Getting to Yes: Scaling Comprehensive Efficiency in Commercial Buildings

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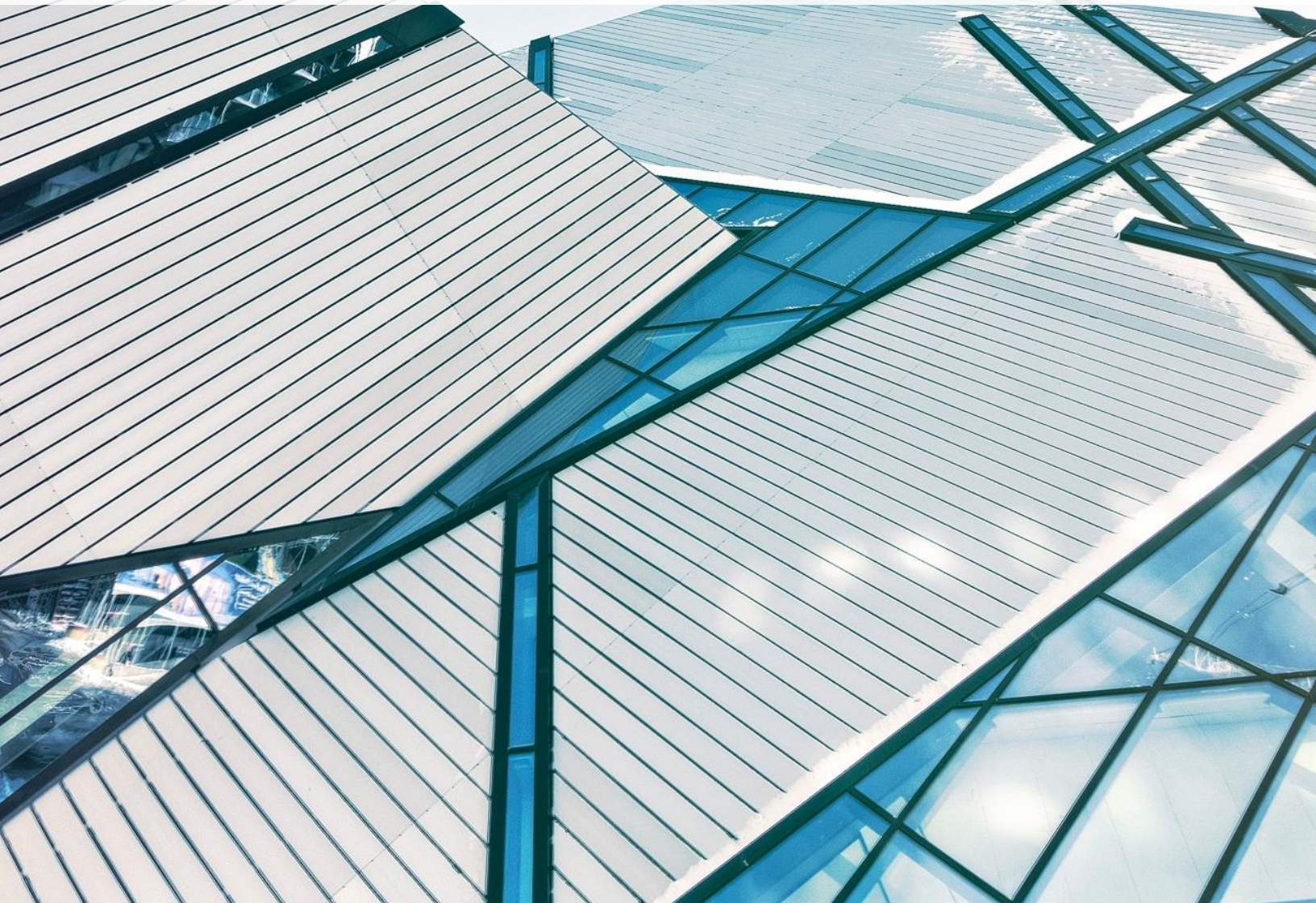

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About NEEP

NEEP was founded more than 20 years ago as a non-profit to accelerate energy efficiency in the Northeast and Mid-Atlantic states. Today, it is one of six Regional Energy Efficiency Organizations (REEOs) funded, in part by the U.S. Department of Energy to support state efficiency policies and programs. Our long-term shared goal is to assist the region to reduce carbon emissions 80% by 2050.

Disclaimer: NEEP verified the data used for this white paper to the best of our ability. This paper reflects the opinion and judgments of the NEEP staff and does not necessarily reflect those of NEEP Board members, NEEP Sponsors, or project participants and funders.

Executive Summary

As NEEP continues to advance our mission of carbon reduction in the Northeast and Mid-Atlantic, we must stop to consider the achieved successes as well as the remaining potential for market transformation of energy efficiency. As we look at this broader context, the commercial sector bubbles to the top. That sector is a large energy user and the energy sources used today are primarily carbon-intensive sources. While efficiency measures—such as HVAC improvements, building controls, high efficiency lighting and equipment—have brought the commercial sector to a more efficient place, the commercial sector can do more across the region. There is more potential to be reached than our current efforts achieve. New technologies—such as high efficiency rooftop units, advanced lighting controls, and demand response-enabled equipment—can help push commercial sector efficiency further. This, however, is not the end of the story.

Commercial business owners and managers are not energy experts, and do not desire to be. They are in the business of providing the service or widget that their business provides, with their attention and focus directed on how to improve their product or service. As such, commercial businesses are challenged in committing to energy efficiency improvements; upfront cost and potential disruption can make projects unappealing. Determining workable financing mechanism for efficiency improvements, therefore, has been a key consideration for decades. Leasing, loans, and utility incentive programs have all been established to help reduce barriers for the commercial customer looking to do efficiency. In many cases, however, those efforts have only made the easiest efficiency measures, such as high efficiency lighting retrofits, within reach for a motivated commercial customer. While efficiency efforts have been implemented with some success in the commercial sector, progress has been uneven in gaining scale for other measures. Even with financing options in place to make efficiency more appealing, most commercial customers are not pursuing deeper energy savings projects, if they are pursuing efficiency at all.

Efficiency programs cite example after example where positive project economics were helpful but not sufficient to gain approval for an energy efficiency project. Much of the challenge of commercial customers pursuing deeper efficiency comes down to a lack of trust, absence of authority when faced with these options, and a muddled value proposition from an inconsistent range and volume of sales activity. Getting customers to “yes” and overcoming these challenges to achieve comprehensive commercial efficiency projects at scale requires a fresh perspective, new approaches, and coordination across stakeholders.

Emerging Approaches to Commercial Efficiency

In a NEEP-conducted survey of commercial efficiency stakeholders, significant barriers to adopting efficiency were identified, primarily around pushing projects from proposal to implementation. Historically, lack of familiarity with efficient technology or lack of capital were keeping many efficiency projects from completion, but these traditional barriers to success are no longer hindrances. Rather, the lack of value, lack of proposal clarity, or inertia are keeping projects from moving forward. Luckily, there are several new ways various stakeholders (program administrators, ESCOs, or other entities) can deploy to overcome these barriers and bring comprehensive commercial efficiency to scale.

Several new financing models have emerged that warrant consideration and understanding. These include Commercial Property Assessed Clean Energy (C-PACE) programs, Pay-for-Performance models, Energy Aligned Leases, and Energy Services Agreements (ESAs). Those looking to achieve commercial efficiency must also look

to ensure that energy efficiency is appropriately valued as a resource to attract new and diverse sources of funding. Financial intermediary companies are emerging to help sort out this effort, with a range of services provided across the commercial sector. Green Banks are also becoming more common, with several providing public dollars to leverage private investment within the Northeast and Mid-Atlantic. Finally, new models of organizing efficiency through "as a service" arrangements are gaining popularity, including equipment as a service, energy as a service, and software as a service.

The future of commercial efficiency success not only depends on new models and approaches to efficiency, but also on creating a more compelling case to drive commercial customers towards undertaking and completing efficiency projects. New ideas and thinking are required to enable energy efficiency projects within the commercial sector to rapidly scale in comprehensiveness and volume. There are several approaches that could be beneficial. An i**ntegrator approach** enables energy efficiency to occur by including it with other energy solutions, such as solar or storage. By expanding the range of services offered by one provider, a customer has a more compelling reason and an easier time following through with an efficiency project. Another approach is the **business school model**, in which efficiency programs and solution providers approach commercial customers from a business-oriented perspective that paints efficiency in a new light such as a means of improving profit margins or retaining staff. The **utility service provider** model includes account management, attribution, and intermediaries to help a commercial executive more easily come to a decision on an efficiency project. Finally, through **non-economic value stacking**, commercial projects are presented as a social norm (making it seem expected and customary to be efficient) that produces benefits beyond energy and dollar savings. These projects become more compelling through emphasis on their data analytic insights, non-energy benefits such as carbon footprint, worker productivity, and health improvements.

While policies can be improved and balanced to better enable commercial efficiency efforts, ultimately it will be a multi-pronged approach to successfully transform the commercial sector and make progress towards achieving the regional goal of 80 percent carbon reduction by 2050. NEEP will continue to be a regional resource to bring stakeholders together, connect the dots of the commercial efficiency story, and assist the region in bringing more projects to "yes" with the goal of growing comprehensive commercial efficiency efforts to scale.

Introduction

The commercial sector has been a target for energy efficiency for decades, though the work is not nearly complete. In many ways, as companies in the commercial sector have evolved, so too have their needs and priorities regarding energy use. A reasonable pay-back period and handsome incentive may have once been enough to make a project compelling. Those same conditions may no longer be enough to motivate a commercial business to move forward with an efficiency project. Many of the most willing customers have already been targeted for lighting efficiency upgrades – the measure with the most compelling economics and largely considered the "low hanging fruit" - the challenge remains bringing more efficiency (beyond just lighting retrofits) to the less willing commercial customers in order to achieve transformation of the commercial sector.

This report intends to highlight the latest information on commercial efficiency, from summarizing new and emerging business models, policies, and technologies, to addressing some near-universal barriers that emerged through our research and strategies to overcome them. This information can be used by market actors - from

utilities, service providers, equipment manufacturers, policymakers, and more - to not only innovate as they bring commercial efficiency projects forward, but also to be more successful as they "sell" efficiency to commercial customers.

Commercial Energy Efficiency Market Summary and Emerging Trends

For appropriate context, the first part of this report focuses on level setting to examine current practices in commercial energy efficiency and summarizing energy use in the commercial sector.

How is Energy Currently Used across the Commercial Sector

The commercial sector is a significant contributor to total energy use within the United States. Commercial buildings use 19 percent of all energy across the U.S.,[1] and on a national level. That energy is split between 51 percent electric, 36 percent natural gas, 10 percent petroleum, less than two percent direct biomass, less than one percent combined of solar and geothermal, and less than one percent direct coal (not including coal from electricity production).[2] When put in the broader context, the commercial sector is a large energy user and the energy sources used today are primarily carbon-intensive sources.

According to the United States Energy Information Administration (EIA),[3] mercantile and service buildings use the most total energy of all commercial building types. Below is a summary of the top five energy-consuming commercial building categories, which collectively used about half of the energy consumed by all commercial buildings in 2012.

Table 1: EIA's Top Five Energy Consumer Commercial Building Categories, 2012

Category	Examples	% of energy used (compared to all commercial sector energy use)
Mercantile and service	Malls and stores, car dealerships, dry cleaners, gas stations	15%
Office	Professional and government offices, banks	14%
Education	Elementary, middle, and high school, colleges	10%
Health care	Hospitals, medical offices	8%
Lodging	Hotels, dormitories, nursing homes	6%

Across the Northeast and Mid-Atlantic, the commercial sector has a large opportunity to achieve more energy efficiency. According to a recent Electric Power Research Institute (EPRI) report[4], states in the region have a highly cost-effective commercial efficiency savings potential, ranging from 18.2-20.3 percent of annual state energy sales by 2035.

[1] https://aceee.org/sector/commercial
[2] LLNL 2016 Energy Consumption flow chart, https://flowcharts.llnl.gov/content/assets/images/energy/us/Energy_US_2016.png.
[3] https://www.eia.gov/energyexplained/index.cfm?page=us_energy_commercial
[4] https://energy.gov/sites/prod/files/2017/05/f34/epri_state_level_electric_energy_efficiency_potential_estimates_0.pdf

Table 2: EPRI's Summary of Commercial Efficiency Economic Potential, in GWh (% of Adjusted Annual State Sales)

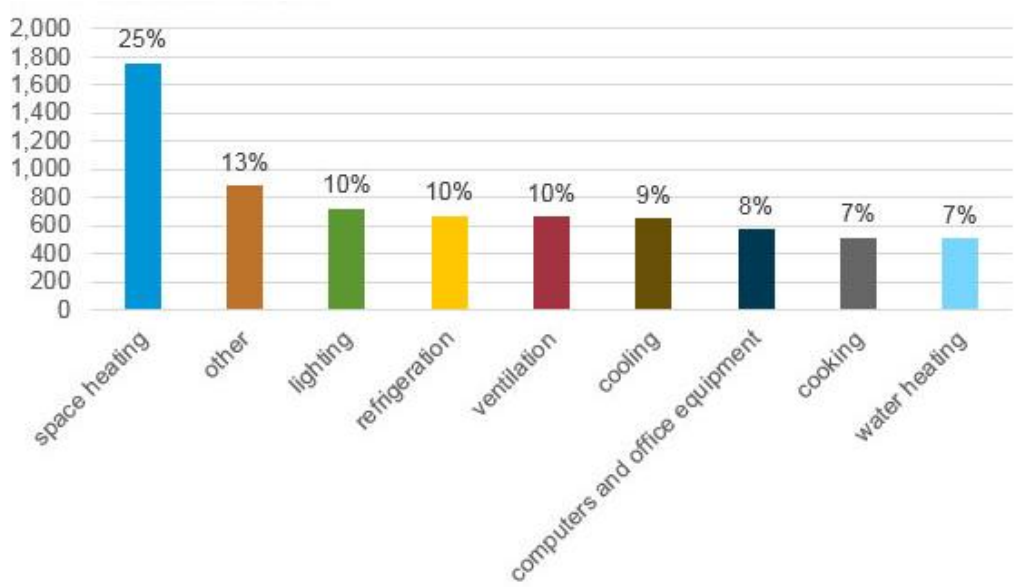
	2017	2020	2025	2030	2035
Connecticut	631 (5.3%)	1,572 (12.8%)	2,345 (18.3%)	2,514 (18.7%)	2,527 (18.2%)
Delaware	213 (5.1%)	552 (12.5%)	880 (18.3%)	1,003 (19.4%)	1,121 (20.3%)
District of Columbia	415 (5.1%)	1,076 (12.5%)	1,716 (18.3%)	1,954 (19.4%)	2,184 (20.3%)
Maine	196 (5.3%)	487 (12.8%)	727 (18.3%)	779 (18.7%)	784 (18.2%)
Maryland	1,511 (5.1%)	3,920 (12.5%)	6,252 (18.3%)	7,121 (19.4%)	7,959 (20.3%)
Massachusetts	1,275 (5.3%)	3,178 (12.8%)	4,742 (18.3%)	5,082 (18.7%)	5,109 (18.2%)
New Hampshire	219 (5.3%)	545 (12.8%)	813 (18.3%)	871 (18.7%)	876 (18.2%)
New Jersey	1,531 (3.8%)	4,735 (11.4%)	7,916 (18.4%)	8,449 (18.9%)	8,390 (18.5%)
New York	3,044 (3.8%)	9,417 (11.4%)	15,741 (18.4%)	16,802 (18.9%)	16,685 (18.5%)
Pennsylvania	1,729 (3.8%)	5,349 (11.4%)	8,942 (18.4%)	9,545 (18.9%)	9,478 (18.5%)
Rhode Island	180 (5.3%)	449 (12.8%)	671 (18.3%)	719 (18.7%)	723 (18.2%)
Vermont	98 (5.3%)	244 (12.8%)	364 (18.3%)	390 (18.7%)	392 (18.2%)
West Virginia	393 (5.1%)	1,021 (12.5%)	1,628 (18.3%)	1,854 (19.4%)	2,073 (20.3%)

Existing Commercial Sector Energy Efficiency Opportunities

The following are descriptions of several long-standing measures and actions to achieve energy efficiency in the commercial sector. As the large potential for increased efficiency demonstrates, these strategies may be tried and true, but are underutilized by commercial buildings today. This list is not comprehensive, particularly not for the specific range of efficient equipment in commercial buildings that can be replaced with a more efficient alternative including refrigeration, commercial cooking equipment, vent hood control, waste heat recycling,[5] laundry opportunities, boiler controls, or use of heat pumps to replace window, wall, and packaged terminal air conditioners. For context, Figure 1 from EIA[6] shows the major energy end uses in the commercial sector. Below, we detail the current efficient activities, grouped in order based on the largest energy using end uses.

[5] https://www.vox.com/energy-and-environment/2017/11/22/16684102/amazon-data-center-district-heating
[6] https://www.eia.gov/energyexplained/index.cfm?page=us_energy_commercial

Figure 1: EIA's Energy Use in US Commercial Buildings by Major End Uses, 2012 (in Trillion BTUs)



Source: U.S. Energy Information Administration, *2012 Commercial Buildings Energy Consumption Survey: Energy Usage Summary*, Table 5 (March 2016)

HVAC Controls and Maintenance

Heating, Ventilation, and Air Conditioning (HVAC) is one of, if not the biggest consumers of energy in commercial buildings. In commercial structures, there is typically either a packaged stand-alone HVAC unit or built-up systems with a central plant, which are more typical on very large buildings. When not in use, setting back the temperature settings can be a significant energy-saving measure. This can be automated through building management systems or through smart thermostats for smaller buildings. Additionally, there are benefits in zoning HVAC to ensure that conditioned air is sent to occupied spaces while peripheral or seldom-used rooms may have more efficient settings.

Building Envelope Improvements

An air tight building envelope, through retrofit or design, can be a cost-effective way to reduce long-term operating costs and increase energy efficiency for commercial buildings. The key considerations to improve building envelopes are: to prevent air movement into the wall and out of the building; prevent water infiltration, which can reduce the effectiveness of insulation and cause wood damage and corrosion; and to allow water vapor to escape when moisture does get in. All of these considerations aim to protect and improve building air quality. Indoor air quality is especially critical in commercial buildings with high rates of occupancy such as nursing homes, dormitories, or hospitals.

Existing Building Commissioning

Commissioning is a process in which specialists systematically check and tune up building systems to ensure that they are operating appropriately and efficiently. Studies have shown that commissioning a building's energy

systems can lead to reductions of around 16 percent in annual energy bills.[7] In addition to providing energy savings, commissioning often increases comfort for occupants because the majority of problems identified tend to concern controls and HVAC systems. If a building had been previously commissioned, one could consider investing in recommissioning every three to five years. Even in new buildings where commissioning was considered complete, it can be rushed in an effort to get buildings occupied, leading to issues with comfort and energy waste. Buildings with complex HVAC and control systems, such as labs and hospitals, are particularly vulnerable. Through proper baselining and monitoring, efficiency drift can be seen.

Retrocommissioning (Rx) or "existing building commissioning," is another efficiency option.[8] Rx takes a systematic approach to identify and implement operational and maintenance improvements to ensure good performance continues over time. While Rx focuses on diagnostic testing as well as operations and maintenance improvements, capital improvement needs may be identified through a retrocomissioning process.

Building Energy Management Systems

Many commercial businesses, especially larger entities, have some sort of building automation or basic Building Energy Management System (BEMS). Also sometimes referred to as Energy Management and Information Systems (EMIS)[9], these systems can help identify operational inefficiencies and, with advanced analysis, may be able to find fault detection or other efficiency improvement opportunities. As Lawrence Berkeley National Lab (LBNL) defines it, EMIS "are a broad family of tools and services used to manage building energy use. EMIS include benchmarking and monthly utility tracking tools, energy information systems, equipment-specific fault detection and diagnostic systems, building automation systems, and automated system optimization tools."[10] EMIS may allow for a quicker response to energy use anomalies and can drive behavior changes to save energy. Some building management systems come equipped with maintenance alerts and even preventative maintenance algorithms to predict when replacements are necessary. According to a recent report on smart buildings, Class B Offices could save up to 18 percent from BEMS or EMIS "smart" functionality.[11] Smaller businesses or buildings with multiple tenants may be able to invest in supplemental energy management systems to gain visibility into their energy use. An even more basic system such as a smart thermostat could provide visibility for a smaller business.

While the energy management software systems are growing in capabilities, achieving the full savings potential of a BEMS or EMIS often depends on appropriate operations from the on-site facilities managers. A lack of training or communication about the capabilities of a system and its intended use could lead to a building operator not making the most of the system and, in some cases, overriding the most beneficial energy savings algorithms.

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[7] http://cx.lbl.gov/2009-assessment.html
[8] https://aceee.org/topics/commissioning-and-retrocommissioning
[9] https://betterbuildingsinitiative.energy.gov/alliance/technology-solution/energy-management-information-systems
[10] https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/A%20Primer%20on%20Organizational%20Use%20of%20Energy%20Management%20and%20Information%20Systems%20(EMIS).pdf
[11] http://aceee.org/research-report/a1703

Lighting Efficiency

Significant potential exists in improving the lighting efficiency of a commercial building. A Massachusetts study found 74 percent of commercial and industrial lighting was linear,[12] providing ample opportunity to upgrade existing linear fluorescent lamps to more-efficient fluorescent alternatives or LED. The U.S. Department of Energy's Solid State Lighting[13] program has been leading research efforts in LED development, and while LED technology has greatly evolved in the last decade, LED quality can still vary significantly. Relying on qualified products list such as the DesignLights Consortium© or ENERGY STAR can ensure a successful lighting retrofit. The 2015 DOE Lighting Market Characterization (LMC) study[14] showed that across the commercial sector, linear lighting is prominent and there is a significant efficiency potential for LED. Table 3 recreates Table 4.18 from the LMC report, showing the 2015 penetration of various technologies across commercial sub-sectors. While LED technology has a presence across the commercial sector which has only increased since 2015, all sub-sectors have potential for increased LED adoption.

Table 3: Lighting Technology Distribution by Commercial Building Type in 2015

	Incandescent	Halogen	CFL	Linear Fluorescent	HID	LED	Other	Total
Education	0%	0%	4%	89%	1%	7%	0%	100%
Food sales	0%	1%	2%	78%	5%	13%	0%	100%
Food service	10%	4%	8%	60%	0%	18%	0%	100%
Health care (inpatient)	3%	1%	17%	67%	0%	11%	0%	100%
Health care (outpatient)	1%	2%	5%	79%	0%	12%	0%	100%
Lodging	4%	1%	43%	30%	0%	22%	0%	100%
Offices (non-medical)	1%	1%	4%	87%	1%	8%	0%	100%
Other	1%	1%	16%	71%	1%	11%	0%	100%
Public assembly	2%	1%	12%	67%	2%	16%	0%	100%
Public order and safety	3%	3%	12%	72%	1%	10%	0%	100%
Religious worship	3%	1%	13%	70%	1%	12%	1%	100%
Retail (mall & non-mall)	1%	2%	4%	80%	3%	11%	0%	100%
Services	2%	0%	2%	82%	1%	13%	0%	100%
Warehouse and storage	0%	0%	1%	89%	2%	7%	0%	100%
Average	**1%**	**1%**	**8%**	**78%**	**1%**	**11%**	**0%**	**100%**

Plug Load Controls

Plugged-in electric load is growing across sectors, but has the potential to be controlled to limit wasted energy. Advanced Power Strips (APS) and outlet-level plug load controls can regulate various pieces of equipment and reduce the standby power draw of systems. There are several different types of plug-level controls on the

[12] http://ma-eeac.org/wordpress/wp-content/uploads/MA-CI-Market-Characterization-Study.pdf
[13] http://energy.gov/eere/ssl/solid-state-lighting
[14] https://energy.gov/sites/prod/files/2017/12/f46/lmc2015_nov17.pdf

market, but they all operate on the same basic principle of shutting off the supply power to devices that are not in use. In an office setting with a computer, an APS may shut down peripherals such as monitors, printers, or speakers when the computer goes into sleep or off mode. In a shared kitchen setting, an outlet with a timer may shut down water coolers, coffee machines, and other devices in hours when not in use.[15] A 2016 Seventhwave study on commercial plug load reduction strategies found that these strategies, including both APS and computer power management, had the potential to save over 100 million kWh annually in Minnesota alone.[16]

Vending Machines

Typically always on, vending machines can draw significant energy even when seldom used. Equipment controls such as the "Vending Miser" line help reduce energy consumption on all types of vending machines with an optimized operation schedule.

ENERGY STAR Equipment

ENERGY STAR-certified appliances and equipment are available across sectors and have a great opportunity for further uptake in commercial buildings. ENERGY STAR certifies a wide range of commercial cooking equipment and ENERGY STAR office products can provide significant energy savings compared to conventional equipment.[17]

Hot Water and Water Efficiency Measures

ENERGY STAR-certified commercial water heaters include gas storage and instantaneous (tankless) units that use 25 percent less energy than a conventional commercial unit by employing more efficient heat exchangers. ENERGY STAR-certified heat pump water heaters (HPWH) are incredibly efficient. Solar water heaters may also be a potential consideration for commercial businesses with roof or otherwise sun-accessible space. Additionally, low-flow fixtures such as faucets and toilets can significantly reduce the amount of water used by commercial buildings.

Emerging Technological Advancements

In addition to long-standing efficient strategies and technologies in the commercial sector, there are new and emerging technological advancements that are beginning to take hold. This section explores several of those and the new potential they bring to commercial energy efficiency.

Advanced Rooftop Units[18]

Packaged commercial HVAC systems, often referred to as 'rooftop units' (RTU), are a common commercial HVAC technology found throughout the Northeast and Mid-Atlantic. Due to a number of market barriers, the market for efficient RTUs has been slow to develop and has resulted in both the persistent sale of inefficient technology and an installed base of aging equipment, leading to a large energy and peak footprint. U.S. DOE, in addition to setting a federal minimum efficiency standard, has launched two important national initiatives to address these market barriers: 1) the High Performance Rooftop Unit Challenge[19] to engage the manufacturing community to

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[15] http://www.etcc-ca.com/reports/plug-load-monitoring-and-control-technology-office-buildings
[16] http://www.seventhwave.org/commercial-plug-load-study
[17] https://www.energystar.gov/ia/partners/publications/pubdocs/ENERGY%20STAR%20Office%20Equipment%20Brochure_508.pdf
[18] Adopted from NEEP ARTU Report, http://neep.org/sites/default/files/resources/NEEP%20RTU%20Market%20Transformartion%20Strategy%20Report%202016.pdf
[19] https://www1.eere.energy.gov/buildings/alliances/rooftop_specification.html

supply more efficient units to meet unmet market demand; and 2) the Advanced Rooftop Unit (ARTU) Campaign[20] to identify and recognize best practices and kick-start market adoption.

The RTU market in the Northeast and Mid-Atlantic is composed of over one million packaged commercial RTUs, but less than one percent (0.15 percent) meet high performance efficiency levels. The annual sales in 2016 of new rooftop units is estimated at 55,550 for the Northeast and Mid-Atlantic region. These existing units are of a range of vintages, with many RTUs kept in service long beyond their expected useful life. Efficiency programs across the region have been implementing promotional activities for RTUs for many years. Current practice is to incentivize the purchase of new systems meeting high efficiency tiers through a mixture of downstream and upstream promotions or incentivizing advanced retrofit controls on existing RTUs.[21]

U.S. DOE's RTU Challenge was successfully met by a variety of manufacturers who have introduced market-ready high performance RTUs that offer both energy savings and reduced peak demand. These advanced units include self-diagnostics and support two-way communications to energy managers that provide insight into performance, need for maintenance, and participation in demand-response programs. Regulators and program administrators across the region are focusing on efficiency programs to relieve system peaks with high performance equipment and demand response. At the same time, the region's grid operators increasingly look to efficiency and demand response to cost-effectively meet system needs and provide market opportunities for end-use customers to be compensated for relieving peak system constraints.

Another consideration is that an EPA regulation will phase out the use of R-22 refrigerant in 2020. Until recently, the large majority of RTU systems were designed and charged with R-22. The shift to R-410A refrigerant could drive many building owners with aging RTUs to consider replacing existing, older HVAC systems with new High Performance RTUs. A recent Direct Final Rule issued by the U.S. DOE established new minimum federal appliance efficiency standards for Commercial Packaged HVAC through a two-stage process with effective dates in 2018 and 2023. The compliant and efficient Advanced RTUs now exist in the market; the challenge is getting them installed in commercial buildings throughout the region.

Demand Response Enabled Equipment

The commercial sector has not been immune to the impact of the Internet of Things (IoT), where equipment and appliances are now built with communication chips installed to provide users with the ability to monitor, control, or update new equipment. These connected products, ranging from LED lighting to ARTUs to connected outlets to individual pieces of equipment, can be aggregated to provide demand reductions for utilities at optimal times. The on/off demand response switches of the past have evolved to modulating, smart, integrated connectivity and controls among many energy using devices throughout the commercial sector. Utilities looking to manage grid resources more directly will find large, somewhat-malleable loads throughout the commercial sector.

While the demand reduction programs offered by utilities become more sophisticated, there is a present need to ensure that grid-ready, connected equipment is being installed. At present, the demand-response enabled water heater, for example, may have a cost premium because that functionality is only offered on the higher-

[20] http://www.advancedrtu.org/
[21] https://www.masssave.com/-/media/Files/PDFs/Partners/MARI-CI-HVAC-Eligible-Equipment-090117.pdf?la=en&hash=E64590D30114776BFF00B083E89C627540FE2B12

end model. For a commercial customer replacing its water heating system immediately, that would mean the new system installed may not have the functionality needed to be deemed a grid resource. The focus for utility efforts, especially those promoting installation of efficient equipment, must encourage manufacturers and commercial customers to make investments today in grid-enabled equipment that will provide benefits tomorrow. The demand response incentives that may come to a commercial customer can be significant, but only if that equipment is in place and the incentive structure is established to provide that benefit.

Commercial Advanced Lighting Controls

Lighting controls have been installed in commercial buildings for years, with occupancy and sensors installed in 18 percent of commercial lights.[22] Networked Lighting Controls (NLC) take the sensors that have been available for years and integrate them with connected functionality and new data sources to have a greater impact on energy savings that just from LED lighting. By having a connected suite of LEDs across a building, data such as daylight levels, occupancy, zoning of workers, and light levels can be collected and adjusted to have the best experience for the user as well as for efficiency.

The DesignLights Consortium© (DLC) has developed a qualified products list for advanced lighting controls. The results of a recent DLC-published report[23] showed an overall energy saving potential of 47 percent from controls installed across a variety of commercial buildings. Those savings ranged from a low of 23 percent savings for an assembly building to a high of 82 percent for a warehouse. According to U.S. DOE projections, nearly one-third of commercial lighting is anticipated to have networked controls by 2035. The savings potential demonstrated in DLC's report is promising and may help push penetration even further.

Renewable Heating and Cooling

Beyond just high-efficiency HVAC, there are emerging opportunities to use renewable energy sources—such as solar, water, or biomass—to produce heating and cooling with potentially minimal carbon impact. Renewable thermal technologies such as ground or air-source heat pumps or solar hot water, are often on the high end of costs for either space conditioning or water heating options[24] and are coming to market quickly. One barrier that these technologies face is that while they have significant carbon benefits, they do not have the curb appeal that something like solar panels (either on or off-site) would have. A ground-source system that uses very little energy will, to the occupant of the space, not seem any different than a carbon-intensive oil-powered boiler. Solar hot water heaters, while taking advantage of the sun's energy, are not as recognizable or understood and may not be appreciated visually as a green effort. In the short term, coupling with other carbon reduction models or incentives may help these products gain economies of scale to become more competitive with the current alternatives.

[22] https://energy.gov/sites/prod/files/2017/12/f46/lmc2015_nov17.pdf table 4.32
[23] https://www.designlights.org/lighting-controls/reports-tools-resources/nlc-energy-savings-report/
[24] http://cbey.yale.edu/our-stories/renewable-heating-and-cooling-the-next-efficiency-frontier

Summary of Long-Standing Efficiency Financial Models

Investments in commercial efficiency have long been shared amongst interested parties, including the commercial customer themselves, utilities, and traditional financial agencies. This section summarizes traditional mechanisms for financing commercial efficiency.

Lease

A lease allows a customer to use energy efficiency equipment without purchasing it outright. Once project terms are agreed upon, the customer and the lessor sign a lease agreement and the lessor then provides the capital to purchase the equipment. Once installation is complete, the customer begins making regular fixed payments to the lessor.

- In a *capital lease*, the customer becomes the owner of the equipment for most legal and accounting purposes during the term of the lease. The customer must therefore declare the equipment as an asset and the lease payments as a liability on its balance sheet. It functions much like a loan and is sometimes called a finance lease. However, capital leases can offer a few advantages over bank loans and operating leases such as little to no upfront cost, less paperwork, and quicker approval.
- In an *operating lease*, the lessor owns the equipment and the customer rents it at a fixed monthly payment. Compared to a capital lease, a transaction must pass several tests by the Financial Accounting Standard Board in order to qualify as an operating lease.
- A *tax-exempt lease*, known as a municipal lease, is a common financing structure that allows a public organization to pay for efficiency using its annual revenues. It is only available to municipalities and other political subdivisions that qualify and is an effective alternative to traditional debt financing.

Loans

With loans, customers can borrow money from banks or others to pay for efficiency projects, but they must arrange the purchase, installation, and management of the equipment. Loan financing is offered by many equipment manufacturers, vendors, and contractors as third-party banks and lenders.

With *commercial loans,* the customer arranges loan financing through the manufacturer or installer of the purchased efficiency equipment; the customer owns the equipment from day one and pays down the loan over time. Specific terms and loan parameters depend on the credit history of the customer.

Below market loans are typically established by public organization or other private entities for the purpose of serving a specific social need such as greenhouse gas mitigation. Those loans usually fall into categories such as state and local loan programs which can often provide lower rates than traditional private sector lenders and they may operate in communities where loans are less accessible. Other categories, such as community development financial institutions (CDFIs)[25] provide loans to economically-disadvantaged communities. Many CDFIs have programs specifically targeting energy efficiency and renewable energy projects, so they may be a good fit for organizations that seek to reduce their energy costs but otherwise have difficulty accessing capital markets at reasonable rates.

[25] https://www.cdfifund.gov

Grants and program-related investments are mechanisms where foundations and governments issue grants, repayable grants, or program-related investments to found clean energy and energy efficiency projects in mission-driven organizations. A grant is a direct donation and is not therefore considered a loan or debt, whereas a repayable grant comes with a requirement that the principal be paid to the financier.

Utility Programs

Utilities running efficiency programs are typically funded through ratepayer systems benefit charges. These funds are collected and distributed across the utility customer base, in many cases targeting commercial customers for efficiency upgrades. Typically, utilities will both target specific high-energy users for efficiency efforts as well as provide more general efficiency offerings to all their commercial customers. The utility will pay an incentive based on the cost of the efficiency and in many cases will have sub-contractors perform the efficiency work. In some cases, there are prescriptive rebates available, though in most cases a customized utility package is assembled based on the work at hand. The type of efficiency performed varies based on the needs of the commercial customer but very often includes lighting retrofits that can help make the bundle of offerings have a shorter payback period. Some utilities, such as Eversource (in its Mass., N.H., and Ct. service territories), are offering additional services such as insights for customers via an energy profiler online service;[26] this provides commercial customers access to their meter data through a virtual interface, with the back-end powered by Schneider Electric, to allow them to understand and make use of their data.

Energy Savings Performance Contracting

Energy savings performance contracting (ESPC) is a delivery mechanism motivated to provide the maximum amount of energy efficiency resources. Organizations often turn to energy services companies (ESCOs) when considering retrofit projects; ESCOs develop, design, build, and fund projects that save energy, reduce energy costs, and decrease operations and maintenance costs at their customers' facilities. In essence, ESCOs act as project developers integrating the project's design, financing, installation, and operational elements. Project contract terms typically range between seven and 20 years, and as high as 25 years in some states, depending on the types of measures installed. The main differentiator between ESCOs and other energy efficiency contractors is the guarantee of energy savings which is specified as part of the terms of an energy savings performance contract.

ESCOs contract with private and public sector energy users to provide efficiency retrofits across a spectrum of facilities, from college campuses to water treatment plants. A 2013 Lawrence Berkeley National Laboratory Report[27] estimates that ESCO investment in energy efficiency retrofit projects runs about $5 billion a year, though found only eight percent of ESCO revenue is in the commercial and industrial (C&I) sector. The report also estimates that as of 2011, only 10 percent of private commercial buildings in the Northeast had been address by a performance based contract.

[26] https://www.eversource.com/content/nh/business/save-money-energy/manage-energy-cost-usage/energy-profiler-online
[27] https://emp.lbl.gov/sites/all/files/lbnl-6300e_01.pdf

The Challenge of "Traditional" Commercial Efficiency

While energy is a significant operational cost for nearly all commercial entities, the commercial sector is still not living up to its efficiency potential, leaving the energy and money savings from comprehensive efficiency on the table. Why is this?

Commercial business owners and managers are not energy experts and do not desire to be. Simply put, they are in the business of providing the service or widget that their business provides; their attention and focus are directed on how to improve their product or service. While it is true that lowering energy costs may actually help them improve their product or service, most efficiency savings—beyond simple lighting projects—remain too far down the priority list to attract the attention of decision makers.

While the range of efficiency efforts have had some success penetrating the commercial sector, progress has been heavily reliant on lighting opportunities and has struggled to gain scale in other measures. With savings from commercial lighting projected to dramatically decline in the coming five years, efficiency efforts will require dramatic new approaches. Compounding this issue further is that lighting is critical to make other measures in a comprehensive efficiency project appear more economically favorable. If a commercial customer has already invested in a lighting retrofit, it will be an uphill battle to convince them to complete more costly, less visually-impactful projects. When comparing project economics, those that have very quick payback and pose no risk to operations—i.e. lighting—find traction. They require little attention by the business manager. However, as soon as a project reaches a payback period that requires executive attention and/or presents the issue of disrupting operations, barriers emerge and progress slows.

The root of this challenge is unknown, though may be attributed to the invisibility of energy efficiency, the lackluster public relations value an energy efficiency project offers, or the lack of understanding of non-energy value that energy efficiency projects often provide. In too many cases, the intangibles simply do not add up to push a business to adopt an energy efficiency project. This results in a lack of scale for comprehensive commercial energy efficiency projects.

Efficiency programs cite example after example where positive project economics were helpful but not sufficient to gain approval for an energy efficiency project. To understand how this can be, it is instructive to consider the barriers that may influence decision makers. This section considers three key barriers to gaining positive decisions on projects and achieving scale in the commercial sector: trust, authority, and sales activity.

Trust

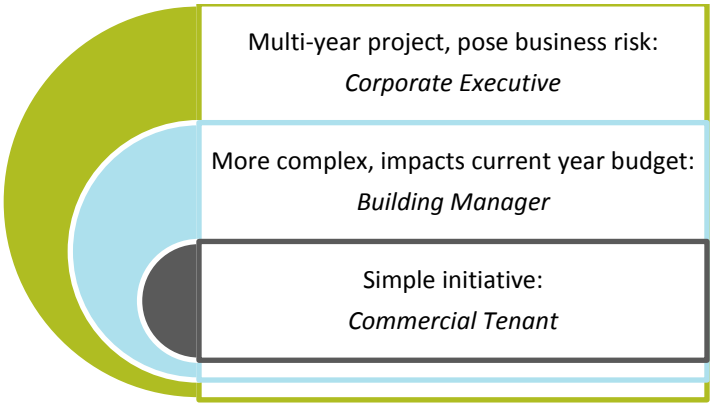
Commercial businesses and public organizations must often operate on tight margins. They cannot afford failed initiatives nor investments that will negatively impact operations. It is not surprising that, as projects get more complicated with business paybacks that fit requirements but are not exceptional, trust in the project grows in importance. Energy efficiency implementers have an understanding of how energy efficiency project economics work, but not with the same importance as the business owner or executive. To them, energy efficiency often seems to be an invisible box of solutions that are hard to grasp, much less count on.

When considered in this context, it is not surprising that lighting projects typically have an easier path to realization. Often, projects can be paid for within the budget year, sometimes without approvals beyond a budget manager. Further, sufficient lighting projects have occurred such that the results are now understood

and trusted. As more comprehensive projects are developed that consider newer and less understood technologies and services, each with longer-term financial paybacks requiring approval across the organization, efficiency project approvals slow down significantly or disappear altogether.

Authority

Figure 2: Levels of Decision Making Needed to Move a Project Forward



Gaining approval to move forward with more complex or less understood technologies requires projects to receive approval by multiple levels within an organization. A commercial tenant may have authority to make decisions on very simple initiatives. The building manager will have authority at a higher level for projects that fit within his or her current year budgets. For projects where funding requires a multi-year commitment or entails business risk to the owner, an individual owner or corporate executive will become involved. Each level of authorization increases complexity of the project. Along with increased complexity, there is a greater need to convince and earn trust from new decision makers and an increased potential for split incentives. As Figure 2 demonstrates, the growth in project complexity is directly related to the level of decision maker getting involved.

Sales Activity

Commercial businesses are accustomed to both selling and being sold to. Currently, businesses may hear pitches from a variety of players within the energy space: energy efficiency programs, ESCOs, demand response providers, utility rate designers, solar installers, storage providers. This can quickly become tiresome or annoying, especially considering the context of businesses that want to focus on their service or product. It is then no wonder that either good projects can't get attention or that an owner selects the solar project first for the public relations value that comes with the installation—even if the energy efficiency project has superior economics. Good energy efficiency projects, then, fall victim to decision inertia. Businesses may have little bandwidth to listen to real opportunities to lower their energy bills.

Fresh perspectives, new approaches, and coordination are necessary at this point in the commercial efficiency evolution in order to overcome these challenges and drive comprehensive commercial efficiency projects to scale.

Emerging Approaches to Commercial Efficiency

This section discusses many of the exciting new approaches being considered for commercial efficiency. In a NEEP-conducted survey of commercial efficiency stakeholders, significant barriers to adopting efficiency were identified, primarily around pushing projects from proposal to implementation. Historically, many efficiency projects were stalling because of lack of familiarity with efficient technology or lack of capital. With new advances in technology and financial mechanisms, however, these traditional barriers to success are no longer the reason for stalling. It is the lack of value, inertia, or clear proposal that are keeping projects from completion. This section explores ways stakeholders are working together to get commercial efficiency projects done. Collaboration between these stakeholders, be they program administrators, ESCOs, or other entities seeking to complete this work, can overcome barriers and bring comprehensive commercial efficiency to scale.

In recent years, several new, non-traditional approaches to commercial energy efficiency have emerged. While traditional efficiency measures still have great value, fresh approaches to improve the adoption and uptake of energy efficiency have created different avenues and opportunities for efficiency actors to be successful. The following section provides a summary of several innovative approaches to add to a portfolio of offerings or services when looking to advance commercial efficiency.

As commercial efficiency approaches and strategies evolve, several new avenues for financial support of commercial efficiency have emerged. This section explores several developments in the financing realm. Much of this discussion straddles opportunities that rely on rate-payer funded efficiency programs and those that can be financed completely independently of utility programs.

New Financial Models

This section will look at innovative arrangements for financing energy efficiency, and will provide specific examples when possible.

Commercial PACE

Property Assessed Clean Energy (PACE) programs are a mechanism to finance energy efficiency, renewable energy, and water conservation upgrades to buildings. PACE programs help home and businesses owners pay for the upfront costs of green initiatives, and depending on state legislation, can be used to finance building energy efficiency improvements like insulation, air sealing, and cool roofs. PACE can be used for commercial, nonprofit, and in some cases, residential properties. It is a national initiative, but programs are established to meet local and regional needs.

A PACE assessment is a *debt of property*, meaning the debt is tied to the property rather than the property owner(s), so depending on state legislation, the repayment obligation transfers with property ownership. It offers loan financing for up to 20 years and can be combined with utility, local, and federal incentive programs. PACE can also be used to finance leases and power purchase agreements (PPAs). For a city, PACE can play an important role in reducing greenhouse gas emissions, supporting energy efficiency improvements in city buildings, and making a shift to renewable energy sources more affordable. PACE is funded through private lending or municipal bonds.

Although PACE programs have been launched in several regions of the United States, most programs are new and have not yet financed significant volumes. For commercial PACE projects (C-PACE), Table 4 is a list of active

programs within the NEEP region. Additionally, Massachusetts has passed C-PACE legislation, but there are no current active program in place. Delaware, Maine, Pennsylvania, and Vermont have not passed C-PACE legislation.

Table 4: Active Commercial PACE Programs[28] (NEEP Region)

State	Year Enabling Legislation Passed	Description
CT	2011, with amendments in 2012 and 2015	There is one active statewide PACE program (CT CPACE) administered by the CT Green Bank. In 2012, the CT legislation approved a revised PACE statute, allowing any municipality in the state to join the program, and any eligible financial institution to provide funding for PACE projects within the program.
DC	2010	There is currently one active commercial PACE program administered by Urban Ingenuity. DC's commercial PACE financing is a comprehensive financing solution for energy and water saving building improvements.
MD	2014	MD-PACE is a statewide partnership between PACE Financial Servicing and the Maryland Clean Energy Center. MD-PACE works with counties and municipalities to pass local ordinances to take advantage of PACE.
NH	2009	There is one active program (NH C-PACE) which was launched by the Jordan Institute and its program partners (Sustainable Real Estate Solutions, Resilient Buildings Group, and the NH Community Development Finance Authority) in 2016 and is currently operational in Hanover, NH.
NJ	2012	Currently, there is one active program in development. The AllianceNRG Program is a statewide residential and commercial PACE financing program administered by Leidos Engineering and CounterPointe Energy Solutions. There are also ongoing efforts to pass updated PACE legislation.
NY	2009	There is currently one active commercial PACE program. The Energy NY Commercial properties make energy efficiency and renewable energy upgrades to buildings.
RI	2015	On April 2016, RI C-PACE, the statewide commercial PACE program, became operational. Municipalities can join the program, which is administered by the RI Infrastructure Bank.

Pay for Performance Models

Rooted in the concept that payments should only be made on efficiency projects that are actually yielding energy savings, commercial sector Pay for Performance (P4P) programs have gotten new life in recent years. A key factor in a P4P effort is the need for clear measurement and verification of the pre- and post-intervention condition, with many pay for performance utility programs[29] using existing condition baselines. Without strong data to demonstrate the energy savings attributed to the efficiency done to a commercial space, and another non-routine event that could increase energy usage (such as increases in occupancy or ramp up of production), P4P programs do not work.[30]

Within the Northeast, New York has been working to develop both commercial and residential P4P programs as part of the Reforming the Energy Vision (REV) effort. There is also a similar, though less strict, metered efficiency

[28] http://pacenation.us/pace-programs/
[29] https://www.nrdc.org/sites/default/files/pay-for-performance-efficiency-report.pdf
[30] https://www.openee.io/post/how-to-calculate-reliable-savings-for-commercial-building-efficiency

effort getting off the ground in Massachusetts. Outside of the NEEP region, California, Oregon, and Washington are working to line up their P4P programs. A large commercial P4P effort is also underway with the Toronto ISO. This approach is gaining momentum as M&V tools get more accurate alongside more refined utility programs budgets and goals pressured to find more savings for less expense.

Energy Aligned Leasing Options

An *energy aligned lease*[31] is a specific, newer style of lease that works to equitably align the costs of efficiency with the benefits between building tenants and building owners. It has been developed to combat the challenge of a split incentive for landlords to invest in the lowest-cost and often less efficient capital equipment and for tenants who are responsible for energy bills who want efficient systems. In an energy-aligned lease, the landlord or building owner would install the efficient equipment leaving the tenant to pay the incremental upcharge. In turn, the tenant would reap the benefits of the efficient equipment through lower energy bills while they occupy that space or over the lifetime of the lease. This model requires communication between the tenants and the building owners, particularly in advance of capital improvements. The payment mechanism would need to be assessed and commensurate to the financial benefits being received. The onus would then be on the tenants to make the most of their efficient equipment through best practices in behavior and maintenance.

To encourage building owners to take on energy-aligned leasing, the U.S. DOE and Institute for Market Transformation (IMT) instituted a Green Lease Leaders Program[32] in 2013 to recognize those following these best practices. That program recently expanded to offer two recognition levels (silver and gold) and to align with the ENERGY STAR for Tenants Program.

Energy Services Agreement (ESA)

Similar to the power purchase agreements (PPAs) popular in the solar industry, an energy services agreement (sometimes referred to as an efficiency services agreement or ESA) is a pay-for-performance model that allows customers to implement energy and water efficiency projects with no upfront capital expenditure. The ESA provider pays for the whole project from the development to the maintenance costs. Before the equipment is installed, the ESA provider performs a baseline of the customer's energy consumption and calculates an upfront estimation of savings. Once project installation is complete, a measurement and verification (M&V) analysis is performed to determine actual savings compared to baseline energy use. The customer then has lower energy usage throughout the contract terms and has to pay the ESA provider a charge per unit of energy saved that is set below its baseline utility price, resulting in immediate reduced operating expenses. The ESA provider retains ownership of the equipment for the duration of the contract and pays for maintenance to ensure reliability and performance.

One specific example of an ESA is metered energy efficiency transaction structure (MEETS)[33]. The MEETS Accelerator Coalition works with a broad group of stakeholders—from utilities and regulators to investors and building owners—to reach collective goals in energy efficiency in a coordinated manner across stakeholders. MEETS is currently being piloted with the Bullitt Center in Seattle, a net-zero energy commercial office building. Under the MEETS program, there is an "energy tenant"—either the building owner or a third-party entity—

[31] https://betterbuildingssolutioncenter.energy.gov/sites/default/files/slides/Year_of_the_Lease-Slides.pdf
[32] www.greenleaseleaders.com
[33] http://www.meetscoalition.org/

usually financed by an investor, who signs a rental agreement with a building owner to harvest the energy savings. In turn, the energy tenant pays for and maintains comprehensive energy efficiency retrofits to the building. The utility pays the energy tenant each month under a 20-year PPA for the value of the resulting saved energy. The building owner and/or tenant pay the utility for the sum of the energy saved and the energy used. The energy tenant pays back the financing investor for the retrofit with the revenues received from the utility for the energy savings. Software is used to track energy saved and energy used for the whole building and reports to all parties. This transaction structure gives building owners a way to finance efficiency upgrades, and also helps with the split incentive problem that usually discourages building owners from investment in buildings where tenants pay the energy bills.

New Value Streams for Energy Efficiency

Financial backing for efficiency in critical to bringing commercial efficiency efforts to scale, but efficiency as a resource must be appropriately valued in order to attract new and diverse funding. With new approaches such as blockchain entering the energy trading realm,[34] efficiency as a true resource becomes even more critical. It has been challenging to capture private capital investment for efficiency, due in large part to the diversity of approaches towards defining energy efficiency projects and their outcomes. One coalition effort, the Investor Confidence Project (ICP)[35] has developed a suite of commercial and multifamily energy performance protocols to overcome this challenge. The protocols assemble existing standards and practices into a consistent and transparent process that promotes efficient markets by increasing confidence in energy efficiency as a demand-side resource.

In general, the ICP protocols are an assembly of existing industry best practices, standards, and documentation in order to generate and present the data necessary to enable underwriting or managing of energy performance risk. These projects, when following the ICP protocol, receive investor ready energy efficiency designation. While this designation does not constitute a guarantee of energy performance, it does ensure that a project developer (ESCO, engineering firm, facility manager, building owner, etc.) is capable of meeting the requirements that are outlined in the ICP Energy Performance Protocols and that each firm has a licensed engineer either on staff or under contract, qualified to certify projects as complying with the requirements of the ICP Energy Performance Protocols.

Emerging Financial Intermediary Companies

As new financing mechanisms become available, so too new intermediaries have emerged to connect the dots between efforts. Table 5 features several emerging companies providing intermediary services between utilities, contractors, financial agencies, and the commercial customers.

[34] https://www.technologyreview.com/s/609077/how-blockchain-could-give-us-a-smarter-energy-grid/
[35] http://www.eeperformance.org/

Table 5: Emerging Efficiency Financial Intermediaries

Name of Company	Service Territory	Services Provided	Customers
Clean Energy Venture Group	New England	An investment group that provides seed capital and management expertise to early-stage clean energy companies	Clean energy companies
Harcourt Brown and Carey (HBC) Energy Capital	National	Works across capital providers and financing solutions for clean energy projects, specializing in commercial leasing, service agreements, C-PACE, and tax-exempt municipal leases	Contractors, project developers, utilities and utility program managers, property owners, and capital providers
Joule Assets	US and Europe	Facilitates the financing and implementation of energy efficiency solutions	Businesses, investors, and communities
L.E.K.	Global	A global strategy consulting firm that aids clients on developing key strategies to improve their company	Aviation & travel, biopharma & life sciences, healthcare services, MedTech, retail, technology, and energy and environment organizations
Metrus Energy	North America and EU	Develops and finances large-scale energy efficiency projects. Offers end-to-end services, from project development to no-first cost financing solutions.	Fortune 1000 C&I, healthcare and higher education
PFM Financial Advisors	National	Consulting and financial advising firm focused on finding the applicable financing structures to meet the funding needs of clients.	Environmental finance, public power companies, government, education, healthcare, transportation, sports, leisure & cultural facilities, housing authorities, charitable institutions, endowments & foundations, community banks, insurance and self-insurance companies

In addition to these financial intermediary companies, the U.S. DOE Load Programs Office (LPO) is a governmental agency with the mission to accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale sufficient to contribute meaningfully to the achievement of our national clean energy objectives – including job creation, reducing dependency on foreign oil, improving our environmental legacy, and enhancing American competitiveness in the global economy of the 21st century. LPO executes this mission by guaranteeing loans to eligible clean energy projects and by providing direct loans to eligible manufacturers of advanced technology vehicles and components

Green Banks

A Green Bank, also known as a green investment bank, is a public financial institution that uses limited public dollars to leverage greater private investment into clean energy initiatives. Green Banks primarily focus on financing commercially viable technologies including solar, wind, and other renewable energy generation technologies; energy efficiency measures; electricity load reduction; on-site generation; and similar projects that support the clean energy objectives.

Government institutions tailor Green Banks to meet specific needs while appropriately investing taxpayer dollars. Green Banks and Green Bank-like entities have diverse rationales and goals, including meeting ambitious emissions targets, mobilizing private capital and lowering the cost of capital, lowering energy costs, developing green technology markets, supporting local community development, and creating jobs. Green Banks aim to accelerate clean energy market growth while making energy cheaper and cleaner for consumers.

In the United States, Green Banks have been created at the state and local levels and while they differ in name, scope, and methodology they all share the same core characteristics. Connecticut established the first state Green Bank in 2011, followed by New York in 2013. Table 6 provides a summary of Green Banks in the NEEP region with an additional table of International Examples of Green Banks in the appendix.

Table 6: Summary of Green Banks in NEEP region[36]

Region/State	Year	Services	Notes
Connecticut Green Bank (CGB)	2011	Offers green energy solutions to home, building, and multifamily property owners, residential and commercial contracts in whole towns and cities. In coordination with CT's C-PACE, CGB offers homeowners low-interest loans with flexible terms for energy efficiency	The first Green Bank in the US. In 2015, it reportedly supported $663 million in project investments.
New York Green Bank (NYGB)	2014	NYGB increases availability of capital for projects, deploying proven and commercially viable technologies. NYGB leverages private sector capital to support and expand clean energy financing markets, animating and growing capital markets, reducing the need for government support, and motivating faster and more extensive deployment of clean energy assets, contributing to economic development, greater energy choices, reduced environmental impacts and more green energy advantages for every public dollar spent	As of June 2016, the NYGB had received over $1.4 billion in investment proposals. NYGB's investments supported clean energy projects with a total project cost of $518.3 million in aggregate.

[36] http://coalitionforgreencapital.com/state-local-activity/

Montgomery County, Maryland Green Bank	2015	The Montgomery County Green Bank was developed under the guidance of a stakeholder working group which reviews legislation, identifies resources for the Green Bank, develops guidelines for the future bylaws, provides recommendations for the governance; and prioritizes Green Bank activities	In June 2015, the Montgomery County Council passed Bill 18-15 to create a Montgomery County Green Bank, the first formal green bank organization established on the local level.
District of Columbia Green Bank	2017 (proposed)	In summer of 2015, the D.C. Department of Energy and Environment (DOEE) awarded a grant to the Coalition for Green Capital to research innovative tools for financing clean energy projects to help DC meet its Climate goals.	On March 15, 2017 D.C. Mayor Bowser announced plan to submit legislation for Green Bank funding and implementation.
Rhode Island Infrastructure Bank (RIIB)	Established in 1989, expanded in 2015	Rhode Island Infrastructure Bank is the state's central hub for financing infrastructure improvements for municipalities, businesses, and homeowners. RIIB was established by the Rhode Island General Assembly in 1989 as the Clean Water Finance Agency.	The Infrastructure Bank's charter[37] was significantly expanded in 2015 to include energy and brownfield remediation initiatives.

As a Service Models for Commercial Efficiency

Equipment as a Service[38]

The Equipment as a Service (EaaS) business model has roots in heavy equipment. This strategy involves bringing a variety of existing and new market actors together, including current efficient equipment sales and service companies, energy service companies, energy efficiency program administrators, demand response market actors, and others to develop turnkey solutions for the region's commercial customers. In this new business model, a third-party energy service entity purchases, installs, and maintains the efficient equipment, and the customer pays a regular service or subscription fee for the service that equipment is providing. A prime example for this is an advance rooftop unit where *conditioned air* from the new efficient unit is the "service" that is being provided.

EaaS has many benefits for commercial customers, including allowing for more rapid technological and market changes by encouraging early replacement of legacy equipment. This could including demand response enabled equipment and storage. In general, the subscription services model has become more customary for businesses in recent years. This is a friendlier investment approach for commercial customers who may otherwise look to avoid spending capital to purchase large equipment, especially if it was an early replacement of an older, inefficient model. This approach also bundles a number of emerging value streams such as demand reduction

[37] http://webserver.rilin.state.ri.us/Statutes/TITLE46/46-12.2/INDEX.HTM
[38] This section adopted from NEEP's ARTU Report, 2016, http://neep.org/sites/default/files/resources/NEEP%20RTU%20Market%20Transformartion%20Strategy%20Report%202016.pdf

value incorporated right into the program. While existing contractors may have little experience bidding these types of resources into the forward capacity market, efficiency programs could partner with these market actors to assist in this process.

With a fixed subscription fee for the user, this model motivates the third-party energy service entities to ensure the equipment is maintained and commissioned and perform regular preventive maintenance. It also demands that service entities are aware of materials and parts that are not performing to expectations and are at risk for failure so they can be replaced or repaired. That, in turn, requires timely, accurate data from and about the critical equipment assets. Connected sensors within equipment can gather and transmit detailed data that tells the service provider about the performance, material conditions, operational details, and location of the equipment, enabling proactive maintenance. If EaaS is implemented successfully, well-maintained equipment may be productive much longer and failures would be rare.

There is the opportunity for measurement and verification (M&V) through detailed data and automated unit performance, when that data exists and is available. In some cases, the data-monitoring element is added in a proprietary manner to ensure all the data needed is being collected. Integrating the needs of vendors, evaluators, regulators, and program administrators from the onset could accelerate the implementation of this new business model.

A vast collection of networked equipment under the "supervision" of responsible ESCOs could also lead to more comprehensive and integrated building management across a number of key building systems, bringing new levels of construction to grid communication and response. This model moves towards monitoring-based commissioning,[39] which can be a successful way to ensure appropriate maintenance of high efficiency equipment.

Energy as a Service

Energy as a Service (also acronym as EaaS) is an emerging "as a service" business model in the energy and environmental industry. EaaS is the idea that it is the energy service company's responsibility to meet all of the requests and desires of a building's future energy costs and needs. According to this practice, if a building uses more or less energy than predicted, it is the energy service company's responsibility to make up that difference. Traditionally, corporate and industrial (C&I) energy and sustainability managers have had very little if any say about the price and type of electricity they procure under traditional, regulated, and centralized grid models. EaaS provides its customers with greater control over their energy usage.

Through use of the EaaS model, companies are attempting to change their relationships with energy and the energy customer; therefore moving the burden of management, implementation, and ongoing technology evaluation from the customer onto the service company. Traditionally, customers receive their energy services from a local utility and other than time of day cost, they do not have much say in regard to their overhead energy expenses. EaaS uses energy optimizing infrastructure that will deploy financed on-site equipment to ensure immediate cash-flow benefits. Through EaaS, companies can also use digital connections, including

[39] Background information: https://drive.google.com/file/d/0BzwNMmcaiO6Bd3BZak9HeWkyNU0/view and http://www.noresco.com/energy-services/en/us/solutions/Energy-Efficiency-Sustainability-Consulting/Monitoring-Based-Commissioning/

sensors and software, to align their energy spend and improve business metrics. EaaS provides companies the ability to gain real perspective on their energy usage and make any changes to their usage rate that they see fit.

Software as a Service [40]

The software as a service (SaaS) model can bring efficiency support to buildings by providing analysis of trends, non-routine events, and further analytics to potentially improve a building's performance. This can be a benefit for the commercial customer directly or for a utility program working with them. Often, SaaS is tied to the BEMS or EMIS, but in some cases is generated using smart meter or other data, especially for commercial customers with multiple buildings or facilities. SaaS can help support customer engagement, marketing, savings tracking, and potentially be used for efficiency program EM&V. Some of the potential offerings include:

- Customized software tools (from the SaaS vendors) that offer multiple customer communication channels to increase customer engagement throughout the program cycle;
- Ability to conduct in-house analysis of project and program performance and monitor program savings on an ongoing basis;
- Direct access to continuous tracking, fault detection,[41] and analysis for utility customers;
- Increased scalability of services through automation of analytics;
- New services for data aggregation and management.

SaaS providers often form partnerships with program implementers and engineering firms to expand their services across the program cycle. For example, Eversource has developed an online platform for customer engagement that can provide virtual audit-type insights to commercial customers in New Hampshire, Connecticut, and Massachusetts.[42]

The SaaS products for virtual audits, remote audits, and virtual assessments identify candidates and engage customers as they assess investments in energy conservation measures or pursue maintenance and operational changes to improve energy efficiency. The remote assessment allows the utility to use customer-specific data in targeted marketing and customer engagement campaigns. A traditional audit requires a site visit to assess energy savings potential, usually at significant expense to the customer; remote assessments model consumption, building characteristics, and operations, without a site visit. Vendors report that savings estimates are produced on a building-by-building basis using industry accepted simulation models. If a small percentage of customers account for the majority of savings, remote assessments function as a first step to engage the largest potential savers. Bringing the most fruitful projects into the program early increases the speed and scale at which projects are executed across portfolios. Remote assessments support targeting and project prioritization to speed up the program delivery cycle. They are sometimes conducted in highly specific geographical areas (geo-targeting) to reduce loads on locally constrained grids.

[40] Adopted from: http://neep.org/changing-emv-paradigm
[41] http://eis.lbl.gov/pubs/lbnl-2001075.pdf
[42] https://www.eversource.com/content/ema-c/business/save-money-energy/manage-energy-costs-usage/energy-profiler-online

As SaaS work continues, the potential to automate some elements of the evaluation process through advanced M&V becomes an additional utility benefits. Many stakeholders, including NEEP,[43] LBNL,[44] and U.S. DOE[45] are following this work very closely and piloting advanced M&V projects with forthcoming results.

Strategies to Get to Scale

The future of commercial efficiency success depends not only on new models and approaches to efficiency, but also on creating a more compelling case for commercial customers to complete efficiency efforts. New ideas and thinking are required to enable energy efficiency projects within the commercial sector to rapidly scale in comprehensiveness and volume. Here, four such categories of solutions are considered: integrator models, business school models, utility service provider models, and non-economic value stacking.

Integrator Models

An integrator model is one that enables energy efficiency to occur by its inclusion with other energy solutions, such as solar or storage offerings. When solutions are integrated, fewer projects are pitched resulting in fewer competing interest for the efficiency project. Further, in integrated projects, the economics of various solutions may be merged into a value stack that is favorable for efficiency. In this case, some project elements will have superior economics, for instance demand response (DR), which may create a revenue stream. These revenues can be blended with an efficiency project which may enable a marginal cost element to be included due to the addition of the DR revenues.

While the ideal outcome is to move all project elements together, trust may be built and strengthened in an integrated model by creating early success and then taking on more complicated projects. For example, a successful lighting project may lead a customer to join a demand response program, which may lead to a combined storage and solar project with high efficient air handling combined with the best controls to enable maximization of demand response revenue, secure business operations, and return on investment. If one stakeholder along the process can “catch the change” when a business is already engaging in necessary equipment upgrades, this could be an entry-point to not only ensure they get the best equipment and financing for that one project, but also bring a suite of other offerings to the table.

Solution providers being viewed as a multi-solution provider will provide additional credibility with the commercial business. Integration will create the most dramatic results when the other three models, discussed below, are also implemented. Each of those models further enables the trust and understanding necessary to fully embrace and enable integration.

Organizational construct is a large barrier to success in providing integrated services. Utilities and efficiency programs are most often not designed to integrate services across their organizational silos. Similar barriers will exist in gaining support from vendors to add additional products and solutions to their sales and installation routines. Flexibility and partnerships are critical to successfully offer an integrated solution. To further demonstrate this concept, two examples are explored. First will be energy efficiency integrated with demand response, and the second is where energy efficiency and solar are integrated together.

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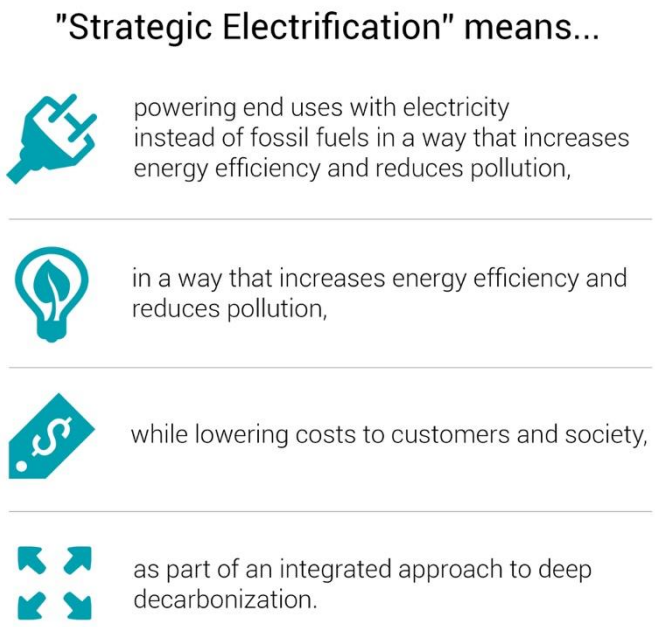
[43] http://www.neep.org/initiatives/emv-forum
[44] http://eis.lbl.gov/pubs/state-of-m-and-v.pdf
[45] https://energy.gov/eere/buildings/downloads/assessment-advanced-measurement-and-verification-methods-mv-20

Energy Efficiency and Demand Response – Imagine being a commercial business owner with two utility proposals on your desk. One describes how many megawatt hours you will save and how your bill will become smaller. The other asks you to consider how you might minimize your megawatt usage with particular focus on doing so at certain periods of time, and yes, your energy bill will also get smaller. The typical commercial business executive understands the basics of energy consumption, but asking them to discern between these two opportunities is likely to create confusion, competition, and at best an unsure decision process.

It is important to note that energy efficiency programs have not created this silo effect on their own. In some jurisdictions, energy efficiency programs are prohibited from speaking to ratepayers about demand response. In most, the divide occurs because the regulatory process dictates goal-driven outcomes for megawatt hours and thus efficiency programs design their offerings accordingly.

Imagine instead that the proposal to the business executive suggesting a combined project that will result using less energy and a much lower bill. The utility may even offer to finance the improvements with cash flow positive, on bill financing, or some other financing mechanism. Such a proposal is much simpler for a decision maker to consider. Sales and authority issues are simplified. Trust issues around impacting operations and understanding the conditions of the projects remain. These may be mitigated by other methods suggested in this report or by simply adopting low-risk projects first to build trust.



Energy Efficiency and Solar – When looking across the range of environmentally-positive investments, solar is the current preferred "shiny" object for businesses and homeowners. While solar, in many cases, is not the most cost-effective action for someone to take, it may be the most appealing and is becoming widely adopted, often before investments are made in energy efficiency.

Mapping potential energy efficiency gains to those that solar providers may agree to include presents a big opportunity in the commercial sector. While it is unlikely a solar installation firm will expand their business to include direct sales of energy efficiency measures, they may agree to include efficient products in their proposals that help to build out necessary electric infrastructure with the most efficient options. For example, including high efficiency air source heat pumps, electric vehicle charging infrastructure, and even lighting upgrades works nicely in a portfolio with solar and even better when considering storage demands on the buildings electric system. If strategic electrification[46]

[46] NEEP Regional Assessment: http://www.neep.org/strategic-electrification-regional-assessment and associated Action Plan: http://neep.org/reports/strategic-electrification-action-plan.

is considered in a project, it is likely that the business and or city/state has a focus on greenhouse gas reduction. This is an additional opportunity for positive public relations.

Combining energy efficiency with solar addresses many potential barriers. The sales request volume becomes lower and efficiency has increased opportunity for advancement by taking advantage of the popularity of solar. Risk on operations is considered to be low for solar projects since, when the sun is not out, energy still arrives at the meter for use via the grid. Thus, any potential risk with efficiency is lowered by its inclusion with solar from a total project perspective.

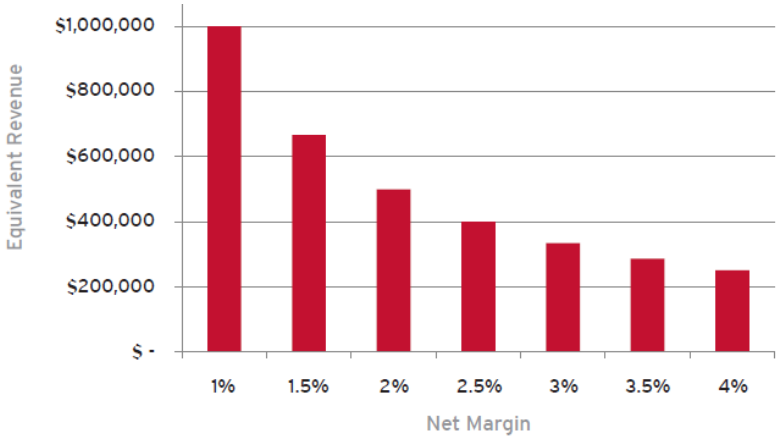
The trust issues involved with financing a longer term, larger project and the authority questions that come with such decision making remain issues to navigate and will be addressed later in this report. Additionally, solar companies have been traditionally wary of adding other components to their core solar sales pitch for fear of losing a sale. Only recently have they begun to consider adding other components. Building strong partnership with these vendors with be important for such an integration to become scalable.

Business School Model

This model suggests that the energy efficiency industry re-think its approach to commercial businesses. Rather than open conversation by talking about energy efficiency, this model would have efficiency programs approach commercial customers from their business-oriented perspective. The choice of language and the framing of the conversation about energy efficiency can be an important barrier to progress. Rather than explain energy systems, why using less matters, and then speaking to topics such as marginal cost, return on investment, capital planning and financing strategy, why not flip the conversation?

Consider energy efficiency as a means to improving profit margins, retaining core staff during a down economy, creating fiscal space to update the brand, or investing in a technology that will increase sales. Simply put, explaining that money not spent on energy means money spent in other areas of the business. As commercial businesses continue to see competition with online sales and global entities having broader reach, energy efficiency as a global competitiveness strategy can be a door opener to creating scale.

Figure 3: Graphic Depiction of the equivalent of $10,000 in energy savings in Revenue across various profit margins (image credit: Efficiency Vermont)



As Figure 3 demonstrates, a $10,000 reduction in expenses from energy savings, can be equivalent to a much greater volume in revenue, depending on the profit margin of the company. For companies with especially slim profit margins such as food service, hospitals, and grocery stores, the benefits of efficiency could be incredibly significant if the value were framed in those terms.

It is also important for energy efficiency programs to understand that framing language can make a big difference. For example, while speaking about saving money may resonate with some commercial customers, for others the idea of avoiding wasting money creates more resonance. This simply suggests that efficiency program administrators know their audience to best understand how to frame a

business conversation for the best chance of success. Speaking the language of business and then applying energy efficiency opportunity within that frame has the opportunity to assist in breaking down trust barriers and resolving authority issues more easily. Implementing this model requires a deeper understanding of the customers' language of business as well as a strategy to develop trust through long and deep relationships with executives.

Utility Service Provider Model

Today, utilities and regulators are engaged in an intense search for a model of the "utility of the future". Often, important elements of this search include adding various market-based service components to a utility's traditional monopoly model. Utilities are introducing new services to assist ratepayers. There are also services that have been applied to other market sectors that may hold promise in the commercial sector. The utility service provider model, then, intends to engage and support businesses in ways that help a commercial executive more easily "get to yes" on an efficiency project.

The ideas shared here are not necessarily new, but are underutilized mechanisms and best practices that overcome identified barriers. Applied widely, these approaches hold great promise in generating high volume, comprehensive projects to more fully capture efficiency savings from this sector. As with other models, the utility service provider model will create the best results when developed in partnership with other approaches suggested in this report.

Account Management – Consistent presence, delivery on promises, and a deep understanding between customer and program are required to fundamentally address and build trust. Trust also requires relationships within a business that span from the executive to the budget manager. These core tenets have been fully developed and have demonstrated success within the industrial sector, particularly around strategic energy management approaches[47]. Applying these same methods to commercial clients can enable growth from smaller, simpler projects to the most complex efficiency projects as well as integrating efficiency initiatives with other capital projects. Creating an MOU or similar written agreement to define mutual goals, responsibilities, and anticipated level of support may be a helpful way to establish this relationship.

Attribution – Providing a financial incentive is not the only way a program can ensure that a commercial efficiency project is completed. One way to free up budgets to adopt account management is for utility and policy organizations to join together to seek alternate attribution criteria. There was a time when the financial incentive was completely critical in order to for a project to move forward; even lighting projects would not have proceeded without an incentive. Today, more complex and emergent technologies may require incentives; however, often incentives are not required for many projects and are offered merely to allow an efficiency program to claim the energy savings.

Rather than a financial connection, efficiency programs should push to gain attribution for savings based on the actions they took that enabled savings to occur. When linked with account management, it is often the case that the technical acumen of an efficiency program is demonstrably more important and valuable to the business than the incentive check. If efficiency programs have the opportunity to determine the appropriate balance of

[47] http://neep.org/initiatives/high-efficiency-products/industrial-energy-efficiency

technical support and incentives for a given set of commercial projects, then providing account management and creating the platform to best enable scale can occur.

Role of Intermediaries– The account manager essentially enables an efficiency program to become a trusted intermediary for the commercial business. Her or his job is to provide what the customer requires to make good decisions. This can take a many forms:

- ***Information:*** Keeping in mind that that commercial executives are not and do not desire to be energy experts, the account manager can fill this void and create positive movement by providing useful information at the right juncture. At times, this will be technical knowledge that the account manager can source from the efficiency programs staff or engineering vendors. Other times, the account manager will need to bring a deep knowledge of what works in situations similar to that of a particular business.

  Some efficiency programs deploy market strategy specialists, often targeted at sub-markets such as grocery stores, office complexes, or multi-family affordable housing. These specialists bring credibility to the business executive with their specialized knowledge. When coupled with a trusted account manager, this fosters trust of the information with the executive. Financing options are another example of information that may be shared that will help an executive to trust in moving a project forward.

- ***Pass through Services***: At times, even the best information alone will not be sufficient to convince a commercial business to move forward with a project. While executives may be convinced that an efficiency project will help their bottom line, it may remain low on their priority list if it requires personal focus and attention to line up contractors and financing.

  Efficiency programs can eliminate this concern by acting as a "one stop shop," lining up vendors and or financing on behalf of the business. Some programs are wary about recommending or directly engaging contractors to deploy recommended projects and/or financing. However, fear of liability – should an approved contractor fail to deliver adequate services or behave in a manner that creates legal risk – can no longer be a barrier to streamlining projects for the customer. Efficiency programs, through partnerships, MOUs, or experience, should prioritize creating a streamlined approach in as many instances as possible. If the efficiency program desires to make the process easy for a business and create scale, then offering these intermediary services can be invaluable. It is likely that a business would only accept such recommendations when deep trust has been developed over a period of time and projects.

  Should the risks of providing contractors and financing be deemed too high, a second approach would be to offer multiple "qualified contractors" and "financing offers", each prequalified with prices pre-negotiated by the efficiency program, and then allow the business to select from a list. Alternatively, if liability is a major stumbling block, efficiency programs should be willing to step aside and let other intermediaries serve in that "one stop shop" capacity, with the utility being one of the partners along the way.

- ***Integration Services:*** Integration was discussed previously as a model in and of itself. For the utility or efficiency program, assisting the business to maximize energy bill savings, to make progress on climate goals, and/or taking advantage of public relations opportunities simply expands the role of the account manager and creates a more helpful and close relationship with the commercial enterprise.

  There will be times where a siloed service will be recommended as a first step in building trust or to meet a current need. It is important to note that moving efficiency services to scale does not require abandoning small, single stream projects. Rather, it does mean there should be purpose in doing so as a means to gain a deeper foothold to broader progress.

  Should the efficiency program engage vendors and contractors in a direct manner to deploy projects, it may also then encourage or require the contractor to attempt to cross-sell other solutions. These may be efficiency-related solutions or integration opportunities. Where an account manager approach is deployed, the contractor may be directed to screen for future opportunities while on-site.

Non-Wires Alternatives: Incenting Utility Embrace of the Integration Services Model. As utilities begin to embrace the trend of non-wires alternatives (NWA),[48] there is a promising model for combining a portfolio of integrated DER solutions. By incenting electric distribution utilities to issue a competitive solicitation for DER when contemplating distribution system upgrades, the third parties who offer DER solutions often find that commercial energy efficiency is one of the most cost effective DERs, particularly when combined with DR and storage. This is especially true when savings are bid for, measured, and verified from an *existing condition baseline* and, generally, by the kW reduction. As this approach becomes more commonplace, there are learnings across stakeholders[49] to help ensure comprehensive commercial efficiency is achieved. New York alone has 49 NWA projects[50] in some stage of development, solicitation, or implementation; this is a growing trend on which to capitalize.

Non-Economic Value Stacking

In order to gain traction, energy efficiency projects must make good direct economic sense for a commercial business before it agrees to move forward. Each business will have its own criteria for return on investment that must be met in order to move a project forward.

Yet, it is often the case that even when these direct economic benefits are understood and met, projects still do not proceed. From the invisibility of energy efficiency to the lack of understanding of all the other values that energy efficiency projects often provide, the intangibles simply do not add up to businesses adopting energy efficiency projects in a manner that creates scale in the commercial sector.

Fortunately, efficiency stakeholders looking to advanced commercial efficiency have the tools available to change these stories. Here are three segments of value creation to support taking energy efficiency to scale:

Data Analytics – Combatting the invisibility of energy efficiency requires clear analysis and proof of results. Gathering performance data, benchmarking information across products, and providing cash flow analysis based

[48] http://www.neep.org/emv-forum-and-policy-brief-state-leadership-driving-non-wires-alternative-projects-and-policies
[49] https://www.vermontspc.com/library/document/download/5936/GTMR_-_Non-Wires_Alternatives_Projects.pdf
[50] https://nyrevconnect.com/non-wires-alternatives/

on this data can create confidence for a decision maker on the front end of a project. When this data is then aggregated and available to energy efficiency programs across a region, it allows for common approaches and solutions to be more widely offered and thus adopted in a scalable manner. Efficiency Vermont is providing its commercial customers metering as a technical service while in New York, NYSERDA has a real-time energy management program.[51]

Efficiency portfolios and program-level measurement and verification are advancing common approaches. Applying the appropriate level of analysis in more granular ways to help move the adoption of newer technologies more rapidly can help create scale by increasing trust that solutions will perform as promised.

Non-Energy Benefits – Presuming a project makes sense from a pure project economics perspective, non-energy benefits can offer additional values that may encourage a decision maker to advance the project. Carbon footprint, air quality, comfort, worker productivity, health, reduction in operations and maintenance costs, and enhanced corporate public relations and brand are examples of non-energy benefits.

For example, if a company has pledged to lower its carbon footprint, then an energy efficiency project can help them meet that goal. In fact, the project can be easily analyzed to determine exactly how many tonnes of greenhouse gas emissions were avoided. In another example, for an affordable housing complex air quality may be improved in the facility, creating more satisfied tenants which has value for the property owner. Lastly, in any commercial facility a likely outcome of an HVAC controls or replacement project will be greater comfort resulting in more satisfied tenants or building occupants.

The concept of improving the employee experience, from health to comfort and ultimately to productivity, can resonate with many commercial businesses, especially those that provide services based on human-power. The WELL Building Standard[52] takes health as the primary goal and is gaining traction. Additionally, for those executives convinced by research, health in buildings has been studied by academics over time[53].

There are many such non-energy benefits. By understanding a customer and what values may resonate with them, stakeholders can create awareness of these benefits and enable an account manager, contractor, or other intermediary to understand which may apply. These additional values beyond a positive direct economic value can help create scale in the commercial sector.

Social Norming – Adding "green" to a business brand has become relatively common. Whether focused on climate change concerns, broader environmental and sustainability topics, or simply to captivate the imaginations of potential clients, businesses are active in greening themselves. Yet, energy efficiency is typically lost in the press release or social media posts associated with "green" brand improvements.

Energy efficiency experts understand efficiency is the lowest cost, biggest potential opportunity to address the green brand interests, yet only occasionally is that message publicly touted by businesses. That being said, the companies who are successfully walking their green talk are very likely to have heavily invested in energy efficiency. Stakeholders can concentrate on bringing that fact to the forefront. If the major competitors of a commercial customer, for example, have invested in efficiency, that creates the norm that others are doing this

[51] https://www.nyserda.ny.gov/All-Programs/Programs/Real-Time-Energy-Management
[52] https://www.wellcertified.com/
[53] One recent example, http://www.sciencedirect.com/science/article/pii/S0360132316304723

and can create motivation to move a project forward. Stakeholders should look to behavioral science research to see what comparisons can be drawn to gain the most traction with which type of business.

Efficiency stakeholders looking to advance commercial efficiency need to become more fully engaged in tying together understanding and recognition of the value of energy efficiency to the "green" movement. This can occur as a standalone strategy or by joining forces with solar installations and other energy improvements on a site. As awareness grows, business concerns with moving an efficiency project forward will decrease.

Conclusion

In order for the states in the Northeast and Mid-Atlantic to achieve carbon reduction goals of 80 percent by 2050, there is a lot of work left to do. Within the commercial sector, several new technologies, business models, financial mechanisms, and initiatives (Appendix: Additional Resources and Approaches contains more exploration) are laid out. When viewed together as tools in a toolbox, this will help more commercial business executives "move to yes" on comprehensive energy efficiency projects.

Policy changes may play a role to ease activities here, as the go-to affordable efficiency measure of lighting erodes in savings potential. States and utilities that can revisit structures, such as cost effectiveness tests, and use balanced and goal-aligned approaches to updating tests (such as those outlined in the National Standards Practice Manual)[54] will find future investments in comprehensive commercial efficiency more cost effective. As utilities are working to meet goals and provide value to commercial efficiency efforts, one area that requires further policy exploration is around baselines, as often project economics are driven by payback according to the *existing-condition* baseline. Looking outside the region for potential solutions, California is experimenting with ratepayer funded programs that have an existing-condition baseline with the passage of AB 802[55]. As we work towards achieving comprehensive commercial efficiency at scale, the challenge of baselines for ratepayer funded programs and what that means for cost-effective savings in the commercial sector will need to be addressed.

While policies can be improved and balanced to better enable commercial efficiency efforts, ultimately it will be a multi-pronged approach to successfully transform the commercial sector and make progress towards achieving our regional climate goals. Through collaboration, integration of new tools and models, and fresh approaches, the commercial sector can reach its energy efficiency potential. NEEP will continue to be a regional resource to bring stakeholders together, connect the dots of the commercial efficiency story, and assist the region in bringing more projects to "yes with the goal of assisting comprehensive commercial efficiency efforts grow to scale.

[54] https://nationalefficiencyscreening.org/national-standard-practice-manual/

[55] http://www.performancealliance.org/Portals/4/Documents/Library/WHPA%20Summary%20of%20AB%20802%20EE%20Baseline%20Policy%20Proposal%20May%2010%202016.pdf

Appendix: Additional Resources and Approaches

Systems Efficiency Approaches

As commercial buildings get more complex, stakeholders have started to move away from a widget-focused approach to energy efficiency and towards a broader look at building systems to achieve efficiency outcomes. One example of this the Systems Efficiency Initiative (SEI)[56], an effort led by the Alliance to Save Energy. SEI is a collaboration of more than 50 private-sector partner, utilities, government agencies, and research organizations with the goals of better understanding opportunities for improving system-level energy efficiency and advocating for a systems efficiency approach for future policies and programs. The effort focuses first on new construction and totally-renovated office and multifamily buildings, as they afford large opportunities for energy savings and relative flexibility for systemic changes. Utilizing a systems efficiency approach during the design phase of new buildings will ensure that decisions about installing, upgrading, and replacing major building components will take into account the efficiency of entire building systems and will help lock in energy savings. To truly optimize building efficiency, there is a need to take into account complete building systems and their interactions with one another, the building, and its occupants within the environment. An example of a systems efficiency approach is the use of adaptive lighting controls based on occupant behaviors as a way to achieve energy savings in lighting systems. This occupant behavior could also be shared with the HVAC system to potentially optimize use of heating and cooling.

The SEI is also exploring issues that have an impact on building energy use and that create opportunities that can be harnessed to improve the efficiency of building systems such as miscellaneous electric loads (MELs) including plug loads as well as large specialized equipment. They offer opportunities both for efficiency improvements in standby or sleep mode.

The SEI guidelines also incorporates information on the use of direct current (DC) power which has the potential to save energy by avoiding conversions needed to transform current from alternating to direct, a process that is happening with many commercial end uses. By taking a comprehensive approach to a building and the systems therein, there is potential to maximize energy savings potential.

ENERGY STAR for Tenants Program

In addition to the long-standing ENERGY STAR for Buildings program,[57] which provides recognition for energy efficient buildings throughout the commercial space, EPA is working on a new ENERGY STAR recognition for energy-efficient tenant spaces[58]. Under legislation passed in 2015, EPA plans to introduce recognition for energy-efficient design and construction, as well as for efficient operation of tenant spaces. To help ensure that this recognition is awarded in an objective and consistent way, EPA is examining potential criteria and options for assessment. EPA has published proposed eligibility and criteria[59] for tenant recognition.

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[56] http://www.ase.org/systemsefficiency
[57] https://www.energystar.gov/buildings?s=mega
[58] https://www.energystar.gov/buildings/tenants/about_tenant_space
[59] https://www.energystar.gov/buildings/tools-and-resources/energy_star_tenant_space_eligibility_and_criteria

Community Choice Aggregation (CCA)

Community choice aggregation (CCA) is another approach to energy efficiency that seeks to integrate energy demand and supply from an objective financial perspective outside of the utility infrastructure considerations. A CCA gives cities and counties the authority to aggregate customer loads in their territory and source generation on behalf of those customers. CCA is authorized in Massachusetts, Ohio, California, Rhode Island, New Jersey, Illinois, and New York, with 1300 municipalities under service in 2016.[60]

As distributed energy resource (DER) technologies and practices become more common, legacy infrastructure (transmission lines and large fossil fuel burning power plants) built to serve the old centralized energy grid may start to become less competitive compared to local DER that is designed and operated to both reduce customer power needs and to reform the community's aggregate peak power demand. To date, CCAs have mostly pursued traditional procurement strategies: buying wholesale power and entering into power purchase agreements with large-scale remote renewable power plants, or purchasing renewable energy credits (RECs).

Local Power, a CCA advocacy organization, has designed large-scale DER infrastructure deployments for Marin, Sonoma, and San Francisco CCAs. Local Power created the local power standard (LPS), which is a renewable portfolio standard concept to expedite the broader localization trend in energy and bring the most benefit to local governments and communities. In addition, Local Power created the nation's first municipal bond authority with CCA in mind so that citizens and local governments could share in the financial benefits: as owners, not renters, of their power.

International Examples of Green Banks

International Green Banks			
Malaysia Green Technology Corporation (GreenTech Malaysia)	2010	GreenTech Malaysia is focused on meeting the objectives of the Malaysian National Green Technology Policy 2009 by developing sustainable and widespread green technology markets, strengthening the local green technology industry, enhancing human competency and capacity in green technology applications, formatting supporting policies and financing frameworks to promote green technology growth, and promoting and creating awareness of green technologies	Since its inception in 2010, the Malaysia Green Technology Corp has successfully approved a total of 237 green projects and ventures amounted to $690 million
Australia Clean Energy Finance Corporation (CEFC)	2013	To help address Australia's greenhouse gas emissions reduction initiative, the CEFC's strategic priorities are focused on the delivery of investment across three areas of economic activity where clean energy investment can cut carbon emissions, improve energy efficiency, and lower operating costs	From 2013 to June 30, 2016 the CEFC made $1.7 billion in cumulative investment commitments for projects valued at $4.34 billion

[60] http://www.localpower.com/

Green Finance Organisation (Japan)	2013	This serves as the governing body of the Green Fund and aims to engage with local communities. This engagement goes beyond clean energy project deployment (small scale hydropower project that includes the creation of a scholarship fund for children)	Since 2013 the green fund has made a commitment to invest a total of $78 million into projects total $664 million
UK Green Investment Bank (GIB)	2012	First established in 2012 by the government, which provided the businesses with its initial investment capital. Primarily supports energy efficiency, waste and bioenergy, offshore wind, and onshore renewable projects (Green Loan Program)	As of 2016, the GIB had supported the creation of 80 green infrastructure projects with a capital commitment of $3.8 billion.