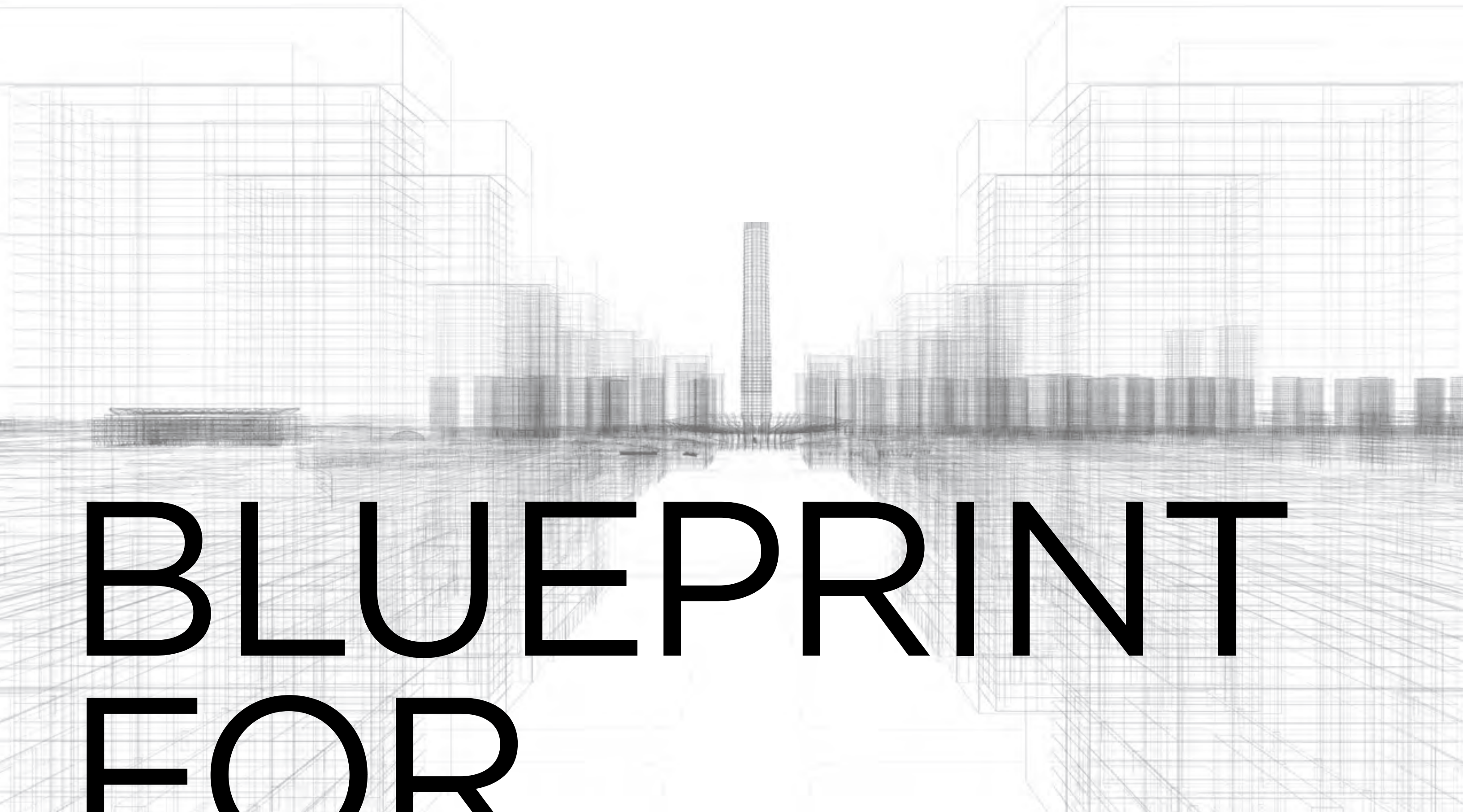
urban green

80x50
BUILDINGS
PARTNERSHIP
August 2018



BLUEPRINT FOR EFFICIENCY

DETAILED PROPOSALS

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1 Cut Citywide Building Energy 20 Percent by 2030

I. Summary

Issue:
Reaching 80x50 means making major reductions in building energy in the coming decades. We must balance the need to act soon with cost, the limits of existing practice and technology, housing affordability, and the uncertainty of more-distant timelines.

Recommendation:
Require large buildings to save 20 percent from 2020 to 2030 in aggregate, with each building sector contributing its proportional share. By 2020, establish default targets for 2040 and 2050 consistent with achieving 80x50, with review and update every five years.

II. Proposal

Require a 20 percent average reduction in building energy use from all sectors between 2020 and 2030. Cover all buildings over 25,000 square feet and calculate reductions before making adjustments for special cases like rent-regulated housing, so that the burden for any shortfall does not shift to other buildings.

By 2020, establish, through rulemaking, default citywide building energy reduction targets for 2040 and 2050 that are consistent with achieving 80 percent greenhouse gas emissions reductions by 2050. The targets should be based on the advice of an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

By 2025, reconvene the advisory committee to review and confirm or update the 2040 and 2050 targets.

Report on progress toward meeting sectoral and citywide building energy reduction targets in the annual *New York City Energy and Water Use Report*.

III. Supporting Information

Expanded Issue:
As outlined in *Proposal 2: Use a Made-in-NYC Metric* through *Proposal 6: Avoid a Compliance Pile-Up*, we recommend a policy framework that includes a sliding scale of whole-building source energy reductions based on a new NYC Energy Metric, which would gauge the relative efficiency of buildings. The fundamental question addressed in this proposal is the stringency and timeline of those energy reductions.

Buildings are the core of the city's 80x50 mandate

Local Law 66 of 2014 legally committed New York City to achieving an 80 percent reduction in citywide greenhouse gas emissions by 2050 (80x50). Building energy use represents the largest source of those emissions, accounting for nearly 70 percent of the citywide total.

Analyses to date–from Urban Green's *90 by 50 Report* to the city's *Technical Working Group Report* and the *80x50 Roadmap*–all agree that the building sector must implement three major changes to reach 80x50: (i) buildings must become significantly more energy efficient, (ii) eventually, many building systems must shift their energy source for heat and hot water from on-site fossil fuels to electricity (a process called electrification), and (iii) the electrical grid will need to become less carbon intensive.

Based on these analyses, virtually every existing building will need to reduce energy use considerably—on the order of 40 to 60 percent—in order for NYC to reach 80x50. Today, there is a significant difference in the performance of the best and worst-performing buildings. Some have implemented many energy upgrades over the years while others have barely scratched the surface. To reach 80x50, that distribution will need to significantly narrow over the coming decades.

How far and how fast should reductions happen?

Perhaps the central question in developing the *Blueprint for Efficiency* was how stringent energy reduction requirements should be over time. That question involves balancing progress made to date, the realities of cost and technology, the uncertainty of future grid composition and building system efficiencies, and the overarching imperative that we must act now to avert the most costly and destructive impacts of climate change.

Based on the NYC Greenhouse Gas Emissions Inventory, the city reduced building emissions by about 2 percent per year from 2005 to 2015. That is effectively the annual compound percent reduction required on a path to achieve 40 percent emissions savings in buildings by 2030 (the city's interim 40x30 target). However, much of the savings to date have been achieved by relatively straightforward and economically attractive oil-to-gas fuel switching and improvements in the efficiency of the grid.

Continuing on the 40x30 trajectory will require NYC building owners to improve building energy efficiency to a much greater degree than in the past. Some have yet to achieve significant efficiency gains through fuel switching and will do so, but virtually all will need to implement deeper energy conservation measures and retrofits over the next three decades.

Using 40x30 as a target for buildings also means accepting a higher emission reduction rate post-2030: to reach 80x50, buildings would then need to reduce emissions about 5 percent annually between 2030 and 2050. Translating these emissions reductions into energy savings beyond 2030 introduces significant uncertainty, as there is substantial debate about the timeline for greening the downstate grid and for the cost-effective electrification of heat and hot water systems. Both of these issues will have a significant impact on building carbon emissions. But it is often true that once much of the lower hanging fruit has been picked, subsequent deeper reductions will be costlier and more inconvenient. In other words, reaching 40x30 may represent less than "half" the effort required to reach 80x50.

This uncertainty about the future makes it challenging to set detailed energy reduction requirements through 2050. On the other hand, we have a wealth of experience and data on existing energy-saving opportunities, and we have reasonable knowledge of the NYC grid profile for the next decade or so. The question then becomes, what down payment on 80x50 is reasonable to expect by 2030?

Applicable guiding principles

We developed ten high-level principles to inform and assess recommendations in the *Create a Smart Framework* chapter of this report. Many are informative to the question of stringency and timeline for energy reductions. See *Appendix 1: Guiding Principles* for the full list.

Several principles are directly relevant to the questions here, including the need to push change in line with 80x50, to achieve maximum carbon emissions reduction with minimum cost, and to frontload emissions reductions where feasible, particularly to combat the tendency to delay action and because initial reductions may be the least expensive (the low-hanging fruit).

Assessment:

A 2030 timeline is feasible and allows flexibility

The timeline for building energy reductions must balance the need for a long-term, 80x50 framework with the practical limits of industry and uncertainty about future conditions. The timeline must also include sufficient flexibility to allow energy upgrades to align with capital planning and tenant turnover cycles, which will improve paybacks and make deeper retrofits more feasible and cost-effective.

Between now and 2030, the vast majority of large buildings will undergo refinancing. Most tenant leases, especially commercial leases, will expire at some point during that period. And most large buildings will be due for at least one system replacement, such as new windows or a new boiler or roof. A 2030 compliance year gives building owners opportunity to time upgrades when they will be more cost-effective, lining up with financing and lease turnover or system replacement.

At the same time, a policy with a 2030 target that is ignored by a large segment of the market until 2029 will set building owners up to fail. Earlier energy savings means greater emissions savings. It may not be feasible to set earlier interim reduction requirements across the board, as doing so would reduce the potential for cost-effective opportunities. Still, early compliance should be incentivized to drive greater emissions savings, including by integrating a green physical needs assessment at the time of refinance. See *Proposal 6: Avoid a Compliance Pile-Up* for more detail on recommendations to motivate early compliance.

Should the timeline stretch beyond 2030? From a practical standpoint, setting detailed requirements beyond 2030 or 2035 may not actually impact decision-making in the next decade;

that timeline is well outside of the typical frame for most building-related financial decisions. And setting detailed 2040 or 2050 requirements now may be too speculative given uncertainty about the grid and the technologies that will be available in those distant years. At the same time, setting high-level default targets for 2040 and 2050 will provide a framework for future years, while sending the market a signal on long-term policy direction. The rationale for setting 2030 targets now–that a decade-long time period allows alignment with financing cycles, tenant turnover, and equipment upgrades–applies equally to setting future targets, so default targets should be revisited and refined later in the decade.

It is also worth noting that 2030 could represent a fork in the road when it comes to electrifying heat and hot water systems, at least for multifamily buildings and potentially for commercial buildings that use on-site fossil fuels. Major mechanical components have approximately 20-year lifecycles. That means the natural life of heat and hot water systems installed after 2030 will extend past 2050. Beyond 2030, the city's policy should clearly signal whether owners need to double down and optimize existing fuel-based systems or switch to high-efficiency electric technology (either upon boiler replacement or incrementally given tenant turnover). Setting detailed requirements now for 2040 or 2050 is likely premature, as we have minimal understanding of what the transition might look like (ie. the impact of heat pumps at scale or the viability of other strategies, like re-skinning existing buildings.)

A 20 percent reduction in source energy is attainable and significant

There is no simple answer to how much energy buildings should reduce by 2030 on the path to 80x50. The stringency of reduction requirements could be based on any number of potential approaches, including modeling 80x50 retrofit scenarios for different building types, determining a viable payback threshold for efficiency measures, or aligning targets with past reduction trends. No matter the approach, the stringency of 2030 targets should be informed by an assumption that efficiency work will be incorporated into capital planning and will entail addressing tenant behavior in some fashion.

Consensus emerged in Buildings Partnership stakeholder discussions that energy use reduction requirements for 2030 should be generally consistent with attaining 40x30 and align with a plausible trajectory to 80x50. However, 2030 requirements should not be so stringent as to require completely new building distribution systems. For example, the stringency should not be such that multifamily buildings with steam distribution systems require conversions to hydronic distribution or installation of heat pumps, which would be unduly expensive on a 2030 timeline in most cases. That said, including an incentive to encourage early adopters of heat pumps where it makes business sense would benefit the market as whole, as these pilots would provide lessons learned for future deployment. For more on this topic, see *Proposal 13: Encourage Beneficial Electrification*.

Based on the annual average two percent emissions reductions necessary for buildings to reach 40x30, a stakeholder consensus emerged around stringency: a 20 percent citywide reduction in source energy from 2020 to 2030 is a feasible and significant step toward 80x50.

Stakeholders, including retrofit experts and building owners, cited professional experience and a substantial number of programs as justification for the feasibility of this target across building types:

- The NYC Carbon Challenge requires each of its participants to achieve a 30 percent carbon reduction over 10 years. Challenge partners include universities, hospitals, commercial owners and tenants, residential property managers, and hotels. In aggregate, the challenge partners account for over 500 million square feet of space, or 9 percent of the city's square footage. At this point, ten participants have achieved their 30 percent reduction goals and 13 have signed onto a 50 percent carbon reduction target.

- As part of the US Department of Energy's Better Buildings Challenge, portfolio owners commit to a 20 percent energy reduction over 10 years. The program now includes 350 partners and 4.4 billion square feet.

- A large commercial office building owner achieved an aggregate 20 percent greenhouse gas emissions savings across a large portfolio from 2009 to 2016, with another 20 percent savings planned by 2026.

- An owner of a large multifamily and commercial building portfolio conducted an assessment that found that at least two to three percent annual savings were feasible, for both class A properties and affordable housing.

- A large multifamily building portfolio owner realized 15 to 20 percent owner-controlled energy savings from efficiency improvements.

- A large, post-secondary educational institution cut its carbon by 30 percent in five years, with two-thirds of those savings from energy efficiency. It is now planning for a 50 percent cut from the same baseline. Retrofit work included cutting fossil fuel heating by 66 percent in a dormitory by converting a steam system to a water-source heat pump, as well as achieving an approximately 70 percent cut in heating energy in a commercial retrofit with envelope performance testing.

- NYSERDA's multifamily program achieved an average of 23 percent savings across all projects, though almost all included some form of capital improvement.

- Federal green financing: Fannie Mae has recently increased its savings goals from 20 percent to 25 percent, while Freddie Mac has increased from 15 percent of owner-paid savings to 25 percent of whole-property savings.

Allocating the 20 percent reduction

Having decided upon a 20 percent aggregate average savings requirement over ten years, stakeholders discussed how to allocate reductions across and within building sectors (such as commercial, multifamily, industrial). Certainly, there are differences in how sectors best maximize efficiency. For example, some sectors benefit most from new super-efficient lighting technologies, while others will implement more low-tech solutions, like fixing steam systems. But since no sector seemed to offer strikingly better opportunities than another for energy savings, there seemed to be little reason to burden one sector with stricter requirements than another. In the end, treating each sector the same and requiring a 20 percent energy reduction for all was the most reasonable and fair strategy. Again, in the interest of fairness, the 20 percent reduction allocation should be applied before any deductions for unique cases, like rent-stabilized housing, that would otherwise result in a greater burden shifting to the remaining properties in that sector. For recommendations on requirements for rent-stabilized buildings, including how to make up the potential shortfall because of lower requirements in that sector, see *Proposal 7: Keep Affordable Housing Affordable*.

Additional analysis is required to translate the average sectoral reduction requirement into specific building-level targets within each sector. For further recommendations on this issue and methodology, see *Proposal 2: Use a Made-In-NYC Metric* and *Proposal 5: Require Less-Efficient Buildings to Reduce More*.

Addressing tenant energy use

In some property types, particularly the commercial sector, total building energy consumption is largely driven by tenant energy use. For example, in many large commercial buildings, energy use from leased spaces may represent 50 percent of building energy use. In large office buildings, that number can often climb as high as 60 or 70 percent. This tenant load is also a major driver of the energy used in base-building systems, such as the increased cooling required for a densely occupied office with a data room and a large number of desktop monitors.

Because of the substantial variety in lease terms, building systems, and metering infrastructure, any policy effort to regulate tenant energy would face significant challenges in the near term, including the potential for negative economic impact on certain space uses. However, city law requires sub- or direct metering of commercial tenant spaces greater than 5,000 square feet by 2025. Buildings Partnership stakeholders felt that, given the sizable portion of energy use driven by tenant load in many buildings, new strategies for addressing tenant energy use should be explored as this law is implemented.

The NYC Energy Metric (see *Proposal #2: Use a Made-in-NYC-Metric*) can provide a more accurate picture of the impact of tenant energy use, such as variation in occupant density and number of computers. But owners will need assistance with tenant engagement, potentially through data-sharing, lease terms, education, and identification of viable conservation measures. In addition, the city should seek opportunities to engage tenants directly and to incentivize tenant energy use improvements. Financing to reduce or eliminate the upfront cost of efficiency measures in tenant spaces will also help remove many barriers. An effort is currently underway at the New York State Green Bank to help with this challenge, and the city should explore ways to build on that initiative.

Looking beyond 2030

Reaching 80x50 will require significantly deeper cuts from most buildings in the decades that follow. While it may not be feasible to set detailed requirements post-2030 today, communicating the future policy direction will help industry understand that aligning deeper retrofits with planning and capital cycles will become increasingly important.

For this reason, today's performance standard should include a process for setting tomorrow's performance requirements. The city should convene an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees,* to inform development of default citywide building energy reduction targets by 2020 for 2040 and 2050 that are consistent with achieving 80x50. The committee should be reconvened starting in 2025 and every five years thereafter to confirm or update future targets. Future targets should be informed by, at minimum:

- Experience to date with how the market has responded to energy performance legislation;
- Progress made on energy savings;
- The latest projections of carbon-free generation in the downstate electric grid; and
- Experience with pilots of heat pump for heating and hot water in large buildings.

Sources:

Globest.com (2018). Fannie Mae And Freddie Mac Green Financing Loan Changes For 2018. Retrieved from www.globest.com/2018/02/28/fannie-mae-and-freddie-mac-green-financing-loan-changes-for-2018/?slreturn=20180401145436

NYC Mayor's Office of Sustainability (2017). Inventory of New York City Greenhouse Gas Emissions in 2015. Retrieved from www.dec.ny.gov/docs/administration_pdf/nycghg.pdf

US Department of Energy (2016). Energy Efficiency in Separate Tenant Spaces - A Feasibility Study. Retrieved from www.energystar.gov/sites/default/files/asset/document/DOE%20-%20Energy%20Efficiency%20in%20Separate%20Tenant%20Spaces_0.pdf

US Department of Energy (2018). Breaking Down the Walls to Energy Efficiency: Vornado Realty Trust and New York City Tenants. Retrieved from www.energystar.gov/buildings/tenants/recognize_and_communicate_success/successes_sustainability/vornado_realty_trust_nyc

2 Use a Made-in-NYC Metric

I. Summary

Issue:
Buildings use energy differently because of differences in construction, operations and occupancy. To accurately compare buildings, an energy metric must account for these variations.

Recommendation:
Develop a metric based on EPA's Energy Star rating tool that is calibrated with NYC building data and reflects the downstate grid.

II. Proposal

Convene an advisory committee to inform the development of a metric to assess the relative energy efficiency of NYC buildings. Use the statistical modelling approach of Energy Star, but base the analysis on an NYC-only dataset. Evaluate the new metric for demonstrable improvements over Energy Star. Make every possible effort to engage and collaborate with EPA, recognizing the most desirable outcome is to revise Energy Star for NYC rather than to create a new, independent metric.

In the legislation, outline key parameters for rulemaking by the Department of Buildings, including:

- An advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*;

- A review of the pros and cons of Energy Star as a metric for NYC buildings;

- Analysis based on a representative data sample from NYC buildings, at least for dominant property types, and a local site-to-source grid conversion factor;

- A metric that:

    - Assesses the relative energy performance of similar buildings by adjusting for key variables that influence energy use within each relevant property type (so multifamily is compared against multifamily, churches against churches);
    - Accounts for unique space uses that have an outsize impact on energy use, such as data centers, production studios and trading floors; and
    - Grades buildings on a relative percentile scale for NYC;

- A determination by the advisory committee that the proposed new metric is a sufficient improvement over Energy Star to justify the departure from the national norms;

- A determination on the feasibility of a carbon metric for alternate compliance, and the potential development of that metric; and

- A deadline to complete the metric by December 31, 2019 or 2020, depending on necessary timeline.

III. Supporting Information

Expanded Issue:
As outlined in the other policy framework proposals, we recommend a sliding scale of whole-building source energy reductions that add up to 20 percent building energy savings from each sector by 2030 (see *Proposal 1: Cut Building Energy 20 Percent by 2030*, as well as *Proposal 3: Measure Energy at its Source* through *Proposal 6: Avoid a Compliance Pile-Up)*. This proposal discusses finding a metric that can effectively gauge the relative efficiency of NYC buildings in order to assign reduction targets on that sliding scale.

How to assess relative energy efficiency

The metric used to assess building efficiency is critical to devising a fair, accurate and effective performance standard. What one wants to measure is not just how much energy a building uses, but how efficiently a building was constructed and is operated. To do this, the metric must take into account factors that influence energy consumption, like building type and tenant activity. A fair and accurate metric must account for factors like occupant density and unusual uses like data centers, ensuring that buildings are truly gauged on their efficiency rather than being penalized for intensive usage.

Metrics commonly used to measure building performance include source energy use intensity (EUI), site EUI, carbon intensity, and Energy Star scoring. With the exception of site EUI, none of these metrics are fixed yardsticks: they change over time, either as the grid becomes greener (in the case of source EUI and carbon) or as the underlying database is updated (in the case of Energy Star scores). See *Proposal 3: Measure Energy at its Source* for a full consideration of site-to-source grid conversion factors over time, as applied to the performance metric.

Differentiation within and between building sectors is a critical challenge for the optimal metric. Building types differ significantly in energy mix and amounts of energy used. Some of that differentiation is due to physical characteristics, such as number of floors, window-to-wall ratio, insulation, and the efficiency of mechanical systems. Some of it is due to operational and usage factors, such as temperature set points and tenant space use. Tenant loads can vary widely: a 24/7 grocery store doesn't use the same energy as a school closed on weekends. To accurately assess efficiency, buildings must be compared against similar buildings: multifamily against multifamily, office against office.

Energy use also varies due to weather, causing shifts in annual heating and cooling demand. It is essential that the metric normalize for this so the measure is not unduly affected by weather.

Raw EUI metrics are undifferentiated, simply presenting the total energy used by a building divided by the building's area. By contrast, Energy Star adjusts source EUI and then compares the adjusted source energy use to other buildings of the same property type. Thus, the Energy Star metric inherently includes some of the most important differentiating factors in building energy use. Energy Star is the only metric commonly used in the United States that was explicitly designed to assess the relative efficiency of buildings.

Applicable guiding principles

We developed ten high-level principles to inform and assess recommendations in the *Create a Smart Framework* chapter of this report. Many are informative to the question of an energy performance metric. See *Appendix 1: Guiding Principles* for the full list of these principles.

Several principles are directly relevant to the questions here, including fairness, industry familiarity, avoidance of unintended consequences, alignment with the long-term carbon reduction goal of 80x50, and the practicality of developing and implementing the metric.

Assessment:

A graduated reduction structure requires an efficiency metric

As detailed in *Proposal 5: Require Less-Efficient Buildings to Reduce More*, we recommend a graduated reduction structure, with lower requirements for more-efficient buildings. For this structure to work, the metric itself must establish the relative efficiency of a building as compared to others of the same building type. Buildings that are less efficient can then be required to reduce more, while more-efficient buildings are required to reduce less.

EUI is insufficiently differentiated

Energy use intensity (EUI) is the energy use of a building per unit of building area, typically expressed in kBtu per square foot. EUI is a common metric and helpful in measuring an individual building's progress against its own baseline over time. (For example, EUI can be useful to monitor and verify the savings achieved through energy conservation measures on an individual building or portfolio.)

EUI measures energy use, but not necessarily efficiency. It is typically less useful in comparing one building to another because of the significant diversity in building characteristics, systems and tenants that influence energy use. There are often too many differentiating factors to make an apples-to-apples comparison.

This is true to a lesser or greater degree across different property types, depending on the diversity of building construction, systems and occupants typical of those property types. For example, EUI may be a relatively useful comparator across many "simple" multifamily buildings with similar systems and occupancy. But it's a relatively poor comparator across commercial office buildings with a greater variety of uses, systems and tenants.

EUI adjusted for density is the minimum for the multifamily sector

An EUI metric adjusted in some fashion for density may provide a reasonable gauge of building efficiency for the multifamily sector, as there is typically less variance in space use. Energy use for space heating scales reasonably closely with building area regardless of the number of occupants. But energy use for hot water is affected more significantly by occupant density, so an adjusted EUI metric for this sector would need to account for the impact of density on domestic hot water use. This could be done via an approximation for sectors (like affordable housing) with higher occupant density, or via a calculation based on demonstrated building occupancy.

As discussed in *Proposal 4: Combine All Building Energy in One Requirement*, on-site fossil fuel used for heat and hot water in multifamily buildings is the dominant source of building-based carbon emissions in NYC. Given the factors discussed above, if a fossil fuel use cap is included in the policy structure alongside the whole-building requirement, the most appropriate metric is weather-normalized site fuel EUI, differentiated based on occupant density. (Similar thinking has been applied in the past: Intro. 1745 of 2017 applied a slightly higher fossil fuel EUI cap for affordable housing, presumably to account for the increased density typical of that sector.) An increased fossil fuel EUI allowance could be awarded to buildings that demonstrate occupant density according to a calculation specified through administrative process or rulemaking.

Energy Star is a good starting point for greater differentiation

Ultimately, occupant density is just one factor influencing energy use. For the commercial sector, and even in simple multifamily buildings, a more robust analysis is necessary to account for a wider variety of factors affecting energy use.

As mentioned above, the EPA's Energy Star tool is the most commonly used building performance metric in the United States. Energy Star scoring provides an assessment using a national database (the Commercial Building Energy Consumption Survey or CBECS, in the case of commercial buildings) of similar buildings as the yardstick. The Energy Star methodology divides buildings into use types and only compares similar types to each other. Scores are generated first by adjustments to weather-normalized source EUI based on factors that influence energy use (like occupancy patterns or the provision of more amenities), and then by comparing that adjusted source energy use to other buildings of the same property type. The result is a fairer comparison between buildings and a more accurate assessment of their relative efficiency, reflecting energy use driven by operations and physical building characteristics.

Energy Star is based on samples of representative building types. The EPA runs hundreds of regression models on approximately 40 variables, identifying the six most influential variables for each property type. For example, the calculation for commercial offices include building area, number of operating hours, number of occupants, and percent of area heated and cooled. The Energy Star algorithm adjusts for these variables to determine the relative efficiency of a building.

But Energy Star has some potential problems

The New York building community generally supports the approach and statistical methodology behind Energy Star. But many have expressed significant concerns about using Energy Star as a metric for NYC building performance requirements. Doing so means comparing NYC buildings to national averages and using a metric that is out of local control.

For multifamily buildings, the Energy Star metric is relatively new and many are unsure that the underlying algorithm adequately represents the larger and denser buildings typical of New York City. Some have also been concerned that the underlying sample size for these buildings was too small. Contrary to these concerns, the EPA indicates that the dataset used as a representative sample for the multifamily tool included a very high percentage of New York City buildings–so much so that the EPA was concerned it might be skewed toward NYC buildings and thus under-represent buildings elsewhere. The EPA also notes that the final multifamily building sample size was 300-400 buildings, which was deemed statistically appropriate and is similar to the size of the office building sample set.

For commercial office buildings, the New York building community expressed concerns about the lack of categories for some property types or space uses, the challenge of accurately representing energy use in mixed use buildings, insufficient differentiation between business types and associated load, and lack of nuance around base-building loads required to serve increasing tenant load. Perhaps the most significant concern is a perceived lack of fairness to the city's portfolio of very large, very dense office buildings. That concern arises partly because Portfolio Manager does not differentiate for some very high-density use types, like trading floors.

This summer, the EPA is updating Energy Star with the most recent data from the Commercial Buildings Energy Consumption Survey (CBECS). The updated CBECS dataset includes an approximately 30 percent larger sample size and significantly more large buildings. The Energy Star update will also reintroduce the ability to use a default value for energy use from unmetered data centers, which previously were treated as regular office space despite much higher energy use. This update may help address some of the concerns expressed by NYC building owners.

Creating an NYC Energy Metric

An effective New York City metric would be based on Energy Star but calibrated to NYC buildings, at least for the most prominent property types: commercial office and multifamily. This new metric could also address concerns unique to NYC, like the prevalence of trading floors.

There are two basic options to achieve this end: First, the city could re-run regression analyses of the Energy Star variables using the city's robust dataset of multifamily and commercial properties. This approach is possible because the city's benchmarking database includes the six key variables determined by EPA to most significantly impact efficiency. While this is the simpler of the two approaches, it would still require the city to engage an entity to run the regression analyses against the NYC dataset and then analyze the results.

However, the EPA indicates that this approach would not necessarily provide accurate outcomes because the six most significant variables were determined (and depend on) the particular underlying dataset (i.e. CBECS). As mentioned, to identify the six most relevant variables for each property type, the EPA runs hundreds of regression analyses on a much larger number of variables (approximately 40) to isolate the most important. If the dataset were limited to only NYC buildings, the six most relevant variables may well be different than those determined through analysis of the CBECS data. In other words, without re-running the analysis on a larger number of NYC variables (e.g. 40 instead of just six), we could be missing some of the factors that most influence energy use in NYC buildings. NYC benchmarking data does not include many of the variables in the broader CBECS dataset. (Re-running analyses may not be necessary for the multifamily sector since, as discussed above, the underlying dataset for multifamily scoring included strong representation from NYC buildings.)

A second, more challenging, approach would entail collecting primary data on a representative sample of NYC buildings, including substantially more variables than used in benchmarking. That would likely mean replicating the CBECS dataset and potentially including variables that the industry believes Portfolio Manager is missing. The end result would effectively be an NYC CBECS database, which could be used to run a comprehensive, locally-tailored regression analysis.

That more comprehensive process would require a well-developed plan, significant resources from the city, and time. Critical steps would include:

- *Assembling the right people*. Key participants in an advisory committee are outlined in *Appendix 3: Advisory Committees*.

- *Collecting sufficient data for a representative sample size*. Since some of the 40 variables that Energy Star uses are not included in NYC's current benchmarking submissions, developing the metric would require new surveys to get accurate data from NYC buildings.

- *Conducting statistical modeling and test results*. Energy Star is the product of hundreds of statistical models that identify the most important six variables influencing energy use for a given property type. And its results are verified against existing databases, including Portfolio Manager. NYC would need to do the same.

Potential downsides to an NYC Energy Metric

Developing an NYC Energy Metric for multifamily and office buildings could potentially produce a more accurate measure of efficiency. But it is very difficult to systematically test accuracy or to show that it is more accurate than the existing, nationally based tool. Downsides include:

- NYC will not have the benefit of a free national tool that is regularly updated. The city would be responsible not only for creating the tool, but for maintaining and upgrading it regularly over the coming decades.

- The benchmarking scores of NYC buildings would no longer be comparable to the rest of the country, which might be of particular concern for building owners with national portfolios.

- NYC will be creating a model that other, less well-resourced cities may not be able to replicate.

In addition, creating a local score will be both expensive and complex to manage. It will take significant time and could risk a delay in the effective date of this policy, with no guarantee that the outcome will be preferable to building owners.

To avoid this outcome, the legislative approach should include a specific timeline for completion and the ability to determine through rulemaking, and on advice of the advisory committee, whether the NYC Energy Metric is more accurate than the existing national Energy Star metric.

The metric must be fixed for the compliance period

Because an NYC Energy Metric will compare buildings to each other, over time the baseline performance will increase as many buildings improve. That feature risks creating a referential and potentially circular efficiency scoring system. To avoid this outcome, the metric must be fixed in time at the outset of the compliance period, with the dataset at that point in time determining a building's relative efficiency performance and the related reduction required for future compliance. See *Proposal 5: Require Less-Efficient Buildings to Reduce More* for additional detail on linking the metric to a graduated reduction requirement.

As discussed in *Proposal 5*, there is concern over the potential for buildings to game their baseline performance: a building could conceivably drive up its energy use in the baseline year in order to diminish its future required reductions. The proposed graduated reduction requirement inherently dampens this incentive to game. If a building increases its energy use in anticipation of the baseline year, then it will be subject to a higher reduction percentage for the compliance period.

Planting the seed for a future carbon metric

The ultimate goal of 80x50 is to reduce carbon emissions, and so it may make sense to include a compliance pathway based on a carbon-focused metric. Indeed, New York State has highlighted this priority in its recent New Efficiency: New York report. However, a carbon metric is unfamiliar to industry and represents a major, unprecedented shift. It presents many challenges and will require a long time horizon.

Including a carbon metric as an alternative compliance path for 2030 could help introduce the concept to industry and lay a foundation for systemic change in future years. With some early adopters between now and 2030, new data will help the engineering, consulting and policy communities to gain some initial familiarity and comfort with a carbon metric. In addition, having a carbon path would help incentivize the development of other strategies, such as low-carbon fuels or solutions as-of-yet unknown.

Developing a carbon metric entails confronting some challenging questions, such as how to structure equivalency between a source energy requirement and its carbon counterpart. But given the longevity of this policy and the substantial long-term appeal of a carbon metric to drive 80x50 solutions, developing the NYC Energy Metric should also entail evaluating the feasibility of a carbon metric for alternate compliance. On advice of an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*, the city should assess whether a carbon metric is possible at this point in time and, if so, develop such a metric through rulemaking.

An NYC Energy Metric must align with existing laws

In 2017, the City Council passed Local Law 33 requiring large buildings to post a letter grade based on their Energy Star scores. If the city ultimately develops a new energy metric, that metric should form the basis for energy performance grades, and that law should be amended accordingly. The new metric will be tailored to New York City building and consistency across building efficiency requirements will help make compliance easier for building owners. Similarly, the city will need to revisit the metric used for building energy benchmarking (Local Law 84) and determine any adjustments for consistency.

Sources:

Urban Green Council telephone conference with representatives of EPA, May 5, 2018.

New York State Energy Research and Development Authority (2018). New Efficiency: New York. Retrieved from www.nyserda.ny.gov/About/Publications/New-Efficiency

3 Measure Energy at its Source

I. Summary

Issue:
Energy is measured either solely at the building level (site energy) or by also including energy used to generate and transport power to the site (source energy). Site energy is what owners control directly but source energy reflects energy's full environmental impact and is used for benchmarking. Source energy changes as the grid changes, which could mean a shifting metric for owners.

Recommendation:
Use source energy to measure energy consumption. Base the source energy calculation on the local grid composition in 2020 so owners don't face a moving target in 2030. Adjust that calculation for future compliance periods based on the changing grid.

II. Proposal

Require that energy consumption be measured in weather-normalized source energy.

Set the site-to-source energy conversion ratio according to the actual electrical and steam grid compositions for NYC during the baseline year. Hold that conversion factor constant to determine source energy reductions required during the compliance year. Develop specific details through rulemaking, on advice of an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

Align the approach with the Greenhouse Gas Emissions Inventory and require disclosure of the methodology behind those annual calculations to promote understanding of the downstate grid mix over time.

III. Supporting Information

Expanded Issue:
As outlined in the other policy framework proposals, we recommend a sliding scale of whole-building energy reductions that add up to 20 percent savings from each sector by 2030, with an NYC Energy Metric that gauges the relative efficiency of NYC buildings (see *Proposal 1: Cut Building Energy 20 Percent by 2030*, *Proposal 2: Use a Made-in-NYC Metric*, and *Proposal 4: Combine All Building Energy in One Requirement* through *Proposal 6: Avoid a Compliance Pile-Up)*. The issue addressed here is how to measure whole-building energy.

Site and source energy

The energy used by buildings can be viewed either as "site energy" or "source energy." Site energy is the amount of energy – the British Thermal Units (Btu) – in the gas, oil, district steam, and electricity consumed at the building. Source energy includes this building-level energy but it also adds the energy from the fuel used to generate electricity and steam at power plants yet lost during generation and transmission. Source energy is therefore a more accurate picture of the total energy use of a building.

The relative amount of energy burned at the generation source compared to the amount ultimately used at the building is called the site-to-source conversion factor. This conversion factor varies depending on the raw fuel source, technology, combustion efficiency and method of delivery. For example, the site-to-source ratio for electricity generated by gas power plants varies depending on the efficiency of a gas generator but is approximately 3, since about 3 Btus of gas are burned at a power plant to deliver one Btu of electricity to a building.

EPA's Energy Star Portfolio Manager, the nation's leading benchmarking tool, uses a national average site-to-source conversion factor for electricity of 3.14. The tool also applies a conversion factor of 1 for on-site renewable generation and varying factors for other building energy sources, as shown in the table below.

Energy Type	U.S. Ratio
Electricity (Grid Purchase)	3.14
Electricity (on-Site Solar or Wind Installation)	1.00
Natural Gas	1.05
Fuel Oil (1,2,4,5,6,Diesel, Kerosene)	1.01
Propane & Liquid Propane	1.01
Steam	1.20
Hot Water	1.20
Chilled Water	1.00
Wood	1.00
Coal/Coke	1.00
Other	1.00

Assessment:
Portfolio Manager generates both a site and source energy use intensity (EUI) based on user input, though the 1-100 Energy Star score is based on source energy. The question of whether to use site or source energy is a critical decision for measuring compliance. Each offers advantages and disadvantages for a long-term metric to drive energy performance.

Advantages and disadvantages of site energy

The key **advantages of site energy** measurement include:

- Site energy is a fixed yardstick because it is not defined by underlying conversion factors that will change over time. That constancy could make it easier to determine, explain and administer over the long run.

- Site energy reflects what building owners directly control (energy use in their buildings) and not what is beyond their control (energy used to make electricity).

- Site energy inherently provides an incentive for beneficial electrification, such as conversion from fossil fuel-based heat and hot water to high-efficiency heat pumps. Since electricity use is not multiplied by a conversion factor, on-site fuel savings have greater weight.

- The recently announced NY State energy efficiency initiative (New Efficiency: New York) uses site energy as a basis for formulating statewide building efficiency targets. Alignment with this approach could promote greater integration between NYC and NY State efficiency planning.

- Because site energy does not vary with grid composition, this approach could allow for better comparisons across cities (whereas source energy comparisons may use different site-to-source ratios based on varying local grids).

The key **disadvantages of site energy** measurement include:

- Site energy is divorced from the true cost of energy and greenhouse gas emissions because it does not account for the total energy used by buildings. It's therefore not a good yardstick for reducing emissions.

- It is generally unfamiliar to the industry as an energy performance metric. Requirements for benchmarking, energy performance grades, the Better Buildings Challenge and various other programs are calculated using source energy. A sudden shift to site energy could create confusion and uncertainty.

- Site energy unfairly credits the use of "secondary" energy such as electricity or district steam, which could have unintended consequences. With little market familiarity, these consequences are uncertain; technologies like co-generation could further complicate things.

- Site energy inherently favors the conversion of heating and hot water systems from fossil fuels to electricity, which is good. But it also applies to "non-beneficial" electrification, such as resistance heating (e.g., electric baseboards). Owners might take shortcuts to install less-green technology, particularly in cases where operational costs can be offloaded to tenants.

- The upcoming NY State Stretch Energy Code, which will form the basis of the 2019 NYC Energy Code, includes a new source energy (and not site energy) performance pathway alongside the longstanding energy cost budget method. An energy code in source energy and a performance standard in site energy could be problematic for new construction and substantial retrofits that must meet code.

Advantages and disadvantages of source energy

The key **advantages of source energy** measurement include:

- Source energy has a long history of use and is familiar to industry. It is the national standard approach as reflected in Portfolio Manager, as the EPA determined that "source energy is the most equitable unit of evaluation."

- Source energy is also consistent with current local laws, including the requirements for benchmarking and energy performance grades, as well as a host of existing building performance programs at all levels of government.

- Perhaps most importantly, source energy takes into account losses due to generation and transmission of electricity and steam and therefore provides a more accurate assessment of carbon impact–the ultimate aim of this performance standard.

- The upcoming 2019 NYC Energy Code noted above includes a new source energy (and not site energy) performance pathway. So a source energy measurement would better align the performance standard with future energy codes.

- Since source energy weighs the full cost of electricity, it provides more incentive to reduce electric load than a site energy measurement. Electric load reductions are necessary over time to reach the high fraction of renewable energy needed for 80x50.

The key **disadvantages of source energy** measurement include:

- Source energy will vary over time as site-to-source conversion factors are updated with changing grid composition. As more renewables come onto the NY State grid over the long term, the conversion factor will lower. While this accurately reflects the reality of the grid over time (and the related energy and emissions impact), building owners would face shifting goalposts unless this variance is addressed.

- Source energy will also vary depending on where the boundaries of the grid are drawn, as different grid composition means a different site-to-source conversion factor.

- Source energy could provide a stronger signal to encourage new cogeneration, potentially at the expense of efficiency work. Cogen systems generate electricity on site and make use of waste heat. The resulting grid electricity savings have greater weight under a source energy metric. See *Proposal 14: Cap the Efficiency Credited to Cogeneration* for a full discussion of this issue and the proposed solution.

- Source energy does not inherently promote beneficial electrification, because the current site-to-source conversion factor reduces the efficiency credit for shifting on-site fossil fuels to high-efficiency heat pumps for heat and hot water. See *Proposal 13: Encourage Beneficial Electrification* for a full discussion of this issue and the proposed solution.

Source energy is preferred as the industry standard

Although site energy offers some distinct advantages, the industry consensus is that a source energy measurement is the preferred approach, because it is consistent with existing practice and more accurately represents total energy use.

In determining the parameters for source energy measurement, a number of details must be addressed.

Fix the site-to-source conversion factor in time and consider adjustments beyond 2030

Energy reduction requirements must be calculated using a fixed methodology for both baseline and compliance years. Otherwise, building owners will face shifting goalposts and uncertainty around energy use reduction requirements. Accordingly, the site-to-source conversion factor should be fixed for the duration of the compliance period, determined at baseline year and held constant through 2030.

However, over this time period, the city should explore the possibility of creating a more dynamic source energy calculation with more frequent updates and a more nuanced accounting of the impact of energy use at different times of day. This type of accounting may be feasible post-2030 and would help lay the foundation for market-based carbon management programs in the future.

Use the present grid composition to set the conversion factor

With a ten-year span for the initial compliance period, a key question is whether to use a current or forward-looking site-to-source conversion factor for the electricity grid.

Major policy initiatives and legal requirements in New York State are driving toward a cleaner grid. A forward-looking conversion factor could help align policy signals with this anticipated future greener grid. For example, the conversion factor could reflect the state's Clean Energy Standard, which requires that 50 percent of NY State electricity be supplied by clean power by 2030. A forward-looking factor could also help incentivize beneficial electrification, as more renewables means a lower conversion factor and thus lesser weight to electricity use. However, significant uncertainty surrounds the timeline for delivering that cleaner grid in the downstate region, particularly with the looming closure of Indian Point nuclear facilities. See *Appendix 2: New York State Policy Context* for more discussion of this subject.

Ultimately, a present-day site-to-source conversion factor will be less controversial and easier to determine, and will avoid the significant uncertainty around the greening of the downstate grid. It will also help drive both permanent thermal and electrical load reductions.

How local should a conversion factor be?

To calculate the site-to-source conversion factor, the boundaries of the grid must first be drawn. Energy Star uses a national average conversion factor, which is substantially different from an

NYC-specific conversion factor that would reflect the actual energy consumption profile of the city. Similarly, a state (NYISO) or regional (RGGI) grid factor would reflect the different generation profile of those geographies. The downstate grid is relatively "brown," as New York City is limited by constraints on the generation of local clean power and on the transmission of green power from other regions.

To ensure that the metric is as accurate as possible, the site-to-source energy conversion ratio should reflect the actual grid composition for energy consumed in NYC. This approach will better account for the actual energy and carbon impact of the city's electricity use. The specific details and methodology should be developed through rulemaking and in consultation with the an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

Account for the generation of renewables

There are several options to account for renewable generation when calculating a site-to-source conversion. The prevailing methodology is called "fossil-fuel equivalency." It was developed in an era when renewable penetration on the grid was low. It uses the average efficiency of fossil fuel generators to represent the efficiency of renewable generation, in essence assuming that renewable generation has the same losses in conversion as fossil fuel generation.

Some experts argue for a "captured energy" approach, which assumes that the source energy of renewables like wind and solar is equal to the electricity produced (in essence, a conversion efficiency of 100 percent). These two approaches will have different implications for an NYC-specific site-source conversion factor, particularly as the electric grid gets greener and new site-to-source conversion factors are applied post-2030. The advisory committee should consider the appropriate methodology for renewable generation in formulating the site-source conversion factor.

Proposal 13 addresses beneficial electrification

As noted, unlike site energy, source energy does not encourage building electrification. In the next 5-10 years, cost reductions and incentives may shift the business case for heat pumps, whether mini-split or VRF for heating, or for hot water, broadening their appeal beyond pilot projects. Energy efficiency specialists who initially raised these points consider the issue addressed by layering onto source energy the targeted bonus outlined in *Proposal 13: Encourage Beneficial Electrification*.

Align the conversion factor with the GHG Inventory and disclose calculations

There is already precedent for this NYC-specific approach: the city creates a local site-to-source electricity conversion factor to calculate the carbon impact of electricity in its annual Greenhouse Gas Emissions Inventory report. Since the ultimate aim of the *Blueprint for Efficiency* is to advance 80x50, the city should apply a consistent methodology and site-to-source conversion factors when calculating building performance targets and citywide emissions.

It is also critical that these calculations be made public. Currently, the annual Inventory reports offer only general details on methodology and, in some years, the average site-to-source conversion factor used for electricity. Increased disclosure of the methodology would build confidence and understanding and shed light on how the downstate grid is changing over time. It would also help foreshadow how conversion factors might change post-2030, during the next leg of the performance requirement.

Sources:

EIA website: www.eia.gov/tools/faqs/faq.php?id=107&t=3

Energy Star website: www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/understand-metrics/difference

New York State Energy Research and Development Authority (2018). New Efficiency: New York. Retrieved from www.nyserda.ny.gov/About/Publications/New-Efficiency

U.S. Department of Energy (2018). EPA Energy Star Portfolio Manager Technical Reference. Retrieved from https://portfoliomanager.energystar.gov/pdf/reference/Source%20Energy.pdf

U.S. Department of Energy, Energy Efficiency and Renewable Energy (2016). Accounting Methodology
for Source Energy of NonCombustible Renewable Electricity Generation. Retrieved from https://www.energy.gov/sites/prod/files/2016/10/f33/Source%20Energy%20Report%20-%20Final%20-%2010.21.16.pdf

4 Combine All Building Energy in One Requirement

I. Summary

Issue:
Buildings use many sources of energy, including electricity from the grid and oil and gas burned on site. Separately regulating each source would increase certainty about future emissions but add red tape and reduce flexibility for owners.

Recommendation:
Regulate all energy sources together in a single, whole-building requirement. In the alternative, supplement with a cap on fossil fuels burned by the least-efficient multifamily buildings.

II. Proposal

Regulate whole-building energy use, including all fuels, in one aggregate number. Whole-building energy regulation will mean less red tape and more flexibility for owners to find lowest-cost solutions. Since whole-building energy will address fossil fuels, district steam, and electricity, it will drive carbon reductions, fossil fuel savings and local air quality improvements.

In the average multifamily building, on-site fuel use is responsible for the large majority of energy use controlled by the owner. That means a whole-building regulation will inevitably drive fossil fuel use down in the multifamily sector. But if the City Council nonetheless deems a fossil fuel-specific regulation critical, keep it simple and targeted: supplement the whole-building energy regulation with a cap on fossil fuel use that applies only to the multifamily sector, and set the stringency to affect only the least-efficient multifamily buildings.

III. Supporting Information

Expanded Issue:
As outlined in the other policy framework proposals, we recommend a sliding scale of energy reductions by 2030, using an NYC Energy Metric to gauge the relative efficiency of buildings (see *Proposal 1: Cut Building Energy 20 Percent by 2030* through *Proposal 3: Measure Energy at its Source*, and *Proposal 5: Require Less-Efficient Buildings to Reduce More* through *Proposal 6: Avoid a Compliance Pile-Up)*. The issue addressed in this proposal is the type of energy use that will be regulated. The key options are to regulate only on-site fossil fuel use, whole-building energy use, or a combination of the two.

New York City buildings primarily rely on three sources of energy: (i) on-site burning of fossil fuel for heating, hot water and cooking, (ii) district steam for heating and cooling, generated through fossil fuel combustion, and (iii) electricity for lighting, cooling, appliances and numerous other end uses. Electricity is generated from a mixture of sources, though in NYC the largest source for electricity is fossil fuels burned at power plants.

On-site fossil fuel use is of particular interest because it is responsible for roughly 60 percent of NYC's building-based carbon emissions. These emissions not only contribute to climate change, but also negatively impact air quality.

Assessment:
As noted, there are three primary approaches to regulating energy use: fossil fuel use only, whole-building energy use only, or both whole-building energy use and fossil fuel use.

Fossil fuel energy use only

A 2030 cap on fossil fuel use only would essentially require poorly performing buildings to fix steam heating distribution systems, the primary source of on-site fuel use in NYC buildings over 25,000 square feet.

The overwhelming sentiment of participants in the Buildings Partnership is that a stand-alone fossil fuel requirement (with no regulation of other energy use) is not a viable, cost-effective pathway to 80x50. While the advantage of this approach is that it would directly target the largest source of carbon emissions in NYC buildings, it's disadvantages are crucial:

- First, to achieve 80x50 the city needs to reduce fossil fuel *and* electricity *and* district steam use. Moreover, the electrification of vehicles and buildings will eventually add load to the current grid, which— unless electric load is also reduced—would necessitate costly expansions.

- Second, if only on-site fuel use is regulated, the multifamily sector would shoulder the majority of the energy reduction burden, since multifamily buildings use significantly more on-site fossil fuels than most commercial building types.

- Third, regulating fossil fuels only could lead to non-beneficial electrification (such as electric resistance heaters) and disincentivize cogeneration.

Whole-building energy use only

Under a whole-building energy approach, buildings would not be required to reduce a specific type of fuel; instead, requirements would apply in aggregate to all energy used, whether electricity, fossil fuel or district steam.

A whole-building energy approach would provide the following **advantages**:

- *Flexibility at least cost*. Setting requirements that address all energy sources would allow building owners to choose the most economical, lowest-cost strategies. It also maximizes opportunity to align upgrades with capital cycles and tenant turnover.

- *Regulatory simplicity*. Building owners would only need to comply with one requirement (rather than, say, separate fossil fuel and electricity standards).
- *Precedents and track record*. Most energy reduction programs and challenges address whole-building energy use, including the US Department of Energy's Better Buildings program (encompassing 4.4 billion square feet) and the New York City Carbon Challenge (encompassing over 500 million square feet).
- *Avoiding unintended consequences*. A fossil fuel requirement could lead to non-beneficial electrification and disincentivize cogeneration. Targeting whole-building energy avoids preferential signals for one fuel over another.
- *Air quality*. Because 60-70 percent of site energy in multifamily buildings comes from on-site fossil fuel use, and reduced electricity use reduces emissions from local gas and oil-fired power plants, air quality will improve.

A whole-building approach provides the following **disadvantages**:

- *Less direct targeting of steam heating and hot water systems*. If not paired with a fossil fuel requirement, a whole-building target does not send an unambiguous signal for building owners to fix the most inefficient steam and hot water heating systems. Heat and hot water are responsible for more than half of all building-based carbon emissions.
- *Lack of a long-term signal on electrification*. If not paired with a fossil fuel requirement, a whole-building target does not signal to building owners that, by 2050, most heat and hot water systems will likely need to be electrified. This is especially true with a source energy metric because source energy accounts for the full energy used to make electricity (see *Proposal 3: Measure Energy at its Source* for more discussion on this issue). Note that a fossil fuel cap designed to address the most inefficient heat and hot water systems on a 2030 timeframe would tend to promote cost-effective tune-ups of steam systems over electrification.

However, these disadvantages can be addressed without a fossil fuel target. Owners of multifamily buildings, which are responsible for the majority of on-site fuel combustion, will largely focus on steam and hot water system inefficiencies anyway, as that will almost always be the most cost-effective path to achieving a whole-building performance requirement. The policy can also include an incentive for early adopters of beneficial electrification technologies, as discussed in *Proposal 13: Encourage Beneficial Electrification*.

Both fossil fuel and whole-building energy use

Under this dual approach, two separate requirements would apply: one for whole-building energy use and another for fossil fuel use, potentially targeting the most inefficient heat and hot water systems.

This dual approach would provide the following **advantages**, largely based on inclusion of a specific limit to fossil fuels:

- *Direct targeting of greenhouse gas emissions*. Regulating building-based fossil fuel use would lead to a direct and predictable reduction in greenhouse gas emissions in the buildings subject to the fossil fuel requirements.

- *Direct targeting of local air quality*. Regulating building-based fossil fuel use would also lead to a direct, predictable reduction in air pollutants from those buildings.
- *Signal a longer-term shift toward electrification*. Requiring buildings to reduce their on-site fossil fuel use might drive beneficial electrification (i.e. the use of efficient heat pump technology). That said, reasonable caps on a 2030 horizon would need to be designed to drive steam system improvements, and would not be stringent enough to drive electrification except in a small number of early adopters. As such, this advantage is more relevant to establishing a longer-term framework that could signal the need for building electrification beyond 2030.

This dual approach would provide the following **disadvantages**:

- *Constraints and expense*. An additional requirement on fossil fuel use will give building owners less flexibility to follow the most cost-effective path for their buildings.
- *Red tape*. Having two requirements rather than one–with potentially different compliance schedules–will be burdensome to building owners and necessitate additional bureaucracy.
- *Redundancy*. Fossil fuel combustion drives energy use on the residential side and scales up with square footage. For these buildings, the choice between a whole-building approach and separate fossil fuel regulation does not make much difference.
- *Lack of precedents and unintended consequences*. We are not aware of any jurisdiction that has imposed a fossil fuel cap on buildings, or of any programs that target only fossil fuel reduction. The strategy appears untested and might have unintended consequences for buildings with certain technologies, like gas absorption chillers, co-generation or tri-generation, or district steam.

Would impacts on local air quality vary under these approaches?

Directly targeting fossil fuels offers certainty of carbon impact, and also guarantees reductions in local pollutants. Would whole-building requirements have the same or similar results?

The broader context of air quality in NYC–and the building-related share of pollutants–is helpful in understanding this issue. In 2008, the city began phasing out dirty oils used for heat and hot water, which are major contributors to air pollution, with impressive results. As detailed in the New York Community Air Survey, as of 2016 the annual averages of fine particulate matter, nitrogen dioxide, nitric oxide and black carbon have declined 28 percent, 27 percent, 35 percent and 24 percent, respectively, from the 2008 baseline, and the wintertime average of sulfur dioxide has declined by 95 percent. These decreases will continue through 2030, when the phase-out is complete.

However, such impressive results are unlikely to be replicated through future policies directed at on-site building energy use. Once the phase-out of dirty fuel oil is complete, reductions in the remaining cleaner fuels burned in buildings will not contribute to air quality improvements at the same rate, because on-site fossil fuel combustion will represent a smaller portion of local air pollutants than before. In other words, as on-site fuels get cleaner, other emissions sources like traffic and power plants account for a larger percentage of local air pollutants. Still, every improvement in air quality is positive, and the city's air quality stands to benefit from energy efficiency requirements on buildings.

In practice, there is likely to be only a marginal difference for most multifamily buildings–the most relevant buildings for this question–between a regulation on whole-building energy and a fossil fuel cap. In multifamily buildings, site-based fuel use represents 60 to 70 percent of energy use, and it's the vast majority of the energy use controlled by owners. As noted previously, to comply with either a whole-building or fossil fuel reduction requirement, most multifamily building owners will take steps to reduce fossil fuel use, with one result being improved local air quality.

It's also critical to view this issue in the context of NYC's local electric generation, which is dominated by fossil fuel use and is a significant contributor to local air pollutants. In addition to driving down fuel use, a whole-building energy requirement would lead to reductions in electrical use in multifamily buildings—and, more significantly, in commercial buildings, where electricity use makes up a larger share of whole-building energy. That will mean lower emissions from local power plants. This downward pressure on electricity use will likely become a more significant driver of air quality benefits once the Indian Point nuclear facility goes offline and local gas and oil plants are generating more electricity.

Is it feasible to separately target tenant energy?

In many commercial buildings, tenants are responsible for a large portion of whole-building energy use. Given this reality, some are interested in exploring options for dividing whole-building energy use into base-building use and tenant energy use, with each portion being handled separately. At this point, such a division would introduce considerable complexity because buildings, especially office buildings, do not consistently divide tenant energy use from base energy. For example, some buildings provide heating and cooling to tenants while others do not. And what is provided to tenants can vary within a building.

A tenant/owner split would also present significant challenges for currently available data systems and metrics. Portfolio Manager, which forms the backbone of the city's building data collection system, does not collect or store energy data separated into owner and tenant share. No metric for tenants currently exists to support a separate regime for tenants.

Still, other jurisdictions—particularly Australia—have shown that separate treatment of tenant and owner energy can be feasible with the right infrastructure in place. While outside of the scope of current inquiry, this area may be worthy of further exploration in future years, particularly as the 2025 deadline for NYC's submetering law approaches.

Sources:

NYC Department of Health & Mental Hygiene (2018). The New York Community Air Survey. Retrieved from www1.nyc.gov/assets/doh/downloads/pdf/environmental/comm-air-survey-08-16.pdf

5 Require Less-Efficient Buildings to Reduce More

I. Summary

Issue:
Two core reduction strategies were considered for most buildings: cap a building's energy use, or require all buildings to reduce energy by a percentage. A one-cap-fits-all approach doesn't account for how different buildings use energy, while leaving those under the cap untouched. But using the same percentage reduction for all buildings may require too much from top performers and not enough from the least efficient.

Recommendation:
Require most buildings to meet percent reductions that are smaller the more efficient a building is.

II. Proposal

Establish building-level source energy reduction targets using a graduated percent reduction structure. That means applying progressively lower percent reductions as building efficiency increases, with reductions combining for 20 percent aggregate average savings in each major sector.

In the legislation, outline key parameters for rulemaking, including:

- Analysis based on existing building energy data to:
    - Assign, at the baseline year, building-level percent reduction targets that correspond to relative efficiency scores from the NYC Energy Star-like metric ("NYC Energy Metric"); and
    - Ensure the distribution of building-level percent reduction targets achieves at least an aggregate average 20 percent source energy savings from each sector, calculated before adjustments for any special cases like rent-regulated housing;
- A maximum building-level percent reduction requirement of 30 percent source energy savings by 2030, for the least-efficient buildings;
- An exemption from 2030 requirements for the most efficient buildings, but set that bar at a very high level (e.g. Passive House standards);
- A determination on appropriate requirements for recent construction, if different in any manner, including any applicable cut-off date; and
- A deadline to complete rulemaking by December 31, 2019 or 2020, depending on necessary timeline for creating the NYC Energy Metric.

III. Supporting Information

Expanded Issue:

Finding a fair, effective and long-term framework

As outlined in *Proposal 1: Cut Building Energy 20 Percent by 2030* through *Proposal 4: Combine All Building Energy in One Requirement*, we recommend whole-building source energy reductions, using an NYC Energy Metric to gauge the relative efficiency of buildings. The next step in creating the policy framework is designing a mechanism that assigns reduction targets to individual buildings.

Potential options include fixed caps, percentage reduction requirements, a hybrid of features of the two, or a graduated reduction requirement. Each approach was assessed to determine an effective, feasible and long-term framework.

Assessment:
We considered four possible models to assign reduction targets to individual buildings:

1. A fixed cap on energy use, which would require those above the cap to reduce energy consumption down to the threshold.

2. A uniform percentage reduction requirement, which would affect all buildings equally.

3. A uniform percentage reduction requirement with “bookends”: a cap to address the poorest performers and exemptions to exclude the top performers; and

4. A graduated percentage reduction structure that would require greater energy savings from less-efficient buildings and smaller savings from high-performing buildings, with a possible exemption for the very top performers.

Placing a fixed cap on energy use

With a fixed energy use cap, buildings would reduce energy consumption below a certain threshold (regardless of baseline energy use). The level of that cap could vary according to any number of categories, such as by building sector or space use (though greater differentiation would increase complexity). Buildings using less energy than allowed by the cap would not be required to make any energy reductions.

Potential **advantages of a fixed cap** approach include:

- *Addresses the poorest-performing buildings*. High energy use does not necessarily correlate with inefficiency. But if the NYC Energy Metric effectively normalizes for the most influential factors affecting building energy use (e.g. space use, building area and density), then poor-scoring buildings should have more opportunity to reduce energy use. A fixed cap would force the worst-performing buildings to do substantially more than others.

- *Rewards high performers*. Similarly, a fixed cap would reward higher performers in each building category who may have already invested in energy efficiency or for whom it might be increasingly expensive to achieve percentage reductions from their own efficient baselines.

- *Resistant to gaming*. A fixed cap is a simple system that does not depend on a baseline year that may be susceptible to gaming.

Potential **disadvantages of a fixed cap** approach include:

- *Challenging program design*. An effective structure would be difficult to shape. To be fair, targets must be sufficiently customized by building or space type, which is challenging given the large variation in energy use in all building sectors. (For example, NYC benchmarking data shows the multifamily source EUI median at about 124 kbtu/sqft/yr, but a quarter of properties are below 103, a quarter are above 150, and a significant number are over 200.)

- *Complexity in defining sectors*. Classifying buildings into sufficiently diverse sectors is politically and logistically challenging. For example, should Class B office buildings be lumped in with high density, high-performance office buildings? Where would mixed-use buildings fall?

- *Intrinsic inefficiency*. Setting a cap will be intrinsically inefficient, either too stringent for many buildings to reach at manageable cost, or too lenient, leaving substantial energy savings on the table.

- *Uneven distribution of burden*. The structure of a cap demands great contributions from those further from compliance, but leaves many contributing nothing.

Uniform percent reductions

With uniform percent reductions, all buildings would need to reduce energy consumption by a fixed percentage, measured against each building's existing baseline. Percent requirements could vary by building sector or be uniform across all building types.

Potential **advantages of a uniform percent reduction** include:

- *Familiarity and track record*. Percentage reduction requirements from a baseline are familiar to much of the building community through programs like the NYC Carbon Challenge, the DOE Better Buildings Challenge, and NYSERDA's multifamily program. These programs have a strong track record of achieving their goals. That said, the NYC Carbon Challenge and the Better Buildings Challenge typically address portfolios–

meaning that the portfolio in aggregate, rather than each individual building, must achieve a percent reduction.

- *Easy applicability across sectors, occupancies, and use types*. Programs that require uniform percentage reductions have worked across a large number of building types. With a percent reduction, a building's compliance is simply assessed against its own baseline, obviating the need for granular differentiation in types, space use, vintage, systems, and other complicating factors.

- *Absolute reductions scale with energy use.* While all buildings would reduce by the same percentage, the absolute reduction would be higher for buildings using more energy and lower for those using less energy.

Potential **disadvantages of a uniform percent reduction** include:

- *Unfairness to very efficient buildings*. Very efficient buildings, which typically can achieve only modest additional cost-effective reductions, would be held to the same percentage reduction as all other buildings. Further improvements in these buildings would likely be quite costly.

- *Unfairness to early adopters*. Uniform percent reduction requirements might penalize building owners who have previously implemented energy efficiency improvements, since they would have to achieve the fixed percentage reduction on top of the reductions they have already achieved. This could be mitigated by permitting projects to choose alternative baseline years, as was done in the NYC Carbon Challenge.

- *Easier ride for very inefficient buildings*. Inefficient buildings with more energy savings opportunities would need to achieve only the same percentage reduction as higher-performing buildings. This approach would leave substantial energy savings on the table, including some that would likely be very cost-effective.

- *Expense*. Requiring equal reductions from all buildings would also not ensure the lowest-cost path to carbon abatement, since all buildings would need to reduce energy by the same percentage regardless of the ease or cost-effectiveness of available energy saving measures.

- *Gaming*. A building could conceivably drive up its energy use in the baseline year in order to make its required future reductions easier to achieve.

Adding "bookends" to a uniform percent reduction

With this approach, the majority of buildings would need to reduce energy consumption by a uniform percentage, but the extreme ends of the distribution would be treated differently. The most efficient buildings would be exempt, while the least efficient buildings would need to meet a cap. These "bookends" could be tailored to building sector, occupancy group, or other factors.

This hybrid approach garners many of the benefits, and tempers many of disadvantages, of the two approaches discussed above. It would allow greater flexibility for the existing distribution of building efficiency, while exempting high performers and ensuring lower-cost abatement from poor performers.

It would require a more sophisticated regulatory structure and raises important questions around how to avoid gaming in the baseline year and where to set target bookends to ensure a plausible trajectory to 80x50. However, this approach only addresses the extremes of the distribution curve, not the variation in likely energy savings in the middle majority.

A graduated percent reduction structure blending the features of all

A final option, which addresses the full continuum of building energy use, is a graduated structure that applies progressively lower percent reductions as building efficiency increases. In many ways, the distinction between a fixed cap and a percent reduction begins to deteriorate as a cap becomes more differentiated by building characteristic or a percent reduction requirement becomes more tailored to a building's relative efficiency. The graduated structure, then, seeks to capture the advantages of both approaches. It aims to be reasonably fair to all while taking advantage of lower-cost carbon abatement.

With a graduated reduction structure, buildings are subject to different percentage reduction targets ("brackets") within property type, depending on their relative efficiency score under the NYC Energy Metric. The most efficient, highest-scoring buildings would have the smallest required percentage reductions and the least efficient, lower-scoring buildings would have higher percentage reduction requirements.

Various approaches are possible to implement a graduated reduction structure. Buildings could be grouped in percentile score categories (for instance, 1-10, 11-20, etc.), with percent energy reductions applicable to each category. Reductions requirements could also be structured as marginal rates, like the tax code, where lower scores under the NYC Energy Metric would translate into increasingly higher energy reduction requirements. The advantage of the first approach is that it would be easy to know a building's required reduction. The advantage of the second is that required reductions would form a smooth curve, without hard jumps between categories.

Uniting the efficiency metric and the graduated reduction requirement

As outlined in *Proposal 2: Use a Made-In-NYC Metric*, the efficiency score from the NYC Energy Metric would account for key variables that influence energy use, such as occupant density and hours of use.

Within each property type, scores under the NYC Energy Metric would translate into a source energy reduction target for individual buildings. The precise details of that allocation should be left to rulemaking, on the advice of an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees* . The figure below is <u>purely illustrative</u> of a possible distribution of reduction requirements across efficiency scores.

This approach would account for a building's starting point based on the adjustments in the NYC Energy Metric. It would provide a gradual increase in requirements, whereby less efficient buildings would be required to reduce more. Paired with a 30 percent maximum reduction requirement, an exemption for truly high performers, and a hardship exemption for special cases, this approach will help ensure a fair and effective policy framework.

Building Bin	Building Goals
Energy Star-Like Score Range	*% Reduction Required by 2030*
91 - 100	4%
81 - 90	8%
71 - 80	12%
61 - 70	16%
51 - 60	20%
41 - 50	23%
31 - 40	25%
21 - 30	27%
11 - 20	29%
1 - 10	30%

A graduated structure inherently minimizes gaming

Because requirements increase as efficiency scores decrease, the graduated structure has a built-in deterrent for gaming baseline year energy use. In other words, if a building increases energy use in baseline year in order to make future "reductions" easier to achieve, its efficiency score will decrease. That decrease will translate into an increased reduction requirement, offsetting the benefit of increasing baseline year energy use.

Should the reduction requirement simply be a higher NYC Energy Metric score?

Within this graduated reduction structure, we also considered the possibility of requiring that buildings achieve a higher score in the NYC Energy Metric, instead of a percentage source energy reduction. At least two challenges complicate that approach. First, it may be difficult to distribute that higher score requirement across all building bins in a manner that will deliver predictable total source energy savings, in part because many factors affect a building's score. Second, many building owners may find it more difficult to grapple with a requirement to improve a score, as opposed to the clarity of an energy reduction target.

Still, this approach may be worth further inquiry through the legislative or rulemaking process, on advice of an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*. A policy requiring efficiency score improvements might be more complicated to design, administer and comply with, and it may lead to more uncertainty around the energy savings delivered. On the other hand, it might offer a feasible way to adjust for significant changes in relevant factors, like space use. These details should be explored as the metric and reduction allocations are being developed.

Are energy savings more available and cost effective in high energy use buildings?

Experts agree that most NYC buildings can cost-effectively reduce energy use, particularly with a long timeline that enables upgrades at the time of equipment replacement. There is some debate, however, on whether high energy users typically have larger savings potential and lower marginal energy or carbon-saving costs. Some studies have shown that buildings with high EUIs tend to have greater savings potential, at least in certain sectors. But that tendency may not necessarily always correlate to lower-cost opportunities. Some less-efficient buildings may be inefficient due to higher cost barriers.

This is a large and challenging question, beyond the scope of current inquiry. Additional study is warranted on the correlation between high energy use / low efficiency scores and greater energy savings opportunities / lower cost options to inform further policy development.

Sources:

Deutsche Bank (2012). Recognizing the Benefits of Energy Efficiency in Multifamily Underwriting. Retrieved from www.db.com/usa/img/DBLC_Recognizing_the_Benefits_of_Energy_Efficiency_01_12.pdf

6 Avoid a Compliance Pile-Up

I. Summary

Issue:
A distant compliance date could delay upgrades. That means less carbon saved in the interim and a potential rush near 2030 that could overwhelm the workforce.

Recommendation:
Develop a phased timeline to avert a 2030 pile-up. Options include multiple compliance years, an interim capital plan, and incentives for early compliance.

II. Proposal

Include a graduated or sequenced compliance timeline to avoid delay, build capacity, and avert an unmanageable compliance pile-up in 2030. Options include:

- Allow for multiple compliance years.
- Allow compliance extensions for buildings refinancing in the late 2020s or early 2030s.
- Require capital plans from lagging building owners when they submit information for Local Law 87 audits.
- Consider incentives for early compliance, such as allowing those complying earlier to meet lower energy reduction requirements.

III. Supporting Information

Expanded Issue:
As outlined in *Proposal 1: Cut Building Energy 20 Percent by 2030* through *Proposal 5: Require Less-Efficient Buildings to Reduce More*, we recommend a sliding scale of whole-building source energy reductions by 2030, using an NYC Energy Metric to gauge the relative efficiency of buildings. This section addresses the structure of the compliance timeline.

Long time horizons are critical for long-term capital planning. But if a 2030 target is ignored by a large segment of the market until 2029, building owners will be set up to fail due to missed financing and upgrade opportunities. In addition, the retrofit industry won't be able to manage a massive uptick in efficiency work in the last years prior to the compliance deadline. For a successful policy, owners must begin planning now to align efficiency upgrades with tenant turnover and refinance cycles.

Assessment:
Several potential strategies could help prevent a pile-up around the compliance year 2030.

Allow for multiple compliance years

Allowing two or three compliance years would stagger construction and retrofit activity over a longer time period, alleviating some of the pressure on the market in the late 2020s. Any such increase in compliance years should be modest, or buildings due in early years will be at a financial disadvantage compared to buildings due in later years. Although Local Law 87 provides a precedent for a staggered compliance year approach, ten years between the first and last buildings would mean substantial delays in emissions reductions and widely varying cost profiles for work on different buildings.

Use capital refinance cycles to motivate compliance, with extensions where necessary

From commercial real estate to multifamily co-ops to affordable housing, the vast majority of buildings impacted will undergo refinance by 2030. Integrating green upgrades into the refinancing process could help ensure early planning for compliance. Lenders should be interested to know if they are making a loan to a building with financial liability due to either unanticipated capital expenditures or potential future fines. The energy performance documentation required by the retrofit policy could be requested by lenders as part of loan closing, a practice that is growing in the regulated multifamily affordable housing sector.

On the other hand, a small number of building owners may not refinance between 2020 and 2030. Allowing these owners a short extension upon request (to align significant retrofit work with financing cycles) would spread compliance over another year or two.

Require capital planning from laggards to ensure early action

Some buildings will have much farther to go than others. And owners who have not begun planning retrofit work may struggle to reach compliance by 2030. To address this concern, owners could be required to submit a capital plan detailing the necessary energy efficiency strategies, with the goal of achieving on-time or early compliance. This plan could be requested in the early 2020s to ensure that building owners have sufficient time to plan for the 2030 deadline. Any such requirement should be aligned with or substitute for the audit required under Local Law 87.

Incentivize early compliance

The city could also incentivize early compliance in several ways. One option is to lower energy reduction requirements for those buildings complying early (e.g. a small reduction in the percent reductions required for buildings that comply by 2025). Doing so makes sense, as earlier permanent efficiency improvements deliver greater aggregate savings. But any such reduction would need to be balanced against the longer-term emissions implications.

It's also worth noting that with an efficiency trading program (see *Proposal 11: Let Owners Trade Efficiency*), earlier reductions could generate efficiency credits that are sellable to other building owners. This financial value might be sufficient to incentivize significant early compliance.

7 Keep Affordable Housing Affordable

I. Summary

Issue:
The cost of “Major Capital Improvements” (MCIs), like boiler replacements, can often be passed on to tenants in rent-stabilized apartments, who may be unable to afford the resulting permanent rent increases. Nonetheless, owners need a way to pay for efficiency improvements. The rent-stabilized sector accounts for about 40 percent of large multifamily building space, so it’s essential to get it right.

Recommendation:
Require low-cost, energy-saving measures that don’t qualify as MCIs for the rent-stabilized sector, instead of the percent reductions applicable to other sectors. Require adjustments to this approach if MCI rules or their interpretations change. And provide support and incentives so that the rent-stabilized sector can achieve the same efficiency gains as market-rate buildings.

II. Proposal

In place of the percent reductions required of market-rate buildings, require buildings with rent-stabilized apartments to undertake a portion of the following low- to no-cost energy-saving measures. Based on existing analysis of energy conservation measures, implementing varying packages of these measures could deliver as much as 10-13 percent source energy savings in a typical multifamily building:

1. Changing temperature set points for heat or hot water
2. Repairing heating system leaks
3. Tuning up heating system
4. Installing temperature controls on radiators (thermostatic radiator valves or TRVs)
5. Insulating pipes for heating and/or hot water
6. Insulating steam system condensate tank or hot water tank
7. Installing heating system sensors and boiler controls
8. Replacing or repairing steam traps
9. Installing or upgrading master venting (steam system)
10. Upgrading common area lighting
11. Air sealing and weatherization, such as caulking and replacement of gaskets
12. Installing timers on exhaust fans
13. Install insulating radiator enclosures with temperature controls (like the Cozy)
14. Install radiant barrier behind radiator

The New York State Department of Homes & Community Renewal (DHCR) has stated these measures are not individually eligible for MCIs. Indeed, none appear on the Schedule of Major Capital Improvements in DHCR regulations. Consider the feasibility of including other measures, such as low-flow faucets and showerheads, which can deliver substantial energy savings and are not MCI-eligible unless installed building-wide. This recommendation should be contingent on the fact that there are no major changes to MCI rules or their interpretation.

If, through rules changes, agency interpretation, or judicial decision (1) any listed energy conservation measure is deemed eligible for MCI, it should automatically be struck from the list of required measures, or (2) MCI regulations change such that the entire above prescriptive approach is deemed MCI-eligible, this "checklist" requirement should fall away and the city will need to determine a new path forward for buildings with rent-regulated units.

If the MCI laws are updated such that efficiency requirements can be reached without driving rent increases, then rent-regulated buildings should fall back under the regular multifamily reduction requirements.

Robust verification will be needed to ensure measures are implemented.

See *Proposal 8: Lend a Bigger Hand Where it's Most Needed (Part 1)* for details on support and incentives for owners of buildings with affordable housing units.

III. Supporting Information

Expanded Issue:
The city can only meet its 80x50 emissions target if all buildings, including affordable housing, reduce energy consumption. The challenge is how to ensure building owners make efficiency upgrades while not significantly impacting rent on affordable units or reducing the affordable housing stock.

In buildings with rent-regulated apartments, rent increases are set annually by a local board of mayoral appointees (the Rent Guidelines Board). Since the ability to pass along costs to tenants is limited, owners of rent-stabilized apartments are less likely to take on the financial risk of implementing energy efficiency improvements.

Owners of rent-stabilized or rent-controlled housing (1) are often unable to install retrofits on the same timelines as market rate building owners and (2) are incentivized to recoup energy efficiency investments by increasing rent via MCI regulations.

What are MCIs?

MCIs are substantial building improvements that are regulated under the NY State Rent Stabilization Law, which governs rent stabilization in New York City. Owners making MCIs are legally allowed to raise rents. To qualify as an MCI, the law requires that a building improvement:

- Be deemed depreciable under the Internal Revenue Code
- Be for the operation, preservation and maintenance of the structure
- Benefits all tenants, directly or indirectly

- Includes the same work in all similar components of the building or building complex, unless some components do not require the improvement
- Replaces an item that is past its useful life as specified in the Useful Life Schedule, unless the owner receives a waiver

Annual MCI-based rent increases are permanent; they are allocated to all rent-regulated units in the building according to the number of rooms per unit and based on the cost of the improvement spread over eight or nine years (depending on the building size). MCIs cannot exceed six percent for any apartment, with any excess sum added to rent in future years.

MCI-based rent increases may also arise on two related grounds. First, work "performed in connection with, and directly related to" an MCI may be included in the rent increase if the work was completed within a reasonable time after the MCI and improves the building or grounds. Second, a building-wide improvement (other than repairs) that is necessary to comply with a specific requirement of law may result in a rent increase.

Once an apartment's annual rent exceeds about $2,700, it "falls out of regulation" and, upon vacancy, is no longer subject to rent limits. MCI-based rent increases can push rent above that ceiling, lowering the amount of regulated affordable housing units in the city. Even if raising rent won't push a unit out of regulation, it still makes rent more burdensome for the tenants, many of whom are unable to afford higher rent.

Assessment:

Voluntary measures and mandates that won't work

In order to achieve 80x50, we need significant energy savings. In order to maintain affordability, we must minimize rent increases. We won't get to both ends through voluntary measures or by applying the same standard used for market-rate buildings.

Voluntary approaches allow owners to make updates more flexibly and when funds are available. The success of a voluntary approach, however, requires that tenant and building owner incentives align. Building owners will only implement energy conservation measures (ECMs) if they can recoup the investment; tenants are more likely to support ECMs if their rent will not be increased. However, tenants currently have little incentive to reduce consumption, as they are typically not charged directly for the energy they use. A voluntary approach thus risks inaction.

Meanwhile, requiring that rent-regulated buildings reduce energy use according to the same standards as market-rate buildings would help the city reach its 80x50 goals. However, this approach does not protect tenants from rent increases. It also doesn't address the difficulty of finding financing, pushback from tenant advocates, or the potential reduction of rent-regulated stock if units are pushed above the deregulation threshold because of increased MCIs.

An effective policy approach must account for affordable housing types, address challenges faced by tenants and owners of buildings with rent-regulated units, and avoid reducing the city's affordable housing or rent-regulated stock. Typically, energy-saving improvements are most feasible at the time of building refinance or when existing building systems reach the end of their useful life.

Low to no-cost energy-saving measures

There is another path that will achieve significant reductions and minimize costs to owners, while not increasing rents: requiring owners to implement low-cost ECMs and better operations techniques.

As noted, the 14 recommended ECMs listed in section II are not currently individually eligible for MCIs, and others such as installing low-flow faucets and showerheads may be feasible to include as non-MCI measures with qualifications. Many of these measures are assessed for cost and energy savings based on New York City audit data in The Community Preservation Corporation's recent publication *Underwriting Efficiency*. Based on that analysis, supplemented by Urban Green calculations to avoid overlap in savings when bundling conservation measures, a typical multifamily building that implements packages of half or more of these measures can expect to see as much as 10-13 percent energy savings.

Actual reductions between 2020 and 2030 may be higher for these buildings because, independent of any city requirement, various building systems will reach the end of their useful life during this decade. As these systems are replaced, energy code standards will ensure that new, replacement equipment is substantially more energy efficient than the old equipment.

The risk of prescriptive lists like the one proposed here is that owners are regulated to complete steps rather than achieve goals. Past experience with prescriptive programs shows that energy savings may fall short of their potential. As a result, robust verification will be needed to ensure energy efficiency measures are properly implemented.

The city should seek to ensure that reductions from rent-regulated housing achieve the same aggregate 20 percent savings of other sectors. The city could achieve this aim with targeted funding; any work paid for through government and utility grants is not eligible for MCIs. This approach could make up for any shortfall in rent-regulated buildings and ensure the sector meets an aggregate 20 percent savings target.

The city should continue to explore policy options for buildings with a very low percentage of rent-regulated units. As our recommendation stands, owners with just a few rent-regulated units will have less burden and benefit from subsidies unavailable to owners of market-rate buildings. One approach is to subject these buildings to the same requirements as market-rate buildings and provide tenants with a rent subsidy to cover MCI-driven rent increases. The downside of this approach is that it would not protect against the loss of rent-regulated units, as rents could still eventually exceed the deregulation threshold. To mitigate this problem, the city could finance additional affordable housing to make up for any loss in housing stock. Tenants (perhaps subject to an income test) in recently deregulated units could have first option on this new rent-regulated housing.

Ultimately, the approach proposed here is an interim solution on a 2030 timeline. As greater efficiency improvements are required in the decades ahead, more comprehensive reform of the MCI system is necessary to align the city's climate and affordability goals.

Sources:

9 CRR-NY 2522.4(a)(2)(ii)

9 CRR-NY 2522.4(a)(4) and (8). Note that the regulations online have an 1/84 amortization rule that appears to be the old 7-year amortization rule (the law was updated in 2015)

9 CRR-NY 2522.4(a)(12)

Department of Homes and Community Renewal (2017). Fact Sheet #24: Major Capital Improvements. Retrieved from www.nyshcr.org/Rent/factsheets

NYC Admin. Code §26-511(c)(6). Note that Chapter 4: Rent Stabilization is recodified at the state level through chapter 907 of the Laws of New York (1985) as the New York City Rent Stabilization Law

Urban Green Council telephone conference with representatives of DHCR. May 1, 2018.

The Community Preservation Corporation. Underwriting Efficiency (2017). Retrieved from http://communityp.com/wp-content/uploads/2017/05/CPC_Underwriting_Efficiency_Handbook_Full_Interactive_FINAL.pdf

8 Lend a Bigger Hand Where it's Most Needed (Part 1)

I. Summary

Issue:
Affordable housing owners often face thin margins, financing challenges, and a backlog of upgrades to implement. Without help, they may struggle to achieve required energy savings.

Recommendation:
Help affordable housing owners by expanding support programs, improving access to financing, and coordinating with NY State programs to achieve energy savings on par with market-rate buildings.

II. Proposal

Convene city and state regulators and other key stakeholders to explore new and revised financing programs, as outlined in *Appendix 3: Advisory Committees*. Options may include:

- Leveraging traditional financing mechanisms
- Expanding NYC's Housing Preservation & Development's Green Housing Preservation Program to larger buildings (above 50,000 sq ft), and incorporating it into HPD's other programs to facilitate utilization
- Reforming J-51 to simplify applications and appeals; adjust how benefits are calculated
- Enacting C-PACE
- Convening non-traditional lenders to explore opportunities for new lending products
- Expanding NYSERDA and utility rebates, including for gas efficiency
- Expanding existing city agency financing for affordable housing

Beyond these financing programs, provide owners of rent-regulated buildings with subsidies that enable them to close the gap between a prescriptive checklist approach and the 20 percent sector reduction expected of market-rate buildings. These may include a mixture of existing, planned, or new subsidies, whether property tax incentives or NYSERDA or utility programs. See *Proposal 7: Keep Affordable Housing Affordable* for more detail on the proposed approach for the rent-regulated sector.

III. Supporting Information

Expanded Issue:

The challenge for affordable multifamily housing

The city's 2016 Technical Working Group and *Roadmap to 80x50* reports demonstrate that the majority of large buildings (>25,000 square feet) must undergo deep retrofits over the next 32 years for the city to achieve its carbon reduction goals. Whether this is accomplished with mandates, incentives, financing tools, technical assistance, or some combination, implementing these retrofits will be challenging for building owners and represents a departure from standard capital improvement processes.

The challenge is even greater for owners of affordable multifamily properties, which make up a large portion of the properties in need of retrofits. Affordable housing will need to keep up with the efficiency gains of market-rate buildings over the next decade in order to meet a more rigorous compliance cycle starting in 2030.

"Affordable housing" encompasses a number of different housing categories. The first category, which represents a majority of affordable units, contains buildings that are subject to New York's rent regulation laws, which limit the rent increases that landlords can impose. Buildings with rent-regulated units include:

- Buildings that were originally wholly rental buildings subject to rent regulation but were converted to cooperatives where some regulated rental units remain;
- Buildings consisting entirely of rental units, containing a mixture of market-rate and rent-regulated units;
- Buildings in which most or all of the apartments are rentals subject to rent regulation.

The second category is comprised of affordable units that were constructed using various types of government financing. This financing was provided on the condition that the residential units would be priced at levels considered affordable to families earning a set percentage of area median income (as determined by HUD). These affordability restrictions are generally in place for a term of years and may be renewed if the building takes advantage of an applicable refinancing program. The conditions of the programs vary significantly depending on the agency providing the financing.

The third category are buildings owned and operated by the City of New York as public housing, under the auspices of the New York City Housing Authority.

Each category of building is subject to limitations in passing the costs of improvements on to tenants. For example, permissible rent increases on rent-regulated units are set annually by the Rent Guidelines Board, but the costs of upgrades that qualify as Major Capital Improvements may be passed on to tenants (for more on this, see *Proposal 7*: *Keep Affordable Housing Affordable*). Buildings in which rents are tied to percentages of area median income may be unable to incorporate any improvement costs in their rental structure, but may be able to access other forms of financing.

Assessment:
Due to limited income from capped rents, many multifamily affordable housing (MFAH) properties operate on tight margins. According to the Rent Stabilization Association (RSA), between 2014 and 2016 operating costs of rent-regulated buildings increased 11 percent while rent was only allowed to increase one percent. MFAH owners often have limited financial reserves, limited ability to support debt, and substantial deferred maintenance; therefore, they can have trouble accessing sufficient financing to cover essential repairs and upgrades, even at the time of refinance.

Making this sector more energy efficient is not only essential to the city's climate goals, but also provides many benefits. Efficiency lowers operating costs for owners, which can help keep properties affordable and well-maintained. It lowers energy bills for low-income New Yorkers who pay a significantly higher portion of their income on utilities and rent than mid- to high-income residents. Efficiency improvements also improve community health and make homes safer and more comfortable for low-income residents. As the city presses forward with its climate agenda, these properties cannot be left behind.

The Partnership identified a number of institutions and programs, both within and outside of existing programs, that could incentivize and motivate energy efficiency retrofits in line with 80x50 goals.

Traditional banks and lending institutions

Financing options for large building energy projects have grown in recent years, but simple and straightforward energy efficiency financing is not yet readily available through *traditional* financing mechanisms. To help inform and spur the adoption of underwriting to energy efficiency in the traditional lending process, the Community Preservation Corporation recently released the Underwriting Efficiency handbook. Financing efficiency as part of a building's refinance or first mortgage may be most beneficial to distressed properties, which lack access to the reserve budgets and private financing available to larger, more sophisticated properties.

Leveraging the existing mortgage finance process to support energy upgrades may be the most effective strategy to tackle the large number of building upgrades needed to reach energy targets. Most buildings in the city will go through at least one major financing event (acquisition, rehab, refinance, or new construction) between now and when the targets are enacted. If underwriting efficiency becomes part of the normal real estate finance process for both lenders and borrowers, it could unleash sufficient capital to support the large-scale transformation of NYC buildings, while also helping lenders and investors meet their goals and volume objectives. The City Council should encourage the practice of underwriting efficiency as a key strategy to support the implementation of wide-spread energy upgrades.

Green Housing Preservation Program (GHPP)

Administered by the NYC Department of Housing Preservation & Development, GHPP provides low- or no-interest loans to small- and mid-size building owners to finance energy efficiency improvements and moderate rehabilitation work. Buildings with at least five units and less than 50,000 square feet that require energy efficiency improvements are eligible to apply. The project scope of work must reduce a building's energy use by at least 20 percent, and HPD can lend up to $50,000 per residential unit. A third-party firm must conduct a roof-to-cellar assessment of the physical conditions and energy efficiency needs of the building. The loan amount is then based on the efficiency and repair work identified through the assessment.

The city should consider expanding the budget of GHPP to serve more properties, as well as those over 50,000 sq ft. Another city program, Community Retrofit NYC, serves as a pipeline for GHPP that provides low- and no-cost financing for efficiency upgrades as part of a broader scope of work in exchange for an affordable housing agreement.

J-51 reforms

J-51 is an HPD tax exemption for the renovation of multi-unit residential buildings. J-51 reduces the taxable assessed property value, which is the basis for calculating real estate taxes.

The current program design is challenging for owners: J-51 exempts properties from a certain threshold of additional taxation subsequent to capital improvements that increase the value of a property. The tax exemption is tied to projected increases in assessed value. In many cases, the assessed value of properties may have increased so significantly that it exceeds the allotted value of the J-51 exemption, resulting in property taxes not anticipated by the owner and not supportable by project cash flow. The process for addressing this issue with relevant city agencies can be highly bureaucratic and burdensome. Owners also often have difficulty extending program benefits upon expiration.

The city should consider the following:

- Streamline the administrative process to apply, renew, and receive J-51 benefits.
- Create a fast-track appeals process where J-51 benefits not covering a project's full post-rehabilitation tax liabilities can be reviewed.
- Adjust the process of how J-51 benefits are calculated to factor in market conditions.

Commercial Property Assessed Clean Energy (C-PACE) financing

C-PACE programs offer financing for commercial property owners to fund energy efficiency and renewable energy projects on existing residential and commercial structures. In exchange, the property owner agrees to have a special assessment or special tax charge placed on their annual property tax bill. This allows the property owner to make improvements without requiring a large upfront investment.

The city should work with HPD, the NYC Housing Development Corporation, and public and private lenders to make C-PACE work as gap financing for subsidized affordable housing. It should also prioritize C-PACE for recapitalization–not for mid-cycle retrofits for subsidized housing.

C-PACE is a national program available in 30 states. To be successful in NYC, it's essential to learn from challenges that other municipalities have faced in administering C-PACE, especially in the affordable market.

State, nonprofit, and CDFI financing

Several lenders, like the NY Green Bank, NYCEEC, and Community Development Financial Institutions (CDFIs) focus on market niches underserved by traditional financial institutions. NYCEEC is a nonprofit finance company that offers direct loans to building owners and their representatives for both the construction and permanent financing of clean energy projects. CDFIs are community-based specialized financial institutions that serve low-income residents or businesses underserved by traditional financial institutions. CDFIs may offer more flexible rates and terms than traditional financial institutions.

The city should host targeted roundtable discussion(s) including The Mayor's Office of Sustainability, NYGB, HPD, NYSERDA, NYCEEC, CDFIs, relevant financial stakeholders, and affordable housing managers and developers. The goal should be to explore opportunities to blend NYCEEC/utility/NYSERDA energy dollars with private multifamily affordable lending products through CDFIs and/or HPD products. The best financing solutions would be low-cost, flexible, unsecured (where possible), and easily coupled with existing affordable housing resources.

Utility/NYSERDA rebates or incentives

NYSERDA offers multifamily residential programs—like EmPower New York and the Multifamily Performance Program—that help owners identify efficiency opportunities in their properties and provide assistance in completing those improvements. While there are several existing incentive and rebate programs administered by NYSERDA and the utilities, the scale of these programs is insufficient to support retrofits in more than a very small portion of NYC's affordable multifamily properties. These resources should be scaled up and continuously improved.

HPD/HDC programs

HPD administers finance programs to facilitate new construction, preservation and renovation of privately and publicly owned multifamily affordable housing buildings. HDC offers programs with favorable financing terms that are generally unavailable in the commercial market for the new construction and rehabilitation of housing.

We recommend exploring the development of new or expanding existing HPD/HDC/HCR programs. There should also be increased efforts to determine why many of the MFAH programs are underutilized or considered difficult to access by owners.

Expand the Retrofit Accelerator and associated programs

The city's Retrofit Accelerator currently provides owners with free assistance to retrofit their buildings. However, the need for assistance will dramatically grow as this policy is implemented, with the scale and scope of such demand eclipsing the support that the Retrofit Accelerator currently provides, especially to affordable housing. The city should expand the Retrofit Accelerator's affordable housing-specific resources and link the Accelerator's efforts to other city, state, and utility-based energy efficiency measures.

Specific ways to improve and expand the Retrofit Accelerator are further discussed in *Proposal 16: Make Efficiency Easier through Expanded Services*.

Sources:

Energy Efficiency for All (2018). Commercial PACE for Affordable Multifamily Housing, pp. 16-17. Retrieved from http://energyefficiencyforall.org/resources/commercial-pace-affordable-multifamily-housing

New York City Department of Finance. J-51 Benefit History Request Screen. Retrieved from http://webapps.nyc.gov:8084/cics/cwba/dfhwbtta/abhq

New York State Energy Research and Development Authority (2018). Commercial Property Assessed Clean Energy (PACE) Financing Guidelines. Retrieved from www.nyserda.ny.gov/All%20Programs/Programs/Commercial%20Property%20Assessed%20Clean%20Energy

Rent Stabilization Organization. June 2017 Comments on the Preliminary Rent Guidelines Order 49. The Rent Guideline's Board concurs that costs for owners of rent-regulated building have risen (33.5% since 1990), but asserts that income and net operating income have climbed even faster (44.7% and 64.0%, respectively). *See* Rent Guidelines Board (2008). Income and Expense Study, p. 10.

www1.nyc.gov/assets/rentguidelinesboard/pdf/ie18.pdf. RSA disputes the Board's NOI calculations, noting the numerous significant expenses not reflected. *See* Rent Stabilization Organization (2017). Comments on the Preliminary Rent Guidelines Order 49, June 2017. For instance, construction costs are not reflected, even though MCIs resulting from construction is added on the income side. Debt service is not an expense. (Surprising, but there is no way to distinguish debt used to reinvest in the property versus debt incurred to remove value from the property for other purposes.) Nor are Local Law 11 façade inspections or lead paint remediation. Even if the calculations are accurate, they still show 10% of rent-regulated buildings don't have any net operating income, and 30% of buildings have "marginal" levels (21% of income or less).

9 Lend a Bigger Hand Where It's Most Needed (Part 2)

I. Summary

Issue:
Efficiency upgrades may be challenging for many nonprofit organizations. They often have constrained finances, limited staff, difficulty accessing available resources, and minimal experience with energy management.

Recommendation:
Provide dedicated financing and technical support for nonprofits and religious organizations, streamlining access to incentives.

II. Proposal

Categorize the nonprofit sector as a unique class requiring special consideration. The city should provide direct financial assistance, short- and long-term financing, and technical and operational expertise specific to the needs of the sector.

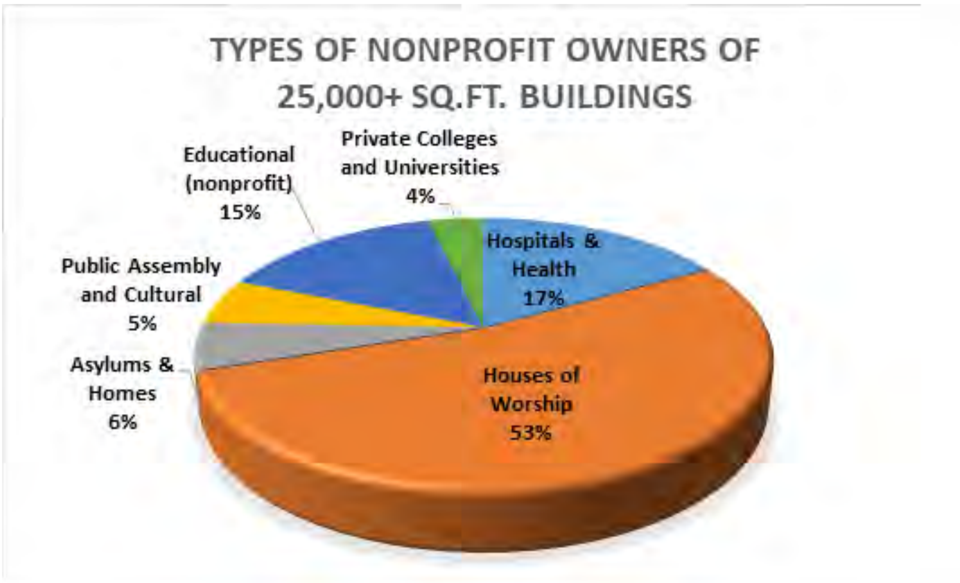
III. Supporting Information

Expanded Issue:
Due to known financial constraints on the affordable housing sector, it's identified as a building class to be uniquely considered by City Council in any energy efficiency policy. Other buildings classes may also qualify for special consideration, given the unique financial and logistical challenges in implementing energy efficiency measures. These challenges could stem from a sector's building stock, building use type, staff energy efficiency expertise, cash flow or a fully leveraged borrowing position. These building classes should be identified and potentially considered separately in any legislation.

Efficiency upgrades may be challenging for many nonprofit public-interest organizations, including houses of worship, educational centers, and museums. Nonprofit property owners can generally be defined as those qualifying for real property tax exemption under NYS RPTL 420a and b. Other applicable provisions are RPTL 420c and Article 11 of the NYS Private Housing Finance Law (PHFL), which help provide tax exemptions for low-income housing developments owned by nonprofits.

As a class, nonprofit owners of buildings are diverse. A board of directors (who must volunteer their time) governs each nonprofit building owner, and most organizations have staff primarily focused on the organizational mission. They are pastors, educators and human service providers who offer services that often supplement or supplant established governmental programs. Generally, few staff or volunteer board members have substantive experience in facilities management and energy efficiency. There are, however, some very large nonprofits (e.g. universities and hospitals) with more resources to bring on energy efficiency and facilities management professionals.

There are approximately 4,100 nonprofit-owned properties in New York City that are larger than 25,000 square feet, comprising 12 percent of the buildings that will need to comply with upcoming energy reduction legislation.



DOB building class definitions and building square footage data are taken from the NYC PLUTO database, retrieved from www1.nyc.gov/site/planning/data-maps/open-data/dwn-pluto-mappluto.page. NYC Property Valuation and Assessment Data, retrieved from https://nycprop.nyc.gov/nycproperty/nynav/jsp/selectbbl.jsp, were used to refine the PLUTO data and verify tax exempt status of buildings within each building class. This chart does not reflect low income housing properties.

Assessment:
Given the diversity of nonprofit organizations, a single nonprofit path or group of policies to get to 80x50 goal would not be optimal. The goals for a particular building type should be relative to other, similar building types. Building owners will need flexibility as they work toward achieving efficiency goals. While some very large nonprofits are ahead of the curve on efficiency, the bulk of nonprofits will likely require a range of support programs to comply with an energy reduction policy. And the standard for any hardship exemptions from energy reduction requirements should consider nonprofits' unique public-service missions.

Short- and long-term financing

Any major renovation requires upfront costs (for example, a NYSERDA-compliant energy audit, consultants, loan initiation fees, appraisal costs and legal costs). And savings from efficiency improvements take time to manifest. Such costs are a major drain on a nonprofit's cash flow and pose challenges to its core mission. Many nonprofits do not have access to the financial resources and energy efficiency expertise needed to successfully implement energy efficiency measures.

For example, nonprofits are likely unable to access PACE financing, where investment paybacks are collected through an assessment on property taxes, due to liens and tax-exempt status. PACE loans are intended to be roughly analogous to a mortgage that may be funded through the energy savings that result from the upgrades. However, nonprofits face several challenges in accessing this proposed financing vehicle:

- Uncertain savings: Nonprofits and nonprofit boards have greater sensitivity to uncertainty in projected savings from upgrades. Given tight financing and public-interest mission, they tread carefully before committing to such borrowing.

- Liens: Many nonprofits, especially religious organizations, are averse to placing a lien on their most significant assets, their houses of worship and schools. These loans would not be appropriate for such entities.

- Regulatory concerns: Some nonprofits may not be able to enter into such financing agreements without approval from the New York State Attorney General. To streamline the process, it would be wise to develop financing mechanisms in consultation with that office.

- Constitutional Questions: Funding for houses of worship may not be constitutional. The recent *Trinity Lutheran* case reaffirmed the principle that, "denying a generally available benefit solely on account of religious identity imposes a penalty on the free exercise of religion." That principle seems to apply to PACE financing. However, *Tilton v. Richardson* (1971), held that a federal program that provided construction grants to colleges and universities but prohibited grantees from using the funds to construct facilities "used for sectarian instruction or as a place for religious worship" or "used primarily in connection with any part of the program of a school or department of divinity" was constitutional. Before any legislation moves forward, the NYC Corporation Counsel should prepare a formal Memorandum on this issue.

Energy efficiency expertise

In order for an energy reduction policy to be successful, nonprofit owners should have access to a free portal or program that can provide an array of expertise to building owners. Similar access could also be provided to smaller commercial and residential owners, who also lack such technical expertise.

The city should utilize the Retrofit Accelerator, or a similar city agency, to allocate specific staff who are familiar with the missions and challenges of nonprofits to assist with energy efficiency upgrades. See *Proposal 16: Make Efficiency Easier through Expanded Services* for more discussion of this issue.

10 Lead the Way with City Buildings

I. Summary

Issue:
Scaling retrofits in NYC requires a proving ground so designers and contractors can experiment, shedding light on costs, risks, and solutions. City buildings have long paved the way for green building innovations.

Recommendation:
Require city-owned buildings over 10,000 square feet to reduce energy consumption 20 percent by 2025 (twice as fast as private sector buildings) and reduce fossil fuel consumption. Publish case studies with lessons learned on deep retrofits and new technology pilots.

II. Proposal

City-owned buildings over 10,000 square feet should reduce source energy use 20 percent by 2025 and reduce on-site fossil fuel consumption below caps established via rulemaking. Given the wide variety of city buildings, the city will need to create different source energy and fossil fuel targets.

To meet this goal, the Department of Citywide Administrative Services (DCAS) will need additional funding and project management staff. DCAS should also meet with current and past consultants to solicit feedback on opportunities to streamline its procedures.

Finally, DCAS should publish case studies on implementing energy efficiency measures and new technology pilots that:

- Represent a range of common NYC building types, sizes and building systems; useful examples include steam and natural gas boiler/cogen and central HVAC versus distributed HVAC;
- Include details of the ECMs considered, analysis of cost and savings, and measurement and verification (M&V);
- Follow the example of the Empire State Building and Urban Land Institute's Tenant Energy Optimization Program, which used a calibrated energy model and iterative modeling of ECM packages with accurate pricing; and
- Meet ASHRAE Level 2 plus or Level 3 audit with all details shared on analysis, decisions and results.

III. Supporting Information

Expanded Issue:

Government has long led on green building

New York City and State government have long embraced the mantle of first mover on green building. LEED's early years were advanced by the city's voluntary and legislated government leadership; in the early 2000s, Battery Park City Authority began requiring LEED for its projects. In 2005, New York City enacted Local Law 86, mandating LEED and energy efficiency standards for city-funded buildings. These early steps laid the foundation for the subsequent explosion of LEED projects in New York, the city having served as a green building training and testing ground for many leading owners, designers, and contractors.

Furthermore, Under the Greener, Greater Buildings Plan, city properties were covered at 10,000 square feet rather than the initial 50,000 square feet for private sector buildings. City-owned buildings were also required to implement energy-efficiency measures that paid for themselves within seven years; there was no equivalent requirement for the private sector. The phase-out of #6 fuel oil required earlier compliance by city buildings. 2016's Local Law 31 requires new municipal buildings to use 50 percent less energy compared to code or the median energy use for similar NYC buildings—radically more efficient than most buildings under construction.

And under Executive Order 26, Mayor De Blasio has committed city agencies to reducing carbon emissions in adherence with the Paris Climate Agreement's goal of limiting global temperature increase to 1.5°C above pre-industrial levels. In pursuit of this goal, the city has committed agencies to achieve an additional 20 percent energy reduction by 2025, with DCAS serving as the lead agency.

History shows that earlier compliance by the city encourages the development or expansion of a qualified workforce by driving demand for energy efficiency-related services. It also primes the market for building products. Most importantly, it provides a critical place to learn and experiment.

Hurdles to retrofitting city buildings

Despite $2.7 billion in commitments to retrofit city buildings, DCAS faces significant challenges to achieving the energy reduction targets required under the 1.5°C pledge.

Due to the technical and administrative requirements the city has in place to limit the risk of fraud and corruption and ensure public dollars achieve high-quality outcomes, public projects generally cost more than the same work in private buildings.

DCAS is responsible for overseeing an enormous variety of building types, including hospitals, schools, universities, police precincts, fire houses and garages, which drives the need for more specialized energy management. For example, police precincts can have higher energy consumption because they have longer operating hours than office buildings with a similar occupancy classification. There is no such thing as a generic "city building."

Funding sources (Expense or Capital budget) for energy efficiency projects vary depending on certain criteria, such as the specific category of building improvement and dollar amount. Expense dollars ("Opex") are much harder to come by than capital dollars ("Capex"). Capital projects are those that cost equal to or more than $35,000 and have a probable period of usefulness of five years or more. Generally, the city has more freedom to issue bonds for capital dollars. However, many of the energy efficiency initiatives identified as important to reducing on-site fossil fuel combustion fall under the Opex budget, as shown in the chart below.

Measures to Reduce On-Site Fossil Fuel Combustion	Primary Public Funding Type
Install low flow fixtures	Expense
Air sealing around room air conditioners	Expense
Closing shaft vents for elevators/stairs	Expense/Capital*
Steam distribution upgrades (master venting, trap/vent maintenance, room by room controls)	Expense/Capital*
Optimize existing boiler controls	Expense/Capital*
Roof insulation and sealing for smaller buildings	Capital
Replace windows at end of useful life	Capital
Right size boiler at end of useful life	Capital
Roof insulation and sealing at end of useful life for larger buildings	Capital
Investment in operations and maintenance	Expense
Commercial: Install Local Tankless DHW	Expense/Capital*
Install ASHP DHW heater for 50% of load (limit to applicability in portfolio)	Capital

**If projects are wrapped into larger rehab projects, they may be capitalized.*

How DCAS selects projects

Historically, DCAS has funded agency retrofit projects on a standardized, competitive basis. Agencies submitted grant proposals once or twice per year, and projects typically had to be completed in either the year the funding was awarded or during the subsequent year.

DCAS is implementing a new Deep Energy Retrofit Program to scale energy efficiency project implementation. This non-competitive funding opportunity was developed to support the climate goals outlined in Executive Order 26. It is meant to complement existing DCAS programs while helping to expedite additional projects and better align upgrades with agencies' capital plans.

The new program solicits information from agencies about the need for various types of energy efficiency measures, as identified by the Mayor's Technical Working Group and DCAS. The measures, listed on the following page, largely fall into two categories: (1) measures where sufficient data removes the need for a competitive grant application (for example, lighting upgrades or steam trap replacements), and (2) measures that would not typically qualify for DCAS's competitive grant programs, but that are necessary to achieving 80x50 (for example, building envelope work).

Category 1 / Quick Implementation Measures		
1	Lighting System Upgrades	
	1.1	LED Lighting Upgrade
	1.2	Occupancy Sensors
	1.3	Lighting Controls
	1.4	Daylight Controls
2	HVAC Controls	
	2.1	Heat Timer & Boiler Controls
	2.2	Balance Air/Water Systems
	2.3	Ventilation Controls
	2.4	Economizer Controls
	2.5	Thermostat Upgrades
	2.6	Control Valves
	2.7	Pneumatic to DDC Control Upgrades
	2.8	Damper Upgrades
3	Heating & Cooling Systems	
	3.1	Domestic Hot Water Heaters
	3.2	Steam Traps Replacement
	3.3	Thermostatic Radiator Valves Upgrades
	3.4	Tanks & Pipe insulation
	3.5	Burner Replacement
	3.6	Condensate Heat Recovery
4	Electrical Upgrades	
	4.1	Electric Motor Upgrades
	4.2	VFDs Installation & Replacement

Category 2 / Advanced Measures		
1	Envelope	
	1.1	Wall Insulation
		Roof & Attic Insulation
	1.2	Window Upgrades
2	HVAC Controls	
	2.1	BMS Upgrades
	2.2	Demand Control Ventilation
	2.3	Constant Volume to Variable Air Flow
3	Mechanical Equipment	
	3.1	Air & Ground Source Heat Pumps
	3.2	Variable Refrigerant Flow Systems
	3.3	Cooling Tower
	3.4	Chiller Reconstruction
	3.5	Air Handling Unit Upgrades
	3.6	A/C Units & Split Systems
	3.7	Fuel Conversion Oil/Gas/Electricity
	3.8	Boiler replacement
	3.9	Pumps & Fans
	3.10	Compressors

Assessment:
As noted, New York City has publicly pledged to reduce energy consumption in its own portfolio 20 percent by 2025. By applying the pledge to buildings over 10,000 square feet, the city will also be capturing many more buildings than the private sector. Formalizing this pledge into law is all that's needed.

A commitment by city buildings to an earlier energy reduction timeline will provide cost clarity and promote market development by driving demand for energy efficiency products and services. But for the private sector to fully benefit from the city's leadership, DCAS should publish case studies on a variety of projects and pilot novel techniques that are likely to be applicable to the private sector.

Achieving these goals necessitates more resources for DCAS given the city's diverse building portfolio, small pool of contractors, and higher cost structure than the private sector. Those resources should include more project management resources, and possibly construction management and commissioning resources as well. The variance within its portfolio means that more specialized energy management is required to meet the specific needs of each building type. Similarly, DCAS requires more resources for energy efficiency projects due to the higher administrative requirements for public projects. Additional project management resources may also create opportunities to bundle similar small projects that would normally fall into the expense category, into larger capital projects.

Typically, DCAS requires that contractors supplying energy efficiency services perform measurement and verification (M&V) on their own projects. In many cases the contractors are not familiar with the procedures, and even if they are, there is an inherent conflict of interest. The same issue arises, for example, with commissioning, and is resolved by requiring independent commissioning agents at least in larger projects. DCAS should hire and support independent M&V firms, at least for larger projects.

NextGen: NYCHA's sustainability agenda

NYCHA provides an instructive example of New York City government commitments. Under the NYC *Roadmap to 80x50*, NYCHA, which provides housing for more than 400,000 New Yorkers in its public housing portfolio, has pledged to reduce the energy used per square foot in its buildings 20 percent by 2025. Their 10-year NextGen NYCHA Sustainability Agenda includes strategies for portfolio-wide energy efficiency upgrades, smart buildings technologies, and deep, whole-building retrofits for specific buildings. NYCHA plans to attract $300 million in private capital through energy performance contracts, which will fund upgrades for large scale retrofits. For small buildings and scattered sites, NYCHA will leverage New York State and utility-run efficiency programs to reduce energy use and secure $30 million in public and private incentives by 2025. All new NYCHA construction projects will be required to conform to the New York City-specific requirements outlined as Enterprise Green Communities Criteria, while substantial and moderate rehabilitation projects will also be required to meet new energy standards. NYCHA will also work with HPD and HDC to require or encourage ultra-low energy buildings when considering requests for proposals to develop housing on unused NYCHA properties. DCAS should explore whether a similar, comprehensive agenda would add value beyond its Deep Energy Retrofit Program.

11 Let Owners Trade Efficiency

I. Summary

Issue:
Every building has a different cost for energy savings. Allowing buildings to bundle together or trade efficiency "credits" would give owners flexibility and reduce the cost of cutting carbon.

Recommendation:
Develop an optional efficiency trading program, enabling owners to reach their energy reduction targets by buying energy savings from upgrades in other buildings. Consider providing greater credit for efficiency improvements in the nonprofit and affordable housing sectors.

II. Proposal

NYC's Department of Buildings, in consultation with the Mayor's Office and a stakeholder advisory group, should develop an efficiency credits trading program via rulemaking. This program would serve as an alternate compliance path to energy use reductions. Key parameters of program development should include:

- Investigation of how best to implement and monitor a trading scheme that meshes with the city's building stock and emissions reduction goals;
- Evaluation of the successes and challenges of existing trading schemes and incorporation of best practices;
- Exploration of opportunities to use energy efficiency credits to reward or support policy aims, such as:
    - Reductions made in affordable housing properties, nonprofits, and/or communities with poor air quality; and
    - High or early performance on energy use reduction targets; and
- A final determination that a trading program is feasible, effective and will not exacerbate environmental justice issues.

III. Supporting Information

Expanded Issue:
Most environmental issues, such as acid rain, can only be solved through the actions of many private-sector actors. A widely used policy tool for cost-effectively addressing pollution from multiple sources is the tradable permit. Under such a system, individual actors must achieve targets based on an overall policy goal, such as reducing total sulfur dioxide emissions by a certain amount to prevent acid rain. Tradable permit programs have been developed for stormwater, carbon, and other pollutants.

In any complex system, it will cost some entities less than others to reduce an output, and some may be able to cost-effectively decrease emissions or energy use below their individual targets. Tradable permits allow these low-cost excess reductions to be sold as "credits" to other regulated entities that did not meet their targets. A tradable permit market allows actors to decide whether it is most cost effective to (1) go beyond their target and sell the excess, (2) meet their target, or (3) not meet their target and instead purchase credits to comply. In this way, the aggregated societal goal is met by using the power of the market to find the lowest cost path for each individual actor, and therefore the system as a whole.

In the simplest case for building energy use, imagine an owner who maintains two adjoining properties. Both must cut their energy use by the same amount to comply with a city law. The owner performs energy audits of both buildings and finds that one building can cost-effectively reduce its energy use far below the target. On the other hand, due to differences in age, use, typology, equipment, or other factors, improvements to the other building are very expensive, making it cost-prohibitive to meet the target. If the owner is allowed to submit the two separate buildings as a package and show that the total energy reduction between them is the same as their individual requirements combined, the same energy reductions will be reached. But the owner will achieve the reductions at a lower total cost.

Tradable permits are the same concept extended to all regulated buildings. Energy efficiency credits would be tracked to ensure that required energy reductions are achieved in aggregate across the stock of regulated buildings, whether that is within a specific portfolio or through a broader credit-trading market.

Tradable energy efficiency credits have been successfully applied in multiple jurisdictions. See the Additional Resources section at the end of this proposal for more detailed information:

- Tokyo has a cap-and-trade program for carbon emissions from its largest buildings. Established in 2010, the program sets an overall cap on the emissions from the 1,300 largest facilities in Tokyo. Each building is required to reduce emissions by a fixed percentage during five-year compliance periods. However, buildings can trade emissions reductions with others if it's cheaper than meeting the cap in their own facility. In the first compliance period (2010-2014), emissions from the covered facilities were reduced by 25 percent.

- In Connecticut, a market for tradable energy efficiency credits (originally based upon the state's structure for supporting renewable generation projects) has been operating since 2007. Under the system, energy efficiency improvements are measured and verified, and energy efficiency certificates are created, sold, and tracked for compliance. Most certificates in Connecticut are purchased by electric utility providers to meet state energy efficiency portfolio requirements.

- The Regional Greenhouse Gas Initiative (RGGI) is a trading program developed by and administered by nine northeast US states, including New York. The RGGI "CO_2 cap" established a regional CO_2 budget for the electric power sector, which ratchets down each year and is adjusted periodically through a multi-state process. Since 2009, electric power producers have traded emissions allowances.

- While not linked to energy efficiency, New York City already has an analogous program: air rights. Each building lot is granted air rights, equivalent to a “cap” on use of above-ground air space. Unused air space can be sold to another parcel to enable the receiving property to develop beyond its nominal cap. In place since 1961, this type of mechanism is well understood by the NYC financial, real estate, and regulatory community.

It is probably beyond the city’s authority to require all building owners to participate in a tradable permit program, which likely requires state authorization. However, preliminary legal consultations suggest that if building owners are regulated to meet building energy reduction targets, the city does have the ability to allow owners to incorporate a trading program as an alternate means of compliance.

To be successful, a tradable permit program will need to be closely monitored. For instance, if the cost of credits is too high or too low, credits won’t be useful to building owners or to the program’s goals. Washington D.C.’s tradable stormwater credit market has addressed this by creating an initial “price lock program” to incentivize the development of tradable stormwater retention volumes.

Assessment:
Several key features are necessary for an effective tradable credit program. These features can be grouped into three main categories: (1) criteria for participation, (2) validity and credibility of the scheme, and (3) successful implementation. The city will need to investigate how best to develop, implement and monitor a trading scheme that meshes with NYC’s building stock and emissions reduction goals.

The city should consider participation criteria for the program:

- Is participation in the market limited to buildings on the covered building list? Or can credits be purchased from buildings outside the list? (Tentative recommendation: limit to the covered building list.)
- Should buildings have to meet certain minimum reduction levels or prescriptive compliance items (perhaps Local Law 87 retro-commissioning requirements) before being allowed to buy permits? (Tentative recommendation: require minimum reduction levels.)

The city must consider how to maintain the validity and credibility of the trading program:

- How are energy savings verified to enable reductions beyond the required level to be credibly sold as tradable permits? Is there third-party measurement and evaluation, or may owners sell credits per self-reporting or affidavit? (Tentative recommendation: third-party verification.)
- How can arbitrage and gaming be limited to the greatest extent possible? (Tentative recommendation: encourage early action while including a thoughtful credit resell policy or mechanism; for example, to prevent bigger players from generating or purchasing credits early to sell to less savvy consumers at an increased price, incorporate a price floor, limit purchase amounts, limit credit transactions, or enact similar measures.)
- Should the trading program be timed such that building owners are not incentivized to implement only low- and no-cost measures and delay larger retrofits? (Tentative recommendation: have the trading program begin at the first compliance date. The

transferable savings should be from upgrades beyond what would have been legally required.)

- Feasibility and impact studies should investigate whether, under intra-portfolio trading, building owners are more likely to focus efforts on their most expensive buildings, while ignoring other low-performing buildings, or target less expensive upgrades in low-performing buildings, as this proposal intends.

The city must consider how to successfully implement the program:

- How can the plan be made as simple as possible to administer, enforce and verify, in order to maintain a robust market with meaningful price signals? (Tentative recommendation: address this during program development and planning.)
- Could third-party service providers serve as aggregators and take responsibility for compliance? (Tentative recommendation: allow this practice.)
- Can this marketplace be used to support efficiency in nonprofits, affordable housing, certain neighborhoods, or other sectors where increased benefits are desired? (Tentative recommendation: allow credits that have been purchased by bigger market players but that are pledged to energy efficiency retrofits in specified sectors to be eligible for a credit multiplier or weight. This could incentivize investment in buildings that need more help financing energy efficiency measures.)
- Are creative financing mechanisms needed to facilitate trading across property types? (Tentative recommendation: explore financing mechanisms during program development and planning.)

Over the long term, a tradeable efficiency credit program could be a transformative element of a building energy reduction policy. Stakeholder input is essential to addressing the many complex issues and challenging questions of design and implementation noted above. In developing the program, the city should be informed by an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

Sources:

Successful tradable permit programs for the city to investigate include:

- NYC air rights trading (airrightsny.com)
- US EPA acid rain program (wikipedia.org/wiki/Acid_Rain_Program)
- Tokyo buildings program (kankyo.metro.tokyo.jp/en/climate/cap_and_trade/index.html)
- Washington DC storm water credit program (doee.dc.gov/src)
- Regional Greenhouse Gas Initiative (rggi.org)
- Connecticut white tag program (e4thefuture.org/wp-content/uploads/2016/09/State-View-Harnessing-Tradable-Credit-Markets.pdf)

12 Include Flexibility to Buy Green Power

I. Summary

Issue:
Financing cycles, equipment life and tenant turnover may make 2030 compliance especially challenging for some buildings. Allowing owners to defer some energy savings by buying green electricity would provide helpful flexibility. But not all green power is created equal. If used, it must not undercut efficiency as the top priority.

Recommendation:
Allow owners to buy new, additional green power to defer a small portion of their required energy savings. Limit the option in quantity and duration, and prioritize New York green power.

II. Proposal

Permit buildings to offset a small percentage of their energy reduction through the purchase of green power that:

- Is regional (within the NY Independent System Operator, or NYISO), verifiable, does not duplicate existing requirements, and is limited in quantity and duration
- Represents a certain percentage of the building's energy usage, to be determined in the legislative process or rule-making.

III. Supporting Information

Expanded Issue:
Energy efficiency is the primary focus of the *Blueprint for Efficiency*. But efficiency targets that are feasible for most buildings may present unique challenges for some. We hope to correct for differences in space use and other relevant factors with the NYC Energy Metric (see *Proposal 2: Use a Made-in-NYC* Metric). But what about other situations?

For instance, it doesn't make sense for a building scheduled for demolition in 2031 to make energy efficiency improvements by 2030. Or a commercial building's tenant leases may extend past 2030, making it very challenging for a commercial owner to implement many retrofits. A building's refinancing may not fall until 2030, meaning it's difficult to find inexpensive loans. Perhaps a building's retrofit measures may slightly under-deliver on anticipated savings.

One option for creating flexibility in situations like these is to enable buildings to offset some energy efficiency improvement through the purchase of green power.

Green power purchasing mechanisms

There are two core structures for purchasing green power: renewable energy certificates and power purchase agreements.

- **Renewable energy certificates (RECs)**: RECs, also known as “green tags,” “green certificates,” and “renewable energy credits,” are tradable instruments that can be used to meet voluntary renewable energy targets, as well as to meet compliance requirements for renewable energy policies. A REC is a certificate that represents the generation of one megawatt-hour (MWh) of electricity from an eligible source of renewable energy. Each REC denotes the underlying generation energy source, location of the generation, year of the generation (a.k.a. “vintage”), environmental emissions, and other characteristics associated with the generator. RECs represent a claim to the environmental attributes associated with renewable energy generation.

- **Renewable Energy Power Purchase Agreement (PPA)**: A bilateral contract (typically 10-20 years long) between a renewable power generator (seller) and a power purchaser (buyer). PPAs can be direct (physical) or financial (virtual).

- In a direct PPA, energy is “physically” delivered to the buyer, with the seller delivering the power to the grid (buyer must be located in the same grid) and the buyer paying the seller directly for the electrons at an agreed-upon price per kWh. In this situation, a project developer handles the financing and installation of the energy source, such as solar, and the building owner enters into a relationship with the developer.

- In a financial (virtual) PPA, energy is delivered to the grid and the seller receives the wholesale market price. The buyer pays the seller an agreed upon PPA offtake price (essentially a purchase of future production) for the generated energy, but also continues to buy energy from the grid. If the wholesale market price is more than the PPA price, the seller pays the buyer the difference (and vice versa). A virtual PPA is essentially a financial hedge, often referred to as a contract-for-differences, or a fixed-for-floating swap.

  Virtual PPAs offer more flexibility than direct PPAs, as the buyer and seller do not need to be located in the same grid region. In both cases, buyers can opt to purchase the bundled energy and RECs (in order to claim the environmental attributes) or can unbundle the RECs and solely purchase the energy.

Not all green power is created equal

Various factors impact the degree of the green power’s benefit to the environment, the grid and local air quality:

- **Geography**: The location of the renewable generation. Renewable power can be generated from a solar array within the five boroughs, across the country at a wind farm in Kansas, or somewhere in between. In general, power produced regionally has higher benefits, but green power development within the boundaries of New York City faces substantial cost and space constraints.

- **Additionality**: The concept of additionality addresses causation. That is, did the purchase of green power cause new generation to be built? Would this renewable project have been built without the green power purchase? An alternative compliance option needs to ensure that RECs or PPAs support new renewable power development and do not involve the purchase of renewable power that has already been used for compliance purposes in other programs (e.g., New York's Clean Energy Standard or "CES").

- **Term Length**: RECs can be purchased for already-generated energy on a spot market, on a one-year basis, but they can also represent yet-to-be-generated renewable energy (through forward-market purchases of RECs or a PPA commitment).

- **Renewable Technology**: There are many renewable energy sources, some considered "greener" than others. Existing Renewable Portfolio Standards have made the distinction between Tier 1 and Tier 2 renewables, and NYSERDA has defined eligible technology types for Renewable Energy Standard compliance as part of New York's Clean Energy Standard. For example, wind and solar qualify as Tier 1 renewables, while certain kinds of biomass, biogas, and hydro do not.

- **Certification**: Third-party audits and reviews of renewable energy generators and REC sellers can protect consumers by monitoring chain of custody and ensuring RECs are not "double counted" (i.e. two parties are claiming the same environmental benefits of the generated energy).

Rewarding green power purchases

LEED and Energy Star include mechanisms to encourage green power purchasing.

- **LEED v4**: LEED awards projects up to three points if between 5 and 20 percent of a project's annual energy comes from on-site renewables. LEED also offers up to two points toward green power and carbon offsets in the Energy and Atmosphere category. Project teams seeking this credit are required to purchase 50 percent (one point) or 100 percent (two points) of their power for a minimum commitment of five years. If the project is in the United States, green power and RECs must be Green-e Energy certified. RECs may not be used to offset Scope 1 emissions; instead, a separate carbon offset mechanism is required.

- **Energy Star**: Energy Star allows buildings to enter on-site renewable energy generation and offsite green power purchase into Portfolio Manager. On-site renewable energy generation must be split into power consumed on the property and power exported to the grid. Renewable power that is generated and consumed on-site will have a favorable impact on the property's Energy Star score. Energy Star strictly prohibits users from assigning on-site renewable energy meters as "green" if the owner has sold the RECs associated with the energy production. Green power produced on-site with retained REC ownership will lower the source energy and GHG emissions footprint of the property, as well as increasing the Energy Star score. Once the RECs are sold, the property owner loses these benefits. When offsite green power purchases are entered into Portfolio Manager, it has no impact on the site energy, source energy, or Energy Star score of the property, but has benefits to the emissions calculation for the building.

Assessment:
To align with the overall goals of the *Blueprint for Efficiency*, this alternate compliance path should ensure that the green power is regional, verifiable, does not duplicate existing requirements, and is limited in quantity and duration. Green power should not be a “cheap” way to achieve compliance, but rather an alternative to be used under extenuating circumstances or when other options are exhausted. Regional should mean the NYISO. Anything more local, such as Zone J and K, or within the five boroughs, would effectively eliminate green power as a viable alternative path because the substantially higher cost associated with large renewable projects in NYC would limit availability. Green power should also be certified by Green-e (or equivalent), following the example of LEED.

LEED provides a rigorous standard for both on-site generation and green power purchasing. The LEED program only awards credits when a property makes substantial commitments to green power. The same terms—50 percent or 100 percent renewably-powered, with a five-year commitment—should be considered for NYC.

Buildings that meet the green power thresholds would be rewarded with a reduction in their energy target (targets are discussed in *Proposal 5: Require Less Energy-Efficient Buildings to Reduce More*).

Finally, the green power purchases and on-site generation could be documented in Energy Star Portfolio Manager to enable tracking and yearly reporting, in line with existing city laws (e.g., Local Law 84). While it’s not entirely specific on the type of green power purchased, using Portfolio Manager would leverage a relevant and widely-familiar platform to house the data.

Measuring and Verifying Compliance

REC purchases/retirements could be tracked within New York Generation Attribute Tracking System (NYGATS), an online certificate-tracking system administered by NYSERDA that records information about electricity generated, imported and consumed within New York State. NYGATS serves as the platform for Renewable Energy Standard (RES) Tier 1 certification under New York’s Clean Energy Standard and tracks RES and ZEC (Zero-Emissions Credits) compliance. NYGATS can be further expanded to track compliance with the alternate compliance option, ensuring all REC purchases/retirements are not double-counted across the various regulatory programs in New York State.

Pricing

REC pricing and PPA terms would be determined by the market. RECs can be purchased bundled with electricity from a third-party supplier and/or Con Edison, or they can be purchased unbundled from a marketer/broker. PPAs would be offered by and negotiated with renewable energy project developers.

Developing an effective green power purchase compliance option will require addressing the many complex issues of program design discussed above in greater detail. Stakeholder input will be critical in developing this option and the city's efforts should be informed by relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

Sources:

US Department of Environmental Protection (2010). Guide to Purchasing Green Power. Retrieved from www.epa.gov/greenpower/guide-purchasing-green-power

US Environmental Protection Agency (2013). EPA Energy Star Policy on Green Power. Retrieved from https://portfoliomanager.energystar.gov/pdf/reference/Green%20Power.pdf

US Green Buildings Council. LEED v4 Renewable Energy Production. Retrieved from www.usgbc.org/credits/neighborhood-development-plan-neighborhood-development/v4-draft/gibc-5

13 Encourage Beneficial Electrification

I. Summary

Issue:
To achieve 80x50, buildings must reduce their fossil fuel consumption and eventually begin using electricity for heating and hot water. Electric heat pumps are a likely solution. High electricity prices make them more expensive to operate now, but early adopters can help pave the way for taking them to scale.

Recommendation:
Encourage heat pump pilots and installations by reducing the energy savings requirement for buildings that convert to high-efficiency electric heat and hot water systems.

II. Proposal

Reduce a building's source energy reduction requirement for the installation of high-performance electric water or space heating.

For heating equipment to qualify, set a minimum threshold for performance, based on New York City winter design conditions and updated over time:

> *"High performance" means water or space heating equipment with a high coefficient of performance (COP) in New York City winter design conditions (down to 25° F), as determined by the Commissioner every three years based on an assessment of the availability of devices with such COP. In determining what constitutes high performance, the city should give significant weight to thresholds utilized in NYSERDA and utility incentive programs. In any event, the COP must be above 2.5.*

Determine additional parameters through consultation with relevant stakeholders, either during the legislative process or subsequent rulemaking. Include:

- Potential installation thresholds to qualify, such as:
    - High-performance electric water heating, providing a minimum of approximately 3 to 6 kBtu/sf; or
    - High-performance electric space heating for a minimum percentage of all occupied spaces in the range of 80 to 95 percent.

- The mechanism and magnitude of the reduction in energy savings requirement. Options include a flat percent reduction in a building's requirement based on future emissions benefit (e.g. 50 percent) or a reduction based on the percentage of a building's source energy that is electrified.

III. Supporting Information

Expanded Issue:

Why Building Electrification?

Analyses by Urban Green Council and the City of New York outline three essential steps to achieving 80 percent carbon reductions by 2050: (1) reduce energy demand in buildings through increased efficiency, (2) shift building heating and hot water systems from burning fossil fuels to using electricity ("building electrification"), and (3) green the electrical grid.

Energy efficiency (1) has been in the policy crosshairs for decades and is the focus of the Building Partnership's work. While a hard slog, we are making progress: in New York City, energy use in large buildings declined ten percent from 2010 to 2015. And increasingly stringent state and city energy codes will continue to push improvements.

Likewise, Renewable Portfolio Standards for utilities continue to be adopted around the country. New York State is aiming for 50 percent renewable energy by 2030 under the Clean Energy Standard, which tackles (3).

By comparison, building electrification (2) is in an embryonic state. The math behind 80x50 shows that it needs to happen, but how it will happen is highly uncertain. Appropriate technologies exist and are being improved constantly, but there is almost no experience when it comes to their deployment in existing New York City buildings (though the path is less uncertain for new construction).

What are heat pumps?

Shifting heating and hot water from fossil fuels to electricity means transitioning those systems to use heat pumps. There are other ways to generate heat from electricity—the simplest (electric resistance) means converting the energy directly into heat—but they are vastly less energy-efficient.

Heat pumps work by moving heat; they are effectively air-conditioning units that work in two directions. (The heat that air conditioners kick outside can also be brought inside.) In the winter, heat pumps extract heat from the outside by running refrigerant through that air at even colder temperatures. Doing so uses far less energy than electric resistance.

Heat pumps can draw their heat from the ground, water, or air. In dense areas like Manhattan with crowded underground infrastructure, air is typically the most practical option for existing buildings, but ground source heat pumps are operating at several sites and may be more viable in new construction.

Heat pumps save carbon now, but cost more

There is some misconception that heat pumps will only reduce carbon emissions once the electric grid becomes cleaner. That is not so. Properly installed and operated heat pumps will save carbon even with the current grid because they are more efficient than fossil fuel-based systems.

The greater challenge for heat pumps is their cost, especially for heating. Replacing a building's heating system with heat pumps will cost in the range of ten times more than retrofitting the existing system to achieve the equivalent efficiency improvement. The capital cost of replacing water heaters with heat pumps is about on par with energy efficiency retrofit work.

However, heat pumps cost much more to operate given the current relative costs of electricity and natural gas in New York City. In the few buildings that have installed heat pumps for heating, tenants are generally paying the operating costs, either through lease terms or because they are condos or coops. Building owners that cannot pass along these costs are unlikely to install heat pumps.

The New York City grid will benefit from heat pump deployment for years

In NYISO Zone J (NYC), total electrical demand currently peaks in the summer at about 11,000 MW, driven largely by air conditioning. Building electrical demand peaks at about 8000 MW. However, the city has a "utilization factor" of only about 50 percent, meaning that the average load is about one-half the peak load and the minimum load is even smaller. Because these smaller loads occur during cooler weather, the capacity to supply electric power to heat pumps for winter heating loads is already present, with grid infrastructure built to meet summer peak loads. Making better use of this system by increasing winter loads will lower distribution costs, since they can be spread over more kilowatt-hours. So, installing more heat pumps over the next 20 to 30 years would actually make the grid work better. (The same heat pumps can supply cooling in the summer and help to relieve peak summer electric grid strain, as they would replace older and less efficient PTACs and window air conditioners.)

However, the party will not last forever. Urban Green Council's *90 by 50* report found that buildings could operate on electric energy comparable to what is used today after reducing energy consumption 50 to 55 percent (through envelope and other efficiency improvements) and changing all heating and cooling to heat pumps. However, the peak load due to buildings would be 50-60 percent higher than today and would occur on cold winter nights.

But such an extreme outcome is unlikely and avoidable. Thermal storage within buildings, in water or phase-change materials, can shift much of the load to the daytime and smooth the peak. And the modeling used in *90x50* assumed a 100 percent conversion to heat pumps – if some gas-fired heating is retained, as it likely will be, that will help. Even after these steps are taken, there will eventually be an increased peak, and we will have to find a solution. In the meantime, heat pumps can smooth the load curve and improve the performance of the distribution grid.

Assessment:
Any policy to encourage building electrification must balance the following considerations:

- It eventually needs to happen to achieve 80x50.
- Heat pumps are expensive and only very cutting-edge owners are likely to install them in retrofits. When it comes to heating, installation is only likely to occur when tenants pay operating costs.
- This is very new territory. Heat pump technology and experience (particularly when used in cold weather and large buildings) are in early stages.
- The grid is not equipped to manage a winter peak from heat pumps.

These factors counsel strongly against any medium-term *requirement* for building electrification. At the same time, the cost and novelty of heat pumps should assuage any concern that by 2030 heat pumps might be deployed at sufficient scale to create winter grid challenges.

And when buildings do install heat pumps, it’s important that they also improve energy efficiency.

To balance all of these factors, there should be an incentive for buildings to electrify heating and hot water. It should work within the structure of the *Blueprint for Efficiency* and should not exempt any building from meeting energy efficiency targets. Still, given the cost of heat pumps, that incentive will need to be substantial.

The efficiency threshold must be paired with an outdoor temperature

As indicated above, the system efficiency threshold to qualify for any incentive must be set according to a specific NYC winter outdoor temperature. High-quality and high-performance equipment has higher COPs at colder outdoor temperatures. Lower-quality equipment will essentially revert to electric resistance heating at colder temperatures. The NEEP cold climate heat pump standard is the optimal reference for mini-split type equipment, requiring a COP of 1.75 at an outdoor temp of 5° F. But this standard is not perfectly translatable to some technologies, including Variable Refrigerant Volume or air-to-water heat pumps, so the definition of high performance recommended above includes some flexibility for developing specifications.

What technology should be included or limited?

The source of heat transferred in a high-performance electric water or space heating system is a critical factor in determining eligibility for incentives. NYSERDA’s determinations on “renewable heating” are instructive; they consider the following to be “renewable heating”:

- Air source heat pumps that pull Btus out of outdoor air; and
- Water source heat pumps that pull Btus either from a ground loop or out of a process waste stream (such as condenser water being sent to a cooling tower)

On the other hand, NYSERDA does not consider renewable heating to include water source heat pumps that pull Btus out of a loop that is heated by boilers. There is some confusion in the industry about this type of system because it uses heat pump terminal units that have been configured for use in a different system. Such a system is more accurately termed a “boiler source heat pump,” simply transferring Btus from a boiler to a space. The legislation should not include this form of system conversion in any incentive.

There are also a number of considerations around which systems might be best suited for use in New York City, such as mini- and multi-split systems (which are relatively small and sized for one house or apartment) and Variable Refrigerant Flow systems (which have a central larger outdoor unit and multiple individual room indoor units). Ultimately, legislation should not “pick winners,” but instead leave determinations of the most viable strategies (within certain efficiency requirements) to the market.

How should installation thresholds be determined?

An installation threshold is necessary to ensure that the beneficial electrification incentive only kicks in for substantial heat or hot water system conversions.

One approach would be to set threshold requirements based on the water or space heating capacity of the installation. For example, as noted above, such requirements could be set as:

- High-performance electric water heating, providing a minimum of approximately 3 to 6 kBtu/sf; or
- High-performance electric space heating a minimum percentage of all occupied spaces in the range of 80 to 95 percent.

This approach would provide clear guidelines to qualify for the reduced energy target. It would also ensure that the incentive would only apply to full, rather than supplementary, installations of high-performance water and space heating systems.

On the other hand, these installation thresholds might need some variation. For example, in commercial buildings the electrification of hot water systems or partial electrification of heating systems might not hit the thresholds above. These details should be addressed through additional consultation with relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

How significant should the reduction in requirements be?

Various approaches could be used to determine the size of the reduction in a building’s energy target. One approach would be to set a flat percent reduction in the energy savings target for buildings where installations meet the performance and size thresholds. This reduction would need to be determined with the higher cost of heat pumps in mind.

The reduction could also be based on an estimate of the resulting reduction in greenhouse gas emissions given a future, cleaner grid scenario. Using this basic methodology, a rough calculation of the emissions savings from a conversion to high-performance electric water heating in a typical multifamily building suggests a 50 percent reduction would be appropriate.

Different systems are responsible for differing amounts of energy use across building types. For example, space heating is responsible for a more significant portion of energy use in multifamily buildings than in offices. Because of this variety, it might be more appropriate and effective to tailor the reduction incentive to relevant criteria. For example, reductions to the energy requirement could vary for (i) hot water system conversions, (ii) space heating system conversions, or (iii) a combination of both. With this approach, conversions of systems using greater energy could generate a larger credit.

Another approach that might achieve this objective would be to use a sliding scale based on the percentage of a building's source energy that is electrified, subject to the minimum installation threshold and a maximum incentive percentage. Based on the analysis in the *NYC Energy and Water Use Report*, a qualifying high-performance installation in the average multifamily building could generate approximately a 45 percent reduction in the requirement, while a hot water system conversion could generate about a 20 percent reduction.

With these considerations in mind, the details of the mechanism and magnitude of the reduced requirement should be developed with additional stakeholder consultation, as outlined in *Appendix 3: Advisory Committees*.

Sources:

New York Independent System Operator (2018). Load Capacity Data Report Gold Book, p. 14. Retrieved from www.nyiso.com/public/webdocs/markets_operations/services/planning/Documents_and_Resources/Planning_Data_and_Reference_Docs/Data_and_Reference_Docs/2018-Load-Capacity-Data-Report-Gold-Book.pdf

Peak Power LLC. Analysis retrieved from www.peakpowerllc.com/notes/2015/2/17/whats-the-problem-with-peak-demand

14 Cap the Efficiency Credited to New Cogen

I. Summary

Issue:
Cogen plants generate electricity from natural gas and then use exhaust heat that is normally wasted. It's a carbon benefit whenever the downstate grid is "dirty." Once the grid is clean, burning gas on site will mean more emissions than electricity from the grid. Investment in new cogen should be valued now, but not at the expense of building efficiency.

Recommendation:
Limit the amount of new cogen that counts toward reduction requirements. Develop rules that require metering for new cogen and a transparent calculation for the efficiency credit. If a fossil fuel cap is included, exempt gas burned in cogen plants in the near term. But end that exemption once gas no longer dominates the downstate grid.

II. Proposal

Specify that no more than 30 percent of a building's 2030 source energy reduction be achieved through the installation of new cogen systems. Develop rules for implementing this requirement, informed by an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

Rules should include:

- A requirement that new cogen installations be filed and metered for electricity, gas and thermal output to enable efficiency measurements;
- A methodology for calculating the efficiency achieved by cogen installations for the compliance year; and
- A minimum threshold design efficiency requirement for cogen systems consistent with the threshold used for the NYSERDA Combined Heat and Power Program.

If the energy performance policy ultimately includes a fossil fuel cap, exempt some portion of the gas burned in cogen systems from that cap for a limited time, while gas is the marginal fuel or generating unit for the NYC grid. Set the details of this limited exemption through rulemaking, informed by the advisory committee.

Note: The "marginal" generating unit is the last one to have been brought onto the grid and the first to be cut back or turned off when demand is reduced. In NYC, this is generally a combustion turbine fired by natural gas.

III. Supporting Information

Expanded Issue:

Cogen and NYC greenhouse gas benefits

Cogen, or combined heat and power (CHP), refers the simultaneous generation of electricity and useful heat from the combustion of fossil fuels. CHP is widely regarded as a more efficient way to use natural gas to produce heat and power than the standard combination of utility generation and local boilers. Cogen also offers resiliency benefits, generating local electricity even when the grid is down. New York City currently has about 130 CHP installations, with a total capacity of about 130 MW. Because CHP is more efficient, it is often assumed to lower GHG emissions from buildings. This is true only to the extent that the grid power displaced has higher emissions.

With natural gas as the marginal generating fuel, New York City's current electricity supply has a high carbon intensity. In the near-to-medium term, new CHP installations will therefore offer carbon benefits, which are particularly important in light of Indian Point's planned closure, the timeline for incorporating renewables into the downstate grid, and uncertainty regarding new transmission capacity.

But in the long term, as carbon-free power is implemented on a utility scale, electricity from the grid in NYC will become less carbon-intensive than electricity from cogen. The exact timeline for this shift is uncertain. But analysis shows that reaching 80x50 requires both a significantly less carbon-intensive grid and a reduced reliance on gas-fired cogen. Since cogen infrastructure lasts 20 to 30 years, decisions over the next decade will have significant implications for the city's ability to achieve 80x50.

Cogen shouldn't come at the expense of building efficiency

In the context of the *Blueprint for Efficiency*, a significant concern with CHP installations is their potential to displace building efficiency upgrades between now and 2030. In other words, rather than install cogen systems in addition to implementing building efficiency improvements, some building owners might only install CHP to achieve compliance. This trade-off would impede progress toward 80x50, which requires substantial on-site efficiency improvements.

Market forces already incentivize cogen to some extent at the expense of efficiency in NYC, due to the high cost of electricity and the low cost of gas, as well as the comparative simplicity of installing cogen (at least for smaller, reciprocating engine systems) versus implementing a complex retrofit. With the source energy metric outlined in *Proposal 3: Measure Energy at Its Source*, energy performance requirements will weigh electricity savings higher than on-site fossil fuels, which will also tend to incentivize cogen.

Unchecked, these market forces, combined with a requirement to reduce source energy, could result in significant adoption of cogen with minimal efficiency improvements (and minimal beneficial electrification). This result could be increasingly likely as the compliance year approaches, with significant efficiency upgrades harder to implement in a narrow timeframe.

Assessment:

Limit the efficiency credit for new cogen

In light of these challenges, the performance metric should include an adjustment that balances the short and mid-term benefits of cogen against the long-range imperatives of 80x50, while ensuring that the energy reduction policy leads to significant efficiency improvements.

As outlined above, to address this concern the credit for source energy savings attributable to a new cogen system installation should be limited. The specifics of this limit and the methodology to attribute savings to CHP should be developed through rulemaking. Based on Building Partnership stakeholder discussions, the recommended portion of a building's 2030 requirement that can be achieved through new cogen installations should be limited to 30 percent.

Should the limit reference a minimum efficiency requirement?

NYSERDA's Combined Heat and Power Program, which provides incentives for new CHP systems, includes a threshold design efficiency requirement of 60 percent. Expert consensus suggests that industry is already exceeding this threshold, and so it may not be a meaningful requirement for many buildings. Still, alignment with state-level CHP programs will help ensure consistency for NYC owners. Such a requirement would also help avoid the installation of oversized systems.

Should the limit distinguish between CHP systems?

Different CHP systems have different efficiencies, emissions profiles and purposes. Microturbines (units from 20kW up to one or two MW) typically serve a single building. They often lower costs because gas is cheap, but they may not lower energy or carbon, and they don't respond to price signals because they run all the time.

By contrast, central plants that serve multiple buildings can ramp up and down to respond to price signals. These larger systems may have a different value. It will also be difficult to assign the energy and carbon content of the gas burned in a central plant to individual buildings. This issue, and the possibility of a different treatment for larger CHP systems, should be assessed further by an advisory committee of relevant experts and stakeholders, as outlined in *Appendix 3: Advisory Committees*.

A cogen exemption under a fossil fuels cap

The recommended primary policy structure is a whole-building source energy reduction requirement. However, as discussed in *Proposal 4: Combine All Building Energy in One Requirement*, the City Council may decide to supplement whole-building requirements with an additional cap on on-site fossil fuels for multifamily buildings. The rationale for this approach is to directly target GHG emissions and improve local air quality. Given the short and medium-term benefits of cogen, the energy reduction policy should provide some degree of exemption for gas burned in cogen systems until the grid is cleaner.

The question, then, is what schedule and scale of exemption for fossil fuels used in CHP is appropriate? CHP installations can take years to plan, permit and install. The exemption must allow owners and developers adequate time to plan rationally. The ideal timeline would encourage the development of CHP so that it can operate while it would reduce emissions, but not extend system life past that point, unless biogas becomes available.

The degree of exemption should take into account both the extent to which the CHP system lowers total GHG emissions and the fact that the building is burning fuel to make electricity. A significant exemption of this fuel from the on-site fuel cap may be reasonable as long as gas is the marginal utility fuel for the electricity grid, because that fuel would otherwise be burned by the utility to generate electricity.

On the other hand, a building with cogen is still burning fuel, and using at least some of the output for thermal loads. With this use in mind, a partial exemption makes sense: include gas that would have been used to satisfy thermal loads absent a cogen system, but exempt gas burned beyond that amount to avoid penalizing a building for producing its own electricity. To avoid detailed building-by-building calculations, a standard exemption could be set at approximately 50 percent of the gas used for cogen.

However, since cogen plants will have about a 20-year life (the ASHRAE standard for reciprocating engines, though some systems may only last 15 years), it is very likely they will survive into a time when gas is no longer the marginal fuel on NYC's electric grid all or most of the time. Cogen systems will then be contributing to increased GHG emissions. And partial or full exemptions for systems installed after 2025 will only increase this problem.

To address this concern, the energy reduction policy should include a phase-out for exemptions at a rate or time that reflects decreasing GHG emissions from grid electricity. The prescribed approach should be developed through rulemaking, on advice of relevant stakeholders. Considerations should include:

- Should the timeline be based on grid projections or simply pegged to the actual carbon intensity of the grid, leaving the risk to developers?
- Should the exemptions account for variations in efficiency or scope of CHP systems (e.g., including absorption chillers or not)?

One approach would be to set the exemption limit based on when GHG-emitting generators are marginal less than a specified number of hours. The city could project this or leave it to developers to make their own estimates, as they do now for future prices.

Supplemental Analysis of the Emissions Benefit of CHP Systems:

The value of CHP in reducing GHG emissions depends on the efficiency of the CHP system and on the emissions associated with the displaced source.

Substantial data is available on the efficiency of a number of CHP systems, including microturbines (50 – 500 kW) and reciprocating engines (50 kW – 10 MW). This discussion will be limited to two systems, a 100kW reciprocating engine with 26 percent electrical efficiency (which might be used in a multifamily building) and 1.0 MW, 43 percent electric efficiency system (which might be used in a hospital for both back-up and regular generation).

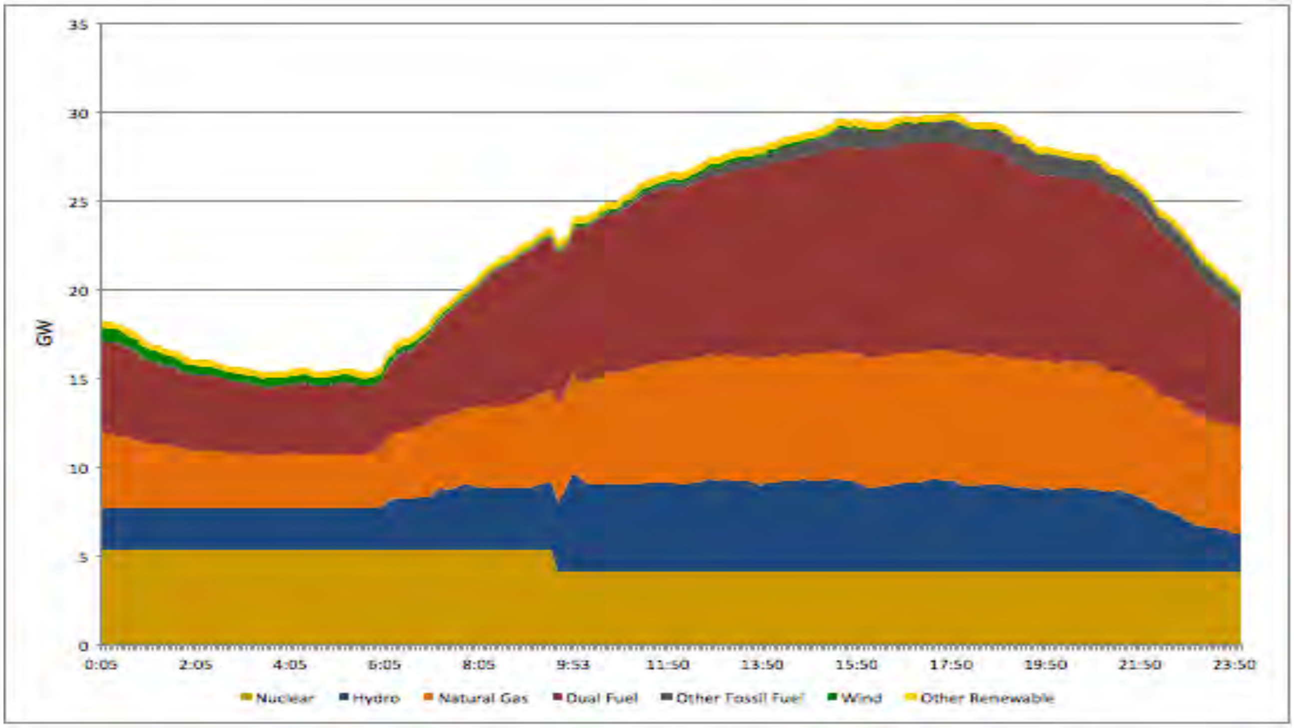
The more complex question is what GHG emissions are avoided when electricity produced by the CHP allows the grid to lower its output. The output to be lowered will be the electricity produced by the marginal generating unit, which is normally natural gas.

The present

Electric generators have two costs: the capital cost for construction and the operating cost incurred while generating. Once spent, the capital is a “sunk cost.” The owner must pay off the loans whether the unit runs or not, so a high capital cost creates an incentive to keep the unit running as much as possible. Operating costs include both personnel and fuel. A nuclear plant or a wind turbine has high capital cost and low operating cost, and strong incentives exist to keep it generating. Combustion plants have lower capital costs and higher fuel costs, especially if they are old and have low efficiency, so there is less impetus to keep them running.

The New York State Independent System Operator (ISO) manages the dispatch of these generators in the electrical grid. The ISO accepts bids from owners of generators to provide kilowatt-hours (kWh) of electric energy at a specified price and then brings the plants on line as needed to meet load, starting with the lowest-cost option. In today’s market, nuclear plants, hydro, wind, and solar all have low operating costs and are dispatched first, with fossil fuel plants being added as needed to meet the load.

This is an over-simplified picture, of course, omitting reliability constraints and the fact that transmission limitations make it difficult to bring power to NYC from hydro-rich upstate. The mix of fuels, although not what is called the “loading order,” is available from ISO for New York State as a whole, but not NYC. An example covering 24 hours is shown in below (again, this represents NY State, not NYC).



The "dual fuel" plants (in red) generally burn gas today but are capable of burning oil. The fuels are only partially in "loading order." Wind and solar are always used if available.

Frank Norcross at Related Companies has produced convincing evidence that gas is currently the marginal fuel in the more isolated NYC market and that it has been for the last ten years. His analysis indicates that either natural gas or "dual fuel" (gas or oil) or "other fossil" were varied in response to demand all day, so adding a CHP unit would have reduced the use of natural gas. (Had it reduced the use of dual fuel or "other fossil," the reductions in GHGs would have been larger, so the use of natural gas is a conservative way to estimate GHG emissions reductions due to CHP). The research also presents an estimate of the efficiency (heat rate) of the natural gas generators supplying the New York City market ("Zone J"), which could be used to assess relative GHG emissions.

Another option to assess the GHG impact of cogen in NYC would be to use the analysis from the New York City Greenhouse Gas Inventory. In its Appendix B, the Inventory describes a model developed to calculate the GHG emissions coefficient for electricity accurately. For the purposes of the Inventory, all that was needed was the average GHG coefficient across all generating units, and that is all they reported. For CHP analysis, the marginal GHG coefficients, as explained in the previous paragraph, would be required.

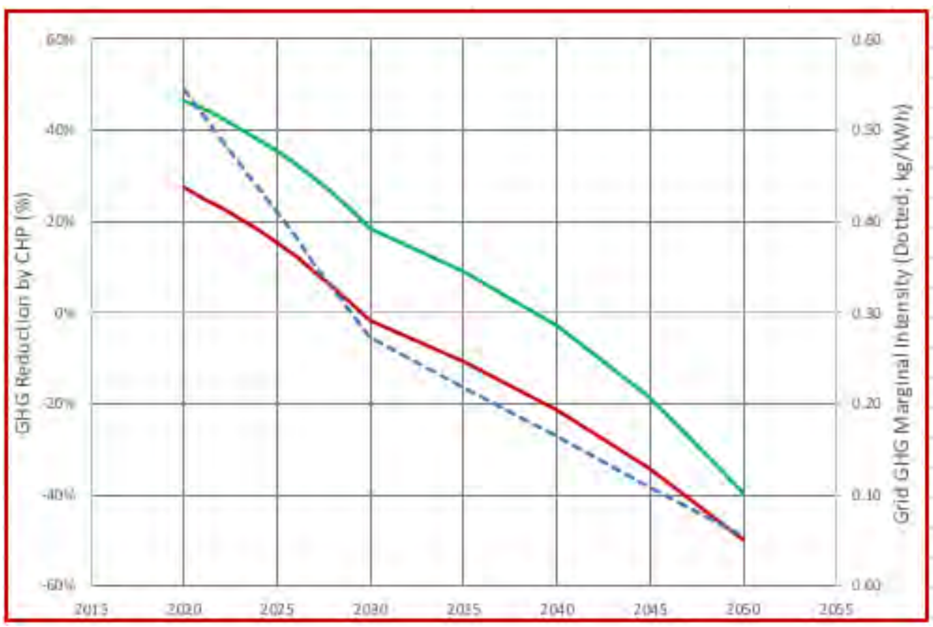
It's also worth noting that the 2016 report of the Mayor's Technical Working Group examined the value of CHP and found that, although there were clear-cut GHG savings from available CHP systems when measured against the 2005 grid's GHG intensity, the savings would become less clear going forward, as more carbon-free sources are added to the generation mix. This study underestimated the GHG savings potential by using the average NYC GHG emission intensity, rather than the marginal value. However, the basic point that a cleaner grid means fewer savings from CHP is clear. The question is how quickly the grid will become less carbon-intensive.

Overall, for current and near-term installations, it's a safe assumption that the marginal fuel for the New York City grid is natural gas. In that case, for current efficiencies for grid generation, CHP electric generation, and boiler production of hot water in the absence of CHP, CHP produces reductions of about 20-30 percent in GHGs over the standard combination of grid electricity and on-site boilers. For a large installation with absorption chillers the savings may be greater, but the analysis is more complex.

The future

New York State's Clean Energy Standard requires that 50 percent of the state's electricity come from renewable sources by 2030, while the Regional Greenhouse Gas Initiative (RGGI) aims to reduce GHG caps 30 percent by 2030. And locally, the reduction of GHG emissions associated with 80x50 can only be achieved given a dramatic decrease in emissions from electricity production.

The pace at which these reductions take place is critical: as emission-free generation expands, natural gas will cease to be the marginal fuel, at first for a few hours late at night, then for increasing periods of low loads. There will probably always be a need for some gas to meet extreme peak loads (even after 2050), but its role will be significantly diminished. As that happens, natural gas-fired CHP will become a source of increased GHGs rather than an improvement over grid electricity.



A Microsoft Excel version of this graph is available from rwleigh@earthink.net.

Given New York State's legislated goal of a 50 percent reduction in GHGs by 2030, a model based on this reduction was constructed for two CHP systems: a smaller, lower-efficiency system (such as would be used in a residential building), and a larger, higher-efficiency system.

The result, shown above, is that net GHG emissions for the low-efficiency system are neutral by 2030 and negative thereafter, while the high-efficiency system becomes GHG-neutral in 2038 or 2039, and GHG negative thereafter. If the state is less effective in cleaning the grid, (meaning natural gas is still the marginal fuel in NYC 50 percent of the time in 2040), the lower-efficiency CHP becomes GHG negative in 2033 and the high-efficiency unit in 2043. More parametric analyses are needed to fully assess this issue, as is a careful look at planning for the NY State grid and transmission into the NYC region (Zone J).

Uncertainties about the grid prevent any precise forecast of a schedule for decreased GHG emissions. Issues include:

- The closing of Indian Point (scheduled for 2020-2022): This source of 2000 MW of carbon-free power will no longer be available.
- The implementation of wind power: NYSERDA is currently developing 2.3 GW of offshore wind power. The potential offshore resource is enormous.
- A 1.0 GW high-voltage DC power line from Quebec Hydro has been permitted by the PSC and is raising capital.
- Solar electric power is growing rapidly, but needs associated diurnal storage.
- Other options, such as tidal power, may contribute modestly.

Sources:

New York City Mayor’s Office of Sustainability (2015). Inventory of New York City Greenhouse Gas Emissions in 2015. Retrieved from www.dec.ny.gov/docs/administration_pdf/nycghg.pdf

New York Independent System Operator. Data Graphs and Fuel Mix Chart: Real-Time Fuel Mix. Retrieved from www.nyiso.com/public/markets_operations/market_data/graphs/index.jsp?load=pie

New York State Energy Research and Development Authority. Clean Energy Standard. Retrieved from www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard

New York State Energy Research and Development Authority. Combined Heat and Power Program. See www.nyserda.ny.gov/All-Programs/Programs/Combined-Heat-and-Power-Program

New York State Energy Research and Development Authority. DG Integrated Data System. See http://dg.nyserda.ny.gov/facilities/index.cfm?Filter=CHP
Norcross, Frank. Private study.

Technical Working Group Report (2016). pp. 98-100.

15 Reward Peak Demand Savings

I. Summary

Issue:
The electrical grid is sized to meet a very small number of hours of maximum demand each year. A kilowatt-hour saved at 3AM in winter is worth much less for carbon and air pollution than a kilowatt-hour saved at the peak of a hot summer day, when the least efficient power plants are firing.

Recommendation:
Evaluate options to account for the carbon benefits of peak demand savings without undercutting permanent energy reductions.

II. Proposal

Require the Mayor's Office of Sustainability to assess the feasibility and impact of a reduced energy savings requirement for buildings that participate in demand response or achieve permanent demand savings. Any such potential reduction in energy savings requirements should be modest in order to avoid undercutting permanent energy efficiency upgrades.

In assessing this potential reduction allowance, evaluate the relative carbon value and cost of demand response and permanent demand reduction. Analysis must also determine whether any allowance will result in additional demand response and demand savings beyond what would already occur from utility rate structures and existing incentives.

III. Supporting Information

Expanded Issue:
Reducing electricity use during times of peak demand has disproportionate benefits on carbon emissions and local air pollution. Electricity use in New York City peaks in the summer, when grid demand is met only by firing up the city's oldest, dirtiest, least-efficient power plants. Shaving usage at this time has much greater air pollution impact than energy savings during off-peak or winter hours. As a result, we should carefully guard against the potential to *disincentivize* this best practice in energy management.

What is demand response?

Demand Response (DR) is consumer reduction in electricity use during periods of very high electricity demand, typically in response to a payment program from utilities or grid operators, time-based electricity rates, or other financial incentives. DR is primarily focused on large energy consumers, such as very large commercial buildings. Participating in DR typically entails some combination of decreasing energy consumption and shifting consumption to off-peak times when the grid is less stressed. For example, buildings can reduce lighting, cooling and ventilation in non-essential areas upon request from a utility during a several-hour window of peak demand on a hot summer day. They can also delay some electricity-intensive activity, such as a manufacturing process, until after the period of very high demand has passed.

Participating in DR requires the building owner to have access to real time utility demand data, as well as a certain degree of control over building systems that can be “curtailed” in order to meet a DR requirement. With these conditions in place, the building owner or manager can better understand when the building’s peak energy use occurs, how large that peak is, and how frequently during a given period the building approaches that peak. Familiarity with demand curtailment protocols can make building operators comfortable exercising these protocols on a more regular basis, thereby converting a DR strategy into an ongoing demand management (DM) solution (where building energy demand is reduced outside of short-term DR periods). DR can be thought of as an “on ramp” for buildings to build towards a deeper commitment to energy efficiency.

Customer participation in DR is often facilitated by companies known as DR aggregators. DR aggregators specialize in finding curtailable energy loads within a building and design curtailment protocols that are activated when a DR event is scheduled. DR aggregators and customers usually share in the payment revenues as a business model.

Opportunities for demand response

Manual Opportunities: The most basic curtailment methods are manual, where a customer shuts off loads when a demand response event is predicted. Building occupants can shut off equipment like lighting, reduce HVAC loads by adjusting thermostats, turn off computers, and lessen other plug loads. While this method is the most labor intensive, it is the least expensive method to implement and requires no automation or systems integration.

Partially Automated: Equipment can be partially automated for demand response when it’s run by a central system, but still requires manual adjustment to facilitate participation in curtailment. Elevators, for example, are run through a central control system, but may require a facilities manager to manually shut them down. Buildings that have multiple fuel sources for HVAC equipment (e.g., the option of running a steam absorber or an electric chiller for cooling) may have to manually start up one source of cooling, after which the process is automated through the control system.

Fully Automated: A fully automated DR protocol requires equipment to be connected to a building management system, accompanied by a pre-programmed sequence of operations that is initiated with one signal into the system. When a demand response event is predicted, building operators are notified of the event and can enable participation by running the DR sequence. All equipment programmed to respond will commence curtailment before the DR event begins, to ensure that the full curtailment load is reached throughout the official duration of the event. Examples of equipment that typically can perform in this arrangement include large system fans and pumps, cooling towers, large lighting systems, and generators. A further automation of such programs may involve a remote start from a DR aggregator, which would require no input from an on-site building operator.

Voluntary Curtailment by Tenants: The methods outlined above are largely the responsibility of a facilities manager or engineer, but there are additional opportunities for voluntary curtailment by tenants. With effective communication and a well-planned strategy, tenants can meaningfully curtail within their space during a DR event. This can be most easily accomplished by turning off lights and computers, adjusting supplemental HVAC loads, or optimizing IT equipment to go into “sleep” mode. Larger tenants can further their DR protocol if they have independent HVAC or automation systems and perform like “buildings within buildings.” Such DR protocols may contribute substantially to the building’s overall curtailment and can be incentivized further through sharing of DR capacity and performance payments between landlord and tenant.

From Demand Response to Demand Management

Buildings often begin participation in DR using manual methods of curtailment and gradually add equipment systems to an automated protocol. Over time, building owners and operators can increase the size of the load curtailment without adversely impacting tenant comfort or operability of the building. With automation in place, operators can employ an approach to energy management that goes beyond temporary demand relief to permanent demand relief. This transition provides the greatest benefit to both the utility customer and the utility grid. The customer has lowered demand charges on a permanent basis, and the grid forgoes supplying the necessary power generation and transmission for the reduced demand.

NYC Curtailment Programs:

Both Con Edison and the NYISO sponsor curtailment programs that compensate customers for pledging a measurable demand curtailment amount (also known as capacity) and for curtailing the pledged amount during a demand response event (also known as performance). The NYISO predicts summer coincident peak – the point in the year at which the grid must provide the greatest amount of power to customers – to increase another 2 percent between 2016 and 2026, despite a predicted reduction in consumption over the same time period. The NYISO’s strategic plan for maintaining grid reliability is a combination of grid-sourced power generation and contributions from distributed energy resources (DER), which provide a localized alternative to bringing additional grid generation online. DER can make temporary contributions to supporting the grid, especially during DR curtailment events when all or some of the grid is strained. Different programs offered by Con Edison and the NYISO sponsor DR participation for different reasons.

Assessment:
Determining if demand savings should factor in to the energy reduction policy as an alternative compliance option depends on a number of issues, including the carbon and air quality benefit, the degree to which DR is already incentivized, and the potential effect of such an option on the amount of on-site efficiency works that owners will do.

To inform this determination, the city should analyze the relative carbon value and cost of demand response and permanent demand reduction. This information would help shape potential methodologies to encourage demand response and demand management, such as a reduction in the percentage source energy use savings required for buildings that participate in demand response. Any such potential reduction should be modest in order to avoid undercutting permanent energy efficiency upgrades. Analysis must also determine whether any allowance will result in additional demand response and demand savings beyond what would already occur from utility rate structures and existing incentives.

Quantifying the benefits of demand response

By measuring historical performance of customers system-wide during DR events, one can quantify the aggregate impact that this performance has on the grid. This impact can be extrapolated going forward to show scenarios where and how demand response, if incentivized correctly, can become an important carbon emissions mitigation strategy during summer periods where the grid is the most vulnerable and the power available is the most carbon intensive.

To assess the linkage between DR and carbon emissions, the city should quantify DR benefits through means such as:

Measure the carbon impact of DR curtailment and ongoing demand management: The fossil fuel mix of grid-sourced electricity varies significantly from the summer to winter months. For example, a typical Monday in January 2018 had 38 percent of grid-sourced electricity from fossil fuels, while in July 2017 it had 53 percent. Because the oldest, least efficient generators are typically reserved for peaking periods, the weighted carbon value of a kilowatt-hour reduced during a DR event is significantly higher than during off-peak periods. If a carbon equivalent per kilowatt-hour in DR enrollment can be calculated, this equivalent could potentially inform development of a methodology for valuing DR participation as a limited alternate compliance option for source energy reduction requirements.

Measure a building's DR curtailment as a percentage of total peak demand: Buildings that can achieve significant curtailment loads can contribute greatly to grid reliability and carbon savings. To scale these accomplishments across all building types, measure the building's curtailment load as a percent of the total peak.

The Green Business Certification Institute (GBCI) currently recognizes DR achievements of greater than 10 percent of a building's total peak with LEED v4 credits, which include a Regional Priority credit for the NYC area. This approach should inform consideration of this issue.

Measure progress in ongoing peak demand reduction: Buildings that demonstrate sound demand management strategy should show reduction in peak demand over time. This accomplishment may not necessarily be paired with a reduction in consumption, in which case it would not impact the building's EUI. Still, that reduction may deliver significant carbon, air quality and reliability benefits.

Assessing quantification approaches

The city should use the following sources and criteria to assess options for including DR as a limited compliance alternative:

Relevant precedents or informative examples: As referenced throughout this document, the NYISO and Con Edison have volumes of information supporting the critical need for DR.

Building data: Anonymized data can be provided by owners and managers of large buildings (including 80x50 Buildings Partnership members) to show examples of registered peak demand and related charges. Current DR participants can be asked to volunteer historical performance of assets during a DR event to illustrate how the process works.

Feasibility (cost, ease of implementation, etc.): Implementing DR initiatives range from no-cost solutions to expensive but comprehensive automation projects. Con Edison and NYSERDA subsidize DR enablement projects through several incentive programs. Con Edison's Non-Wires Solutions programs also target specific neighborhoods for DR enablement where the networks are of particularly critical need for peak relief. These programs should inform consideration of whether any allowance within the energy reduction policy will result in additional demand response and demand savings beyond what would already occur from utility rate structures and these existing incentives.

Alignment with 80X50 trajectory: Much of the 80x50 trajectory relies on the assumption that the grid will continue to add renewable power to its generation capacity, making the electricity supplied by the grid less carbon-intensive over time. While this assumption may be true, the current grid may not be capable of meeting peak demand in the future. A result of a shortfall in grid supply during peak hours will be an increased reliance on "peak loaders," the generators that use dual fuel and natural gas to produce electricity. DR will help alleviate the reliance on these generators during peak periods, and demand management will alleviate this reliance on a permanent basis.

Necessary conditions and opportunities to facilitate: Participation in DR programs would require confirmation from Con Edison and/or NYISO of the building's registration and participation on an annual basis. Such documentation is already provided as part of the validation process for DR Enablement incentive funding from NYSERDA and Con Edison, or application of LEED credits for DR.

NYISO provides the data on generation sources of grid electricity on a 15-minute interval basis. Each generation source has a carbon intensity conversion factor that can serve as the basis for calculating the time-weighted value of peak demand reduction.

Verification of demand reduction would also require disclosure of registered peak demand from Con Edison electricity bills. EPA's Portfolio Manager allows the inclusion of peak demand in monthly metrics, allowing Portfolio Manager to remain as the platform to validate demand reduction on an annual basis with NYC's benchmarking submission. The demand values have no impact on the property's Energy Star score.

16 Make Efficiency Easier through Expanded Services

I. Summary

Issue:
The proposed policy would impact about 50,000 buildings. Yet, most building owners are not proficient in energy efficiency or accessing financing for retrofits. Owners will require a lot of help for the policy to be successful, including engaging tenants whose energy use drives the energy profile of many buildings.

Recommendation:
Dramatically expand the scope and capacity of the city's Retrofit Accelerator or other entities and approaches to support owners undertaking retrofits. Prioritize assistance to owners with fewer resources and less technical ability, including smaller buildings and nonprofits. Assist owners with strategies to reduce tenant energy use. Align with state and utility efficiency initiatives to maximize impact.

II. Proposal

The city should expand resources, provide sufficient and targeted support, and mobilize the market with education, research and workforce development to ensure the successful implementation of an energy reduction requirement.

Whether via the Retrofit Accelerator (RA) or new program(s), the city should:

- Scale up existing RA programs and resources to support all building owners impacted by the reduction requirement;
- Offer specialized support for owners that require the most technical assistance and have limited internal capacity, particularly smaller buildings and nonprofits;
- Integrate with utilities and city and state organizations to develop complementary energy efficiency initiatives and funding programs; and
- Develop pilot projects across building types.

Resource allocation and direction can be informed by new or existing cost-benefit analyses and other studies that assess non-energy (e.g. social, environmental, health) benefits of reduced energy use.

III. Supporting Information

Expanded Issue:
Building owners will need a great deal of help for an energy reduction requirement of this scale to be successful. Most of the owners who will be impacted are not experts, or even proficient, in energy efficiency improvements or financing. In affordable housing and small nonprofit/religious buildings, lack of efficiency expertise is often compounded by low cash reserves, difficulty borrowing and small staff size.

Building owners will need wide-ranging support: access to qualified contractors, high quality and fairly-priced materials and equipment, energy and operations consultants, training to ensure their property managers and operators are well-equipped to maximize energy performance, information on financing options, and increased operational support to ensure that upgrades perform as intended. On the supply side, contractors, engineers, architects and consultants must expand capacity and learn about new technologies. Equipment manufacturers will need to see market-tested energy efficiency technologies before they will invest heavily in production.

The scale of the support required is an order of magnitude greater than even the largest existing NYC or NY State programs. Prior to the launch of the RA, major retrofit consulting firms might complete 50 large building retrofits annually. The RA aims to assist 1,500 buildings over three years, a highly ambitious goal compared to past rate of retrofits.

In comparison, the proposed policy would impact about 50,000 buildings.[*] The degree of work required in each of these buildings will vary, but even if retrofits are spread evenly from 2020-2030 (in reality, work will cluster closer to the compliance date), the quantity of retrofits will be many times greater than the RA is designed for.

Assessment:
The city should take the following steps to support building owners, on-site staff, the broader workforce, and other impacted populations:

Scale up the RA

New York City's RA provides owners with free assistance to retrofit their buildings, offering a "one-on-one" service that connects building owners with qualified contractors and incentives,

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[*] Calculations assume the same definition for "covered building" as in the NYC Benchmarking Law: all buildings greater than 25,000 sf or two or more buildings on a single lot that together exceed 100,000 sf. Analysis is based on NYC's Property Land Use Tax Lot Output (PLUTO) data, which provides information at the property level and includes both a total building area and a total number of buildings. Because PLUTO does not provide the area of each individual building, the building count was calculated as the sum of (i) all buildings on properties over 100,000 sf, (ii) all buildings on properties between 25,000 and 100,000 sf with only one building, and (iii) for properties between 25,000 and 100,000 sf with more than one building, the number of equally sized buildings that could be over the 25,000 sf threshold given the total floor area divided by the number of buildings on each lot. For example, a property with an 80,000 sf building area and two buildings would count as two, but the same property with four buildings would count as zero. This methodology shows about 50,000 buildings or 27,000 properties covered. The precise number of covered buildings will ultimately depend on legislative definitions.

and trains building staff on efficient operations. The need for assistance will dramatically grow when a reduction requirement is adopted, with demand eclipsing the amount of support that the RA currently provides.

Specifically, through the RA, the city should:

- Scale up existing programs and resources to support all building owners impacted by the requirement.
- Provide educational resources to real estate owners on the value of data collection and analysis as a way to identify and prioritize cost-effective, energy-saving operational improvements.
- Offer specialized support for smaller owners in the affordable sector, as they often have low internal capacity and require the most technical assistance.
- Provide funding directly to intermediary partners (such as community development organizations and financial institutions) who act as trusted advisors to affordable housing owners.
- Ensure that lenders understand the new energy reduction requirements and incorporate the cost of energy upgrades as part of refinancing, and that owners are aware of and understand applicable funding opportunities though targeted education and outreach to both sides.
- Allocate dedicated staff familiar with the missions and challenges of nonprofits to assist in energy efficiency upgrades at nonprofit and religious institutions.
- Work with Con Edison, National Grid, NYSERDA and NYPA to develop complementary energy efficiency programs and initiatives.
- Ensure that the state, the city and utilities seamlessly integrate their efficiency efforts and leverage respective capacities, expertise and resources.
- Develop pilot projects representing various building types and uses to demonstrate the deep energy efficiency retrofits that will meet performance goals beyond 2030. These projects will also help expand the number and capabilities of the energy efficiency workforce.

Work with, or provide funding to, non-city organizations to develop, organize and deliver relevant training to building owners, contractors, construction companies, maintenance staff, and other impacted parties.

There are myriad organizations that offer sustainability and high-performance building training in NYC, including unions, associations and nonprofits. Collectively, these organizations have expertise in building operations and maintenance, HVAC and heating systems, energy efficiency, high-performance building principles and techniques, and air quality. Support for these programs will become increasingly important as retrofits move to scale.

The city and industry leaders should also explore how to drive changes in engineering and architecture school curricula, as well as green building, energy consultant, and property manager credentials, to better align technical jobs with the requirement.

Ensure that lenders and borrowers understand the new energy reduction requirements though targeted education and outreach to both groups.

Aligning energy efficiency retrofits with capital expenditure cycles or refinance can make the most of long-term efficiency investments. The city should educate financial institutions on the new reduction requirement like building construction, acquisition or rehab. The Community Preservation Corporation's recent Underwriting Efficiency guide and the green mortgage offerings from Fannie Mae and Freddie Mac are useful examples to replicate and build upon. The retrofit work required across all sectors will not be possible without the full participation of real estate finance.

Conversely, the city and/or designated outreach partners must ensure that borrowers are aware of and understand energy efficiency financing opportunities, including how to apply for them.

Consider non-energy benefits when directing city resources

A comprehensive building energy efficiency standard will return value to building owners and tenants over time in the form of energy use savings. Efficiency improvements will also deliver a number of health, welfare and equity benefits to New York City residents and businesses.

These non-energy benefits (NEBs) also called co-benefits, range from improved local air quality to advanced educational attainment to decreased emergency room visits. Often not explicitly quantified during policymaking, each of these benefits could be translated into economic savings or gains to support public, nonprofit, and private sector investment.

The city should make use of existing NYSERDA, state agency, and institutional literature on valuing and quantifying NEBs—or conduct its own benefit-cost analyses—and utilize the findings in developing efficiency programs with greater impact. These quantified NEBs can also inform program design to ensure alignment between efficiency programs and non-energy initiatives, such as health initiatives targeting local air quality.

Foster private sector action and demonstration of leading strategies

Building on the success of programs like NYC's Carbon Challenge, the city should explore contests, grants or other opportunities to foster private sector action that will demonstrate and promote winning retrofit strategies to transform the building sector in the decades ahead.

Sources:

ACEEE (2004). Non-Energy Benefits from Commercial & Industrial Programs: What Are the Benefits and Why Are They Important to Participants? Retrieved from https://aceee.org/files/proceedings/2004/data/papers/SS04_Panel4_Paper13.pdf

ICF (2017). Quantification of Non Energy Impacts for Residential Programs. Retrieved from www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2017ContractorReports/SmallResidential-NEI-PhaseI.pdf

Jacobson, Mark, et. al. (2013). Examining the feasibility of converting New York State's all-purpose energy infrastructure to one using wind, water, and sunlight. Retrieved from https://web.stanford.edu/group/efmh/jacobson/Articles/I/NewYorkWWSEnPolicy.pdf

NYC Economic Development Corporation (2015). Energy and Water Retrofit Accelerator Request for Proposals.

NYS Department of Public Service (2015). Staff White Paper on Benefit-Cost Analysis in the Reforming Energy Vision Proceeding. Retrieved from http://documents.dps.ny.gov/search/Home/ViewDoc/Find?id=7B168B59A0-14A9-4DE3-8B97-DFE25A067CF9%7D&ext=pdf

US Department of Energy (2015). New York City Benchmarking and Transparency Policy Impact Evaluation Report. Retrieved from www.energy.gov/sites/prod/files/2015/05/f22/DOE%20New%20York%20City%20Benchmarking%20snd%20Transparency%20Policy%20Impact%20Evaluation....pdf

17 Bolster Financing Initiatives

I. Summary

Issue:
Many buildings will require specialized financing to undertake energy retrofits, including on schedules that don't align with mortgage refinancing. And straightforward efficiency financing is not yet readily available through the traditional lending process.

Recommendation:
Align and streamline existing financing resources. Simultaneously, enact C-PACE financing legislation, opening a new funding stream at attractive terms and rates. Encourage support for efficiency in conventional underwriting, while advancing other financing options to support retrofits.

II. Proposal

Enact legislation authorizing commercial Property Assessed Clean Energy (PACE) financing in NYC. Doing so will enable owners to borrow at low interest rates and pay through a property tax assessment.

In addition, explore other financial support for building retrofits, including J-51 reforms, private capital, financing programs and workforce development, as discussed in *Proposal 9: Lend a Bigger Hand Where it's Most Needed (Part 2)*. Ensure owners of properties with more complex financing challenges, such as condominiums, receive specialized assistance.

III. Supporting Information

Expanded Issue:

Many buildings will face financing challenges

Building owners can reduce energy use in myriad ways that do not require financing, such as low or no-cost energy conservation measures like air sealing that can often be paid from a building's operating budget. But eventually, building energy efficiency improvements will require capital.

How building owners and managers pay for capital improvements and the challenges they may face in doing so can be as varied as the buildings themselves. Some buildings pay for work with cash on hand; others have no cash reserves. Some access government grants and utility incentives; others engage third parties and pay for upgrades through service agreements.

Timing is often a critical issue for financing, in particular the ability to access capital at low rates through a mortgage. When it's time to refinance, buildings with a moderate loan-to-value ratio can often borrow more to pay for improvements. This group typically includes commercial and industrial buildings and market-rate multifamily buildings with strong cash flow. And they also have the option to take on additional debt from their mortgage lender.

Cash flow-constrained buildings can't always borrow more. These buildings may be highly leveraged and have complex ownership structures. In many of these buildings, significant barriers to financing often include lack of engagement, insufficiently skilled staff and owners, and trust in energy audits.

The city must also recognize that the efficiency improvements required for some buildings may not generate sufficient energy cost savings quickly enough. That is, the return on investment may be negligible, even potentially negative, over the relevant time period and therefore not financeable. This increases affordability concerns and must be taken into account when developing or adapting existing financing strategies to fit the new energy reduction policy.

In some cases, ownership type or structure may complicate financing for efficiency projects. For example, some issues particular to affordable housing and nonprofits are discussed in *Proposal 8: Lend a Bigger Hand Where it's Most Needed (Part 1)* and *Proposal 9: Lend a Bigger Hand Where it's Most Needed (Part 2)*. In condominiums, members own their property (individual units) outright and there can be no underlying mortgage because there is no common ownership. While historically it was challenging for condos to obtain traditional loans, they can now do so using the association's power to create assessments and enforce them via lien as collateral. The New York City Energy Efficiency Corporation (NYCEEC), for instance, does not differentiate between co-ops and condos in their underwriting process. However, infrastructure projects and loan procurement often require majority or supermajority approval from the condo owners, which may represent a barrier to efficiency upgrades. (By contrast, a co-op's board of directors can make decisions with more flexibility.)

Specialized financing options

When a building can't pay for work with reserves or mortgage proceeds, its options are limited. Energy efficiency lenders like NYCEEC will extend equipment-secured loans for efficiency work and give credit for energy savings when calculating loan proceeds. However, to cover risk, they typically charge rates in the neighborhood of 7 to 8 percent, higher than most mortgages and in some cases cost-prohibitive.

Alternatively, Energy Service Companies (ESCOs) will pay for more efficient equipment such as a new boiler and charge an energy service fee to the building, typically with a guarantee that the value of savings will meet or exceed the payment. The building then covers the fee through its energy savings. This option, while placing construction and performance risk on the ESCO, is typically more expensive than other financing options and is often constrained by the payback periods of the improvements. Also, many ESCOs have traditionally only lent to the MUSH (municipals, universities, schools, hospitals) market.

Standard banks can also provide loans for energy efficiency work, but few are willing to account for savings generated by the measures in their underwriting. Outside of a mortgage, most also charge higher rates and are not long-enough-term to make retrofits with longer paybacks cost-effective.

In summary, some specialized financing for efficiency improvements exists, but the options are imperfect and uptake is limited.

Assessment:

PACE financing

There is one financing option that can fill in for mortgages but doesn't have the high rates or other challenges of specialized financing: property assessed clean energy (PACE). PACE is an innovative financing mechanism for energy efficiency improvements on private property. It allows owners to borrow at low interest rates to finance the up-front costs of an energy efficiency upgrade – such as a new boiler, increased insulation, or systems controls – and pay back the loan through a voluntary property tax assessment. That assessment is attached to the property instead of the individual.

Commercial PACE programs have spread in recent years. More than 30 states have enabling legislation, with more than $500 million in projects financed. While most commercial PACE programs (including in NY State), require approval by the mortgage holder(s), this has not proved a significant barrier.

Adopting a commercial PACE program for NYC will create an attractive financing option for many owners, addressing many of the challenges that now exist when financing retrofits. Still, PACE will not solve the financing challenge alone, and some owners like mission-driven nonprofits or religious institutions may be averse to liens on their primary asset.

Change underwriting rules

Financing options for large building energy efficiency projects have grown in recent years, but simple and straightforward energy efficiency financing is not yet readily available through *traditional* financing mechanisms. To help inform and spur the adoption of underwriting to energy efficiency in the traditional lending process, the Community Preservation Corporation recently released the Underwriting Efficiency handbook. Incorporating energy efficiency financing into a building's refinance or first mortgage may be most beneficial to distressed properties, which lack access to the reserve budgets and private financing available to larger, more sophisticated properties.

Given the large number of building upgrades that will be needed to reach proposed energy targets, leveraging the existing mortgage finance process and institutions to support energy upgrades may be the most effective strategy to provide the large-scale support needed. Most buildings in the city will go through at least one major financing event (acquisition, rehab, refinance, or new construction) before compliance with energy use reductions is due in 2030. If underwriting efficiency becomes part of the normal real estate finance process for both lenders and borrowers, it could unleash sufficient capital to support the large-scale transformation of buildings, while also helping lenders and investors meet their goals and volume objectives. To support the implementation of wide-spread energy upgrades, the city should encourage traditional mortgage lenders to adopt the practice of underwriting efficiency.

Other financing & incentive options

Many of the ideas proposed in *Proposal 9: Lend a Bigger Hand Where it's Most Needed (Part 2)* should also be considered for market-rate buildings. Refer to that proposal for discussion of J-51 reforms, private capital, financing programs and workforce development.

Sources

Community Preservation Corporation. Underwriting Energy Efficiency: A Lender Handbook. Retrieved from http://communityp.com/resources/underwriting-energy-efficency-lender-handbook/

U.S. Department of Energy. Property Assessed Clean Energy Programs. Retrieved from https://www.energy.gov/eere/slsc/property-assessed-clean-energy-programs

18 Align Energy Use with Energy Bills

I. Summary

Issue:
People tend to waste things that are free. When electricity is included in rent, apartment dwellers use about 20 percent more than when tenants foot the bill. And metering and billing for water has saved 35 percent in some buildings. While more direct billing is possible now, regulatory hurdles mean it's cumbersome. Any change must be equitable for tenants in affordable housing.

Recommendation:
Convene a task force with NY State to implement electric and cold water submetering and simplify regulatory requirements. When metering occurs in rent-stabilized units, ensure it is cost-neutral for tenants through rent reductions. Experiment with heat submetering, and later assess the potential to mandate.

II. Proposal
It's time to extend electric and water submetering across New York City. Meanwhile, we should begin piloting heat submetering, and later assess whether a mandate is appropriate. When it comes to affordable housing, metering must remain cost-neutral for tenants. For metering at scale to have the lowest cost, current regulations must be simplified.

Discussions between state government, local government, owners and tenant groups will be necessary. The *Blueprint for Efficiency* recommends that NYC and NY State convene a joint task force to determine:

- An appropriate mandate for metering electricity and water;
- Rent-adjustment guidelines for rent- regulated or rent-stabilized apartments, addressing the utility shift from landlords to tenants;
- Simplified regulations on metering that protect tenant interests;
- Financial incentives for "smart" meters, which facilitate time-varying pricing and help align with NY State energy efficiency programs; and
- Voluntary programs or challenges that incentivize tenants to save on utilities, particularly in affordable housing.

III. Supporting Information

Expanded Issue:
People tend to waste things they don't pay for directly. Among the city's benchmarked buildings, electricity use jumps 20 percent when landlords pay for tenant electricity, versus when tenants

pay for it themselves. Major NYC landlords have also tested billing tenants for water; usage plummeted 35 percent. In Europe, billing for heat is common.

A renter may not receive line-item bills for heat, water and electricity, but they are still paying for those services. If landlords have higher utility costs, they pass them onto tenants in the form of higher rents. In this situation, tenants who consume less are, in effect, subsidizing those who consume more.

Significantly, the solution to this issue–metering tenants based on their usage–requires limited capital outlay. After the modest cost of installing meters, savings are achieved when tenants change their behavior. Why is this important? Because if energy efficiency can be achieved through operations and behavior change, less needs to occur through capital improvements—which tend be passed onto tenants through rent increases. This matters to all renters, but especially those living in affordable housing. The lower the cost of reducing building carbon emissions, the less achieving 80x50 will impact housing costs.

Historically, submetering has been difficult or impossible in multifamily buildings because each apartment often contains multiple points of entry for utility services. But in the past decade, metering and data networking technology has advanced dramatically. Distributed submetering systems employing "point-of-use" meters, or submeters that are deployed at fixtures, appliances, or even plug loads, have made submetering more feasible and cost-effective in multifamily buildings. Metering technologies for steam, hot and cold water, and electricity create the potential to directly bill tenants for all utilities and services delivered to the apartment.

The flip side of this opportunity is the regulatory reality. As described below, submetering is not allowed for some utilities, and where it is permitted, the approval process is extremely complex and time-consuming.

Submetering regulations

Submetering of electricity is heavily regulated in New York State, providing little incentive for owners to do so. Submetering is prohibited for natural gas, but there do not appear to be direct limits on submetering water consumption.

<u>Electricity</u>: Residential electric submetering is regulated by the NY State Department of Public Service (DPS), including the NYS Public Service Commission (PSC). Submetering is wholly governed by 16 NYCRR (Public Service Law) Part 96. The submetering regulations, updated in 2012,[*] regulate and determine the sale of electricity through submeters and the means to ensure consumer protections to residents in residential buildings (including condominiums, cooperatives, and rental buildings). Several of the new submetering requirements relate to the initial application process, while others apply to existing submetered buildings.

To become eligible to submeter residential tenants, a building owner must apply and petition the PSC. Applications are posted on the PSC's website, enabling the public to provide written

[*] Regulations were updated in 2012 to reflect changes in Commission policy, changes in the energy market, new technologies to promote energy efficiency, and additional consumer policies that have been implemented since 1988, when the submetering regulations were last revised.

commentary during a set public comment period. After the public comment period concludes, the PSC confirms all submitted documents are complete before voting to approve the application. A building owner may proceed with installation of submetering equipment and systems, but they cannot begin billing until they are approved by the PSC.

Currently, PSC approval of electric submetering in multifamily buildings can take up to a year. Because the PSC must vote on each individual application, an owner who misses particular PSC meeting dates and deadlines can find their application approval delayed by months. Not surprisingly, less sophisticated building owners are not able to manage the administrative requirements necessary to obtain approval to submeter.

See the "Additional Detail & References" section below for more information.

<u>Heat</u>: We are unaware of regulations directly governing thermal or heat submetering in New York State. Such submetering would entail, for example, measuring the thermal energy delivered to each apartment (e.g. via a steam or hydronic distribution system). PSC regulations prohibit natural gas submetering, though gas is generally not directly used for heat in individual apartments.

The city requires landlords to ensure minimum temperatures inside apartments. This law would still apply even if submetering for heat were implemented. Metered tenants could thus be charged for heat, but landlords could never cut heat off for nonpayment.

<u>Water</u>: There are no existing regulations governing water submetering in New York State. For rent-regulated apartments, there is no barrier to charging rent-regulated tenants for water usage, provided such charges are defined in a tenant's lease.

See the "Additional Detail & References" section for more information on various regulations relating to water submetering.

Impact of submetering on energy & water consumption

About 20 percent of audited building area in NYC (buildings over 50,000 square feet) is still master-metered for electricity, meaning the building has one cumulative utility meter. About half of that space is submetered and half is not metered at the unit level at all. Nearly all multifamily buildings are not metered for water or heat. Increasing case studies and analysis show substantial positive impacts of submetering on energy and water consumption.

According to Urban Green Council's 2017 *NYC Energy & Water Use Report,* multifamily buildings that were either direct metered or submetered use 20 percent less electricity than master-metered buildings. Water submetering installations can yield as much as a 30 percent decline in water consumption (and sometimes more). The NYC Department of Environmental Protection expects water submetering and billing of residential tenants to result in at least a 15 percent savings. The positive impacts of submetering are also documented by submetering billing firms and meter manufacturers. Because of these savings, the submetering of water and electricity—and in some cases thermal energy—is mandated in states, municipalities and other countries where conservation goals are a high priority. NYC Local Law 132 mandates the electric submetering of commercial tenants in large office buildings, but there is no such law applicable to multifamily buildings.

In Europe, the equitable allocation of heating costs to residents in multifamily buildings has been common practice for nearly 100 years; it's been one of the most cost-effective approaches to reducing carbon emissions. EU directive 2012/27/EU requires the consumption-based cost allocation of heating and domestic hot water (DHW) in multi-unit buildings to "ensure that users of such buildings have the right incentives and sufficient information to adopt energy-efficient practices." Germany and Denmark, which both have strong social housing policies, have implemented heat and DHW submetering, and close to 100 percent of their markets have adopted consumption-based billing.

Other U.S. states, such as California, have models for adjustments to rent when heat submetering is implemented in affordable housing. In southern California, water submetering is mandated by municipal water authorities and, in many municipalities, via the building code. When crafting its own policies, New York City can look to each of these regions for guidance.

Providing tenants with line-item usage of their utilities leads to savings. But savings are even higher when tenants receive "normative feedback," such as information about their consumption patterns relative to peers.

Utility allowances

In affordable housing, any attempt to implement billing for utilities will require changes to utility allowances.

Federal regulations define housing costs as both shelter and reasonable utilities, which are capped at 30 percent of a household's actual adjusted monthly income. The net rent that a property owner receives is determined by the difference between the gross rent (rent plus utilities) and the estimated utility costs. The estimated utility costs are known as the *utility allowance*. The utility allowance applies to subsidized properties with tenant-paid utilities. The method used to calculate the utility allowance depends on the type of federal assistance the property receives. See Table 1 in the "Additional Detail & References" section for specific methodologies.

Utility allowances & energy efficiency

The method by which utility allowances are calculated can have a significant impact on an owner's ability to invest in efficiency upgrades. Project-specific utility allowances are calculated through either a high-quality energy consumption model** or an analysis of the project's actual

** Energy Consumption Model: An engineering-based method that provides an estimate of reasonable consumption, considering the specific building and unit characteristics that affect consumption, including unit size, building orientation, design and materials, mechanical systems, appliances and location.

consumption data.[***] These project-specific types of allowance more accurately reflect energy and water use at a specific property and can account for cost savings from efficiency upgrades. This makes it easier for owners to make upgrades, because some of those costs can be recovered through increases in the net rent an owner receives, without increasing the tenant's overall housing costs.

As detailed in Table 1 in the "Additional Detail & References" section below, under IRS rules, Low-Income Housing Tax Credit (LIHTC) and HOME Investment Partnerships Program (HOME) properties are allowed to use an energy consumption model if permitted by the local housing authority. However, we understand that the energy consumption model has not been adopted by the New York City HPD, meaning that NYC LIHTC and HOME properties do not have the option to use a project-specific method for calculating utility allowances.

In NYC, these properties calculate utility allowances based on NYCHA's Public Housing Authority (PHA) schedule. PHA schedules are often based on the typical cost of utilities for their households, based on community consumption data for housing of similar size and type. This method often provides an inaccurate measure of actual consumption for HOME and LIHTC units, which tend to be newer and more energy-efficient than PHA properties. It also fails to represent more efficient PHA properties.

HUD-assisted properties face a different issue. HUD calculates project-specific utility allowances based on actual or projected (from energy models, for eligible new construction or rehab properties) on-site consumption. However, under the current policy, benefits from efficiency improvements and a re-calculated utility allowance for tenant loads accrue to HUD, not the property owner, which disincentivizes efficiency investment.

Assessment:
The energy efficiency case for submetering is strong. But it is yet to be determined which forms of submetering are ready to be mandated, which require further study, which unintended consequences must be addressed, and how to simplify the regulatory environment to facilitate widespread submetering.

New York City has extensive experience with electric submetering. Meanwhile, cold water submetering is straightforward and poses few concerns for tenants. As a result, we recommend an approach similar to Local Law 132, mandating sub- or direct-metering of electricity and cold water.

Submetering for steam heating offers perhaps the greatest energy savings potential, but is new territory for NYC. Open windows on cold days can be found regularly across NYC as a way to regulate heat from unbalanced heating systems. Equitable heat submetering requires pairing rational heat cost allocation (allocating the cost of heating between landlord and tenants) with upgrades to ensure that heating systems deliver the right amount of heat to the right spaces at

[***] Actual Tenant Consumption Data: An analysis of actual consumption based on a representative sample of tenant consumption data or utility bills. The owner or regulatory agency must still select the appropriate data point for determining "reasonable" consumption, whether average or another data point. The use of actuals can only be used after a project has been in operation for 12 months or more.

the right times. This packaging can allow for deep carbon reductions that encourage both efficiency and conservation.

There is some concern that allocating the cost of heating between landlord and tenants could introduce a new split incentive, providing a building owner with no further motivation to invest in efficiency upgrades, such as improved windows, because the tenants would reap the benefit of lower heating bills. Equitable heat cost allocation, paired with a whole-building energy performance standard, would minimize such a concern because building owners would still be accountable for upgrading building systems to meet such targets regardless of who pays the heating bill.

When submetering occurs in affordable housing, there must be compensatory reductions in other costs to avoid affordability impacts. One approach is to utilize utility allowance calculations. Guidelines for rent reductions related to newly implemented direct- or submetering already exist, but they would need to be revisited to be more supportive of energy efficiency goals. Another approach is to directly incentivize tenant savings. For instance, affordable housing tenants could be financially rewarded if their usage falls below a certain target, set by the landlord.

In addition, the city should work with affordable housing organizations to update their policies:

1. For NYCHA properties and properties using the PHA schedule, the city should work with NYCHA to understand and potentially refine their current methodology for calculating utility allowances. It should provide technical assistance for NYCHA to develop new guidelines that allow for project-specific calculations based on actual or high-quality-verified models. This would also require the adoption of a transition policy to ensure that any significant utility allowance decreases or rent increases on occupied units can be dealt with in an equitable manner.
2. For LIHTC & HOME properties, the city should work with HPD to encourage the adoption of the energy consumption model for utility allowance calculations.
3. For HUD-assisted properties, the city should work with HUD to request a special waiver for NYC properties that would allow for a shared savings pilot, where efficiency savings also benefit the property owner and tenants. Alternatively, the city should advocate for permanent policy changes to address the split-incentive issue and equitably balance fiscal benefits among all stakeholders (HUD, owner and residents).
4. The NY State Department of Homes and Community Renewal (DHCR), which regulates rent-stabilized housing, could potentially include water submetering in its lease terms if the PSC were to expand Home Energy Fair Practices Act (HEFPA) protections for residential tenants to include water submetering. On the other hand, this could be a mixed blessing, since it would also impose additional regulatory requirements upon water submetering of non-regulated residential tenants. For more on DHCR and water metering, see the "Additional Detail & References" section below.

Additional Detail & References:

Detailed information on electric submetering policies

Submeter service providers and approved billing companies must comply with the Home Energy Fair Practices Act (HEFPA). Submeter service providers are required to comply with the Public Service Law and all applicable commission rules and regulations.

HEFPA is Article 2, Section 30 through 53 of the Public Service Law, and most residential consumer protections are found there. With the enactment of Public Service Law Section 53 in 2003, the Commission was authorized to enforce the same HEFPA protections for submetered residential customers as exist for direct-metered customers. A submeter service provider must look to HEFPA and its implementing regulations, 16 NYCRR Parts 11 and 12, to ensure that its residential submetered tenants are protected accordingly. The information provided herein on HEFPA is for generic use and applicable to all residential utility customers, including submetered tenants.

Submetering water in rent-regulated properties

Legal research by various firms confirms that an application for permission to submeter water for an *existing* tenant in a rent-regulated apartment would be denied due to the nature of the service. However, that research indicates that the submetering of water is in fact permitted for *new* tenants, if outlined in the lease.

Specifically, the DHCR issued a 1996 opinion letter regarding whether a rent-regulated tenant can be asked to pay a landlord for water. DHCR said 1) They would most likely deny an application to modify their current practice of including water in the rent for existing tenants, because it is a basic service; and 2) It is appropriate to charge the next tenant for water usage, once the current tenant vacates the premises. In 2011, DHCR issued the *Soccer* decision, which states specifically that issues of water charges are not within the jurisdiction of DHCR if the lease sets forth that the tenant is responsible for water charges. And in 2014, DHCR issued the *Hidalgo* decision, which states that Code Section 2522.10 permits a building owner to collect surcharges for utilities where the building owner acts as the provider of such a utility service. The code lists electricity, gas, cable and telecommunications services, but also states that the section is not limited to these four items. Indeed, the Hidalgo decision involved HVAC fees, which DHCR considered to be different from electricity, but which are covered by the code nonetheless. One may assume that the DHCR code also applies to water charges, as the Soccer decision suggests.

IRS-Approved Calculation Methods

The IRS has set guidelines for calculating utility allowances. There are currently five different methods:

1. Public Housing Authority (PHA) approved UA schedule
2. Utility Company Estimate
3. {Housing Finance} Agency Estimate (*HFA adoption is required)*
4. HUD Utility Schedule Model

5. Energy Consumption Model (*HFA adoption may be required)*

Detailed information on utility allowances, by assistance type

Table 1: Utility Allowances (UA) Summary

Assistance type	**Utility Allowance Calculation Method for Rent-Restricted Units**
HUD-Assisted Properties	HUD utility allowance methodology
HOME Properties	Pre-2013 properties: Public Housing Authority approved UA schedule, Post-2013 properties: HUD Utility Schedule Model or Energy Consumption Model
Public Housing Authority Properties	Public Housing Authority approved UA schedule
LIHTC properties not regulated by HUD	IRS approved calculation methods (see below)

Detailed information on the regulation of water submetering

As noted previously, water submetering is not currently regulated. Here is as overview of the various regulatory bodies related to water and the provision of utilities to tenants:

- The NYC Department of Environment Protection (DEP), the water utility in New York City, does not regulate water submetering.
- The New York Public Service Commission (PSC) has no jurisdiction to regulate nor has written any regulations to govern building owner submetering of water usage and billing tenants for this usage.[****]
- The Home Energy Fair Practices Act (HEFPA), enacted in 2001 and amended in 2002, addresses the provision of utility services to residential customers. In accordance with HEFPA, the PSC adopted rules applying HEFPA to electricity, gas, steam and water. Legal analysts note a key difference between the PSC rules applicable to the distribution of electricity, gas and steam to residential customers and those applicable to water: the rules applying HEFPA to water distribution do not apply to submetering. In that regard:

[****] The New York Public Service Law ("PSL") §89-c "General powers of commission in respect to water supply" provides that the PSC has general supervision of all water works corporations. PSL§2(27) provides that the term "water works corporation" as used in the PSL does not include "water…distributed solely on or through private property solely for the use of the distributor or its tenants and not for sale to others." There are, moreover, no PSC regulations applicable to submetering of water. Discussions with the legal staff of the New York Department of Public Service ("Staff") confirm that the PSC does not have jurisdiction of submetering of water on private property. An additional consideration is that water is distributed almost entirely by municipal entities in NY State.

- 16 NYCRR §11.2 (a)(1)(i) provides that "The term *utility* means any such gas corporation, electric corporation…or any entity that, in any manner, sells or facilities the sale, furnishing or provision or gas or electric commodity to residential customers…" The words "any entity" include owners that submeter.
- 16 NYCRR §14.2 (b)(22) defines a *utility* as "any waterworks corporation, as defined in Section 2 of the PSL, having annual gross revenues in excess of $250,000." There is no reference to "any entity."
- Extension of HEFPA protections to water submetering. It is not known whether the PSC will extended protections to residential customers in the same manner they did when promulgating the above-referenced HEFPA rules.

Sources:

California Housing Partnership Corporation & National Housing Law Project (2016). An Affordable Housing Owner's Guide to Utility Allowances. Retrieved from www.nhlp.org/wp-content/uploads/2018/02/CHPC-NHLP-UA-Guide-2016.pdf

Enterprise Green Communities (2011). Utility Allowance Options for Investments in Energy Efficiency: Resource Guide. Retrieved from http://energyefficiencyforall.org/sites/default/files/Utility%20Allowance%20Options.pdf

European Commissin (2017). Analysis of Member States' rules for allocating heating, cooling and hot water costs in multi-apartment/purpose buildings supplied from collective systems.

European Commission (2016). Guidelines on good practice in cost-effective cost allocation and billing of individual consumption of heating, cooling and domestic hot water in multi-apartment and multi-purpose buildings. Retrieved from http://eur-lex.europa.eu/legal-content/DA/TXT/?uri=CELEX%3A52016SC0405

European Commission (2016). Impact Assessment, Proposal for a Directive of the European Parliament and of the Council amending Directive 2012/27/EU.

Mayer, Peter W. et. al. (2004). National Multiple Family Submetering and Allocation Billing Program Study. Retrieved from www.allianceforwaterefficiency.org/assets/0/28/142/2534/77adbb1c-89d1-4590-be67-587e9af15b80.pdf

New York City Department of Environmental Protection (2017). Water Conservation and Cost Management. Retrieved from www.nyc.gov/html/dep/pdf/wccseminar.pdf

New York City Local Law 132 (2016). Retrieved from www1.nyc.gov/assets/buildings/local_laws/ll132of2016.pdf

New York State Department of Public Service. Regulations on Electric Submetering. TITLE 16. DEPARTMENT OF PUBLIC SERVICE. CHAPTER II. ELECTRIC UTILITIES. PART 96. RESIDENTIAL ELECTRIC SUBMETERING (Statutory authority: Public Service Law §§4, 53, 65

and 66):
www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/d4f1e6b0f51ac85785257687006f39cc/$FILE/16%20NYCRR%20Part%2096%20-%20Submetering%20Regulations.pdf

Pacific Institute (2014). Metering in California. Retrieved from http://pacinst.org/wp-content/uploads/2015/04/Metering-in-California.pdf

Urban Green Council (2017). New York City's Energy & Water Use 2014 and 2015 Report. Retrieved from www.nyc.gov/html/gbee/downloads/pdf/UGC-Benchmarking-Report-101617-FINAL.pdf

US Department of Energy (2002). Sub-Metering Energy Use in Colleges and Universities: Incentives and Challenges. Retrieved from www.energystar.gov/ia/business/higher_ed/Submeter_energy_use.pdf

26 CFR 1.42-10 – Utility allowances. Retrieved from www.law.cornell.edu/cfr/text/26/1.42-10?qt-ecfrmaster=0#qt-ecfrmaster

19 Shorten the NYC Heating Season

I. Summary

Issue:
NYC classifies October 1 to May 31 as the "heating season," when owners must maintain certain indoor temperatures. This means heating systems can only be upgraded or repaired during four months of the year. Over the last 20 years, the temperature has stayed above 50 degrees for 70 percent of days in May.

Recommendation:
Reduce the heating season by four weeks, shifting it to October 1 to April 30.

II. Proposal

Amendment to the Housing and Maintenance Code:

1. Amend section §27–2029 as follows:

§27–2029 **Minimum temperature to be maintained.**

During the period from October first through ~~May thirty-first~~ April thirtieth, centrally-supplied heat, in any dwelling in which such heat is required to be provided, shall be furnished so as to maintain, in every portion of such dwelling used or occupied for living purposes:

(1) between the hours of six a.m. and ten p.m., a temperature of at least sixty-eight degrees Fahrenheit whenever the outside temperature falls below fifty-five degrees; and

(2) between the hours of ten p.m. and six a.m., a temperature of at least sixty-two degrees Fahrenheit.

III. Supporting Information

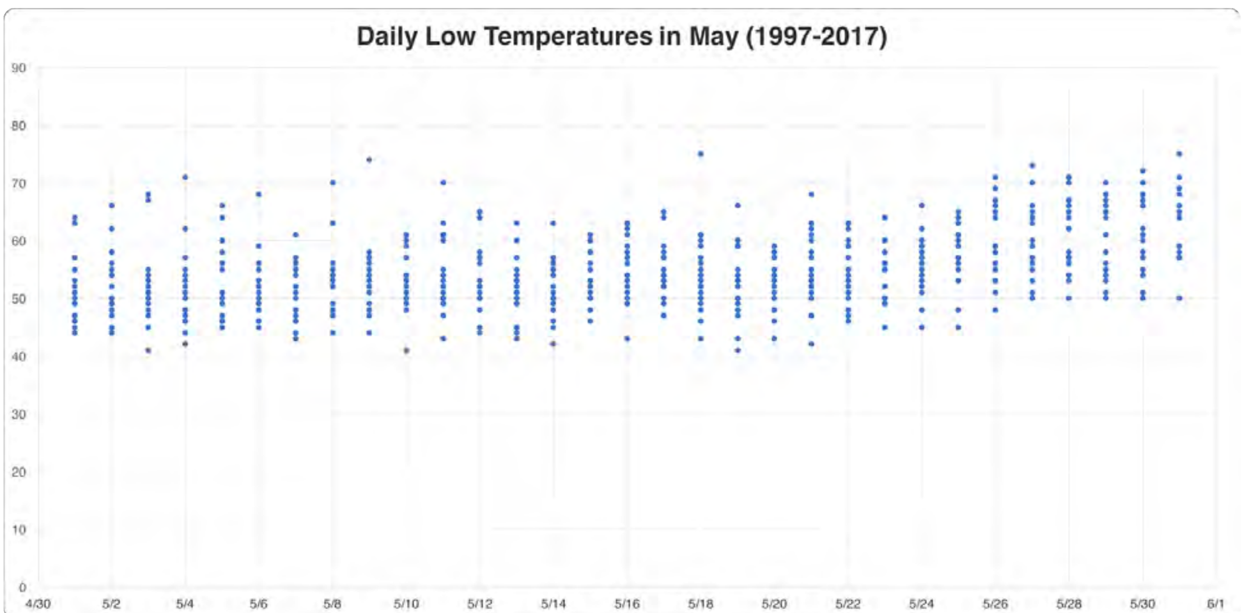
Expanded Issue:
The New York City Housing Maintenance Code (HMC) requires owners to maintain an indoor temperature of 68 degrees between 6 AM and 10 PM when the outside temperature falls below 55 degrees. Between the hours of 10 PM and 6 AM they must maintain an indoor temperature of 62 degrees regardless of the outside temperature. These requirements apply from October 1st to May 31st.

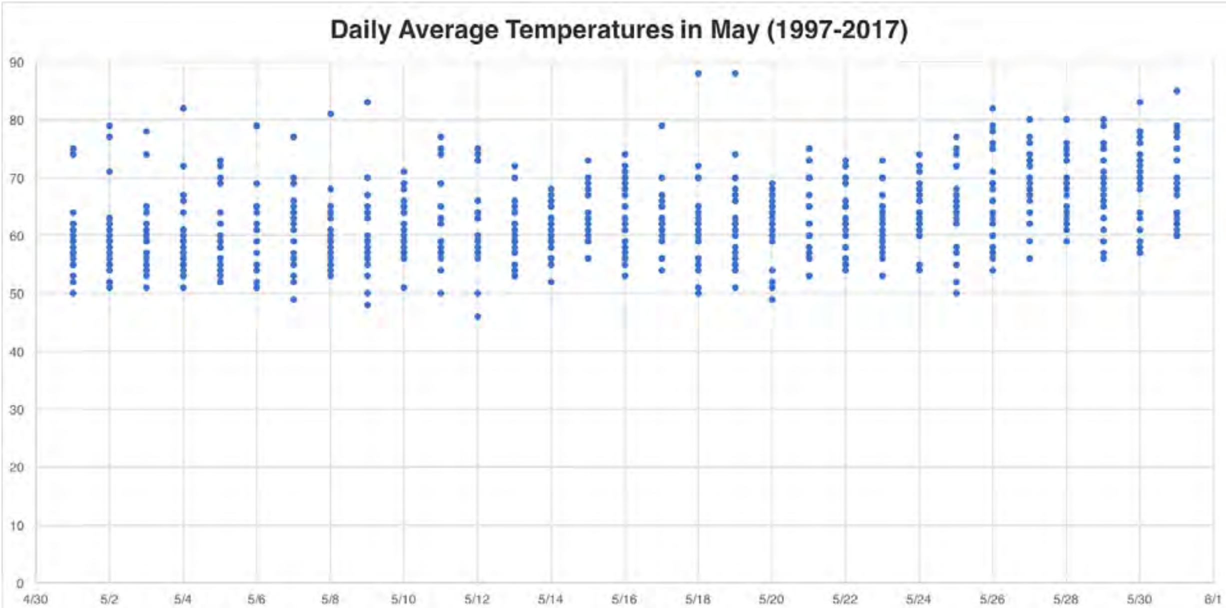
The eight-month heating season leaves owners with just four months for heating system maintenance and upgrades. Work must be completed during this period, and owners are competing for the same pool of contractors.

Reducing the heating season by one month would substantially facilitate the process of scheduling and completing heating system upgrades.

Assessment:
Before an update to minimum heating requirements in 2017, the New York City Housing Maintenance Code (HMC) required that owners maintain a nighttime temperature of 55 degrees during the heating season if the outside temperature fell below 40 degrees. (The law changed in 2017, raising the daytime outside temperature trigger to 55 degrees and the inside temperature requirement to 62 degrees regardless of outside temperature to protect tenants from under-heated apartments in the wintertime.)

A review of historical New York City minimum temperatures shows that the lowest daily outdoor temperature during May has not fallen below 40 degrees in the past twenty years. In other words, prior to last year's change, the law has not required heating during May because the outdoor temperature requirement (40 degrees) was not triggered.





The average temperature in May during the last two decades was 62.7 degrees, and the average during the second half of May was 64.9 degrees. Over the past twenty years, the temperatures was higher than 50 degrees during 70 percent of May days; in the second half of May, the temperature was higher than 50 degrees on 89 percent of days. These outdoor temperatures do not take into account residual heat that buildings retain overnight on warm spring days.

Protecting the health, comfort and well-being of all New York City apartment dwellers is essential. But there appears to be little need to require heating in May. Many stakeholders were unaware that May is currently part of the legal heating season, and at least some tenant advocates appear comfortable with removing the month of May from heating requirements. As temperature trends continue upward due to climate change, allowing additional time for heating system upgrades will enable more to occur across the city.

20 Facilitate Access for Retrofits

I. Summary

Issue:
Many efficiency improvements require work within tenant apartments, like upgrading radiators or insulating exposed pipes. Owners need predictability, while building service workers need clear access guidelines. Skipping work in just a few apartments can have an outsized impact on the cost, timeline and energy savings of a retrofit. But any changes must continue to protect tenant rights.

Recommendation:
Explore the feasibility of facilitating access to tenant spaces for legitimate efficiency upgrades while balancing the need to protect tenants. Options include developing a form letter from the city and guidelines for service workers to clarify the rules for access.

II. Proposal

The city should explore opportunities to facilitate access to tenant spaces to make legitimate energy efficiency-related repairs, while protecting tenant rights and privacy.

A reasonable first step may be a public oversight hearing to offer interested parties the opportunity to comment on the feasibility and rationale for further action on this issue.

At minimum, the city should consider developing a standard notice to clarify the rules around access. This could help landlords explain to tenants energy efficiency requirements or energy use reduction targets and the subsequent need to access tenant spaces.

The city should also consider developing a report on the issue of access to tenant spaces to do retrofit work, including identifying barriers and potential solutions. Any proposed changes to this process or the related legislation should be subject to broad stakeholder review and consensus, with both owners and tenant advocates represented.

III. Supporting Information

Expanded Issue:
Landlord access to commercial and residential tenant spaces is necessary to impement many energy efficiency measures. The Cozy, for example, is a radiator cover that traps heat and allows tenants to control the temperature, but installation requires access to tenant units. A successful retrofit requires reaching about 75 percent of radiators.

According to the New York State Attorney General's Tenant Rights guide, tenants have the right to privacy in their apartments, but a landlord may enter a tenant's apartment with reasonable prior notice with the tenant's consent. Courts have interpreted "reasonable prior notice" to mean 24 hours' notice for an inspection and one week's notice for repairs. Notice must be given in writing and state the nature of the repair. At present, the NYC HPD Tenants' Rights guide states that the landlord can enter a tenant space:

At a reasonable time, after providing appropriate notice, if the entry is either:

- To provide necessary or agreed upon repairs or services, or
- In accordance with the lease, or
- To show the apartment to prospective tenants or purchasers; and
- In an emergency, at any time and without notice.

Currently, if a landlord follows the above procedure and is still not granted access by a tenant, the only recourse is a legal process to force the tenant to grant access. Due to the time and the potentially substantial cost of legal action, many landlords choose to postpone work in certain units.

Skipping energy efficiency work in just a few apartments can greatly reduce the energy savings potential of many retrofit projects and may have ripple effects, like delaying or preventing additional energy savings initiatives that build off the initial project. For example, a landlord may want to install temperature sensors and radiator controls in a unit, as controls tied to an automated building management system would improve indoor comfort and reduce energy waste. If the landlord is unable to access the unit, not only will that tenant be negatively impacted, but without sufficient sensor coverage, the building automation system will not operate optimally.

But it's critical that rules and guidelines for access protect tenant privacy and shield tenants from potential harassment. As documented in recent New York Times coverage, some unscrupulous landlords use any available pretext to drive tenants from affordable housing, including the pretense of construction work in common areas or tenant spaces. Access is a particularly sensitive issue in the residential sector, but these considerations are also relevant to commercial building tenants.

Assessment:

Reaching 80x50 will require landlords to make efficiency improvements in tenant spaces, but tenants must remain protected from potential landlord misconduct. The existing legal process helps shield tenants from landlord overreach and unwarranted access. But there may be feasible ways to improve this process, enabling access for legitimate retrofit work while preserving tenant privacy and rights.

Given the importance of this issue, the city should explore opportunities to streamline access for efficiency upgrades without sacrificing tenant privacy or enabling predatory landlords. One example of what this might look like is an official notice that landlords could request from the city and distribute to tenants. The notice would explain the rules around access to tenant spaces and the importance of completing the energy efficiency upgrades.

Sources:

Itzkowitz PLLC (2015). Landlord's Rights to Access an Apartment for Repairs When Tenant is NOT Cooperating; Tenant Asking for Contractor's Licenses, Etc. Retrieved from www.landlordsny.com/blog/landlord-s-rights-to-access-an-apartment-for-repairs-when-tenant-is-not-cooperating-tenant-asking-for-contractor-s-licenses-etc

National Resources Defense Council (2011). Energy Efficiency Lease Guidance. Retrieved from www.nrdc.org/sites/default/files/CMI-FS-Energy.pdf

NYC Department of Housing Preservation and Development (2014). The ABCs of Housing: Housing Rules and Regulations for Owners and Tenants. Retrieved from www1.nyc.gov/portal/apps/311_literatures/HPD/ABCs-housing-singlepg.pdf

Office of the New York State Attorney General. Tenants' Rights Guide. Retrieved from https://ag.ny.gov/sites/default/files/tenants_rights.pdf

StreetEasy. Can Your Landlord Enter Your Apartment at Any Time? Retrieved from https://streeteasy.com/guides/renters-guide/can-your-landlord-enter-your-apartment-at-any-time/

21 Lower the Burden of Façade Inspections

I. Summary

Issue:
Since 1980, the façades of buildings affected by Local Law 11 have been thoroughly inspected eight times. Regulations and industry customs make these inspections the single largest expense for many buildings.

Recommendation:
Require less-frequent inspections for buildings with clear track records. Reduce other cost factors by creating a role for drones or cameras, allowing reports to be filed despite open permits and clarifying rules for site-safety inspectors.

II. Proposal

Explore opportunities to reduce the burden and cost of façade inspections, including:

- Less frequent inspections for buildings with clear track records
- Incorporating drones or cameras
- Allowing buildings to file reports even if they have open permits
- Clarifying the requirements for site safety inspectors, including the amount of time required on a site
- Implementing a version of Chicago's "Ongoing Inspection and Repair Program"

Also consider opportunities to incorporate energy efficiency improvements into façade inspections.

III. Supporting Information

Expanded Issue:
New York City's building stock suffered from years of neglect and abandonment in the middle of the 20th century. As interest in city living was rekindled, inadequacies became apparent. Triggered by the death of a Columbia student from falling masonry, the City Council passed Local Law 10 in 1980, requiring the inspection and repair of street-facing façades of buildings taller than 75 feet every five years. Local Law 11 followed several years later, expanding the inspection requirement to the sides of these buildings. Now called the Façade Inspection Safety Program (FISP), Local Law 11 continues to protect the public from façade failures.

Some requirements of this law—or customs that have grown up around it—are generally viewed as excessively stringent and engendering costs that inhibit many buildings from investing in other improvements. The city should consider some modifications to the current FISP requirements to mitigate these costs, and, possibly, to add energy components to the report requirements.

In the years since New York initiated façade inspection requirements, many other cities have followed suit. The following chart shows the diversity in filing requirements and compliance intervals.

Façade repair laws in other jurisdictions

Location	Buildings Impacted	Frequency
New York, NY	H ≥ 75 feet	5 years
Boston, MA	H ≥ 70ft	5 years
Chicago, IL	H ≥ 80ft	- Critical inspections every 4, 8 or 12 years depending on building classification - File “Ongoing Inspection & Repair Program” reports every 2 years in lieu of Critical Examination Reports if building meets certain qualifications
Philadelphia, PA	H ≥ 6 stories	5 years (initial inspection depends on building age)
San Francisco, CA	H ≥ 5 stories	10 years (initial inspection depends on building age)
Milwaukee, WI	H ≥ 5 stories Age > 15 years	5, 8, or 12 years (based on building classification)

Assessment:
There are aspects of the FISP program that could be modified to save costs and possibly include an energy component without detriment to the city’s commitment to façade maintenance:

Return to the Local Law 10 timeframe for inspections

FISP reports are required in five-year cycles. Under LL 10, as a building’s report date approached, it had a two-year window to perform requisite tests and file the FISP report. The requisite scaffold drop to inspect the façade could be performed at any time during that two-year window. With Local Law 11, the inspection must be performed no more than one year before the submission of the report. But because the preparation and review of the report can take longer than a year post-inspection, this often requires a second, costly physical inspection to be performed before the report can be submitted. The prior two-year window for testing was better suited for careful preparation and timely submission of the FISP report.

Legislation would be necessary to change the length of the FISP compliance cycle.

Don't link open permits to FISP filing

Buildings today are being prevented from filing FISP reports if the Department of Buildings has any open permit for the building. This causes delays as the building owner seeks to identify these permits and get them cleared. If the filing is delayed it can create significant added costs for the owner. Buildings should be allowed to file FISP reports as they are ready. This can also be an opportunity for the filer to clear open permits, but the permits should not prohibit filing.

Appropriate site safety inspector requirements

When the site safety inspector law was created, it never envisioned that Local Law 11 projects would require a 40-hour-a-week site safety inspector; this requirement was designed for new construction with large cranes. Unfortunately, though regulations for site safety inspectors were written and circulated within the Department of Buildings, they still haven't been widely disseminated or understood. This has created considerable confusion concerning the site safety inspector requirement for a building doing FISP work.

The Department of Buildings should publish and promote the rules for site safety inspectors and help buildings to ascertain the level of inspector necessary for a particular project. It was never intended that FISP projects should require a full-time, 40-hour-a-week site safety inspector.

Possible alternate resources for façade inspections

In some cities, drones are used to photograph and/or film building façades, often accessing tight spots that cannot be reached by workers on a scaffold. Carefully controlled, legalized use of drones for portions of the New York City inspection process could reduce costs and increase the efficiency of FISP inspections. Drones equipped with thermal cameras could also help determine where weatherization is most needed.

New legislation would be necessary to allow the use of drones for building inspections in New York City.

Consider implementing a version of Chicago's "Ongoing Inspection and Repair Program"

Chicago generally requires its buildings to undergo "critical inspection," requiring hands-on inspection and scaffolding every 4-12 years (depending on building type). However, in 2016, it added an optional "ongoing inspection" program: if certain criteria are met, a short form report can be filed every two years, in lieu of filing critical inspection reports at category-mandated frequencies. If adopted in New York City, a similar program could reduce regulatory burden while providing a wider implementation window for energy efficiency measures.

Assess strategies around roof insulation requirements and parapet height

Many buildings are foregoing necessary roof replacements, as roof insulation requirements that raise the level of the roof also mean that the height of the parapet must increase. The resulting cost considerations cause owners to settle for repairs rather than perform the full replacement. Roof insulation requirements should be revisited with the understanding that substantive incremental improvement is better than discouraging roof replacement completely.

Maximize FISP scaffold drops by adding weatherization and energy improvements

Because of the significant cost of requisite scaffolding to inspect the building façade and sidewalk sheds to protect the public, adding energy components to the FISP requirements could prove economical. The soundness of the building envelope is a vital component of resident comfort. Drafty, un-caulked windows and air conditioner sleeves allow heat to escape and increase the cost of maintaining comfortable indoor temperatures. The city should consider requiring thermal evaluation of the façade, with caulking, weatherization, etc. to remedy areas where heat loss is excessive.

Other potentially viable opportunities to encourage integration of energy-related improvements to the FISP process should also be explored, such as consideration of solar (or wind) installations, installation of insulated window AC panels, or studies to relocate building systems to roofs or courtyards.

Appendix 1: Guiding Principles

Principles to Guide the Policy Framework

In developing the policy framework, stakeholders generated a list of ten consensus principles to inform policy design and help evaluate options.

The optimal policy should:

1. Push change in line with the city's 80x50 goals.

2. Be grounded in building science and data with as simple and transparent a methodology as possible.

3. Not penalize buildings for things they cannot or should not change (e.g. density), or for early adoption of energy efficiency measures.

4. Motivate parties that are responsible for energy use and have the power to change it.

5. Encourage efficiency in NYC buildings without pushing higher-intensity uses or affordable housing elsewhere.

6. Be compatible with alternative compliance options (e.g. green power).

7. Ensure that measurement and compliance processes are feasible, not unduly burdensome, and align with existing compliance structures to the extent possible. Feasibility may require different approaches for the commercial and multifamily sectors.

8. Achieve maximum carbon emissions reduction with minimum cost (or deliver the largest carbon abatement for the least cost).

9. Frontload emissions reductions where feasible to combat the tendency to delay action and because initial reductions may be the least expensive ("low-hanging fruit").

10. Encourage (and not discourage) beneficial electrification.

Appendix 2: New York State Policy Context

New York State Policy Context

New York State's overarching energy strategy, Reforming the Energy Vision (REV), sets three key energy goals to be achieved by 2030:

- 40 percent reduction in greenhouse gas (GHG) emissions from 1990 levels
- 600 trillion Btu increase in statewide source energy efficiency
- 50 percent of statewide electricity generation from renewable energy sources

The state's energy efficiency and renewable energy initiatives in pursuit of these goals will impact the downstate electricity grid and support efficiency upgrades in New York City over the coming decades. This document provides background on some key state-level initiatives and requirements that should inform any NYC-specific energy reduction policy.

1. Clean Energy Standard

The Clean Energy Standard (CES) is a statewide renewable energy goal, implemented through the New York Public Service Commission, requiring that 50 percent of New York State electricity come from renewable energy sources by 2030.

The CES is implemented through two main mechanisms relevant to utilities serving New York City: the renewable energy standard (RES) and the zero-emissions credit requirement (ZEC).

The RES requires every "load-serving entity" (electricity providers) to procure Tier 1 renewable energy credits (RECs) for their retail customers. Each Tier 1 REC derives from 1 MWh of energy production by eligible electric generation sources. The New York Generation Attribute Tracking System (NYGATS) tracks entity compliance. Alternate compliance payments are available to those load-serving entities unable to meet their Tier 1 obligations.

Annual REC purchase requirements are set as a percentage of a utility's load, with increasing obligations each year. The annual percentage of load that must be satisfied by Tier 1 RECs through 2021 is shown in the table below.

Tier 1 REC Annual Obligations	
Year	**LSE Obligation**
2018	0.15%
2019	0.78%
2020	2.84%

2021	4.20%

The ZEC requirement mandates that each load-serving entity purchase a number of ZECs from NYSERDA based on its proportional share of statewide load each year. ZECs are generated by upstate nuclear facilities.

2. Energy Efficiency Initiatives

At least two state-level energy efficiency initiatives will impact emissions reductions and support for retrofits in New York City in the coming years. First, the RetrofitNY program, spearheaded by NYSERDA, aims to bring a large number of affordable housing units to or near net-zero energy use by 2025. New York City has a sizeable affordable housing stock and is a prime target. RetrofitNY has the potential to provide critical support to a sector that has traditionally struggled to finance efficiency work. While improving quality of life for thousands of the city's affordable housing tenants, this initiative could also pilot innovative and minimally-invasive renovation solutions, improve knowledge of energy efficiency in the city's workforce, and foster relationships between owners and financial organizations.

Second, the state recently announced New Efficiency: New York, an energy efficiency initiative that could bring substantial support for scaling up retrofits in New York City. With this initiative, the state has set a 2025 statewide energy efficiency target of 185 trillion Btu of cumulative annual site energy savings relative to forecasted energy consumption. The plan also includes an electric efficiency target: 30,000 GWh reduction from forecasted consumption in 2025, including annual electric efficiency savings of 3 percent utility sales by 2025. New York City utilities will need to significantly increase support for efficiency programs to reach these targets.

3. Renewable Electricity Generation

New York generates substantial clean energy, particularly hydro and nuclear power. But transmission constraints prevent clean energy generated upstate from reaching the city. Currently, less than a quarter of the electricity supplied in NYC comes from renewable sources. Moreover, the upcoming closure of Indian Point nuclear facility in 2021 will remove 2,000 MW of clean energy from the downstate grid.

State-level efforts will help bring more renewable electricity to New York City, though the timeline is uncertain. The PSC has approved a 1,000 MW transmission line down the Hudson River to bring clean energy from Hydro Quebec to Astoria, Queens. REV's NY-Sun program will also help increase the percentage of NYC's electricity supply coming from renewable sources. Perhaps most importantly, the NY State Offshore Wind Master Plan aims to bring 2,400 MW of offshore wind power to the downstate grid by 2030. And it's moving forward: in July 2018, Governor Cuomo announced a plan to procure 800 MW through a solicitation issued in Q4 2018, in consultation with NYPA and LIPA. Awards will be announced in Q2 2019.

In the 2018 State of the State address, the Governor also announced an energy storage target of 1,500 MW by 2025 to help integrate renewable energy into the grid. Future initiatives in support of this target may help the city more effectively use local renewable energy and alleviate the demand on the transmission-constrained city grid during peak hours.

4. Financial Assistance

NYC building owners can leverage state-sponsored financing institutions and funding mechanisms. The Clean Energy Fund, a fundamental component of REV, established a $5 billion fund to support clean tech innovation, help mobilize private investment in energy efficiency initiatives, and eliminate barriers to scaling up clean energy technologies. The fund covers the NY Green Bank, which has driven $1.6 billion in public and private investment in clean energy projects across the state. The state also secured a $300 million Environmental Protection Fund in 2016 that supports climate-related projects statewide.

5. Regional collaboration

New York State is part of the Regional Greenhouse Gas Initiative (RGGI), a cooperative effort among Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont to cap and reduce power sector carbon emissions. Collectively, 26,100MW of installed capacity participate in RGGI. In 2014, the RGGI states implemented an initial regional carbon cap of 91 million short tons. The cap will decline 2.5 percent each year from 2015 to 2020.

Appendix 3: Advisory Committees

Ongoing Stakeholder Input

A number of the proposals in *Blueprint for Efficiency* reference the need for additional stakeholder input as the policy framework is further developed and refined throughout the legislative and rule-making processes. Significant examples include developing the NYC Energy Metric (*Proposal 2*), determining the site-to-source conversion factor (*Proposal 3*), allocating the graduated reduction percentages within each sector (*Proposal 5*), developing an efficiency trading program (*Proposal 11*), and refining the adjustments to reduction requirements for beneficial electrification (*Proposal 13*) and cogeneration (*Proposal 14*).

Stakeholder input can come in many forms, with the potential spectrum ranging from public comment periods, to formal advisory committees required by legislation, to informal targeted requests on specific issues. While the forum may vary, input from a diverse and engaged group of experts and stakeholders is essential to developing the best possible policy with widespread support.

The following is a suggested approach, based on the 80x50 Buildings Partnership process and recommendations:

Formal advisory committees

1. **Metrics Advisory Committee**

    - Composition: Building owners and managers, tenants, utilities, engineers, architects, energy and retrofit experts, and environmental and community advocacy groups, supplemented as needed by statisticians or actuaries.

    - Scope: Inform development of aggregate targets for 2040 and 2050, the NYC Energy Metric, the site-to-source conversion factor, building-level graduated targets for each sector, the target adjustment for beneficial electrification, and the cap on the efficiency credit for new cogeneration.

2. **Alternate Compliance Advisory Committee**

    - Composition: Building owners and managers, tenants, utilities, engineers, architects, energy and retrofit experts, and environmental and community advocacy groups, supplemented as needed by economists or other academics experts in relevant fields.

    - Scope: Inform development of a green power alternate compliance option and an efficiency trading program.

Stakeholder consultation process

As discussed throughout *Blueprint for Efficiency*, a policy of this magnitude will require an unprecedented mobilization of support for retrofits (see in particular *Proposal 16: Make Efficiency Easier through Expanded Services*). Stakeholder consultation is critical to effectively addressing the wide variety of challenges to financing and deploying efficiency upgrades in NYC's varied building stock.

Given this challenge, we recommend a thorough stakeholder consultation process to inform the development of effective support services, financing improvements, and alignment with state and utility initiatives.