape, budget changes, and administrative priorities* - Green Banks are meant to be institutions that do not come and go, or waver significantly with changing political or budget conditions. As lending institutions with a financial foundation, they are stable and consistent, as this is what the market requires from lending partners. In this way, they are different from policy-based programs that are budget-dependent and could be eliminated year to year based on funding or other conditions.

- *Be flexible and adaptable to react to market* - As market-oriented finance institutions, Green Banks are responsive to market conditions and are willing to adapt as needed. Green Banks offer finance where it is needed, but will discontinue finance into a given market once private capital is flowing. And Green Banks learn from mistakes. If something doesn't work, they'll react and change, rather than continue to provide a service that has no demand or uptake. These operating changes do not require political approval, but rather are part of the organization's regular governance & management structure.

Benefits of the Green Bank Model

Green Banks produce numerous economic, fiscal and environmental benefits.

- *Reduce barriers to adoption* – By offering up to 100% upfront financing, Green Banks eliminate the upfront cost of clean energy adoption, a primary barrier to market growth.

- *Lower energy costs* – Green Banks only finance projects that are economically and financially viable. This means, just like private actors, they only finance the construction of projects that are value creating for the user and generate revenues to repay the loans. This value could mean a lower price of energy to the end user, or a similar price but lower GHG emissions, lower total energy costs due to reduced consumption (efficiency) or some combination of these.

- *Create more local jobs* – Green Banks effectively are in the construction finance business. Everything Green Banks support requires construction and service at a specific location. There is no way to install efficient equipment without putting boots on the ground at the location. More investment, means growing businesses and more jobs.

- *Stimulate macroeconomic growth* – There is a massive global savings glut and decline in investment. This has contributed to sustained slow growth. Wise and sustained investment in clean energy, through public-private partnership structures, can close the savings-to-investment gap and spark higher growth.

- *Preserve public capital* – By using finance, rather than subsidies, the public capital invested in the Green Bank is preserved and can be recycled repeatedly for more clean energy investing. And every time public dollars flow back to the market they leverage new private capital. This preservation reduces the burden on taxpayers, and can actually generate positive returns

Green Bank Finance Tools

Green Banks use a range of financing techniques to drive clean energy investment. Many Green Banks also focus on demand generation and market development to ensure efficient markets grow around the financing offerings. Though many individual investment structures are used (senior debt, subordinated debt, second loss reserves, etc.), most Green Bank financing methods can be categorized in three buckets.

- *Credit Enhancement* – Green Banks use various credit enhancement mechanisms to mitigate risks for private investors and incentivize investment on better terms. This can be in the form of a first or second loss reserve, a partial loan guarantee or subordinated debt.

- *Co-Investment* – A Green Bank could directly lend into a project alongside a private sector partner. This technique is most useful when there is a specific gap in capital needed to complete a project. It might also provide better financial returns for the Green Bank.

- *Aggregation, Warehousing & Securitization* – Aggregation is a critical Green Bank method of lending to and bundling small clean energy projects that are traditionally difficult to finance. Many clean energy projects, like distributed generation and building efficiency, are inherently small, scattered and have varying credits. This makes them unappealing for private lenders. Green Banks can directly originate, or aggregate these kinds of loans to achieve scale and diversity of risk. This can lead to securitization, which allows the Green Bank to recapitalize its warehouse.

Other Green Banks in the Region

Many of Massachusetts neighboring states have already created Green Banks. The Connecticut Green Bank (CGB) was created in 2011 as a quasi-public entity with bipartisan legislation and the support of the governor. The CGB is capitalized primarily by two sources: a systems benefit charge and the state's proceeds from the sale of emission allowances through the Regional Greenhouse Gas Initiative (RGGI) Program. In total, this adds to a total annual infusion in the CGB of approximately $30 million per year. The CGB has engaged in a variety of financing activity including: loan, lease, and PPA products for commercial and residential solar and efficiency projects; developing the best commercial PACE program in the country; and pre-development loans for multi-family energy efficiency. Since its inception, the CT Green Bank has received $186 million in state funding and deployed $165 million for project investments. With its investing activity, it has leveraged $755 million in private investment. In total, it has mobilized more than $1 billion in public and private investments in clean energy and has created 4,443 direct and indirect jobs in the state.[47]

The New York Green Bank (NYGB) was created in 2013 as a financing institution within NYSERDA, the state's energy office, that would use $1 billion to fill financing gaps in the New York clean energy capital market. The NYGB was capitalized by redirecting a portion of the ratepayer surcharge funds and a one-time infusion of state's RGGI proceeds. The NYGB operates as a wholesale clean energy finance lender (as opposed to Connecticut, which operates more as a retail lender). The NYGB issued an open-ended RFP seeking applicants for funding that could demonstrate that they could not find private funding elsewhere, and that NYGB deal participation would produce "market transformation." As of its latest quarterly report in June 2017, NY Green Bank has committed $409.4 million in public capital to support approximately $1.4 billion in total investments.[48] In FY 2017, the NYGB grew its portfolio by almost $300 million, and finished the year with $9.7 million in revenue against $7.0 million in expenses for a net profit of $2.7 million.[49] The NYGB is the first Green Bank in the U.S. to generate positive net income, meaning the revenue earned on its finance activity is greater than the operating costs of running the organization.

Rhode Island's Green Bank was created in 2015 when the governor repurposed the state's quasi-public water financing authority to include clean energy, and renamed it the Rhode Island Infrastructure Bank (RIIB). The RIIB was funded by a combination of an ARRA grant, state RGGI revenue, utility bill surcharges, re-directed operating funds, and its own bonding authority. RIIB was assigned responsibility for two specific financing programs in the legislation. RIIB has responsibility for both commercial and residential PACE programs in the state, and with running the Efficient Buildings Fund (EBF), which finances energy upgrades for municipal buildings in the state. This past year RIIB completed the first round of EBF funding, which used an innovative structure and partnership with the state energy office to finance 17 municipal projects across 6 towns with $17.2 million of capital.[50]

Green Bank Model Applied to Massachusetts

Massachusetts's clean energy market has a unique set of challenges and gaps that could be addressed with a Green Bank. There are many aspects of creating and operating a Green Bank—its organizational form, its capitalization, its financing and market development activities, hiring, fundraising, governance and others. Though no two Green Banks are the same, nearly all Green Banks follow the same set of

foundational principles and best practices. Green Bank case studies from other states are available in the Appendix.

The Green Bank should be founded with a market-oriented, entrepreneurial culture, rather than a culture of government-regulated program. The Green Bank can and should take on a lean and flexible posture, prioritizing speed, multi-tasking, and outcomes over structure and bureaucracy. The sources and amount of capital may be uncertain in the early phases, so the Green Bank may need to run with a small operating budget to start and must be able to pull in foundation dollars and investment capital where it can. The Green Bank should also seek to complement a small in-house staff by drawing on the know-how contained in the broader community of clean energy project financing organizations.

Best practices on product design, go-to-market strategy and recommendations on service providers and other potential partners can all be gleaned from the generous and growing network of clean energy lenders, including those represented in the newly founded Green Bank Consortium. To the extent possible the entity should also seek to piggy-back on the back-office functions and overhead of other partner organizations until it can reach a scale where it can sustain such expenses itself. The Green Bank should also seek to heavily leverage technology solutions wherever possible, building in paperless and people-less standard operating procedures from founding.

Organizational Form

Green Banks are often public or quasi-public, directly connected to government. More recently, Green Banks have also taken the form of an independent non-profit lender that is aligned with the missions of the relevant government entities in their host state. Green Banks that are a part of government have the benefit of increased access to government funds, though they may be constrained by various laws and regulations, and a bureaucratic approach to clean energy financing. Green Banks that are independent 501(c)3 non-profits have the benefit of tax-exemption, which will allow them to receive grants and program-related investments from foundations. The non-profit Green Bank allows the organization to operate more as a service provider, or contracted agent of the state. This in turn allows for more independent and market-oriented operation.

Recently there have been a few attempts to create a governmental Green Bank in Massachusetts through legislation. Massachusetts should replicate the non-profit approach and incorporate a non-profit Green Bank, which is then designated by legislation to serve as the Commonwealth's official Green Bank. The legislation should not seek to form a brand new government body or quasi-governmental entity.

The legislation would outline various criteria, and then designate a non-profit that meets all those criteria as the state's official Green Bank. Creating a Green Bank in Massachusetts in this way would allow the entity to benefit from a close relationship with government and a non-profit corporate form. Doing so would allow the Green Bank to access philanthropic dollars, to become operational quicker, be more responsive to market conditions, and be unencumbered by bureaucratic structures. This corporation could be a new stand-alone entity, or it could be operated by the MassCEC, given its existing role in funding clean energy market deployment.

A non-profit corporation can be independently incorporated relatively quickly in the state. The corporation would then apply to the IRS for 501(c)3 status so that it could receive charitable contributions.

The corporation would be formed to adhere to the requirements of the legislation, so that once it is functional (i.e. incorporated, has a board and bylaws) it can receive the official Green Bank designation.

Green Banks have a public purpose, are mission-driven, seek to collaborate with and supplement existing market activity, and offer financing that the private sector is unable to offer today. Regardless of the organizational form the Green Bank ultimately takes, it must establish itself as a mission-driven entity and create public trust and comfort for all borrowers, partners, or government collaborators.

Capital Sources

There are many sources of capital that a Massachusetts Green Bank could draw upon. Any and all of these funding sources, should be pursued. Legislation calling for the creation and designation of a non-profit Green Bank in Massachusetts should also allocate $100 million of public-purpose funds to that entity as a starting pool for lending. This allocation can be disbursed over time, but initial funding must be sufficient to allow the Green Bank to start operations and lend in a significant manner. As a non-profit, the Massachusetts Green Bank could also raise capital from various other sources to supplement its original allocation.

The Massachusetts Green Bank will have two general uses for capital: operating funds and lending capital. While both are vital, in the early stages of the Green Bank it is more important to secure operating funds for the Green Bank to cover expenses such as rent, salaries, and other startup costs. These expenses do not provide a return, and therefore are best funded by capital that has no return requirement. The best sources of funds for the Green Bank's operating funds are those that are most accessible, with the least amount of restrictions placed on the use of the funds. Philanthropic grants or allocations from government are thus very useful for the Green Bank in the startup phase, before it has built of a portfolio of revenue-producing assets that can help cover expenses. If the government provided a public capital allocation, it could specify how much of the funding could be used for operating expenses (as was the case when the New York Green Bank was founded).

A diverse array of capital—including capital that requires a return (such as program-related investments from foundations and private investments)—can be used to support the Massachusetts Green Bank's financing activities. Because each source of capital has a unique set of requirements and constraints attached to it, the sources of capital have an impact on the types of products the Green Bank can offer.

It is possible and prudent for a Green Bank to draw from multiple funding sources. Nearly all domestic Green Banks are funded from multiple sources or streams of capital. An objective of the Green Bank is to raise capital at the least cost possible, and should seek capital from the following sources:

- State or Local Government – The Green Bank should solicit investments or grant funds from government as a service provider fulfilling a government function and public purpose. These funds carry the lowest cost of repayment (if the funds are granted, there is no cost.)
- Foundations – The Green Bank should seek out foundation support both for operating funds and for investment capital. Like government, the funds could be fully granted, or they could be loaned through a program-related investment (PRI).
- Impact or Mission-Driven Investors – The Green Bank should seek out funds from other mission-oriented investors that are actively seeking out vehicles for secure green investment.

- Federal Government – The Green Bank can pursue federal grant or financing capital. This may come through the DOE, the Treasury (via the CDFI program, should the Green Bank choose to become a CDFI), through the USDA or through the EPA. CGC and other Green Banks have experience and know-how to pursue these funds.
- Existing Bonding Tools – The Green Bank can seek to partner with existing government agencies (such as Mass Development) to utilize the bonding tools already in place. These include QECBs, CREBS, industrial revenue bonds, and private activity bonds. The Green Bank can form arrangements with other issuers that allow the Green Bank to utilize the capital generated from those bond programs.
- Private Banks – The Green Bank may seek loan capital from institutional capital providers who are willing or able to lend to the Green Bank at low interest rates. Banks have shown prior interest in this kind of lending to local "green" financial institutions because it fits within their community or climate investment mission, or because they can receive Community Reinvestment Act credits. It is likely this kind of general borrowing would only come at significant scale once the Green Bank has a sufficient base of assets on its balance sheet.

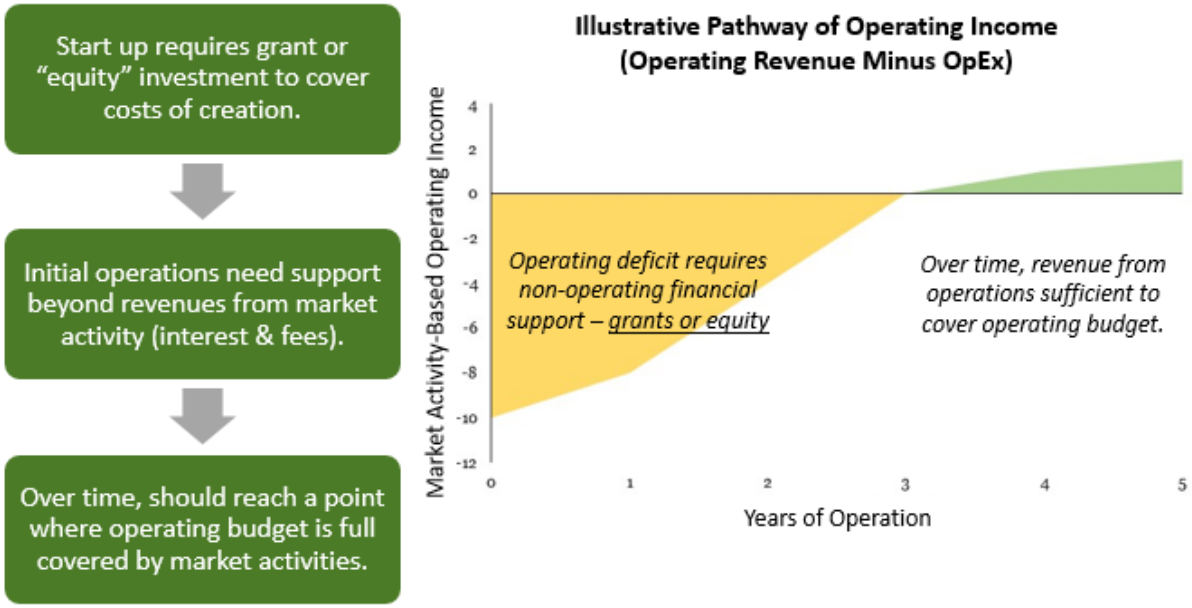
If the Green Bank is able to secure a significant initial influx of grant capital from government or philanthropy, for instance, a portion of that funding would be used for operating expenses, with the remaining funds reserved as loan capital.

The Path to Self-Sustainability

The Massachusetts Green Bank's goal should be to achieve financial self-sufficiency, meaning operating revenues are equal to or greater than the operating expenses, as soon as possible. At start-up, the Bank will have to expend funds to hire staff and launch operations before loans are issued and generating a stream of returns. Therefore, like any business, it will not be profitable at start-up. This means the Green Bank will have to be launched with start-up funds that are comfortable absorbing losses. Over time, though revenues should increase to meet or exceed operating costs.

This progression of revenues and net operating outcomes are explained visually in the chart below. Even if the Green Bank receives a large installment of lending capital at the day of launch, it will still take time to launch products and deploy capital that can generate revenue for the Green Bank. It is expected that it will take 3-5 years of operation for the Green Bank to generate sufficient revenue to cover its full operating expenses. The NY Green Bank, for example, achieved self-sufficiency less than 4 years after its inception. As reported in the FY 2017 Financial Statements for the period ending March 31, 2017, the organization finished the year with $9.7 million in revenue against $7.0 million in expenses for a net profit of $2.7 million.[51]

Figure 5: Green Bank Pathway to Financial Self-Sufficiency



Based on this financial model and revenue/cost pathway, the Green Bank will need to be capitalized at the appropriate level for each stage of development.

Fundraising

The Green Bank staff may need to develop a fundraising plan to supplement any public-purpose funds allocated to the Green Bank. This includes seeking both governmental and philanthropic funds to initially staff and grow the organization, and loan capital from a range of resources. Depending on the capitalization schedule, raising even modest amounts of funding for initial operation (to pay for the salary of an acting CEO) can be critical. This can be as little as $10,000 to $25,000 from individuals or board members to fund a few months of activity. If the Green Bank is a non-profit, or has the fiscal sponsorship of a non-profit, these kinds of contributions are tax deductible.

The Green Bank may also need to raise lending capital as well. Any fundraising effort for lending capital should aim to raise larger sums ($10 million or more) and should prioritize no and low-cost sources of capital. The newly formed Green Bank Consortium will able to assist with fundraising efforts.

Products and Activities

Once the Green Bank is established and operational, it has to make strategic decisions about what markets to focus on, what financing support to offer, and how to build the markets to generate demand. There are several activities the Massachusetts Green Bank should prioritize for early success. The potential Green Bank products outlined below are not meant to preclude Green Bank activity related to other technologies and market segments. It is also worth noting that the Massachusetts market is currently in a state of flux. The new SMART program, the new PACE program, the new storage incentives, and the changes to Mass Solar Loan program may result in various market participants currently active in

Massachusetts markets changing their business models or withdrawing from certain segments, which may create new market gaps that could be addressed by additional Green Bank products.

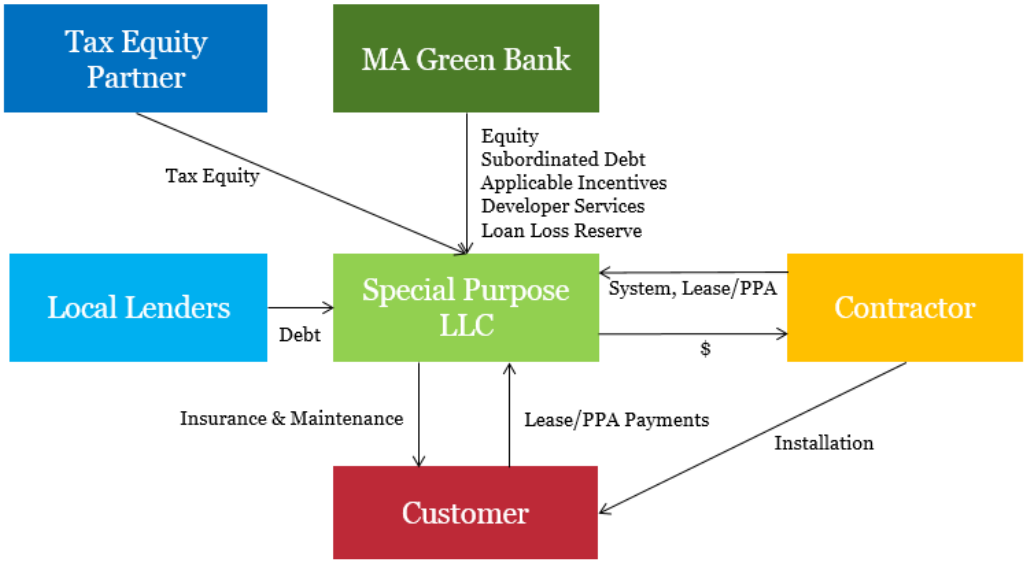
Solar Project Financing for Small-to-Medium Commercial and other Non-Residential Buildings

An attractive product for the Massachusetts Green Bank would be financing for solar projects in the currently underserved market segment of commercial and non-profit buildings seeking solar projects approximately 50 to 200 kW. Many projects in this size range would be too small to merit PACE financing, and those large enough for PACE financing may not be located in a municipality that has opted in to the Massachusetts PACE program. Another challenge is that many building owners in this market segment do not have the tax liability necessary to fully monetize the solar tax incentives.

The Green Bank could address this underserved market segment by creating a commercial solar fund to allow commercial and non-profit building owners to finance solar projects through a lease or PPA structure. The Green Bank would bring on a tax equity investor to monetize the solar tax incentives, and co-lend with any interested local lenders. The Green Bank could de-risk downcredit investments and facilitate private investment in this market by offering subordinated debt and/or a loan loss reserve along with project equity.

The Massachusetts Green Bank should endeavor to make this a turnkey product—the product should be as seamless as possible for all contractors and customers. As a standard protocol, the Green Bank should seek out and apply all relevant state and local incentives to the project, and only finance the net project costs, after incentives.

Figure 6: Potential Commercial Solar Financing Structure



If private investors do not enter the PACE financing market after the Massachusetts PACE program goes live and municipalities opt in to the program, the Massachusetts Green Bank could fill the market gap and facilitate private entry by modifying this product to operate as PACE financing. Rather than being a straightforward lease or PPA structure, the product would require the building owner to place a lien on

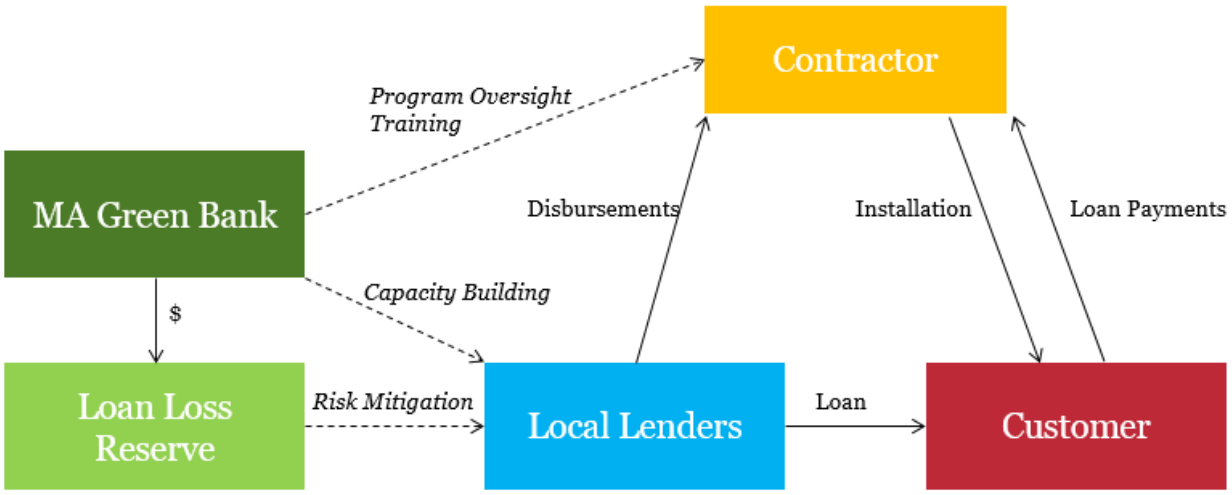
their property, and monthly lease or PPA payments would simply be made via the PACE assessments that appear on building owners' property tax bills.

Credit Enhancement for Whole-Building Efficiency Project Lending in Commercial and other Non-Residential Buildings

The Massachusetts Green Bank could provide a credit enhancement to encourage private lenders to provide financing for whole-building efficiency projects in commercial and other non-residential buildings. The Green Bank could cultivate a group of participating lenders to agree to offer financing terms that fit within predetermined ranges. It could create a loan loss reserve that stands behind the participating lenders that are willing to offer a loan product to commercial businesses and non-profits in the Commonwealth for whole-building energy efficiency and clean energy upgrades. This product could serve buildings in the same market segment identified above—projects that are below the level feasible for financing through PACE, or in geographies that don't yet offer PACE.

In pursuing this approach, the Green Bank should interface with contractors and training them in the use of the financing products as a sales tool. The Green Bank should also develop clear underwriting criteria and clear ranges of lending terms that provide lenders with the appropriate level of risk mitigation necessary to serve this market. The Green Bank could also make the loan loss reserve a second-loss reserve, rather than a first loss reserve—asking lenders to take a small portion of the initial loss will ensure that they have some "skin in the game" as they perform their underwriting and due diligence processes. As a standard protocol, contractors should apply all relevant government and utility incentives to their projects, and only seek financing for the net project costs, after incentives.

Figure 7: Potential Commercial Efficiency Credit Enhancement Structure



If the private lenders do not enter the PACE financing market after the Massachusetts PACE program goes live and municipalities opt in, the Green Bank could modify this credit enhancement to de-risk PACE lending to whole-building efficiency projects in the commercial market segment.

Community Solar for Low-to-Moderate Income Households

The Massachusetts Green Bank could provide financing or credit enhancements for community solar projects that encourage the participation of low-to-moderate income (LMI) households. Such a product would allow LMI homeowners that either have a roof unsuitable for solar (due to shade or angle, for example) or that live in a multi-unit building to benefit from solar energy. Though the private sector currently serves consumers that want to participate in community solar projects, they will may not serve the LMI market segment without Green Bank intervention.

The Massachusetts Green Bank could create a community solar financing structure that mirrors many aspects of the small-to-medium commercial solar structure, with the key difference being that there would be numerous subscribers to the project, paying for the benefit of the net metering credits produced by the project. In addition to including a tax equity partner to monetize the tax credits produced by the project, and the Green Bank could pull in investment from diverse sources of capital including program-related investments from foundations, impact investments, community lenders and credit unions. To de-risk the project, the Green Bank would structure the product to include a large anchor subscriber, a portion of higher-income level subscribers, reserve off-takers, actively-maintained subscriber waiting lists, subscriber underwriting criteria that includes utility-bill repayment history, and a reserve fund for missed or late subscriber payments. These features would reduce many of the actual and perceived risks associated with LMI community solar subscribers, and thereby facilitate private investor participation.

Request for Proposals

If capitalized with sufficient funding, the Massachusetts Green Bank should complement an initial standard-offer product suite with a simple "market-responsive" offering in the form of a request for proposals (RFP). Much like the New York Green Bank, the Massachusetts Green Bank should immediately draft an RFP and make it available to all market participants which outlines the kinds of projects and financing the Green Bank will support. The RFP would also outline the criteria for evaluation and decision-making process the Green Bank will employ to select which projects to finance. This type of offering would provide a financing option irregular projects with relatively new technologies, such as anaerobic digesters, distributed storage, and microgrids. This technique has yielded billions of dollars of project proposals in New York, and is a very light-touch way of identifying investment opportunities quickly. Taken together, an initial product offering and an RFP will minimize the cost and time of product development while accelerating forward the point at which the Green Bank can begin earning revenue.

Online Clean Energy Hub

A Massachusetts Green Bank should make all of its information available through a clear and usable website. The website should be designed to be market facing. It should be user-friendly, dynamic and clear, where the user can explore different solutions and offerings based on their position in the market. For instance, a homeowner should be quickly channeled to only look at residential products. This website should also contain models and tools that give customers and contractors the ability to determine the energy and economic value of a potential product. This kind of interactive platform can enable market participants to engage with clean energy options, understand financing and identify projects for Green Bank financing that are certain to be accepted. For instance, the Green Bank could put on its website a financial model for a commercial building solar project. The model would ask for several inputs and would

tell the user that if the model produces a positive result then that project is assured financing. A platform like this would empower market participants and greatly reduce overhead costs associated with vetting projects.

In addition to providing information on its own products and functions, the Green Bank website could be built to serve as a centralized source of market information that increases consumer and business understanding of clean energy opportunities. Rather than merely list the other programs run by MassCEC and Mass Save, it would have direct links to applications and instructions to drive participants to those programs. The Green Bank website should be a hub of information on market basics, and include all the relevant information and links to other clean energy financing programs. The Green Bank website can eliminate market confusion by unifying information and resources from programs across the Commonwealth into a single easy-to-use platform. The website could serve as a simple, easy-to-use one-stop-shop for all clean energy financing resources. Connecticut has created an effective website and brand using this approach called Energize CT, which cuts across multiple programs and agencies.

Launching the Green Bank

Launching the Green Bank will require a specific sequence of entrepreneurial actions akin to any start-up activity. But these actions will need to be tailored to the specific needs and goals of the Green Bank mission in Massachusetts.

Hiring Needs

The Green Bank will ultimately be defined by its executives and staff. The people that make up the Green Bank will create its culture, interpretation of Green Bank purpose, forms of market engagement, and are critical to the success of the organization. Staffing models and hiring criteria should be considered from the outset. Filling the Green Bank chief executive position with an experienced commercial banker with deep finance experience produces a vastly different institution than would be produced by filling the position with a clean energy market expert familiar with the barriers to growth.

The NY Green Bank Business Development Report, which was the basis of the NY Green Bank creation, pointed to four general capability sets needed by a Green Bank: energy capabilities, finance capabilities, business development capabilities, and operational capabilities.[52] Some of these capabilities can be developed over time, and some can be borrowed or outsourced.

Based on this proposed operating model, the Green Bank should aim to hire two or three initial staff to operationalize and run the Green Bank much like a start-up organization. It should recruit entrepreneurial self-starters with experience in clean energy finance, markets, policy or outreach. Initial staff should be intrinsically motivated by the mission of the organization, the opportunity to create something long-lasting and impactful.

One of the first hires should focus on communications and the other should focus on finance. The communications person should lead business development, sales, partnership building, government relations and business development. The finance person should focus on product design, deal flow management, and underwriting. One of these two should also be responsible for the organization's budget and operations. The Board of Directors should decide which of these two staffers should be the

lead the organization as the chief executive. A third person, if needed, can specifically focus on marketing, communications and contractor training and engagement.

Many administrative tasks can be shared internally among this staff to minimize costs. Multi-tasking and reducing overhead are critical for the organization's start-up phase. The Green Bank should also seek to procure low-cost online services for functions like HR and accounting, or even better, rely on other Green Banks in the broader Green Bank community, such as those represented in the newly formed Green Bank Consortium.[53] There are many online payroll and HR services available for less than $1000 per year, and similar accounting-as-a-service organizations specifically serving non-profits.

Borrowing from Others

Other functions and critical know-how can and should be leveraged from the broader network of Green Bank and Green Bank actors. Many existing Green Banks are happy and eager to help. They allow others to visit their offices and learn from past experience. They share content and materials and legal documents that can be replicated in Massachusetts. They provide references to service providers and capital providers that might be useful. The Green Bank Consortium and the Green Bank Academy are centralized platforms that provide resources and know-how about Green Bank activity around the globe. This includes examples of products, methods for evaluation, and databases of all past transactions. Templates for governance, operational, product development, and communications documents can be easily accessed via these networks.

For specific operational needs, the Massachusetts Green Bank should also seek to leverage the existing resources and functions to cover operating expenses. For instance, the Green Bank could seek to share office space with another non-profit, in a government office, or in a foundation for a small fee or for free. The Green Bank can also ask to share certain services directly with an existing Green Bank. This type of service sharing can be facilitated through the Green Bank Consortium.

Start-Up Operations

The acting CEO, as the first employee dedicated to launching the Green Bank, will have a long but important list of matters to attend to. This includes:

- Selecting and convening the Board of Directors;
- Drafting & adopting corporate governance materials, such as corporate bylaws, standard operating procedures, conflict of interest policies, employee handbooks, etc;
- Filing necessary forms and applications;
- Finding and securing office space;
- Opening an initial bank account;
- Securing accounting services and creating financial statements;
- Creating an initial logo/or basic branding;
- Creating necessary workplans;
- Launching a landing page website to secure the necessary domain space; and
- Beginning outreach to key stakeholders in the clean energy community to build active relationships and lines of communications.

This set of activities can take 3-6 months in addition to the more strategic and mission-oriented activities described below. Though these tasks are administrative in nature, the organization cannot begin to function as a clean energy lender without them.

Governance

The Massachusetts Green Bank should be overseen by a Board of Directors with a mix of clean energy financing experience and Massachusetts-specific market knowledge. At founding the Board should be three to five people. It is important to select Board members who are eager to be thoughtful, and active advisors to the founding staff, but understand their role is not to be managers of the organization. The Board should be particularly focused on supporting fundraising efforts, tapping their existing networks to track down foundation and investment capital for the Green Bank. Otherwise, they should not be involved in day-to-day activity of the organization.

Creating a business plan should be one of the first tasks the Board and acting CEO or the full-time executives should accomplish after the creation and staffing of the organization. The purpose of a business plan is to guide the operations of the Green Bank and provide a framework for decision-making for the organization's leaders. The business plan also provides and important reference for Board members, Green Bank partners, and outside stakeholders about the scope of activities in which the Green Bank will engage, and its manner of engagement.

The Green Bank's business plan should map out many of the details of the organization's mission and goals, product strategies, positioning, capital and pricing strategies, risk management approach, performance metrics, organization, resource requirements, and implementation plans. The Connecticut Green Bank publishes a new "Comprehensive Plan" every two years, and the New York Green Bank updates its Business Plan on annual basis.[54] The CGB and NYGB's business plans provide excellent models for Board members and executives of future Green Banks that wish to compose a business plan.

Green Bank Budget

The acting CEO should create an organization pro forma budget laying out the first year's expenses and lending activity. It should reflect the best estimates of the cost of all facets of the organization, including staff, rent, insurance, internet, website creation, consulting and legal services, partnerships and other aspects of organization formation.

The budget should also include the expected initial level of financing activity based on the estimated or desired level of loan capital to be raised. The Green Bank should aim to be earning revenue on financing activity by the end of year one.

Based on the experiences of other Green Bank organizations, an estimated start-up budget for Massachusetts Green Bank operations (not including lending capital) is $2 million or more per year for the first few years.

Data points and comparables indicate that the Green Bank should not spend more than 10% of its total capital allocation on operating expenses. For example, if the Green Bank is capitalized with $100 million, it should allocate absolutely no more than $10 million per year toward its operating budget. Any more than that, and the ability for the Green Bank to earn sufficient revenue to cover its operating expenses is

diminished. Every dollar spent on operating expenses is a dollar that cannot be used to provide finance, and therefore cannot earn revenue for the Green Bank.

- NYCEEC, a government-created non-profit finance organization, was capitalized with an initial $32 million, and its first-year operating budget was $1.7 million. This is 5% of its capital.
- The Florida Solar Energy Loan fund, a small start-up non-profit lender that raises PRI capital for on-lending, has a loan portfolio of $6 million and runs a budget of $650,000, roughly 11%. And this figure is continuing to decline in order to support sustainable operations.
- The NY Green Bank, a governmental Green Bank which was given $215 million by the end of its first full fiscal year of operation, and its operating budget was $3.5 million or 1.7%. That number increased to 2.6% the next year.

Taken together, alongside data points from other similar kinds of organizations, the Green Bank should seek to run an operating budget no greater than 10% of the capital it raises.

Financial Statements & Pro Formas

The Green Bank will have standard financial statements like any other commercial operation. It will have a profit and loss statement to show its revenue, operating expenses and increase/decrease in net position in a given period of time. Capital received from the State should appear on the profit and loss statement as revenue, but non-operating revenue below the operating revenue and expenses. (This is modeled on the NY Green Bank accounting approach.) As a non-profit, the Green Bank does not earn a “profit”, but rather it increases its net position. The Green Bank will also have a balance sheet with its assets (cash and loan receivables) and liabilities (capital borrowed from others to raise loan capital). The balance sheet will also show the cumulative net position of the organization (the sum of all increases or decreases in net position from operation).

The Green Bank should also be launched with pro forma financial statements that are based on the prepared budget and product development plans. The budget and hiring needs are informed by the products that are prioritized and launched first. And those products will determine the expected revenue levels of the Bank. This independency between budget, products and pro forma financial statements make up the core of the Green Bank launch plan.

Product Development

It is critical that the Green Bank bring its first product to market as quickly as possible. Public demonstration of progress and success is absolutely essential, and the sooner it arrives the better. Though there are several potential Green Bank products described above, and though the Green Bank may ultimately have multiple products, the staff can only have one top priority, so one product will have to be chosen as the first product to be developed and launched. This should ensure clear focus and efficiency, allowing this first product to be brought to market without delay.

Product development requires numerous specific activities. This includes initial product creation, engagement with potential lending partners, engagement with product distributors, customer surveys, and financial modelling. It may be necessary to build commercial relationships with capital providers and downstream partners to distribute and fund the product. Product development also includes creation of

a go-to-market strategy that outlines the channel partners, advertising and detailed step-by-step process through which a product is offered, applied for, adopted and deployed, per the program mechanics. The successful outcome of the product development activity is the launch of the first financial product or market development solution that is commercially viable and attracts customers.

Relationship to Existing Landscape

The Massachusetts Green Bank could have any manner of relationships with many different types of market participants and stakeholders. Several potential relationships with important stakeholders are outlined below.

The Massachusetts Green Bank will collaborate with market participants and government agencies to facilitate the improved operation of clean energy markets in Massachusetts. The Green Bank will co-lend with and drive customer acquisition for various existing clean energy programs, as well as co-lending with various private lenders. The Green Bank will be open to investments from various government agencies, impact investors and mission-driven investors to help them earn an attractive return from various clean energy assets. The Green Bank will collaborate with contractors, and help them serve a wider swathe of the market with financing products. The Green Bank should also work with DOER to help achieve state goals.

Conclusion

Massachusetts has a relatively fossil-heavy energy mix, and high energy prices relative to the national average. Many of the easiest and most attractive energy efficiency upgrades have already been made throughout the Commonwealth. Estimates of the market potential for cost-effective, economically viable renewable and efficiency projects are well into the billions of dollars. Current deployment is well below the market potential, and the current private sector activity and subsidized lending programs do not create substantial market penetration. Certain market segments, including small-to-medium commercial and non-profit buildings, and low-to-moderate income homeowners interested in community solar, are significantly underserved. There is a clear need for financing and private investment to satisfy the investment need. Given this opportunity and the gaps identified, Massachusetts should use an institutional approach to catalyze private activity these gaps.

Through innovative project financing and public private partnerships, a Green Bank would allow wider deployment of clean energy, catalyze private investment in clean energy, and facilitate access to the benefits of clean energy among a broader group of consumers. It would work in tandem with the existing set of programs and public resources already devoted to clean energy to unlock energy savings for consumers. It would also drive growth for Massachusetts businesses in the clean energy industry, create more local jobs, and drive private investment in clean energy.

The Green Bank should be formed as a 501(c)(3) corporation, have its own dedicated balance sheet, and aim to build up a portfolio of investments that would allow it operate as a self-sustaining lender. The corporation should be designated as the Commonwealth's official Green Bank, and receive approximately $100 million in public funding through legislation. This 501(c)(3) Green Bank could operate independently, or be operated by the MassCEC, given its existing role in supporting clean energy market development.

The Green Bank should be formed as an entrepreneurial enterprise with minimal overhead and staffing. It should join the new Green Bank Consortium to collectively raise funds with other Green Banks and procure services and products at scale.

The Green Bank will use innovative financing tools to leverage private capital and encouraging private sector activity in a cost-effective manner. The Green Bank financing techniques include loans and leases, credit enhancements, warehousing, among others. Attractive options for Green Bank products in the Massachusetts market include a solar project financing fund (potentially including PACE financing) for small-to-medium commercial buildings and a second-loss loan reserve for local lenders that finance whole-building energy efficiency in small-to-medium commercial buildings. Additional Green Bank products could include project financing structure for community solar projects for low-to-moderate income subscribers and an open request for proposals for financing one-off clean energy projects such as anaerobic digesters, microgrids, fuel cells, storage, and micro-hydro projects in commercial applications.

As a nimble, market-oriented, mission-driven clean energy financing entity, the Green Bank could dramatically improve the clean energy market and make a lasting impact in Massachusetts by filling market gaps, widening access to clean energy savings for consumers, and driving private market activity. As the Massachusetts clean energy market undergoes various changes, including the new SMART and PACE programs, the Green Bank could play a valuable role in maintaining and increasing public and private clean energy market activity.

APPENDIX A - Green Bank Case Studies

The following sections discuss five existing Green Banks to demonstrate the breadth of possible roles a Green Bank can have in improving clean energy markets.

Connecticut Green Bank

Connecticut Green Bank - At a Glance

Structure and Form: Quasi-public entity created by legislation with mixed board of directors

Capital Sources: Utility bill surcharge; cap and trade (RGGI) revenue; Foundation PRI; Balance sheet loan from private lender;

Financing Activities: C-PACE loan, lease, PPA; Whole-home EE+PV loan; Solar Lease for C&I; Solar Loan for homes, C&I; Pre-development loans for multi-family energy efficiency

Market Development Activities: Contractor training; Central online hub; Demand aggregation; Coordinated outreach and advertising; Turnkey product

Organization

The Connecticut Green Bank (CGB) was created in 2011 as the first state Green Bank in the U.S., and one of the most successful Green Banks to date. Originally named the Connecticut Clean Energy Finance & Investment Authority, it was created through bi-partisan legislation that was initiated by newly elected Governor Dannel Malloy.[vii] The new institution was born out of the existing grant-making institution, the Connecticut Clean Energy Fund. The Fund was repurposed and turned into a deployment financing entity. The CGB was created as a quasi-public agency, with a board of directors that are a mix of government officials and independent directors. The government officials include the state Treasurer, the Commissioner of the Department of Energy and Environmental Protection, and the Commissioner of the Department of Economic and Community Development. The board is charged with setting CGB strategy, approving CGB products and initiatives, and approving loans.

The CGB is capitalized primarily by two sources, both of which were identified in the legislation. The first is a systems benefit charge that collects roughly $20 to $25 million dollars per year. This was an existing system benefits charge, already in place in the state prior to the creation of the CGB. Previously the entire ratepayer collection went towards state-managed grant programs. The re-allocation of those funds to the CGB represents only a portion of the total collection, with the remaining funds still going toward grants. This re-allocation of funds was driven by a desire to maximize private leverage from public funds and get the greatest “bang for the buck” for each public dollar. The second source of CGB funds are the state’s

[vii] PA 11-80, the act creating the Connecticut Green Bank, passed the House by a vote of 139-8 and the Senate 36-0.

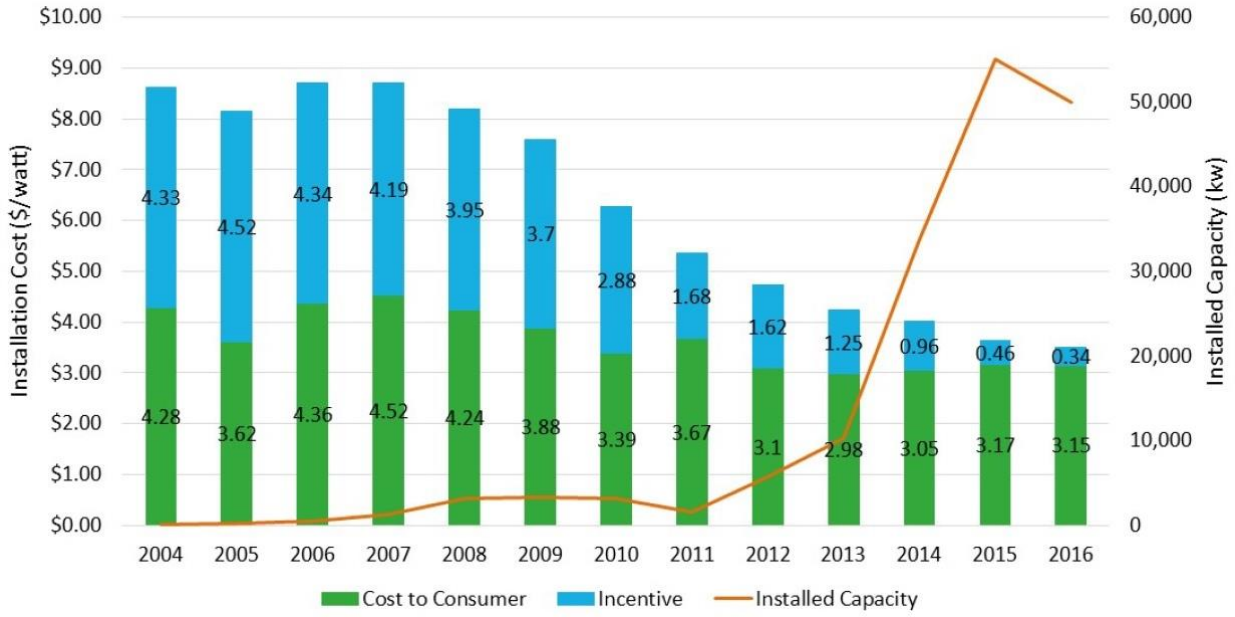
proceeds from the sale of emission allowances through the Regional Greenhouse Gas Initiative (RGGI) Program. In total, this adds to a total annual infusion in the CGB of approximately $30 million per year.

In addition, the CGB is authorized to issue its own bonds based on its own balance sheet. The CGB also has limited ability to issue bonds that are supported by a state bond reserve fund. This is not equivalent to full faith and credit, but does enable borrowing at lower rates based on the state's credit rating. The CGB has not yet issued bonds of this type to increase its lending capacity.

Activities

By statute, the CGB must manage the wind down of the state's residential rooftop solar rebate program. Though this grant-making role is distinct from the CGB's broad financing mission, the ability to manage the ramp down of grant levels and then increase financing under a single coordinated strategy has proven highly effective for market growth. As seen in the chart below, as the CGB lowered grants consistently through multiple steps, the increased availability of financing drove unprecedented market growth.[viii]

Figure 8: CT Residential Solar Market Installation Costs, Rebates, and Capacity[55]

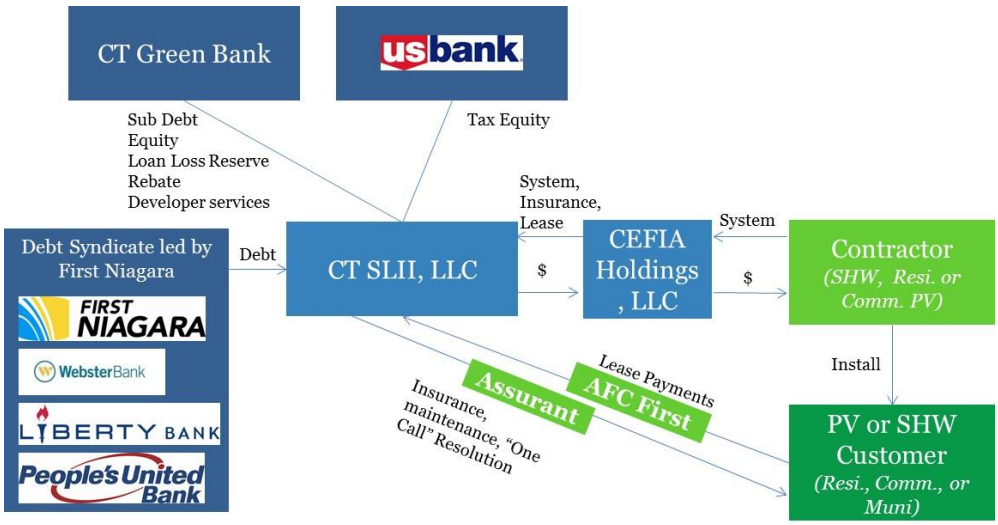


The CGB offered three different financing solutions for the residential market to support solar installation. The first was a unique, state-sponsored solar tax-equity lease fund that could be used by any installer in the state. CT Solar Lease 2 was a public-private partnership structure that brought $50 million of lease financing to the market, with a 5-to-1 private:public leverage ratio. This kind of tax-equity fund enables homeowners to put solar on their roof at no money down, and pay a low monthly price by taking

[viii] In fact, the chart shows that the net cost of solar faced by the consumer, after the rebate, has remained fairly constant in CT over the last decade. This is because the decline in the gross cost of installation was absorbed by the state in the form of reduced rebates. Therefore, the spike in market adoption is attributable to new financing tools that allowed consumers to adopt solar without paying that remaining net cost of installation upfront.

advantage of federal tax benefits for solar.[ix] This financing tool was deployed through local installers, who otherwise would have been unable to offer financing to consumers.

Figure 9: CT Solar Lease 2 Financing Structure[56]



In addition to the Solar Lease, the CGB created the CT Solar Loan product for consumers who wanted to directly own their own solar panels but did not have the cash on hand for the installation. Through this structure, the CGB seeded a loan fund with a $5 million investment. Sungage, upon proving the market viability and demand for solar loans, was quickly able to raise $100 million of private capital from Digital Federal Credit Union to replace the CGB capital once it was expended. In only a year and with only $5 million of public capital invested, the Green Bank effectively demonstrated the value of solar investment to a private lender, crowding-in $100 million of private capital.

The final residential solar product offered, that can support solar, efficiency or other technologies, is the Smart-E Loan. The CGB provides a standard-offer loan loss reserve to multiple local lenders to support their loans into the residential market. These banks were either offering capital at high rates and short terms, or not making loans into the space at any terms. And those that were willing to lend into this market were not actively building deal flow with contractor partnerships or other methods. In exchange for receiving the benefit of the CGB's loan loss reserve, the banks agree to offer capital at specific terms and rates that don't exceed a certain cap. These terms compensate banks appropriately for risk, but ensure that projects can be cash flow positive for borrowers.

In addition to managing the wind-down of the solar grant program, the CGB's enabling legislation also directed the CGB to administer a state-wide Commercial Property Assessed Clean Energy (C-PACE) program. C-PACE programs allow commercial buildings to service debt incurred for clean energy projects through the placement of a lien on the property and assessments on a property tax bill.

[ix] A tax equity investor effectively invests cash in exchange for the federal Investment Tax Credit and the accelerated depreciation tax benefits enjoyed by solar. This tax value only comes through a tax-equity based structure, and allows consumers to pay a lower price for the solar power than they would if they owned the solar themselves.

Through C-PACE, commercial buildings can more easily access whole-building commercial energy retrofits. The whole-building approach to energy upgrades has long been viewed as the most effective way to significantly curtail energy consumption, but the projects are hard to execute and finance. They include multiple energy efficiency technologies and can also include roof-top solar when appropriate.[x] The CGB is able to finance these projects through its C-PACE program.

PACE is legally authorized in over 30 states, but Connecticut is one of only a two states to achieve significant scale with the program (along with California). Unlike in most states where each local government is charged with creating their own program, the CGB is tasked with administering the program across the entire state. Through central administration, the CGB implements programmatic consistency and standardization across the state, critical elements for attracting private investment. The CGB also ensures that every loan offered can be paid back entirely through the savings generated by the project, as stipulated in the state's legislation. The CGB uses a standardized technical underwriting method to ensure that every project has a savings-to-investment ratio (SIR) greater than 1.

Connecticut initially struggled to find private lenders interested in C-PACE projects. However, the CGB was able to kick-start the market by originating and underwriting C-PACE loans using its own lending capital. By taking the first step when private lenders would not, the CGB was able to build scale by aggregating projects. After building a portfolio large enough to attract private investment, the CGB sold 80% of the C-PACE loan portfolio through an auction, drawing in $24 million of private investment.[57] This was the first commercial efficiency securitization in the country, attracting specialized and institutional investors to participate in the market. Without the CGB's investment and coordination, the market would have remained dormant as it has in many other states.

Now that the CGB has demonstrated the mechanics and potential of C-PACE, private investors are preparing to enter the market at far greater scale. To satisfy the growing pipeline of projects, the CGB is raising an external warehouse of at least $100 million in private capital that will be used to originate loans. After only one portfolio sale, the CGB has demonstrated market opportunity to draw institutional investors eager to originate the loans, reducing the need for public investment.

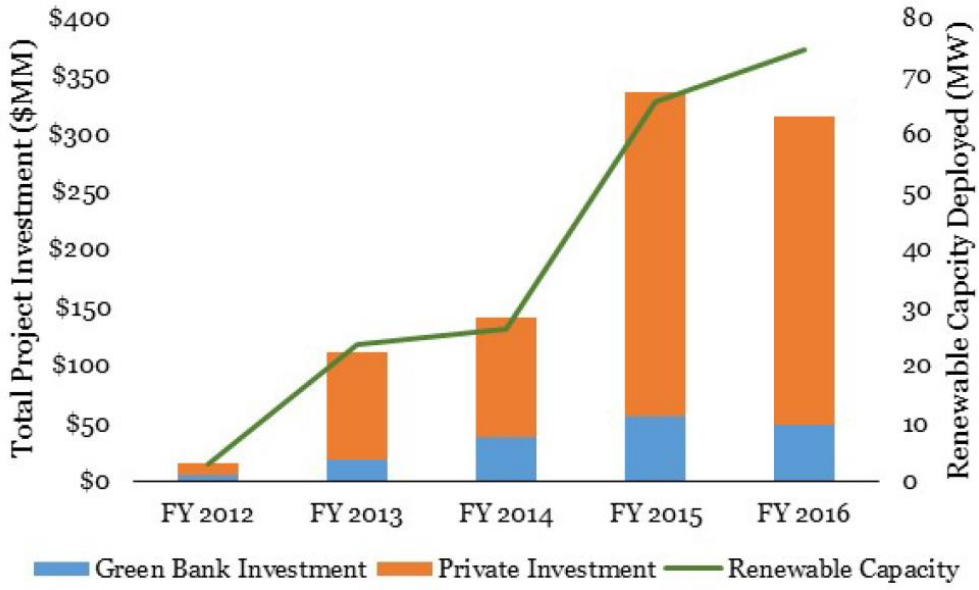
After five years of operation, the CGB is now a mature financial institution that has sparked remarkable growth in the state's clean energy markets. Since its inception, the CGB has deployed $165 million in project investments which has leveraged $755 million in private investment, generating nearly a billion dollars of total investment and achieving a private:public leverage ratio of approximately 5-to-1. This stands in sharp contrast to the market condition prior to the CGB's creation. In the eleven years of operation of the prior Clean Energy Fund, a total of $350 million was invested during that period. And of that total, approximately half of the funds were public dollars, and nearly all were in the form of grants.

[x] According to PACENation, of the C-PACE projects financed in the U.S. to date, 51% are efficiency only, 36% are renewable energy only, and 14% are both renewables and efficiency.

Table 5: Connecticut Green Bank vs. Connecticut Grant-Making Authority[58]

	FY 2000-2011 (CCEF)	FY 2012-2014 (CGB)	FY 2015-2016 (CGB)
Model	Subsidy	Financing	Financing
Years	11	3	2
Energy (MW)	43.1	52.2	139.9
Investment ($MM)	$350	$266.3	$649.6
Leverage Ratio	1:1	4.4:1	6.3:1

Figure 10: Private Investment in Renewables Leveraged by CGB Investment[59]



Montgomery County Green Bank

Montgomery County Green Bank - At a Glance

Structure and Form: Independent non-profit lender designated as official county green bank with mixed board of directors; originally created in response to legislation calling for an independent non-profit Green Bank.

Capital Sources: Utility merger settlement; Foundation grants

Financing Activities: Whole-home EE; Multifamily loan

Market Development Activities: Targeted marketing and demand generation; Information and market transparency

Organization

The Montgomery County Green Bank (MCGB) is a relatively new non-profit Green Bank created in Montgomery County, Maryland in response to county legislation passed in 2015. The legislation called for the independent creation and official designation of a non-profit Green Bank. The Coalition for Green Capital, along with the Montgomery County Department of Environmental Protection, created the non-profit and the non-profit earned the county's designation as the official Green Bank in 2016. The Board of Directors of the MCGB is comprised of various professionals across the energy and housing professions and two ex-officio members from county government agencies.

The MCGB will be capitalized by utility merger settlement funds over a period of several years. The MCGB has also successfully sought additional supplementary grants from foundations. While its 501(c)3 status is yet to be granted, pending review from the Internal Revenue Service, the Coalition for Green Capital served as the MCGB's fiscal sponsor, which functionally allowed the MCGB to solicit philanthropic capital while it waits to get 501(c)3 status of its own.

Activities

The MCGB is in the process of developing its initial products, which currently focus on loan-loss reserves that support local private lenders making loans for whole-home energy efficiency projects and commercial properties. The MCGB also plans to be involved with financing energy improvements in multifamily properties as a part of larger housing finance deals.

New York City Energy Efficiency Corporation

NYCEEC - At a Glance

Structure and Form: Independent non-profit lender with mixed board of directors; originally created as component unit of city government.

Capital Sources: ARRA Grant; Contract with city government; Foundation grants; Private co-investment; Private loans; Public loans

Financing Activities: Equipment Lending; ESAs and PPAs; Green Mortgage Loan; Credit Enhancement for Affordable Multifamily energy improvements; Pre-development loans

Market Development Activities: Targeted marketing and demand generation; Information and market transparency; Free technical and legal advice

Organization

The New York City Energy Efficiency Corporation (NYCEEC) is a non-profit Green Bank that provides financing for projects in commercial and multi-family buildings that save energy or reduce greenhouse gases. NYCEEC generally finances energy efficiency, cogeneration, clean heat conversions, renewables and demand response projects.

NYCEEC was formed by Mayor Bloomberg's office in 2011, and was the recipient of two federal grants awarded to the City under the American Recovery and Reinvestment Act of 2009. Though it began within the Mayor's office as a public authority, NYCEEC was intended to be a non-profit lender from the beginning. After three years of operation, NYCEEC made the transition to an independent non-profit with a Board of Directors comprised of public officials and private individuals.

Though independent, NYCEEC retains a connection to the City though a contract to serve as a consultant. NYCEEC helps lessen the burdens of government with its retrofit accelerator program, financing of oil-to-gas conversions that allow buildings to comply with a local clean air ordinances, and by originating clean energy projects and providing of gap financing for a State efficiency and green jobs program.

The organization maintains a flexible balance sheet from multiple capital sources (public, private, and philanthropic) to support its activities. NYCEEC also partners with various lending organizations to finance energy efficiency and fuel conversion projects while encouraging best practices with respect to energy efficiency retrofit implementation and ongoing performance monitoring.

Activities

NYCEEC offers debt financing, credit enhancements, ESAs and PPAs for clean energy projects in commercial buildings. NYCEEC's deals fall into several general deal-types: equipment loans directly to buildings secured by the equipment; third-party ownership and ESA and PPA financing; mortgage lending

for high performance buildings; credit enhancement for local housing finance organization's multifamily efficiency loan program; and low and no interest pre-development loans.

Since its inception, NYCEEC has deployed more than $33 million in loans and has committed $7.5 million in credit enhancements across 36 transactions with total combined project costs of $75 million. About 31% of those projects were ESAs and PPAs, 21% were mortgages, and 49% were equipment loans. Of the properties served by the projects NYCEEC financed, 40% were commercial and industrial, 34% were market-rate multifamily, and 26% were affordable multifamily.

NYCEEC has in-house expertise to make construction and permanent loans, to provide credit enhancement in the form of loan loss reserves, and to manage both energy efficiency retrofit technical and real estate finance risk. NYCEEC also has a sophisticated outreach effort to drive its deal pipeline, and places a high premium on being a flexible organization capable of serving the particular market segments it was designed to serve.

New York Green Bank

New York Green Bank - At a Glance

Structure and Form: Public entity existing as division of state energy office; created by administrative action and funded by regulatory ruling

Capital Sources: Utility bill surcharge; cap and trade (RGGI) revenue;

Financing Activities Issued RFP for private sector financial intermediaries seeking clean energy project capital

Market Development Activities: Fill information gaps; demand generation

Organization

New York Governor Andrew Cuomo announced his plan to form the New York Green Bank in January 2013 during his State of the State address. His plan was to build a $1 billion financing institution to fill financing gaps in the New York clean energy capital market. It was determined from the outset of the process that new legislation would not be needed to create the financing entity. The state's energy office, NYSERDA, had all the legal authorities a Green Bank would need to provide financing. Therefore it was determined that the New York Green Bank (NYGB) entity would be a division within NYSERDA.

Separately, the Governor decided that the best source of funding for the NYGB would be similar to those chosen in Connecticut. The NYGB would be capitalized by redirecting a portion of the ratepayer surcharge funds collected annually to support grant programs. The NYGB would also receive a one-time infusion of state's RGGI proceeds. The allocation of the RGGI proceeds could be made through administrative action, but redirecting the ratepayer funds to the NYGB required approval by the Public Service Commission (PSC). NYSERDA produced a detailed business plan and explanation of the importance of financing to support its petition to the PSC.[60] This led to PSC approval of NYGB funding in December 2013, initially allocating $165.6 million in ratepayer dollars.[61] Combined with the annual $45 million in RGGI proceeds, this brought the NYGB's initial capitalization to $210 million.[62]

Activities

The NYGB operates as a wholesale clean energy finance lender (as opposed to Connecticut, which operates more as a retail lender). Rather than design specific financing products and programs, the NYGB is looking to the market to learn what financing is needed. In February 2014, the NYGB issued an open-ended RFP seeking applicants for funding that could demonstrate that they could not find private funding elsewhere, and that NYGB deal participation would produce "market transformation."

The first set of NYGB investments were announced in the fall of 2015.[63] The NYGB used $49 million of public capital to leverage $178 million in private capital. Three deals were announced addressing different market segments. NYGB provided $25 million in debt to a NY-based solar installer to support a solar leasing warehouse; provided $4 million in construction financing to a distributed wind installer to support over 160 distributed wind installations in rural New York through a lease structure; and provided $20 million in credit enhancing capital to enroll the state in the multi-state Warehouse for Energy Efficiency Loans program, which provides home energy upgrade financing. As of its latest quarterly report in June 2017, NY Green Bank has committed $409.4 million in public capital to support approximately $1.4 billion in total investments.[64]

In FY 2017, NY Green Bank grew its portfolio by almost $300 million, and finished the year with $9.7 million in revenue against $7.0 million in expenses for a net profit of $2.7 million.[65] The NY Green Bank is the first Green Bank in the U.S. to generate positive net income, meaning the revenue earned on its finance activity is greater than the operating costs of running the organization.

In addition to financing, NYGB does undertakes several activities to help fill information gaps and generate demand for clean energy financing. These activities include an annual meeting series held in numerous locations throughout the state, strategic partnership development throughout the state, and quarterly webinars. These activities ensure stakeholders and market participants are aware of NYGB financing options.[66]

Rhode Island Infrastructure Bank

Rhode Island Infrastructure Bank - At a Glance

Structure and Form: Quasi-public body politic of the state, with board appointed by Governor; created by legislation.

Capital Sources: ARRA Grant; cap and trade (RGGI) revenue; utility bill surcharge; Bonding Authority; re-directed operating funds; QECBs

Financing Activities: Efficiency loan for MUSH sector; Potential R-PACE and C-PACE credit enhancement or lending; Water project lending

Market Development Activities: Statewide R-PACE & C-CPACE administration

Organization

When Rhode Island Governor Gina Raimondo assumed office in January 2015, she very quickly followed through on her campaign promise to create a Green Bank, the Rhode Island Green Bank. Rhode Island had an existing set of state and utility-run rebate programs, and had attempted to build a residential PACE (or R-PACE) program. A new Green Bank, though, would increase financing across new clean energy markets, and importantly drive investment in infrastructure and job grow.

Rhode Island determined that the best path to creating its Green Bank required legislation. And rather than build an entirely new institution, the Green Bank would be built upon an existing entity with a track record of success. The state's Clean Water Financing Authority (CWFA), which had financed water projects in the state for many decades, was tapped to become the Green Bank. The CWFA would be given expanded authorities to address clean energy markets, and be renamed as the new Rhode Island Infrastructure Bank (RIIB). This new organizational structure was passed into law in June 2015 as part the Governor's fiscal year budget legislation.

Activities

The RIIB was assigned responsibility for two specific financing programs in the legislation. RIIB has responsibility for designing, administering, and possibly financing both commercial and residential PACE programs in the state. RIIB chose to follow the Connecticut model by becoming the sole state-wide PACE administrative authority. Though the RIIB hopes that private investors will originate and underwrite PACE loans, the RIIB is able to provide credit enhancements to those lenders should it be necessary. The RIIB was also tasked with designing and implementing an Efficient Buildings Fund (EBF), which finances energy upgrades for municipal buildings in the state. RIIB was given general authority to design the optimal financing structure to serve this market, which has been broadly underserved. This program was given priority because reducing energy bills in public buildings would reduce government budgets at a time when the state needs to maximize the value of all public dollars.

This past year RIIB completed the first round of EBF funding, which used an innovative structure and partnership with the state energy office to finance 17 municipal projects across 6 towns with $17.2 million of capital.[67] The projects are cash flow positive and will save $20 million in energy costs for citizens.

RIIB activities are funded through a combination of RGGI proceeds, system benefit charges, remaining federal ARRA funds, and a small amount of re-directed operating funds. The RIIB also has the authority to issue state qualified clean energy bonds (QECBs). In sum, these funds are intended to both serve as an equity portion of a broader bond issuance, as well as support a larger agency operation. RIIB, like the CWFA before it, is a quasi-public agency with a board of directors, where the chairman is appointed by the Governor.

Florida Solar Energy Loan Fund (SELF)

SELF - At a Glance

Structure and Form: Independent non-profit CDFI lender; created through county government initiative.

Capital Sources: ARRA Grant; Foundation grants; Loans from faith-based organizations; Loans from mission-driven investors; Technical Assistance Grant for CDFIs

Financing Activities: Energy and home improvement loans for LMI; Crowd-funded loan; C-PACE loan with partner

Market Development Activities: C-PACE administration; Contractor network; M&V; Alternative underwriting and de-risking techniques

Organization

The Solar Energy Loan Fund (SELF) is a certified non-profit CDFI designed to provide financing for sustainable residential and non-residential building improvements, including energy efficiency improvements solar systems. As a CDFI, SELF primarily provides clean energy financing for low and moderate-income Floridians.

SELF was created in St. Lucie County, Florida in 2010 with a $2.9 million grant from the DOE Better Buildings Neighborhood Program. St. Lucie County supported the creation of SELF, but is not directly or legally connected to SELF. SELF has supplemented that seed capital by securing numerous small, mission-driven investments from community banks, foundations, impact investors, faith-based organizations, and the crowdfunding platform KIVA. Since 2010, SELF has made more than $5 million in affordable loans that have allowed more than 600 homeowners to upgrade their homes and lower their energy costs.

Activities

SELF offers three key products. First, it has a direct residential loan using SELF's own balance sheet capital. Second, SELF has a residential loan that draws on crowd-sourced funds collected through KIVA. Finally, SELF has a C-PACE lending program. The two residential loans are available statewide. SELF's C-PACE program is only available in St. Lucie County, as it is the county's designated PACE administrator. For its C-PACE program, SELF has a partner that provides capital for the C-PACE projects. SELF is currently preparing to launch an R-PACE program, which is legal in Florida.

SELF's overall delinquency rate on loans is less than 1%—an impressive feat considering they lend almost entirely to low-to-moderate income homeowners. In the underwriting process, SELF collects a lot of personal financial information from the borrower through a survey to understand the household budget and typical expenses to figure out the potential borrower's ability to pay. SELF staff manage this process closely, building trust and helping borrowers understand their typical expenses and understand their budget. SELF usually lends to people who have 30% of their income as disposable cash, and them sculpts

the loan for each person so that the monthly payments fit the ability to pay. SELF runs a credit report to understand the credit background of potential borrowers, but there is no credit score requirement.

SELF aims for (but does not require) a debt-to-income ratio of 45% among its borrowers. SELF aims for home loan-to-value ratio of 80% among its borrowers, and will not lend to borrowers with a loan-to-value ratio above 100% (i.e. properties that are “underwater”). For some slightly more risky borrowers, SELF asks them to pay into a self-funded loan-loss reserve to de-risk to the project. SELF also reports to credit companies so the borrowers can improve their credit scores.

SELF has a contractor network of 185 contractors. Contractors drive about 50% of the projects that SELF finances, while the other 50% are customer initiated. In contractor initiated projects, SELF makes sure the quoted cost looks reasonable. When customers initiate a project financing inquiry, SELF gives them list of recommended contractors and asks them to get quotes for the project. SELF will then review the quotes.

APPENDIX B - Massachusetts Energy Market Profile

Massachusetts is a high-priced energy state, with the 8th highest prices for natural gas and the 4th highest prices for electricity in the country. Residential customers in Massachusetts pay 54% higher electricity prices than the average American. Consequently, Massachusetts is one of the most efficient users of energy in the nation, ranking 44th in total energy consumption per capita. Massachusetts is not a major producer of energy, ranking 45th in the country in total energy production. Massachusetts' electricity generation industry is dominated by natural gas. Of all electricity generated in Massachusetts in 2014, 59% was from natural gas, 19% was from nuclear, 9% was from coal, 6% was from non-hydroelectric renewable, 3% was from petroleum, and 3% was from hydroelectric sources.[68] Massachusetts has a restructured electricity market that allows for retail choice of energy suppliers.[69]

Statewide sectoral consumption of energy across sectors is 30.9% transportation, 30.0% residential, 28.0% commercial, and 11.1% industrial.[70] For home heating, 50.1% of Massachusetts residents use natural gas, 29.3% use fuel oil, 14.7% use electricity, and 6% use liquefied petroleum gases or other sources. Of the Commonwealth's carbon dioxide emissions by sector in 2014, 39% came from transportation, 26% came from residential, 19% came from commercial, 13% came from industrial, and 2% came from other sources.[71]

Total Energy Mix

Massachusetts consumes a mix of energy types to satisfy its energy needs. Natural gas, nuclear, coal, and renewables are consumed primarily to generate electricity for the grid. Massachusetts is a net electricity importer, so about 19% of the energy consumed within the Commonwealth's borders is transported into Massachusetts from out of state.[72] Fuel oil is used for heating buildings while gasoline is consumed primarily for the transportation sector, as are jet fuel and other forms of petroleum.[73]

Figure 11: Massachusetts Energy Consumption Estimates[74]

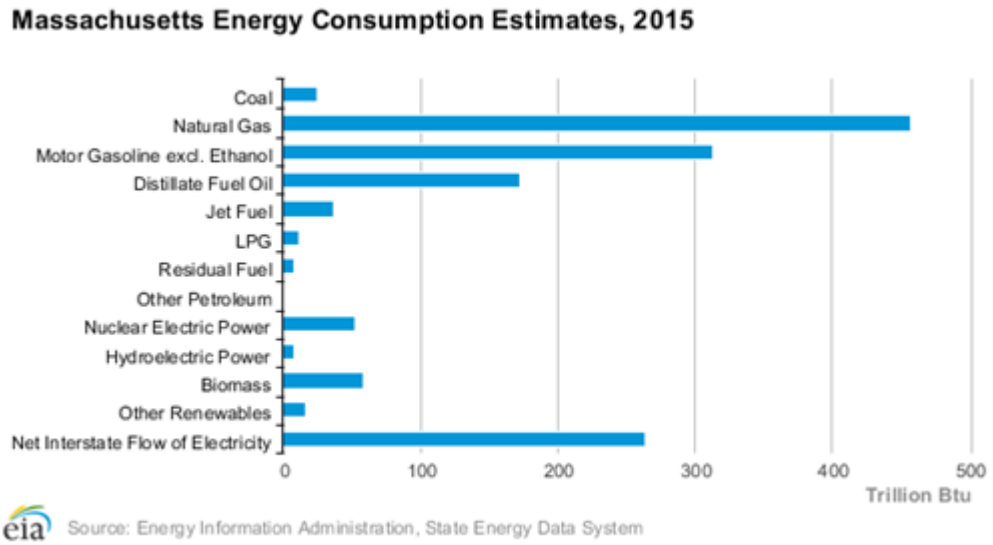
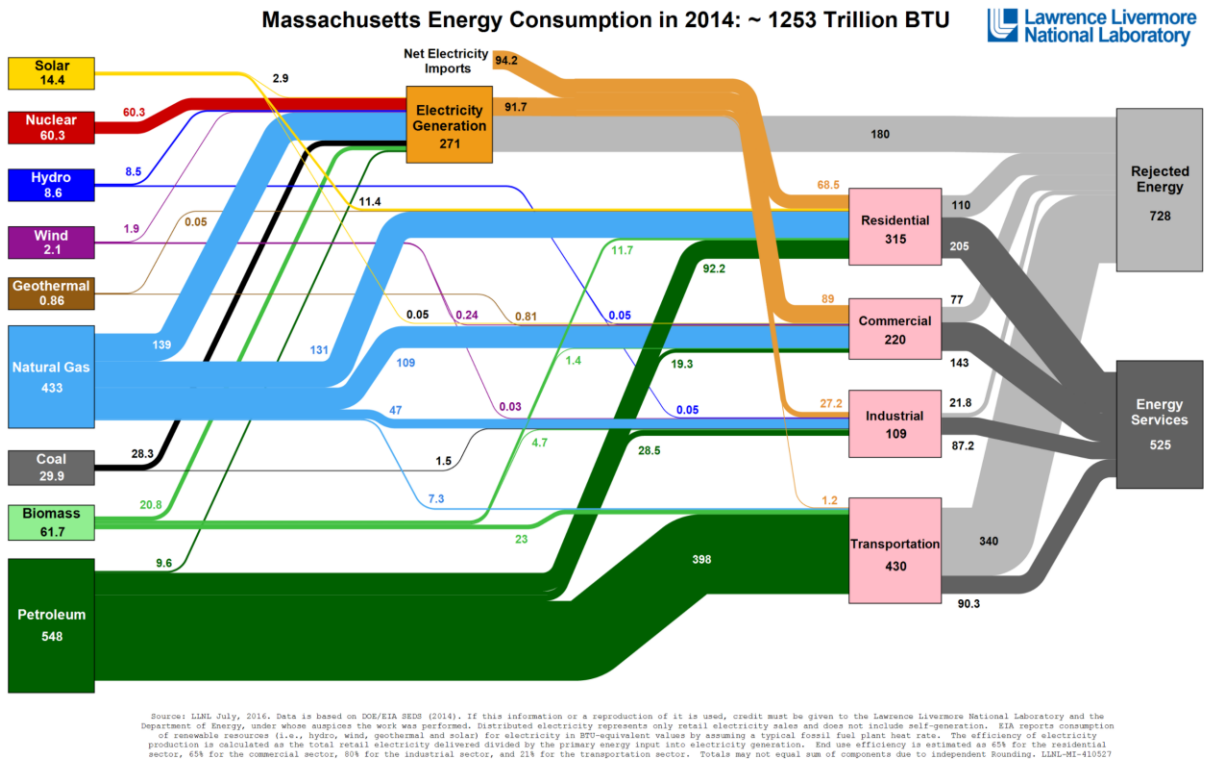
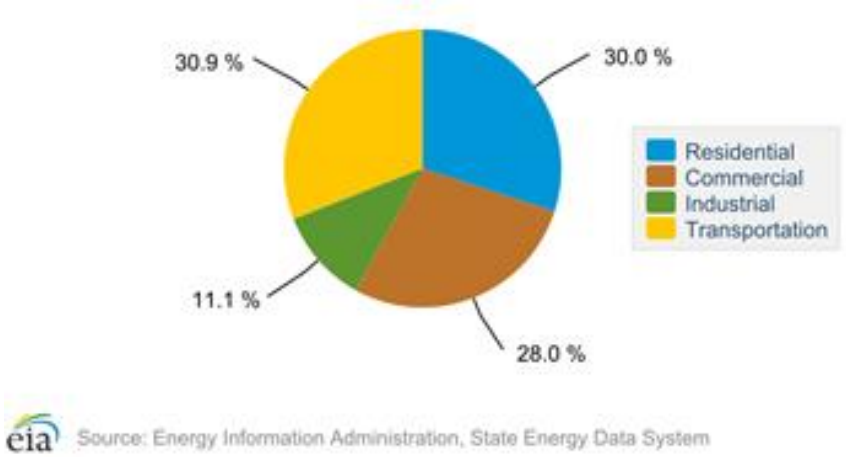


Figure 12: Massachusetts Energy Use in 2014[75]



The residential and transportation sectors respectively consume 30.0% and 30.9% of the energy in Massachusetts, the industrial sector consumes 11.1%, and the commercial sector consumes 28.0% of the energy in the Commonwealth. Massachusetts' buildings—the residential, commercial, and industrial sectors together—consume 69.1% of the energy across the Commonwealth.[76]

Figure 13: Massachusetts Energy Consumption by Sector[77]



Electricity

Utility Structure

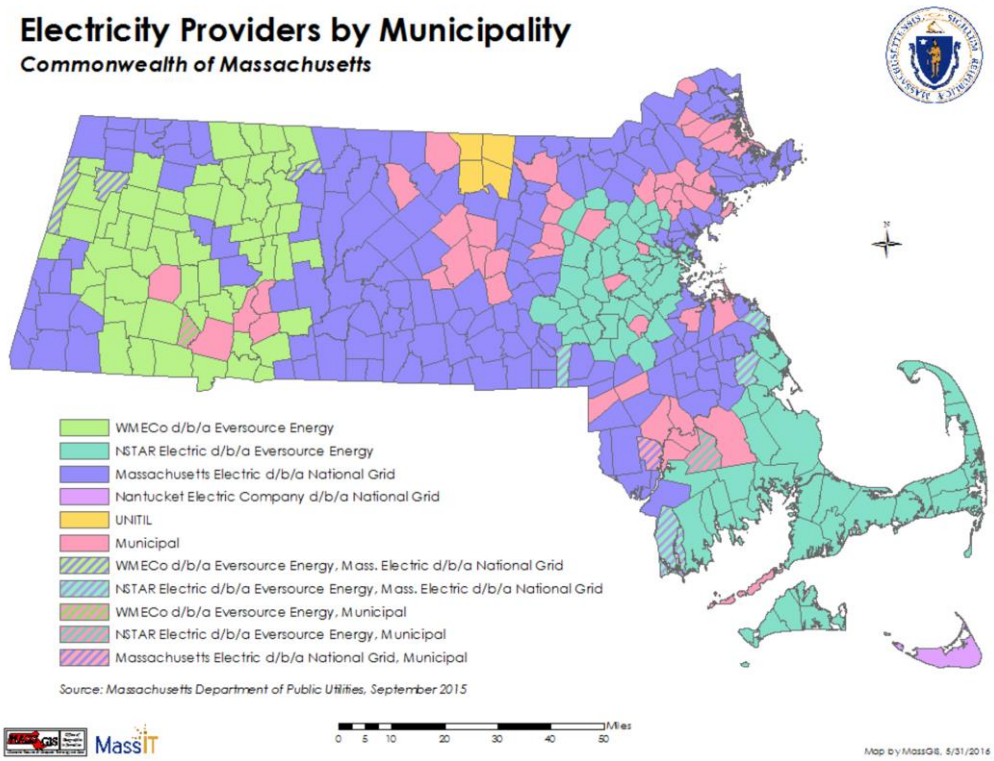
Massachusetts exists within the ISO New England, the regional electricity grid serving the New England region.[78] In 2015, Massachusetts generated approximately 32,085 GWh of electricity and retail sales of electricity within the Commonwealth were approximately 54,621 GWh. Exports and losses of electricity were approximately 3,918 GWh.[79]

Table 6: Electricity Generation, Sales and Exports in Massachusetts in 2015[80]

Net Generation	Retail Sales	Exports, Losses & Direct Use
32,085 GWh	54,621 GWh	3,918 GWh

There are 3 investor-owned utilities, or distribution companies, that serve Massachusetts. Eversource Energy serves Boston and surrounding areas, southeastern Massachusetts, and parts of western Massachusetts. National Grid serves a majority of counties in central Massachusetts, as well northeast, northwest, and southeast Massachusetts. Unitil serves four counties in north-central Massachusetts. There are also a number of municipal utilities scattered across the Commonwealth.[81]

Figure 14: Massachusetts Utility Service Territories[82]



Retail Choice

The Massachusetts electricity market is deregulated and allows consumer choice for retail electricity.[83] Customers can buy their electricity directly from distribution companies through a "basic service" rate package, or they can buy electricity from competitive power suppliers from which customers may purchase electricity in a variety of rate packages.[84] A competitive supplier is a company or group that sells electricity. Suppliers can generate and sell their own power or buy it and then resell it. The electricity sold competitive suppliers is delivered to customers by distribution companies.[85] In 2016, approximately 65% of all customers in Massachusetts received their electricity from competitive suppliers—40% of residential customers, 65% of small commercial & industrial (C&I) customers, 73% of medium C&I customers, and 92% of large C&I customers got their electricity from a competitive supplier.[86]

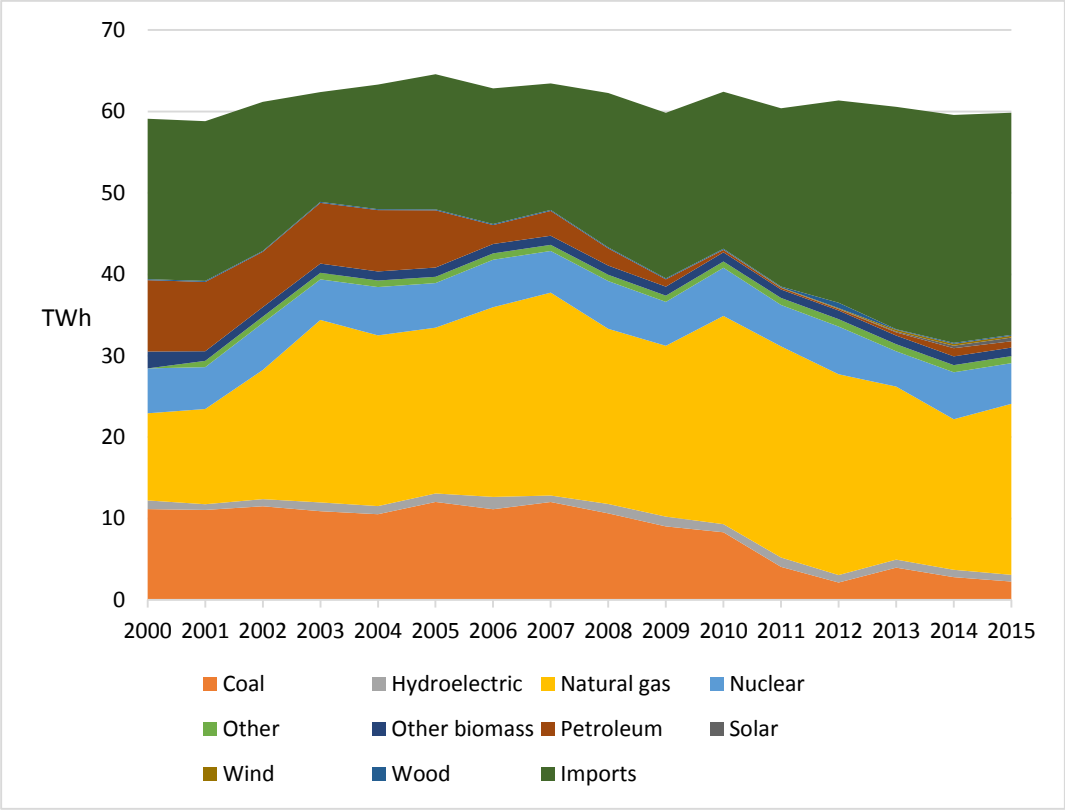
In-state generation and Exports

Massachusetts generated the tenth least electricity of any state in the country in 2015.[87] Massachusetts does not have any natural gas or coal resources located within its borders, but is beginning to tap into its renewable energy potential, which fuel approximately 8% of utility-scale net electricity generation in the Commonwealth.[88] Natural gas from out of state is the largest source of electricity generation in Massachusetts.[89] Electricity production in 2015 was approximately 32 TWh, and was well below in-state consumption. Massachusetts is a net importer of electricity—over the course of 2015, for example, the net imports were approximately 27 TWh of electricity, or 46% of the total supply.[90]

Electricity Fuel Mix

In 2015, Massachusetts's electricity fuel mix was 7.0% coal, 15.6% nuclear, and 65.5% natural gas. Hydroelectric generation was 2.6% of the electricity fuel mix, while wind was 0.7% and solar was 1.4%.[91] Renewable power made up 8.3% of total in-state generation. Over the last decade or so, in-state generation from coal has diminished considerably, which was offset by increased generation from renewables and an increase in the share of electricity imported from out of state. Natural gas and nuclear generation have stayed relatively flat during this period.[92]

Figure 15: Massachusetts Electricity Generation Portfolio 2000-2015[93]



Solar generation saw over a more than fifteen-fold increase from 2012 – 2015, and in that same period went from 0.08% of the total generation mix to 1.41%.[94]

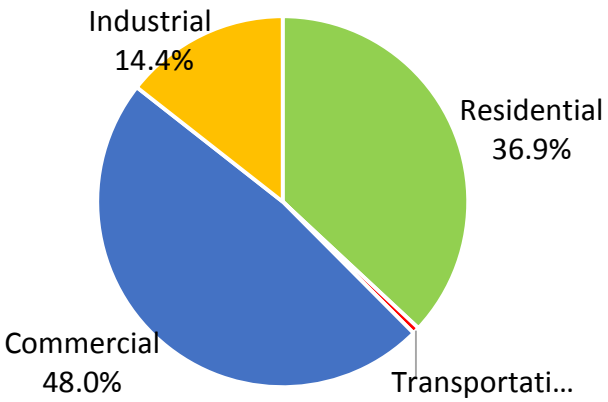
Distributed Generation

In 2015, 875 MW of distributed generation capacity was connected to the Commonwealth's grid in net metering arrangements. Solar accounted for 814 MW of capacity, wind accounted for 44 MW of capacity, and the remaining 17 MW of net-metered capacity was from other technologies. Of the 814 MW of solar distributed generation, 245 MW is in the residential sector while 569 MW is deployed in the commercial and industrial sectors.[95] Distributed solar installations dominate the overall solar market in Massachusetts—only 334 MW of solar is utility-scale.[96]

Consumption by Sector

Of the electricity consumed in-state in 2014, 327% was consumed by the residential sector, 14% was consumed by the industrial sector, 48% was consumed by the commercial sector, and 1% was consumed by the transportation sector.

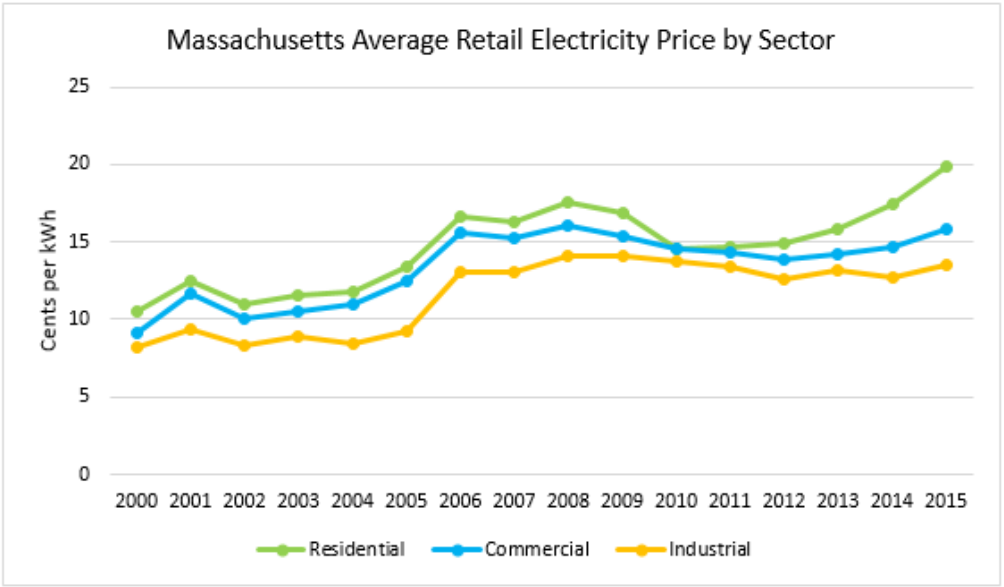
Figure 16: Massachusetts Electricity Consumption by Sector 2015[97]



Electricity Prices

In the period of 2000 through 2015, industrial and commercial electricity prices rose by about 1 cent per kWh each, while the residential price of electricity rose by about 2 cents per kWh.

Figure 17: Massachusetts Average Retail Electricity Prices by Sector 2000-2015[98]



In June of 2017, Massachusetts's average residential electricity prices were above the national average by about 7 cents per kWh, while the Commonwealth's average commercial price was above the national average by about 4.6 cents per kWh. The average industrial price was above the national average by 6.6 cents per kWh.

Table 7: Massachusetts Electricity Prices by Sector in 2017 in cents per kWh[99]

	Residential	Commercial	Industrial
Massachusetts	19.84	15.15	13.34
U.S. Avg.	12.90	10.48	6.74

Electricity Expenditure

In 2015, Massachusetts's total expenditure on energy was $23.8 billion and the statewide expenditure on retail electricity was around $9.2 billion.[100] In 2014, Massachusetts had the 35th highest energy spend per capita in the country with $4,082 spent per capita.[101]

Table 8: 2015 Energy Expenditures by State[102]

State	Retail Electricity Sales (millions)	Total Energy Expense (millions)	Energy Spending per Capita[xi]	State Rank
CT	$5,238	$13,109	$4,307	31
MA	**$9,232**	**$23,840**	**$4,082**	**35**
ME	$1,519	$6,069	$5,681	7
NH	$1,761	$5,233	$4,790	19
NY	$22,747	$55,849	$3,446	49
RI	$1,303	$3,596	$3,985	38
VT	$795	$2,675	$5,225	13

Massachusetts's per capita energy spending is comparable to that of several of its neighbors (Connecticut, New Hampshire, and Rhode Island). Two of its neighbors (Maine and Vermont) have noticeably higher per capita energy spending.

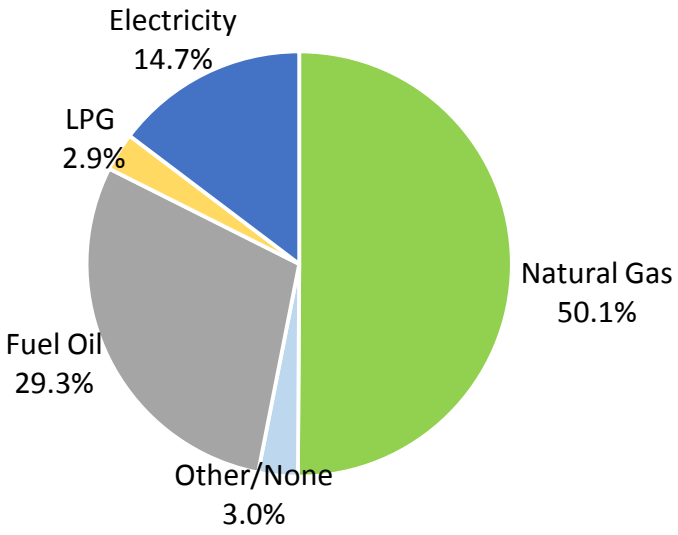
Thermal

Fuel Consumption in Residential Buildings

Fuel consumption in the residential sector is primarily for heating purposes. There are several home heating fuels widely used in the Commonwealth. Of the heating fuel consumed, 50.1% is natural gas, 14.7% is electricity, 29.3% is fuel oil, 2.9% is LPG, and the remaining 3.0% is other fuel sources (such as wood) or no heating.[103]

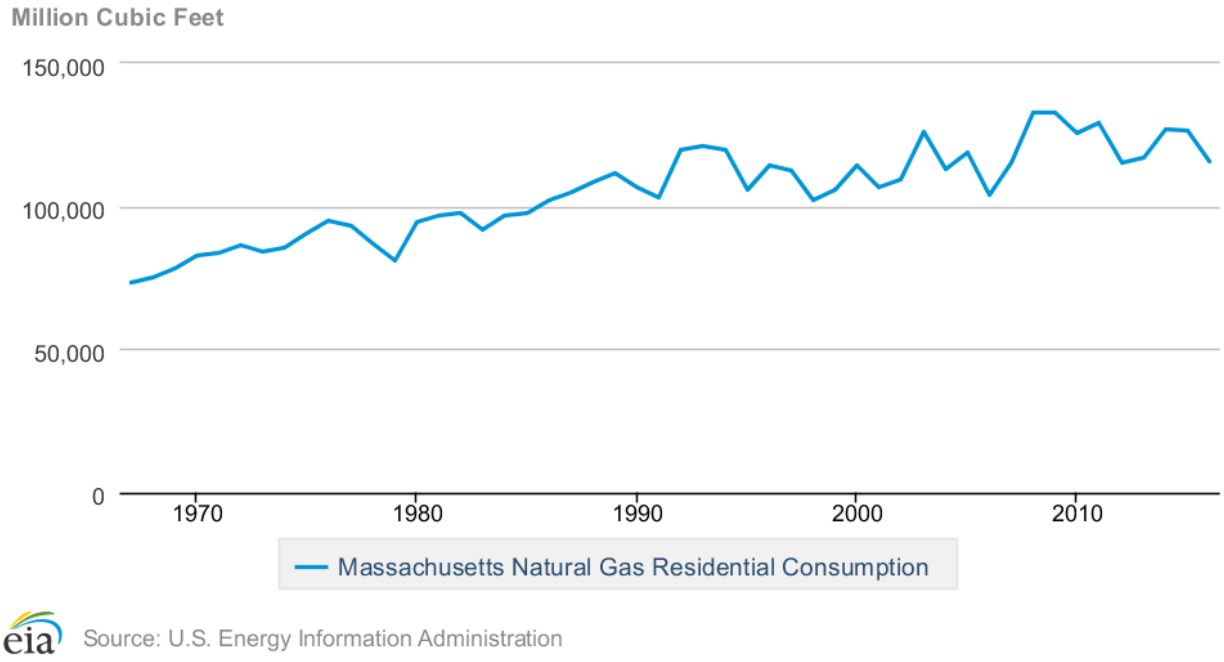
[xi] EIA data for states' energy spending per capita and state rank is from 2014. EIA data for state electricity sales and total energy expense is from 2015.

Figure 18: Massachusetts Home Heating Fuel Consumption by Type in 2015[104]



Since 1990, residential consumption of natural gas in Massachusetts has fluctuated, dipping and rising every few years. Despite the short-term fluctuations, there has been a gradual trend of increasing annual consumption.

Figure 19: Massachusetts Annual Natural Gas Residential Consumption 1967-2016[105]



Natural Gas Consumption in Commercial and Industrial Buildings

Though many fuels are consumed in commercial and industrial buildings, data was only publicly available on natural gas consumption. Since 2010, natural gas consumption has climbed in commercial buildings, but has remained relatively flat in industrial buildings.[106]

Figure 20: Massachusetts Annual Natural Gas Commercial Consumption 1967-2016[107]

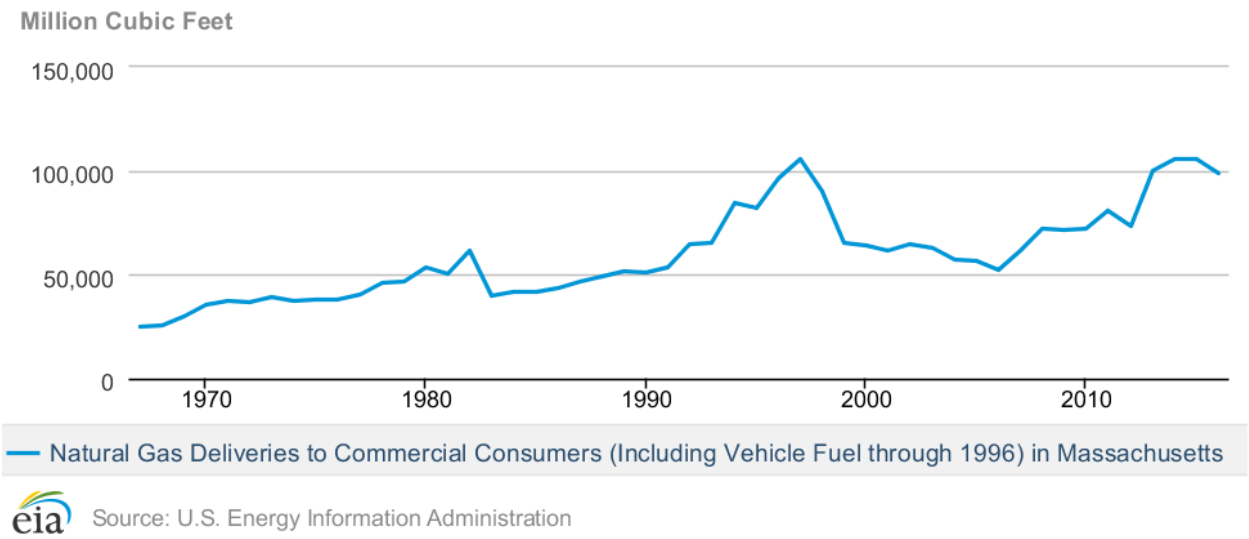
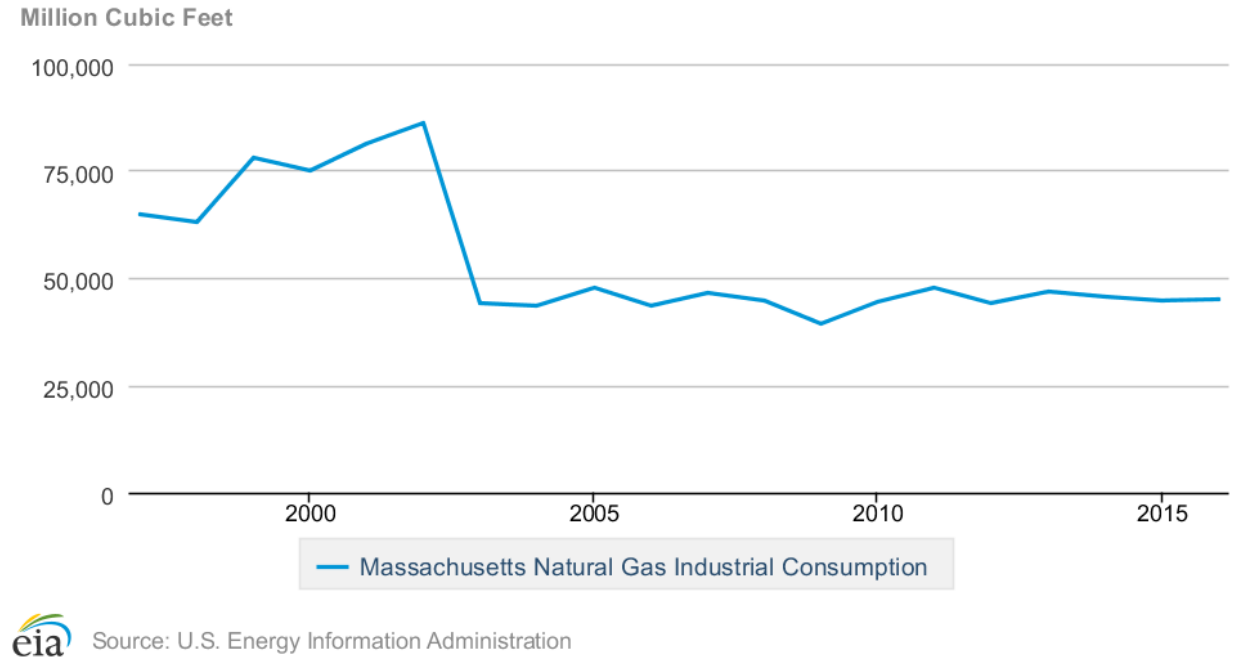


Figure 21: Massachusetts Annual Natural Gas Commercial Consumption 1997-2016[108]



Fuel Consumption in Transportation

In 2015, petroleum made of up the majority of fuel consumption in the transportation sector in Massachusetts, at 96.6% of all vehicle fuels. Gasoline was 72.8%. Natural gas was 2.6% of fuel consumption in the transportation sector, and electricity was 0.3%.[109]

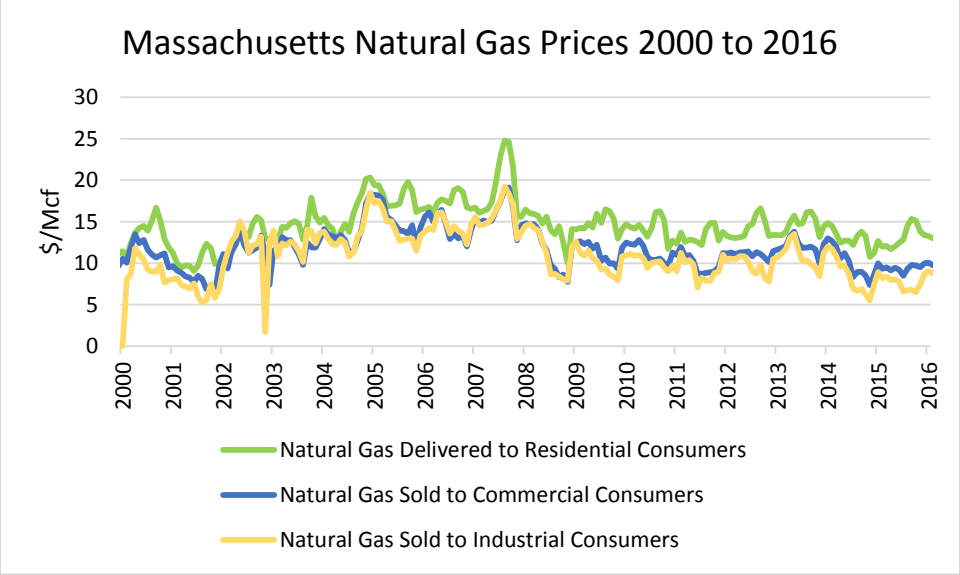
Natural Gas Utility Structure

The natural gas market in the Commonwealth is deregulated, and works much in the same way that the electricity market works. There are 8 investor-owned natural gas distributors in the Commonwealth that serve different territories,[xii] and there are 4 municipal gas companies.[xiii] Consumers can choose to buy their gas directly from the distributor that serves their region or from among dozens of competing natural gas suppliers.[110] The Massachusetts' Department of Public Utilities has regulatory authority over the natural gas utilities.[111]

Natural Gas Prices and Consumption

The price of residential natural gas in Massachusetts peaked in 2007 at $19.07 per thousand cubic feet. Since then, the price dipped in 2009 then has fluctuated in the low to mid teens, and has reached $13.27 at the end of 2016.[112]

Figure 22: Massachusetts Natural Gas Prices by Sector 2000 – 2016[113]



[xii] Investor-owned natural gas distributors in the state include: Bay State Gas Company, Berkshire Gas Company, Blackstone Gas Company, Eversource Energy, Liberty Utilities, Fitchburg Gas and Electric Light Company, and National Grid.

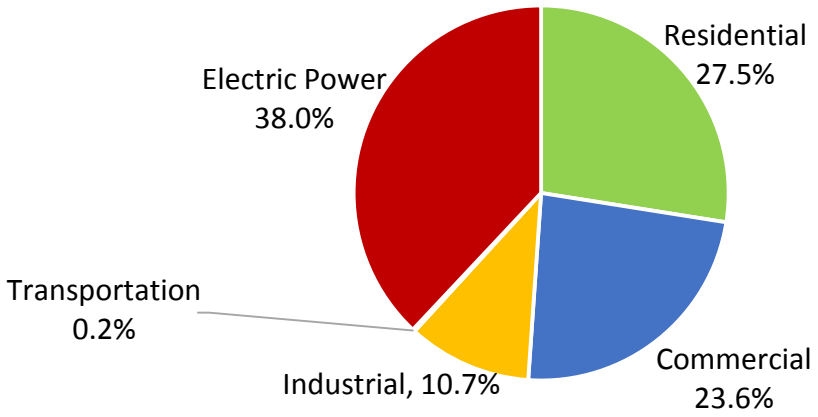
[xiii] Municipal natural gas companies include: City of Holyoke Gas and Electric Department, Middleborough Gas and Electric Department, Wakefield Municipal Gas and Light Department, and Westfield Gas and Electric Light Department

Table 9: Average US and Massachusetts Natural Gas Prices in in 2017 in $/Mcf[114]

	Residential	Commercial	Industrial
Massachusetts	12.57	9.47	7.49
U.S. Avg.	10.07	7.25	3.51

Electricity generation was the largest use of natural gas in the Commonwealth in 2016, comprising 38.0% of consumption, followed by residential and commercial uses which comprised 27.5% and 23.6% of consumption respectively.[115]

Figure 23: Natural Gas Consumption by Sector in Massachusetts in 2016[116]



Emissions

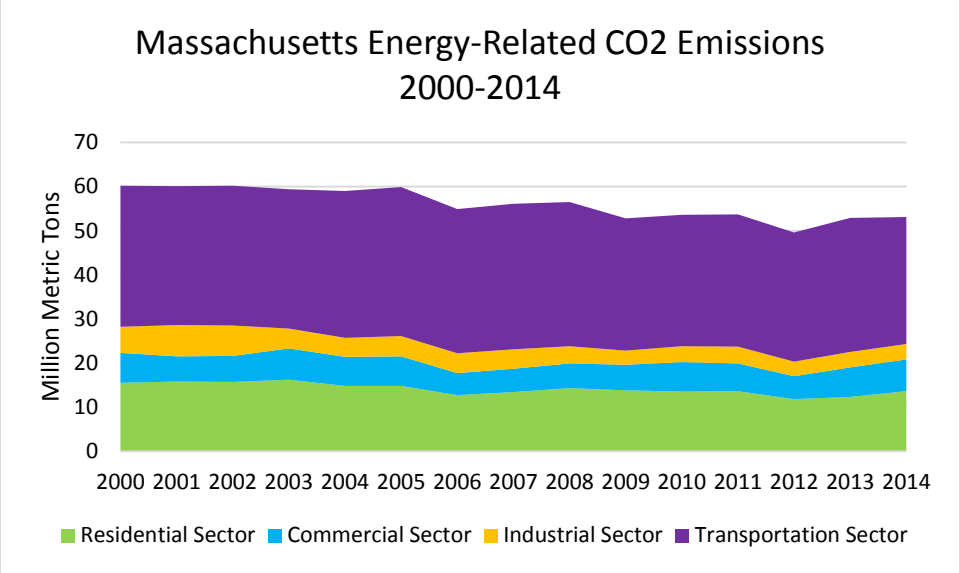
In 2014, Massachusetts was responsible for 63.8 million metric tons of carbon dioxide emissions from energy-related sources. Of those emissions, 11% came from the commercial sector, 17% came from the generation of electricity, 21% came from the residential sector, 6% came from the industrial sector, and 45.0% came from the transportation sector.[117]

Table 10: Energy-Related Carbon Dioxide Emissions by Sector in 2014[118]

Massachusetts Sector	Carbon Dioxide Emissions (million metric tons)	Share of Total
Residential	13.6	21%
Commercial	7.2	11%
Industrial	3.5	6%
Transportation	28.8	45%
Electric Power	10.8	17%

In the period of 2000 through 2014, the overall emissions for Massachusetts has decreased dramatically, from 82.5 million metric tons of CO2 in 2000 to 63.8 million metric tons in 2014, with the transportation and electricity generation sectors leading the way in emissions reductions.[119]

Figure 24: Energy-Related Emissions by Sector in Massachusetts 2000-2014[120]



Massachusetts has the 32nd highest emissions of all the states in the country. Massachusetts has higher emissions than all the states in its region, with the exception of New York.[121]

Table 11: Energy-Related Carbon Dioxide Emissions by State in 2014[122]

State	Carbon Dioxide Emissions (million metric tons)	State Rank
CT	35	40
MA	**64**	**32**
ME	17	44
NH	15	46
NY	170	9
RI	11	49
VT	6	50

Massachusetts's per capita emissions are among the lowest in the country. In 2014, Massachusetts had the 47th highest (or 5th lowest) emissions per capita. Only the District of Columbia, New York, California, and Vermont had lower emissions per capita than Massachusetts.[123]

Table 12: Energy-Related Carbon Dioxide Emissions per capita by State in 2014[124]

State	Carbon Dioxide Per Capita (metric tons per person)	State Rank
CT	9.8	45
MA	**9.5**	47
ME	12.5	37
NH	11.3	40
NY	8.6	50
RI	10.1	44
VT	9.4	48

Energy Efficiency Potential

A number of studies have been conducted on the potential for energy efficiency in Massachusetts. Each study covers different sectors and forms of energy, and has a unique assumptions about baseline or projected energy consumption, a unique time horizon, and a specific means for achieving the estimated efficiency. As a result of the variety of methodologies applied to calculating energy efficiency savings, energy efficiency potential estimates vary widely as well.

The vast majority of energy efficiency studies are undertaken with the assumption that utility or government incentives and top-down policies are the primary means of achieving energy efficiency. A common methodology for determining the cost-effectiveness of an energy efficiency program, "total resource cost" test, or TRC test, frames efficiency as a resource (negawatt hours) that can be "acquired" by a utility, much like supply-side generation (megawatt hours). A shortcoming of framing utility efficiency programs as necessary to "purchase" efficiency is that it often includes the cost of operating incentive programs in the "cost of savings" and it undervalues the private investment potential of energy efficiency. Efficiency does not need to be purchased—it can be invested in, and returns from that investment can repaying the upfront cost of the efficiency measures. This difference in framing (efficiency as cost vs. investment) may distort the dollar amounts necessary to achieve a given level of efficiency.

Looking at clean energy projects, including efficiency, from the perspectives of end-users (the people paying the electricity bills) and investors can increase potential estimates for cost effective efficiency projects. If a set of efficiency measures confers electricity bill savings that are greater than the cost of those measures, those measures create an investment opportunity that may be attractive to a building owner and to a lender.

Table 13: Summary of Massachusetts Energy Efficiency Potential Studies

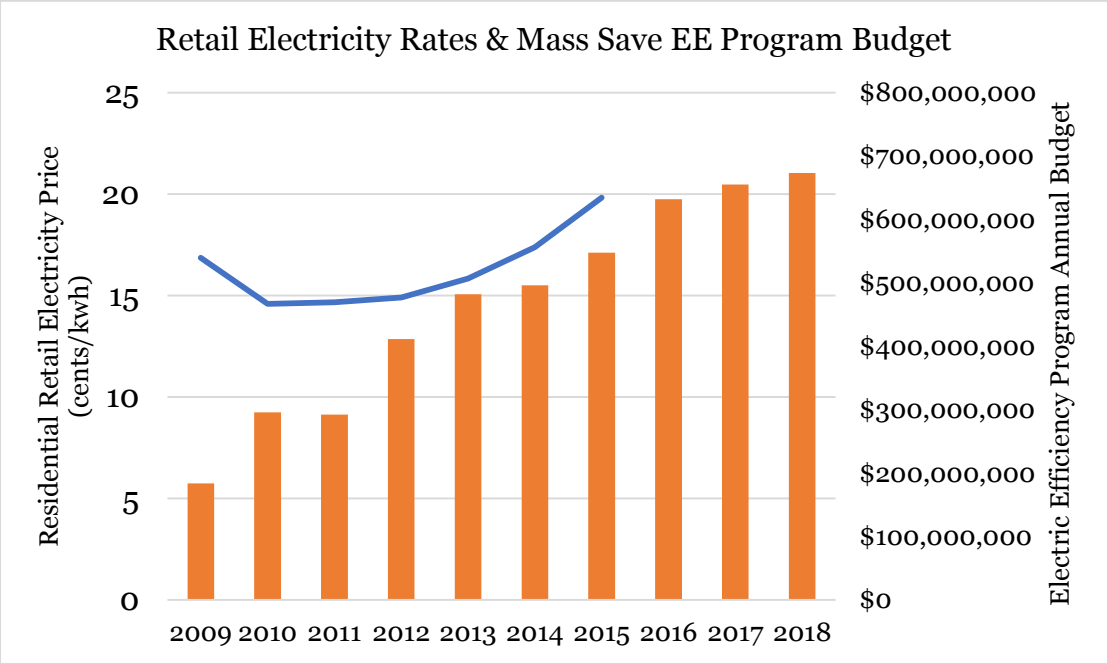
Source	Energy	Sector	Timeframe	Efficiency Potential[xiv]	Means
DOE[125]	Electricity & Thermal	Residential & Commercial	2010-2040	122.2 TBTU	Building Codes
Cadmus[126]	Electricity	Multifamily	2010-2030	520 GWh	Utility EE Programs
Cadmus[127]	Thermal	Multifamily	2010-2030	5.24 TBTU	Utility EE Programs
DOE & EPRI[128]	Electricity	All	2016-2035	9,100 GWh	Utility EE Programs
DOE[129]	Thermal	Industrial	2030	44.1 TBTU	Capex; Energy Management; Federal Programs
DOE[130]	Electricity	Industrial	2030	3,400 GWh	Capex; Energy Management; Federal Programs
NREL & DOE[131]	Electricity & Thermal	Single Family Residential	2009-2042	15% of projected energy use	Undertaking packages of NPV-positive upgrades
DOER & EEAC[132]	CHP	Commercial & Industrial	2016-2018	400 GWh	Utility EE Programs
DOER & EEAC[133]	Electricity	All	2016-2018	4,259 GWh	Utility EE Programs
DOER & EEAC[134]	Natural Gas	All	2016-2018	10.1 TBTU	Utility EE Programs
DOER & EEAC[135]	Oil	All	2016-2018	2.15 TBTU	Utility EE Programs

Incentive and Rebate Programs

Massachusetts has a wide variety of incentive and rebate programs for energy efficiency and renewable technologies, to which the Commonwealth devotes considerable resources. For instance, Mass Save, a program that houses multiple efficiency rebate programs, has an annual budget of more than half a billion dollars. And this does not include other incentive and rebate programs that exist separately from Mass Save.

[xiv] Many studies did not include estimates of the investment needed to achieve the estimated savi, and those that did were not reproduced here due to methodological issues.

Figure 25: Retail Electricity Rates & Mass Save Efficiency Program Budget[136]



Commonwealth Wind Program

The Commonwealth Wind Program is administered by the Massachusetts Clean Energy Center (MassCEC) and offers grants for site assessment services and feasibility studies, and development grants and loans for community wind projects[xv] 100 kW or greater and commercial wind projects[xvi] 2 MW or greater. Every project receiving money from this program must be owned by commercial, industrial, or institutional entity served by an investor-owned utility. Depending on the type of grant and the type of recipients, the cost-sharing requirement ranges from 0% to 40% of the cost of the service.[137]

Commonwealth Hydropower Program

The Commonwealth Hydropower Program is run by MassCEC and offers grants for feasibility studies and construction of hydroelectric facilities that qualify for (or will qualify for) the RPS program. Grants for feasibility studies are capped at $45,000 or less (based on expected production), and grants for construction projects are capped at $600,000 or less (depending on project costs and expected production). Projects receiving feasibility study grants are required to provide a 10% cost-share, and projects receiving design and construction grants are required to provide 20% cost-share.[138]

Commonwealth Organics-to-Energy Program

The Organics-to-Energy grant program is run by MassCEC, and supports the use of anaerobic digestion and other technologies that convert source-separated organic wastes into electricity and thermal energy.

[xv] Community wind projects are typically net-metered and serve onsite load.
[xvi] Commercial wind projects typically serve the ISO-New England wholesale market, or onsite load that is not eligible for net metering.

The program offers grants to customers served by the investor-owned electric utilities and any Municipal Light Plant (MLP) Department which pay into the Massachusetts Renewable Energy Trust Fund.[xvii] Grants from this program are available for the following activities and maximum amounts: Technical Study ($40,000); Procurement Support ($50,000); Project Proposal Review ($8,000); Feasibility Study ($45,000); Implementation Project ($400,000 or less depending on expenses); and Pilot Project ($200,000 or less depending on expenses).[139]

Residential Renewable Energy Income Tax Credit

Massachusetts provides a 15% income tax credit up to $1,000 for the purchase and installation (less federal incentives) of a renewable energy system installed on an individual's primary residence. If the tax credit amount is greater than a resident's income tax liability, the excess credit amount can be applied in the next year for up to three years. Eligible technologies include solar water and space heating, solar photovoltaics, and wind energy systems.[140]

Renewable Energy Property Tax Exemption

Massachusetts provides property tax exemptions for the value added to properties from eligible solar and wind energy systems for a 20-year period.[141]

Utility Rebates

Mass Save was jointly created by the electric and gas utilities in Massachusetts,[xviii] and offers rebates and financing for energy efficiency and clean energy projects.[142] Gas Networks, a similar collaboration among natural gas companies,[xix] offers rebates for gas-efficient technologies.[143] Of the 41 municipal light plants (MLPs) in Massachusetts,[144] many offer rebate and incentive programs for renewable energy and energy efficiency technologies.[xx] These MLPs offer rebates across a wide variety of technologies and market segments. There are MLP rebates for weatherization, appliances, renovations, heating, cooling, and clean energy technologies—each MLP offers rebates for different types of projects and technologies, and the rebates vary in size and in eligible sector.[145]

Massachusetts Clean Energy Center Rebates

The Massachusetts Clean Energy Center (MassCEC) is a state instrumentality created to increase the adoption of clean energy technologies, and facilitate the success of companies in the Commonwealth. MassCEC offers rebates for a variety of clean energy technologies (mostly heating and cooling equipment),

[xvii] Eligible utilities include: Fitchburg Gas and Electric Light (Unitil), Massachusetts Electric (National Grid), Nantucket Electric (National Grid), and Eversource. any Municipal Light Plant (MLP) Department that pays into the Renewable Energy Trust are also eligible

[xviii] Berkshire Gas, Blackstone Gas Company, Cape Light Compact, Columbia Gas of Massachusetts, Eversource, Liberty Utilities, National Grid, and Unitil.

[xix] Berkshire Gas, Columbia Gas of Massachusets, New England Gas Company, NSTAR Gas, Unitil, and National Grid.

[xx] MLPs that directly offer rebates for clean energy and energy efficiency include: Chicopee Electric Light, Concord Municipal Light Plant, Hudson Light & Power, Mansfield Municipal Electric Department, Marblehead Municipal Light Department, Reading Municipal Light Department, Shrewsbury's Electric Light Plant, Taunton Municipal Lighting Plant, Wellesley Municipal Light Plant, and Wakefield Municipal Gas & Light Department. The Massachusetts Municipal Wholesale Electric Company (MMWEC) represents 21 MLPs, and offers rebates on behalf of those MLPs.

and sometimes varying in size based on end-user incomes, for residential, commercial, non-profit, and government buildings.[146]

Laws and Policies

Several key laws and policies have a significant role in shaping the clean energy market landscape in Massachusetts.

Renewable & Alternative Portfolio Standards

Massachusetts has a Renewable Portfolio Standard (RPS) that requires 15% of sales to be from renewable sources by 2020, and increasing by an additional 1% of sales each year after 2020. Investor owned utilities and retail electricity suppliers must comply with this mandate by submitting annual filings to the DOER. The following sources of electricity generation are eligible: geothermal electric, solar thermal electric, solar photovoltaics, wind, biomass, hydroelectric, municipal solid waste, landfill gas, tidal, wave, ocean thermal, small hydroelectric, anaerobic digestion, and fuel cells that use renewable fuels. The RPS also includes a mandated in-state solar photovoltaic generation capacity of 1600 MW by 2020. Renewable Energy Certificates (RECs) produced by the generation of renewable electricity have a lifetime of 3 years, and are owned by the owner of the generation resource.[147] The new Solar Massachusetts Renewable Target (SMART) program will change some features of the current system, and is discussed in a following section.

Massachusetts also as an Alternative Portfolio Standard (APS) that requires meeting 5% of the state's electric load with "alternative energy" by 2020. Eligible alternative energy sources include: biomass, geothermal heat pumps, combined heat and power, flywheel energy storage, energy efficient steam technology, and renewable technologies that generate useful thermal energy.[148]

Solar Massachusetts Renewable Target (SMART)

DOER is designing a new solar incentive program to replace the current system focused on SRECs. According to the current form of the regulation, the Solar Massachusetts Renewable Target, or SMART, program will provide tariff based incentive payments to owners of net-metered solar photovoltaic projects of 5 MW or less. The SMART program will incentivize up to 1600 MW of solar capacity, with carve outs for solar projects of 25 kW or less. Qualifying solar projects greater than 25 kW (and less than 5 MW) are eligible to receive solar tariffs for 20 years, while solar projects less than 25 kW are eligible to receive solar tariffs for 10 years.[149]

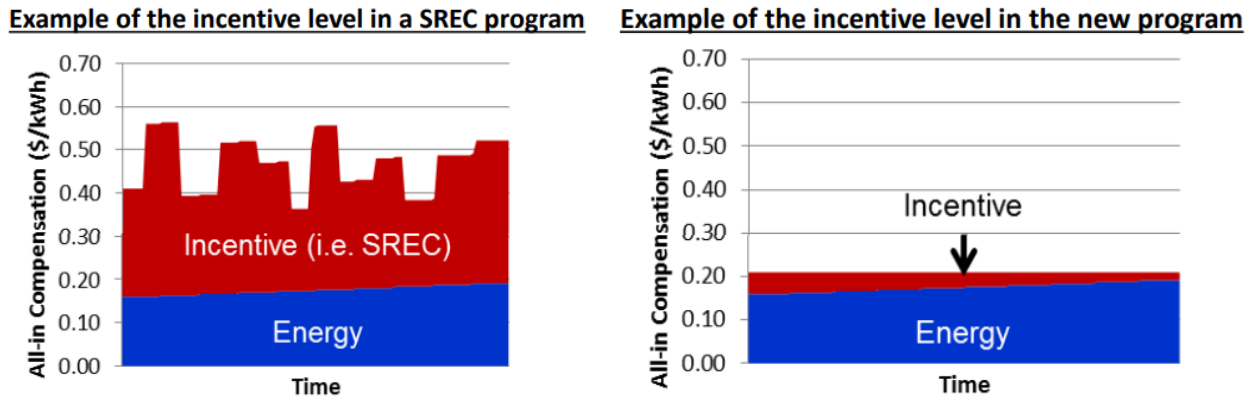
The base compensation rates for projects between 1 MW and 5 MW will be established by a competitive procurement process run by the distribution companies. The base compensation rate for the electricity and RECs may not exceed the ceiling price $0.17 per kWh. Each distribution company will set the clearing price at the highest requested base compensation rate among the accepted proposals.[150]

The base compensation rates for projects less than 1 MW will be determined using a “base compensation rate factor” that multiplies the clearing price of the procurement process for the 1 to 5 MW projects by a certain percentage. The base compensation rate factors produce more favorable tariffs for low income and smaller-capacity projects. Finally, there are various location-based and offtaker-based rate adders that increase the solar tariffs projects receive if they are building mounted; built on a brownfield, landfill,

canopy, or farm; or are a community solar project, low income project, or the project of a public entity; or are co-located with energy storage.[151]

This regulation has not yet been enacted, so it is unclear how it will affect the financing of solar projects in the Commonwealth. It is clear, however, that the SMART program will offer a less generous but more predictable incentive for solar electricity.

Figure 26: Varying incentive levels under SREC and SMART systems[152]



Energy Storage Target

The Massachusetts legislature passed H.4568 which made DOER responsible for establishing an energy storage target. DOER recently set the target of 200 MWh of storage by 2020.[153]

Net Metering

Investor-owned utilities are required to offer net metering in Massachusetts, and municipal utilities may do so voluntarily. Net metering is offered to systems at several levels: 0-60 kW of any type of generation (Class I), 60 kW - 1 MW of solar, wind, or agricultural product systems (Class II), and 1 MW - 2 MW of solar, wind, or agricultural product systems (Class III). In aggregate, municipal or governmental facilities may not exceed 8% of the distribution company's peak load. Private facilities may not exceed 7% of the distribution company's peak load. Massachusetts allows neighborhood net metering, or community solar.[154] Excess generation is credited to customer-generators at a rate slightly below the retail rate for almost all rate classes and customer types.[155]

Energy Reduction Plan for State Buildings

State buildings owned and leased by the executive branch of Massachusetts government are required to reduce overall energy consumption at state-owned and state-leased buildings should be reduced by 35% by FY 2020 from FY 2004 levels. The plan also requires those state government buildings to reduce unadjusted greenhouse gas emissions from the 2002 baseline 40% by 2020, and 80% by 2050.

New construction and significant renovation projects over 20,000 square feet must meet the Massachusetts LEED Plus green building standard and projects smaller than 20,000 square feet must meet the minimum energy performance standards.

State agencies must also implement specific energy efficiency measures such as programmable thermostats, motion sensors, timing devices, efficient lighting, and use of ENERGY STAR certified appliances.[156]

Financing Programs

There are several governmental and utility-affiliated lending programs in Massachusetts.

Holyoke Gas & Electric - Energy Conservation Loan Program

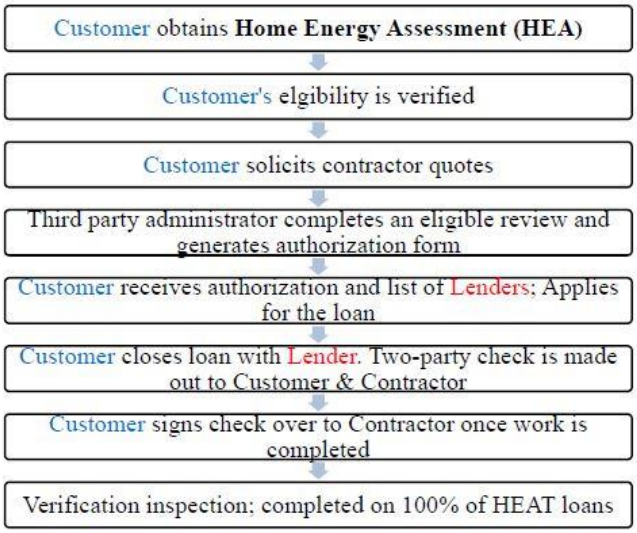
Holyoke Gas & Electric (HG&E), a municipally-owned utility company in Holyoke, has an Energy Conservation Loan Program for its residential and commercial customers (including government and multi-family residential buildings with 5 or more units). The loans charge 0% interest for up to 5 years for efficiency technologies and 10 years for solar, and the monthly loan payments appear on the customers' HG&E bills.

For the residential loan, eligible technologies include solar water heat, solar photovoltaics, equipment insulation, water heaters, furnaces, boilers, air conditioners, programmable thermostats, building insulation, windows, doors, heat pumps, and other efficiency and insulation technologies. Maximum loan amounts in the residential program are $5,000 for single-family homes, $10,000 for owner-occupied multi-family dwellings, and $10,000 for solar.[157] For the commercial loan, eligible technologies are all the same as for the residential loan program, with the addition of processing and manufacturing equipment. Maximum loan amount for multi-family properties with 5 or more units is $20,000.[158]

Mass Save - HEAT Loan Program

The Mass Save HEAT Loan Program buys down interest rates of approved HEAT Loan lenders so the customer pays 0% interest for up to 7 year terms for a maximum of $25,000 for the installation of residential energy efficiency improvements. Participating lenders provide personal, unsecured loans to creditworthy borrowers at the rate of prime rate plus 100 basis points with a floor of 5%. Utilities handle customer acquisition, monitoring and verification and provide capital to buy down the interest rate to 0%. Eligible customers include the residential ratepayers of Cape Light Compact, National Grid, Eversource, Unitil, and municipal electric customers served by Columbia Gas of Massachusetts or Liberty Utilities. FICO scores of qualifying borrowers are typically greater than 620, but vary by lender.[159] Eligible technologies include solar water heaters, biomass wood pellet boilers, geothermal heat pumps, water heaters, furnaces, boilers, heat pumps, duct & air sealing, building insulation, windows, tankless water heaters, and other efficiency technologies. Expanded loans for $50,000 are available for a limited time as the result of a DOE grant. Participants in the HEAT loan program are required to undertake a free home energy assessment.[160] In 2016, there were 8,767 HEAT loans made for a total of more than $88 million, with average loan size around $10,000.[161]

Figure 27: Mass Save HEAT Loan Process[162]



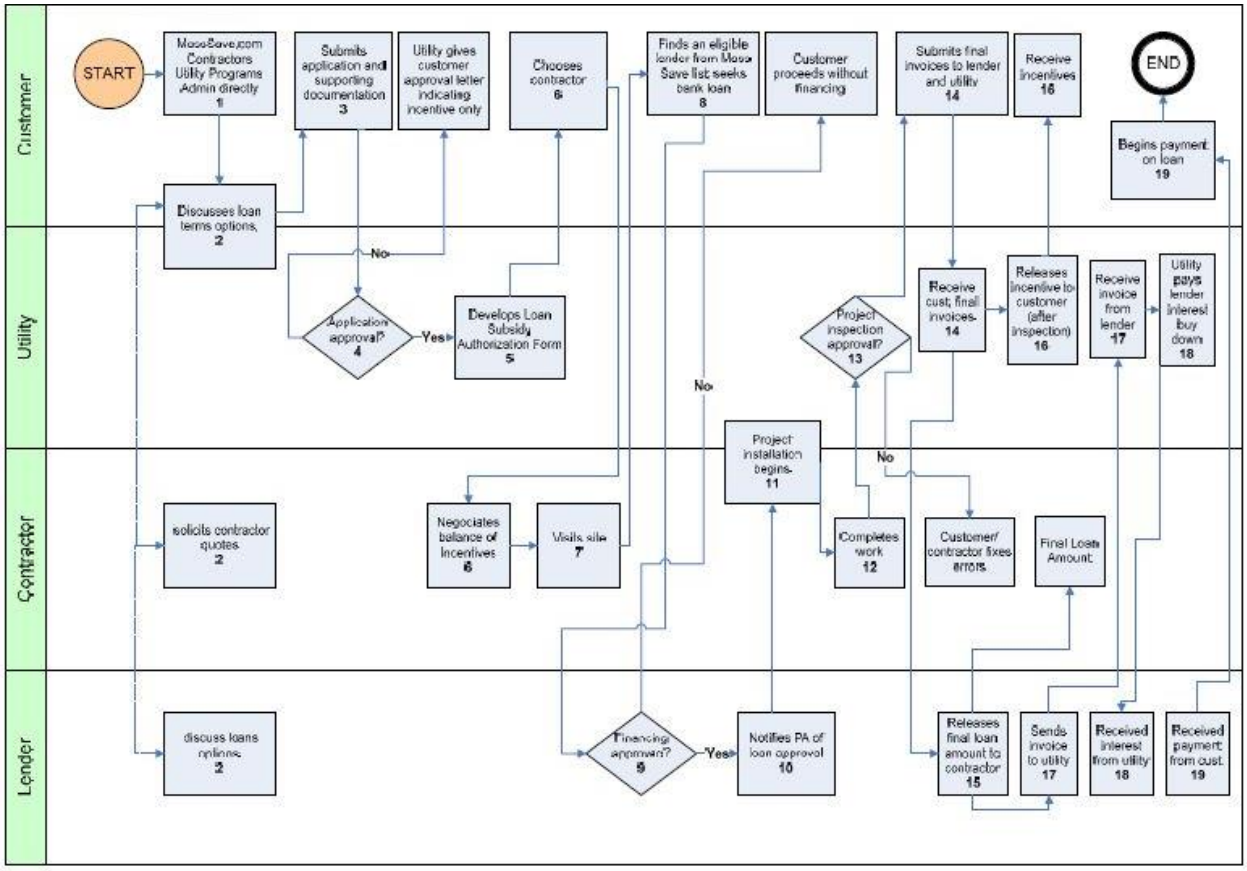
Mass Save - Financing for Business Program

The Mass Save Financing for Business program can prepay interest payments of approved Financing for Business borrowers, so the customer can pay 0% interest for up to 7 year terms for high-efficiency natural gas equipment, lighting, lighting controls/sensors, compressed air, motors, motor VFDs, commercial cooking equipment and other efficiency technologies. Eligible customers include the commercial ratepayers of Cape Light Compact, National Grid, Eversource, Unitil, and municipal electric customers served by Columbia Gas of Massachusetts or Liberty Utilities.[163]

Private lenders from a pre-approved group of 10 lenders[xxi] provide the loans of up to $500,000 at a pre-negotiated rate of prime plus 100 basis points with a 6.25% floor. The borrower's local utility or energy efficiency provider can pre-pay the scheduled interest payments on the loan (instead of providing rebates on the individual measures), so the borrower only repays the principal. The financed improvements must be pre-approved by the borrower's utility or energy efficiency provider.[164]

[xxi] Pre-approved lenders include: Bridgewater Savings Bank, Century Bank, Charles River Bank, Commerce Bank, East Cambridge Savings Bank, Greenfield Co-operative Ban, Marlborough Savings Bank, Mechanics Cooperative Bank, Middlesex Savings Bank, and Webster Five.

Figure 28: Mass Save Financing for Business Process[165]



MassCEC - Mass Solar Loan Program

MassCEC's Solar Loan Program offers secured or unsecured loans up to 10 years at a fixed rate of the Wall Street Journal prime rate + 2.75% (which is currently around 7%) for $3,000 to $35,000 (or up to $60,000 at the discretion of the lender) for the purchase of solar photovoltaics for residential properties. Participants must contract with a pre-qualified Mass Solar Loan installer, and apply for a loan from a participating pre-qualified Mass Solar Loan lender.[xxii] The Solar Loan program also includes a loan loss reserve (LLR) that enhances borrowers' credit at a level depending on their FICO scores.[166] Previously, interest rate buy downs were available for program participants at all income levels. Recently a new program structure was implemented that scales back financial support for higher income participants. Now, program participants with incomes less than 80% of the state median income ("low income customers") are eligible for a 30% loan principal buy down, can qualify for the Loan Loss Reserve, and are eligible for a 1.5% interest rate buy down. Program participants with incomes up to 120% of the state

[xxii] Pre-approved lenders include: Avidia Bank, Bank Five, Clinton Savings Bank, East Cambridge Savings Bank, Equitable Bank, Family Federal Savings, First Citizens' Federal Credit Union, Franklin First Federal Credit Union, Greenfield Cooperative Bank, Mutual Bank, Naveo Credit Union, North Brookfield Savings Bank, Sharon Credit Union, Shrewsbury Federal Credit Union, Southern Mass Credit Union, Stoughton Co-Operative Bank, and UMassFive College Federal Credit Union.

median income ("moderate income customers") are eligible for a 10% loan principal buy down and can qualify for the Loan Loss Reserve. Moderate income customers are no longer eligible for the interest rate buy down. Program participants with greater than 120% of state median income ("non-income qualified customers") are no longer eligible for any incentives (including interest rate buy downs, loan principal pay downs, and the loan loss reserve).[167]

MassCEC was given $30 million by DOER in 2015 to administer the Mass Solar Loan program.[168] Of that initial amount, $12 million was allocated for interest rate buy downs, $10 million was allocated for loan principal pay downs, and $5 million for the loan loss reserve. Since the beginning of the program, more than 2,600 solar installations corresponding to more than 22 MW have been made through the program. To facilitate these solar installations, the Mass Solar Loan program paid out approximately $10.7 million in interest rate buy downs, approximately $9.7 million in loan principal pay downs, and committed approximately $3 million to a loan loss reserve.[169] An additional $10 million was recently made available to continue the Mass Solar Loan program under the new program structure, described above.[170]

Of the recipients of Solar Loan program financing to date, 73% have had FICO scores above 720, 87% have had FICO scores about 680, and 13% have had FICO scores below 680.[171] Private sector solar lenders active in Massachusetts before the Mass Solar Loan program was implemented, and suggested their business has diminish as a result of difficulty competing with the program's concessional approach so solar lending.[172]

MassCEC - Advancing Commonwealth Energy Storage (ACES) Program

MassCEC, along with DOER, runs the Advancing Commonwealth Energy Storage (ACES) program. This program consists of a request for proposals for business and finance model demonstrations of commercially-viable energy storage technologies.[173]

Massachusetts C-PACE

Property-Assessed Clean Energy, or "PACE," is a financing mechanism that allows building owners to finance clean energy upgrades by placing a lien on the property. The financing is paid back though an assessment on the building's property taxes. The lien and the responsibility to pay back the loan through the property tax bill are attached to the property, and stay with the property if it is sold.

Massachusetts passed PACE-enabling legislation in 2016, which allowed municipalities to choose to establish commercial PACE (or C-PACE) programs. The Massachusetts PACE program is to be administered on a statewide basis by Mass Development (the Commonwealth's economic development and finance agency) and the Massachusetts Department of Energy Resources (DOER).[174] Commercial buildings, industrial buildings, and multifamily buildings (with five or more units) are eligible for PACE financing. PACE financing can be used to finance energy efficiency upgrades, renewable energy, and the extension of existing natural gas distribution to a property.[175] Currently there is no operational PACE program in Massachusetts, as no municipalities have passed legislation formally joining the PACE program.[176]

Qualified Energy Conservation Bonds (QECBs)

The American Recovery and Reinvestment Act of 2009 created Qualified Energy Conservation Bonds (QECBs), which are Federally-allocated authority to issue bonds to fund renewable and efficiency projects

that will have part of their interest payment subsidized by the Federal government. A certain amount of QECBs were allocated to each state by a formula, and additional sub-allocations were given to "large local governments" (such as cities and counties) according to a formula based on population.

Massachusetts was initially allocated more than $67 million in QECB bonding authority across the state government and its local governments. DOER and other government agencies managed the process of redistribution of $50 million of the QECB allocations back to the state level, and gave control of the QECB allocation to Mass Development.[177] Of its original allocation, Massachusetts has issued more than $37 million in QECBs and has more than $29 million in QECB issuing authority remaining.[178]

Table 14: Massachusetts QECB Allocations[179]

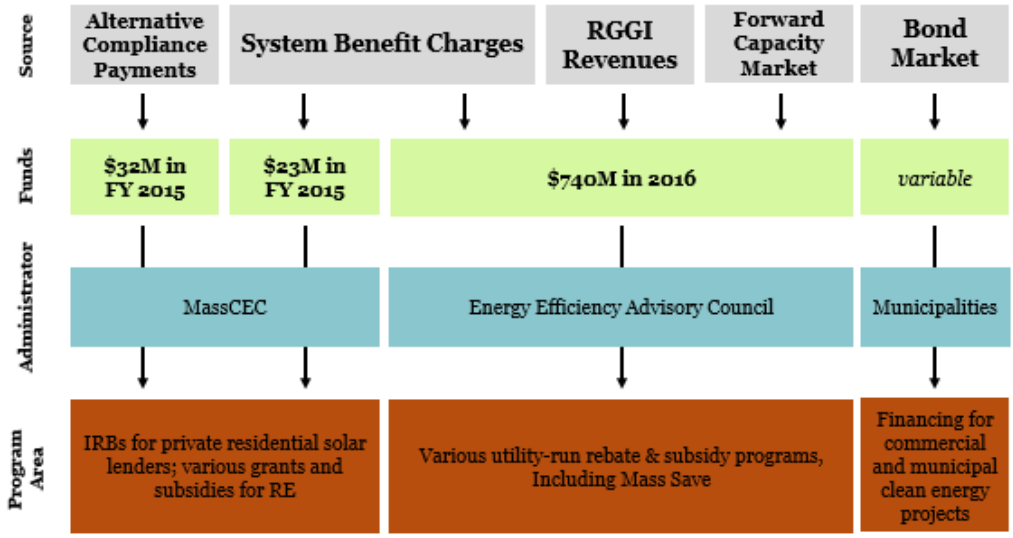
QECBs Allocated	QECBs Issued	Remaining QECBs
$67,413,000	$37,839,237	$29,573,763

A maximum of 30% of QECB allocations can be used for private projects,[180] and of the allocations controlled by Mass Development, 30% have already been issued to private projects.[181] Nearly all of the remaining QECB allocation authority held by Mass Development must be used for public projects, though there has not been much interest in using QECBs from Massachusetts municipalities because QECBs may not provide a sufficiently attractive alternative to their own bonding authority.[182]

Public & Quasi-Public Institutions Focused on Clean Energy

There are several key public and quasi-public institutions in Massachusetts in which many of the main clean energy rebate and financing programs are housed. Each has a unique role in the Massachusetts clean energy market landscape.

Figure 29: Funding for Massachusetts Clean Energy Programs[183]



Massachusetts Clean Energy Center

The Massachusetts Clean Energy Center, or "MassCEC," is a quasi-public research and development entity that provides a wide variety of rebates for clean energy technologies and also provides interest-rate buy downs for private lenders as a part of the Mass Solar Loan Program for residential solar projects. MassCEC also provides workforce training programs and supports innovation and demonstration of clean energy technology. MassCEC also administers the Commonwealth's Renewable Energy Trust Fund, which is described at greater length in another section.[184]

MassCEC gets funds and revenue from system benefit charges, the Renewable Energy Trust Fund, the Alternative and Clean Energy Investment Fund (which itself is funded by the Renewable Energy Trust Fund), investments, REC sales, the Wind Technology Testing Center, and New Bedford Marine Commerce Terminal. In FY 2016, MassCEC's total assets were $210 million, $141 million of which was in the form of trust investments. Revenue for that year was $30.9 million, and its total expenditures were $46.6 million, $37.2 million of which was given out as awards. Of the awards disbursed, $25 million (67.2%) went to renewable energy generation, $6.4 million (17.2%) went to innovation and industry support, and $5.8 million (15.6%) went to investments.[185]

Mass Save

Mass Save was jointly created by the electric and gas utilities in Massachusetts to offer rebates and financing for energy efficiency and clean energy projects. It provides a range of incentives and rebates, building energy audits, and various educational materials and resources on the subject of building energy efficiency.[186]

Mass Development

Mass Development is the state's economic development and finance agency, which focuses on promoting economic growth in the Commonwealth.[187] The primary role Mass Development plays in the clean energy landscape in is that of the co-administrator of Massachusetts' new PACE program, along with DOER.[188] Mass Development also has issuing authority for the Commonwealth's remaining QECB allocations, which were redistributed to Mass Development from the local governments that initially held them.

Renew Boston Trust

The Renew Boston Trust (RBT) is an effort of the city of Boston to create programs that will facilitates the financing of clean energy and resiliency improvements to buildings.[189] The initial RBT program will involve performance contracting for clean energy measures within municipal buildings. The program is not yet active because of the time necessary to change the city's budgeting and financing processes so it can participate in performance contracting, and because of the need to line of program partners in the private sector. The vision for RBT is to have four financing programs to serve the municipal, commercial, institutional, and multi-family residential market segments.[190] RBT has developed a concept for the commercial financing product.[191]

Boston Industrial Development Financing Authority

The Boston Industrial Development Financing Authority (BIDFA) was created as a board of the City of Boston. BIDFA issues bonds to finance the city's businesses and institutions and more broadly to promote economic growth and employment. Since 1972, BIDFA has helped issue nearly $550 million in taxable and tax-exempt bonds for acquisition & construction, expansion, and capital expenses of Boston non-profits, businesses, and government-affiliated institutions. Bonds issued by BIDFA rely on the credit of the borrower, not on that of the City of Boston.[192]

Renewable Energy Trust Fund

The Massachusetts Renewable Energy Trust Fund, or "RET Fund," is capitalized by a surcharge of $0.0005 per kWh (0.5 mill/kWh) on customers of all distribution companies and competitive municipal utilities in Massachusetts. MassCEC administers the fund under the oversight of DOER. MassCEC uses the RET Fund to provide grants, loans, equity investments, and rebates in support of a variety of renewable energy technologies for Massachusetts ratepayers.[193]

Energy Efficiency Fund

The Energy Efficiency Fund is capitalized by several sources: a surcharge of $0.0025 per kWh (2.5 mill/kWh) on customers of all distribution companies and competitive municipal utilities in Massachusetts, revenue from the Forward Capacity Market administered by ISO-New England, and revenue from the Regional Greenhouse GAs Initiative cap-and-trade program. Money in the Energy Efficiency Fund is used to support energy (electric and gas) efficiency programs, including demand-side management programs and low-income energy programs. The energy efficiency programs supported by the fund are administered by electric utilities and municipal aggregators. The state-appointed Energy Efficiency Advisory Council—which includes members of the DPU and various stakeholders—approves which utility programs receive dollars from the Energy Efficiency Fund, and DOER provides program oversight and evaluation.[194]

APPENDIX C - Summary of Best Practices for Green Bank Legislation

There are currently two pieces of legislation introduced to create a "Green Bank" in the Commonwealth of Massachusetts. The following best practices regarding Green Bank legislation have been gleaned from numerous Green Bank legislative efforts and observable operational efficacy from existing Green Banks.

Legislation creating and capitalizing a Green Bank in Massachusetts should include the following components:

- Statement of the Purpose of the Green Bank should be to serve as a dedicated clean energy project financing entity that increases the pace and amount of financing for clean energy projects in Massachusetts.
- Goal of the Green Bank should be to accelerate the growth of renewable energy, energy efficiency and clean transportation markets through financing.
- Focus on investing in clean energy projects in ways that leverage greater private investment.
- Requirement that returns earned through Green Bank financing activities are retained and used to further the mission of the Green Bank.
- Requirement that the Green Bank seek to become financially self-sustaining by developing a portfolio of investments and associated revenue such that it can pay for its own operations.
- Types of financing activities the Green Bank is authorized to use should include senior and subordinated loans, credit enhancements, guarantees, equity investments, warehousing, aggregation, securitization and rebates as necessary.
- Permission to lend to private entities or privately-owned projects, and to co-invest in projects alongside private entities; to engage in long-term contracts with and to sell its assets (loans) to private entities.
- Classes of borrowers will include clean energy projects, property owners, and/or companies developing or installing energy technology.
- Policies and procedures will be developed to determine borrower eligibility, terms, and conditions of support.
- Eligible clean energy technologies will include renewable generation technologies that use solar, wind, geothermal resources, organic biomass or waste streams, small-scale hydropower, tidal currents, fuel cells using renewable resources, and any other source that naturally replenishes over a human, rather than geological, time frame and that is ultimately derived from solar, water or wind resources, and will include efficiency technologies that result in the reduction of energy use or substantially reduces greenhouse gas emissions relative to emissions relative to what would have produced before the application of such project or technology.
- Express focus on technologies which are commercially proven, have very low or no technology risk, and are ready for mass market deployment.
- List of market sectors eligible for Green Bank financing, including: residential, commercial & industrial, non-profit, and MUSH (municipal, university, schools and hospitals).
- Language requiring the creation and designation of an independent non-profit corporation to serve as the state's official Green Bank.
- Provision of $100 million in public funds for Green Bank operations and financing activities.

- Requirement that the Board of Directors have at least one ex-officio government official and that no more than one third of total seats are held by government officials.
- Requirement that the Board of Directors collectively has the following traits: experience with clean energy project finance in a variety of market sectors, experience sitting on Boards of for-profit enterprises, and Massachusetts-specific clean energy market and policy knowledge and experience.
- Requirement that each member of the Board of Directors has no conflicts of interest.

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