U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

New York City Benchmarking and Transparency Policy Impact Evaluation Report

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Prepared for the U.S. Department of Energy by
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Executive Summary

This U.S. Department of Energy (DOE)-sponsored New York City Benchmarking and Transparency Policy Impact Evaluation Report is designed to provide readers with a thorough understanding of both the approach and methodologies used to evaluate New York City's (NYC's) benchmarking and transparency policy, Local Law 84 (LL84), as well as the results of the application of those methodologies to the early period of the policy's implementation. This report is a stand-alone evaluation of the early market transformation impacts; however, there is a DOE-sponsored companion handbook available, from which this report's theoretical underpinnings are drawn.[1]

This report presents a policy evaluation framework (the "framework") used for assessing the impacts of the policy in three key areas: market transformation progress, gross and net energy impacts,[2] and non-energy impacts. This executive summary provides a summary of key findings, an overview of the framework and the three impact evaluation methodologies, followed by conclusions and recommendations.

Key Findings

At this early stage of market introduction of the New York City Benchmarking and Transparency policy, the evaluation team found evidence that supports the notion that the policy, as planned, is having initial impacts on City building owners and their usage of energy. We note, however, that it is too soon in the implementation process to make generalizations about changes in market actor behavior, or to directly attribute to the policy the increased amounts of energy and non-energy benefits found to exist in this study. Rather, we can say that based on the results of the limited number of owner and property manager interviews conducted and the estimated energy savings, greenhouse gas and jobs impacts, it appears that early evidence of the policy's impacts do exist. Further research as the policy and its impacts mature should be undertaken to confirm this positive market change direction. Table ES-1 provides an overview of report findings.

Table ES-1. Report Findings

	Key Study Findings
Market Transformation Progress	• Market transformation progress indicators for immediate and short-term outcomes are present with awareness of the policy present and expectation on the part of interviewees that the policy's influence will grow. • The policy currently plays a limited, but increasingly important role in real estate decision making as the awareness and attention to energy use among tenants and investors appears to be slowly growing. • Energy efficiency program administrators in the City are aware of the policy, assisting in its implementation, as applicable, and are considering plans as the policy matures to integrate B&T information into their program planning.

[1] *The Department of Energy Benchmarking & Transparency Policy and Program Impact Evaluation Handbook ("the Handbook").*

[2] *This report provides gross savings analysis. In this early stage of Local Law 84 (LL84) implementation, the net- energy savings attributable to the various energy-efficiency programs and policies that may have contributed to the gross impacts in NYC buildings have not been assessed. It should be noted, however, that gross savings findings in this report are consistent with the notion that energy savings will occur even in the early stages of NYC policy adoption. In this regard, for future evaluation, methodologies for assessing net savings are presented in Section 4 of this report.*

Gross Energy Savings Impacts	• The City saw a cumulative energy savings of 5.7% during the first four years of the policy from 2010 through 2013. This resulted in total dollar savings of $267,492,147. • The percentage savings steadily increased between 2010 and 2013. The percentage savings between 2010 and 2011 was 0.3%, as compared to 3.7% between 2011 and 2012 and 4.4% between 2012 and 2013. Although this evaluation cannot necessarily attribute these energy savings to LL84, these early results are consistent with the notion that energy savings will occur even in the early stages of policy adoption. • The building types that were most positively impacted by the policy were College/ University and Office. • The source energy savings are higher for older buildings and lower for newer buildings. This is likely the case because older buildings are more likely to have older systems that need replacing and building managers may decide to do other efficiency projects in tandem, such as upgrading the building envelope or installing efficient lighting.
GHG Emission Reductions	• The City saw a cumulative GHG percentage reduction of 9.9% between 2010 through 2013. GHG reductions were small between 2010 and 2011, but much larger in the 2011-2012 and 2012-2013 periods. • The GHG savings estimates are similar to the source energy savings impact estimates in degree and magnitude.
Jobs	• Estimated labor/job increases from benchmarking activities in the City were: 2010, 13 full-time equivalent (FTE) jobs; 2011, 35 FTE jobs, 2012, 40 FTE jobs, and 2013, 39 FTE jobs created from LL84. • An input-output (I-O) analysis estimates direct, indirect, and induced job creation from the labor required to achieve energy savings in buildings through operations and maintenance (O&M) upgrades and capital improvements. 3,132 direct jobs were calculated from the energy savings between 2010, the first reported year of data, and 2013. • Job creation estimates are derived from calculating the labor required to benchmark properties each year and estimated economic activity resulting from energy-efficiency improvements.

Below we present a narrative summary of report findings in the three key evaluation impact areas: market transformation progress, gross energy impacts, and non-energy impacts. At this early stage of the policy's implementation, findings appear positive, but are limited, with expectations that as the policy becomes more embedded impacts related to building owner, tenant, and investor awareness will become more robust.

Market Transformation Progress

Analysis of the limited number of interviewees conducted for this study suggests that the Market Transformation Indicators (MTIs) for immediate and short-term outcomes are emerging. Interviewed NYC building owners and managers are generally savvy about issues of energy management and noted that many large properties have sophisticated building management systems to monitor energy use in real time. Overall, interviewees pointed to the fact that there is a growing understanding that issues of energy-efficiency and sustainable management are now

standard in the building management industry. While energy awareness is growing among building managers, the interviews could not conclusively tie that awareness to the adoption of the benchmarking and transparency policy.

Still, interviewees confirmed that the policy plays a nascent role in energy use decisions, and tenants and investors are increasingly paying attention to energy usage. The interviewed real estate professionals reported that they have begun to see some early interest in tenant and investor requests for data, and they expect this interest to increase over time. Energy-efficiency program administrators in NYC, such as rate payer funded utility efficiency programs, are actively working with other energy-efficiency entities and local governments to incorporate and implement the policy. For instance, all administrators who were interviewed noted that they were working cooperatively with the City to include the benchmarking and transparency policy in program design, and they were at the early stages of using the reported information in program planning for future implementation. Some interviewees stated that the policy has already begun to affect their sales and program strategies. One interviewee noted that they now include benchmarking in their sales package by including upgrade requirements as a factor for their program accounts to consider.

Gross Energy Savings Impacts

Table ES-2 provides a high-level summary of the energy impacts from the first four compliance years of LL84. The savings were calculated using the source energy use intensity (EUI) output from EPA ENERGY STAR Portfolio Manager®, which is the total amount of raw fuel required to operate a building. Source energy takes into account the amount of energy lost due to transmission, distribution, and production, in addition to the amount of energy consumed by a building. As seen below, energy savings steadily increased between 2010 and 2013.

Table ES-2. Energy Savings Summary

Category	Savings (Million Btus) 2010 to 2011	Savings (Million Btus) 2011 to 2012	Savings (Million Btus) 2012 to 2013	Cumulative Savings (Million Btus)
Source Energy *(Weather Normalized)*	335,371 0.3%	12,067,456 3.7%	9,564,756 4.4%	21,967,583 5.7%

Figure ES-1 provides a visualization of the source energy savings alongside the real gross domestic product[3] and real cost of electricity[4] for the NYC region. All displayed values are indexed to 100 in 2010 to show how they have changed in relation to each other. The real cost of electricity has been inverted to reflect the relationship between energy cost and energy consumption. From 2010 to 2013, the gross domestic product (GDP) in NYC grew by 4.2 percent, while the cost of electricity fell by 8.4 percent. Both of these trends suggest an increase in source energy consumption, all else being constant. Thus, the reduction in consumption that was actually witnessed must be due to other factors. Although the attribution of this reduction from the implementation of LL84 was not conducted in this evaluation, the results are consistent with the notion that energy savings are likely to occur even in the early stages of policy adoption.

[3] *NYC gross domestic product is from the Bureau of Economic Analysis at www.bea.gov*

[4] *NYC electricity costs are from the U.S. Energy Information Administration's Annual Energy Outlook 2014 (middle Atlantic region), available at http://www.eia.gov/forecasts/aeo/.*

Figure ES-1. Changes in Energy, GDP and Electricity Prices

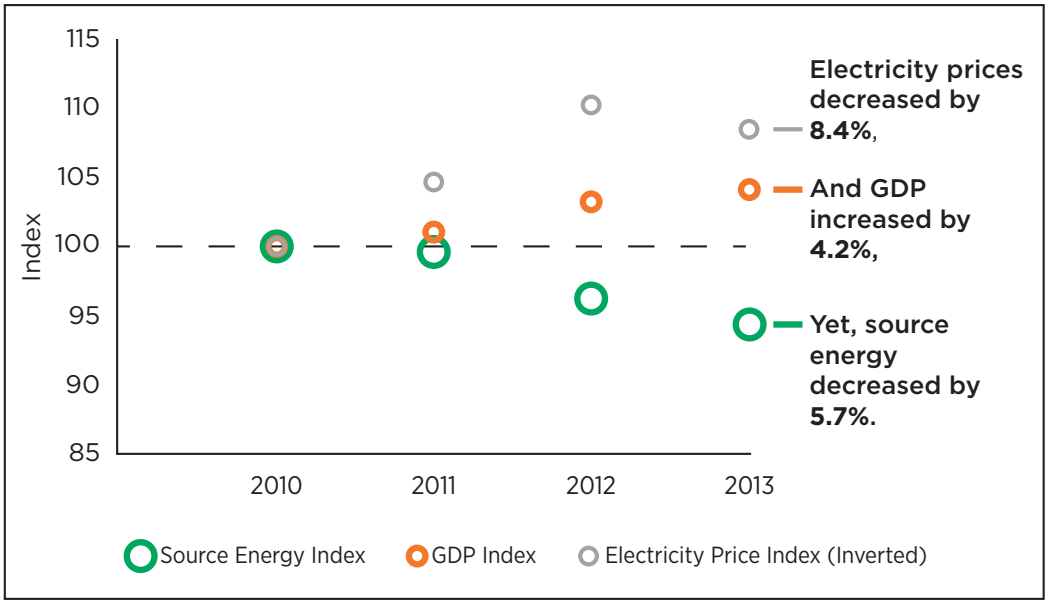


Table ES-3 provides a breakdown of the site energy savings by fuel type. Unlike the weather-normalized source savings in Table ES-2, the savings by fuel type were only available at the site level in the data output file and the values were not weather-normalized. As seen in Table ES-3, the savings vary significantly depending on the fuel type.

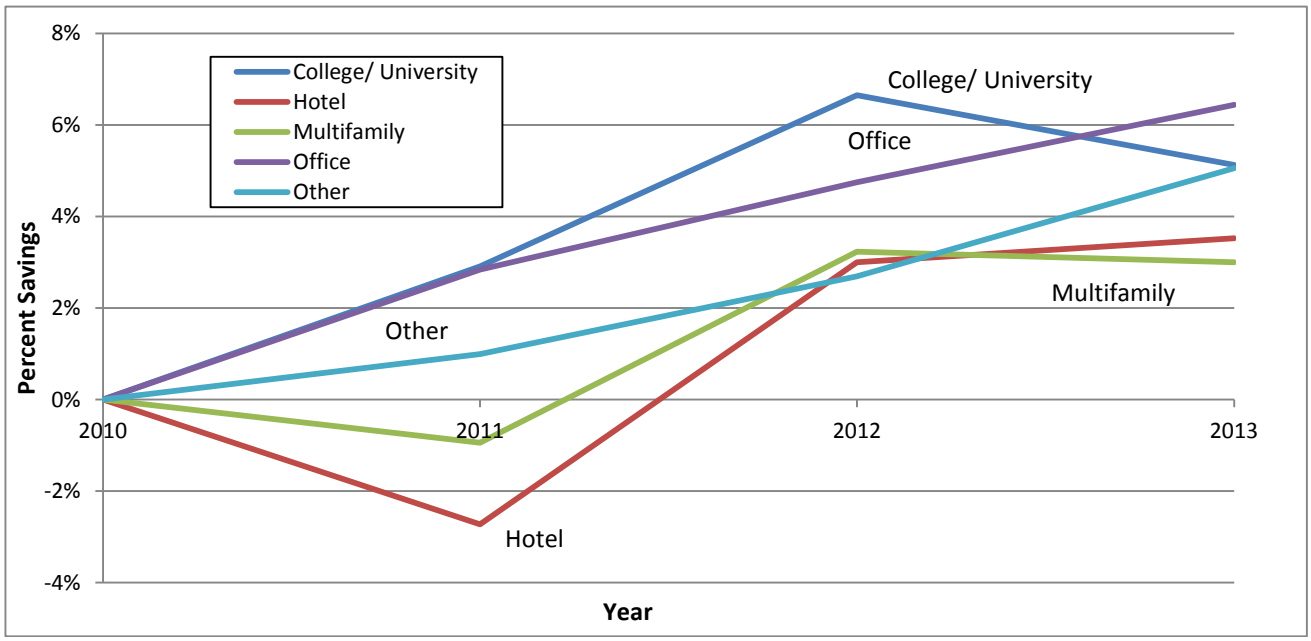
Table ES-3. Non-Weather-Normalized Site Energy Impacts by Fuel Type

Category	Energy Savings 2010 to 2011	Energy Savings 2011 to 2012	Energy Savings 2012 to 2013	Cost Per Unit	$ Savings 2010 to 2011	$ Savings 2011 to 2012	$ Savings 2012 to 2013	Cumulative Energy Savings 2010 to 2013	Cumulative $ Savings 2010 to 2013
Electricity *(kWh)*	80,119,255 (1.4%)	432,015,234 (2.3%)	328,368,003 (2.6%)	$0.15	$12,017,888	$64,802,285	$49,255,201	**840,502,492**	**$126,075,374**
Natural Gas *(therms)*	-574,148 (-0.4%)	22,248,309 (3.9%)	-34,456,686 (-8.8%)	$0.77	$-441,352	$17,102,442	-$26,487,112	**-12,782,525**	**-$9,826,022**
District Steam *(Million Btus)*	132,177 (2.3%)	1,644,497 (9.9%)	-1,216,546 (-10.7%)	$0.03	$3,734	$46,456	-$34,367	**560,128**	**$15,823**
Oil #2 *(Million Btus)*	157,263 (14.7%)	-5,066 (-0.1%)	-1,171,078 (-42.7%)	$19.83	$3,118,275	$-100,448	-$23,220,594	**-1,018,881**	**-$20,202,767**
Oil #4 *(Million Btus)*	260,676 (12.1%)	435,546 (8.6%)	-1,105,130 (-35.2%)	$19.83	$5,168,791	$8,636,181	-$21,912,952	**-408,908**	**-$8,107,980**
Oil #5&6 *(Million Btus)*	937,754 (8.7%)	5,062,099 (20.4%)	2,973,071 (24.1%)	$19.83	$18,594,162	$100,373,286	$58,951,228	**8,972,924**	**$177,918,676**
Diesel *(Million Btus)*	1,000 (60.6%*)	3,536 (54.2%)	50,261 (98.4%)	$28.70	$28,688	$104,528	$1,485,826	**54,796**	**$1,619,043**
Totals					**$38,490,187**	**$190,964,731**	**$38,037,230**		$267,492,147

**** The diesel savings are high because there were a limited number of buildings (less than 10) in each of the three compliance years that contained diesel consumption data. As a result, a few buildings with high percent savings swayed the total savings significantly.***

Figure ES-2 provides a comparison of the source energy savings between 2010 and 2013 for key building types. The savings are based on the changes in source EUIs between each of the years being compared.[5]

Figure ES-2. Source Energy Savings by Building Type



Non-Energy Impacts

A summary of the NYC GHG emissions reductions estimated by Portfolio Manager output are provided in Table ES-4. The results show reductions in emissions were least significant from 2010-2011 and most significant from 2011-2012. GHG emissions savings are about twice as high as the site energy savings. This difference is likely a result of NYC's fuel-switching efforts, where buildings must switch from fuel oil #6 to cleaner fuels before fuel oil #6 is phased out in 2015. Fuel oil #6 releases more emissions per British thermal unit (Btu) than fuel oil #4, fuel oil #2, or natural gas. A building that switches from fuel oil #6 to one of these cleaner fuels can release fewer emissions without reducing energy consumption.

Table ES-4. GHG Emissions Reductions Summary

Category	% Savings 2010 to 2011	% Savings 2011 to 2012	% Savings 2012 to 2013	Cumulative % Savings
GHG Reductions	0.70%	6.30%	2.50%	9.90%

Note that there were over 30 different building types submitted into Portfolio Manager but they were consolidated into a few building types for reporting purposes.

Figure ES-3 provides a comparison of the GHG emissions savings between 2010, 2011, 2012, and 2013 for several building types. The savings are based on the changes in total emissions between each of the periods being compared.[6]

Figure ES-3. GHG Emissions Savings by Building Type

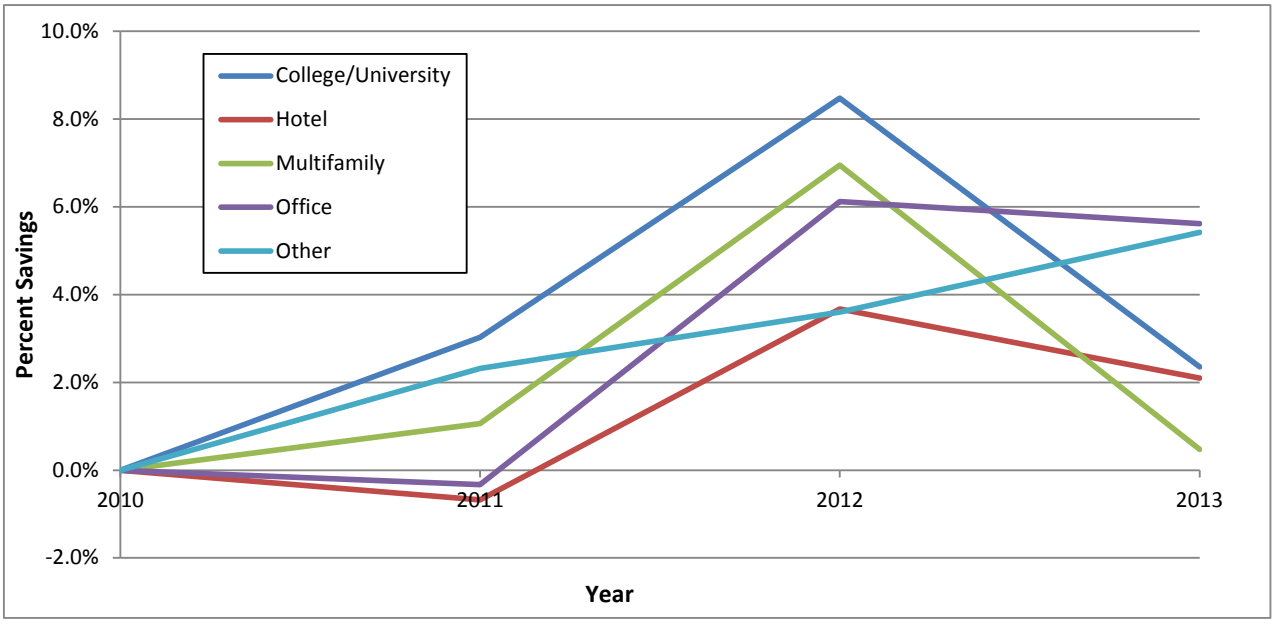


Table ES-5 shows the estimated full-time equivalents (FTE) to benchmark the properties in the four reporting years. By the 2013 reporting year, 39 FTE jobs were maintained. Note that FTE jobs are not additive from year to year. The number of FTE jobs supported each year increased until 2013, when it dropped to 39 from 40 the previous year.

Table ES-5. Number of Estimated Benchmarking Jobs Created

Calculation	Reporting Year 2010	Reporting Year 2011	Reporting Year 2012	Reporting Year 2013	Total
Benchmarking Jobs	13	35	40	39	**39**

[6] *Note that there were over 30 different building types submitted into Portfolio Manager but they were consolidated into a few building types for reporting purposes.*

Table ES-6 summarizes the estimates of the input-output model (I-O model) gross job impacts between the 2010 and 2011 period, the 2011 and 2012 period, and the 2012 and 2013 period from LL84. The I-O model estimates job creation that results from energy efficiency improvements that are the cause of the efficiency upgrades. The job creation comes in the from labor required to perform operations and maintenance improvements and capital upgrade work, and spending shifts from energy expenditures towards other labor. These types of employment impacts are also explored through direct, indirect, and induced job creation, which are the result of the economy-wide impact of this economic activity.

Table ES-6. Number of Estimated Jobs Created

Calculation	Calculated Jobs 2010 to 2011	Calculated Jobs 2011 to 2012	Calculated Jobs 2012 to 2013	Total 2010 to 2013
I-O Modeling Direct Jobs	382	1,456	1,294	**3,132**
I-O Modeling Indirect Jobs	290	1,098	988	**2,377**
I-O Modeling Induced Jobs	269	1,021	912	**2,202**
Total	941	3,576	3,195	**7,711**

In sum, this initial assessment of NYC's policy impacts shows evidence of a growing awareness by owners and real estate professionals, as well as interest and cooperation of energy utilities in the City in supporting and using energy use information in program planning. While encouraging signs of energy savings are present in policy-impacted buildings in the 2010 to 2013 period, further research is needed to link these savings directly to the policy's implementation. Finally, this report estimates reduced GHG emissions and increased job creation due to the policy. It appears too early in the implementation of LL84 to assess a correlation between property value and energy-efficiency increases due to the policy; this finding is expected at this early stage of policy implementation.

1 Introduction and Impact Evaluation Planning Framework

This *New York City Benchmarking and Transparency Policy Impact Evaluation Report* provides an impact evaluation of New York City's (NYC or "the City") Local Law 84 (LL84). LL84 mandates that all privately owned properties with individual buildings over 50,000 square feet or with multiple buildings with a combined square footage over 100,000 square feet annually report both their energy and water usage to the City. This evaluation focuses on three key policy impact evaluation elements: 1) tracking the market transformation progress impacts towards higher states of energy-efficiency, as envisioned by the passage of LL84; 2) gross and net energy savings impacts of the law; and 3) the non-energy impacts associated with adoption of the policy.

These three elements combine with this report's enunciation of a strategic planning framework ("the framework") to provide the City with a basic understanding of the status, impacts, and benefits of LL84 since it was enacted in 2009. In particular, the framework[7] provides city planners and implementers with a policy "logic model." This logic model describes the basic theory and elements of the NYC policy and attendant market transformation indicators (MTIs) that identify markers to track LL84's progress in meeting market transformation policy goals.

Although this evaluation is a stand-alone document, the presented findings and conclusions should be seen as an initial progress report or "snapshot in time" towards developing a longer-term understanding of the policy's progress, benefits, and impacts. To assist in this longer-term evaluation effort, the authors point the reader to the recently developed U.S. Department of Energy (DOE) companion "how-to" document, the *Department of Energy Benchmarking & Transparency Policy and Program Impact Evaluation Handbook* (the "Handbook"),[8] which provides jurisdictional staff with further detailed information to build on this initial assessment. The Handbook provides an in-depth review of the methodologies used in this report and relatively simple steps recommended to jurisdiction staff to track policy impacts over the duration of the policy's implementation.

1.1 Overview/NYC Policy Background

NYC has a long history of encouraging energy-efficiency in commercial buildings. The City's passage of Local Law 86 in 2005—requiring all new buildings, additions, and reconstruction work in capital projects that receive city funds to be built following Leadership in Energy and Environmental Design (LEED) guidelines[9] —is an early example of the City's efforts to be one of the nation's leaders in green energy legislation. This legislation was followed in 2007 with PlaNYC, a sustainability blueprint with an initial focus on climate change, growth, and aging infrastructure. In 2009, PlaNYC became the vehicle for city council passage of the Greener Greater Buildings Plan (GGBP) with LL84, the City's benchmarking and transparency policy, as a leading component. The passage of LL84, which affects over 1.7 billion square feet of NYC commercial space—an area equal to the combined floor space of the cities of San Francisco and Boston—set its own benchmark example for the rest of the nation in requiring energy usage transparency in privately owned commercial and multifamily buildings.

1.2 Local Law 84 as a Foundational Policy

The analysis of this report is focused on the energy and non-energy benefits of the policy and the indicators that can be used to identify if these benefits can be expected. However, another benefit that is less quantifiable, but just as real, is the fact that LL84 is a foundational policy. This means that the data collected via LL84 can be used to evaluate other efficiency policies and activities in NYC. Utility and other efficiency program managers now have underlying knowledge about building energy usage (on an annual basis) in their service areas and can thus target new programs aimed at supporting building owners with utility program support to enhance efficiency. Additionally, and of equal importance, the policy enables relevant efficiency administrators to establish a baseline and measure performance over time relative to other policies and programs. Though this benefit is not addressed in the remainder of this report, it must be acknowledged.

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[7] *See Section 2 for a detailed description of the framework and its logic model and MTI elements.*

[8] *The Handbook provides basic information on how policy-adopting jurisdictions can both incorporate a strategic market transformation evaluation framework into their front-end and ongoing planning efforts, as well as methodologies for determining the policy's progress towards market transformation, and the energy and non-energy benefits of the policy.*

[9] *For additional information, see http://www.nyc.gov/html/oec/html/green/green.shtml.*

1.3 Structure of this Report

Figure 1-1 provides an overview of the impact methodologies found in this report. Included are the primary and supplementary data gathering and analytic methods used (or available for use in the case of supplementary methods).

Figure 1-1. Overview of Impact Evaluation Methodologies

B&T Policy Planning Framework and Impacts Evaluation Handbook	Activity Description	Approach (Primary or Supplemental Method)
Handbook Section 1 & 2 **B&T market transformation planning framework**	B&T policy theory and strategic logic model development	*Primary method* • Identify barriers to energy efficiency • Select activities to overcome barriers • Target expected outcomes
Leading indicators of market impacts	Market transformation indicators (MTI) development to identify the progress of expected outcomes over time	*Primary method* • Analyze market infrastructure and market actor changes • Analyze sustainability of policy impacts over time Identify key milestones indicating policy success • Analyze MTIs using market actor interviews and surveys
Handbook Section 3 **Gross energy impacts**	Portfolio Manager data analysis to identify energy impacts	*Primary method* • Analyze iterative energy use intensities (EUIs) *Supplemental method* • Augmented analysis of iterative EUI outputs
Net energy impacts	Attribution of savings across various energy efficiency policies and programs that target the same buildings market	*Primary method* • Develop historical tracing • Structured expert judgment panel (intermediate & long-term) *Supplemental method* • Quasi-experimental design to estimate net impacts from regression approaches
Handbook Section 4 **Non-energy impacts**	• Greenhouse gas (GHG) reductions • Net job creation • Real estate value enhancement assessment	*Primary method* • Calculate GHG benefits • Calculate direct, indirect and induced jobs • Real Estate comparative sales analysis *Supplemental method* • Real estate – hedonic regression modelling

* Primary methodologies are relatively simple and require minimal data collection efforts beyond what the jurisdictions are already implementing. These recommended approaches appeal to those who wish to perform a very basic assessment of the B&T policy, and match the evaluation resources available in most jurisdictions.

** Supplementary methodologies are more sophisticated and rooted in traditional utility energy-efficiency program evaluation approaches. Supplementary methodologies are intended to be used by jurisdictions who wish to invest greater effort to obtain results that are more robust.

The remainder of this report provides detailed discussion of the strategic evaluation planning framework and methods used to evaluate the three key areas of impact focus of this report:

- Section 2 – Strategic Planning Framework. Section discusses the policy logic model and introduces the market transformation indicators that can be used to evaluate early progress of the policy
- Section 3 – Market Transformation Progress. Section summarizes the initial impacts of LL84
- Section 4 – Energy Impacts. Section describes the gross energy savings that has occurred in NYC's buildings since the passage of LL84.
- Section 5 – Non-Energy Impacts. Section describes in detail both the methodology and findings related to these important non-energy impacts within the City at this early stage of policy implementation.

Each impact section is structured to provide the reader with a detailed explanation of the methodological approach used to assess impacts, data sources, and findings. Section 4 also provides an analysis of the historical context for the benchmarking and transparency policy in the form of a historical tracing diagram, which shows the diversity of policy and program influences currently operating in the NYC energy-efficiency marketplace.

2 Strategic Planning Framework

2.1 Logic Model

This section details the specific barriers, activities, and outcomes of the program theory and logic that, in turn, serve as the basis to assess both a) the progress of the market transformation impacts, and b) the causal relationship between the policy and any energy (and non-energy) benefits.

2.1.1 Barriers to the Use of Energy Performance Data in Real Estate Transactions

NYC has designed its benchmarking and transparency policy to address specific barriers to the adoption of energy-efficiency measures or behaviors in the City's commercial real estate:

- **Internal barriers: Building owners are often unaware of their own energy use** – Owners may not be attentive to energy performance, because certain lease structures pass on costs to tenants; because they do not believe it is worth their time to manage; or because owners focus their attention on other matters.
- **External barriers: The real estate market lacks transparency about energy use for tenants, investors, and underwriters** – Tenants, investors, and underwriters are not aware of the long-term costs of energy in the operation of commercial spaces. Without the information to differentiate between buildings with higher or lower energy performance, they lack the ability to factor this variable into their decision making.
- **Market barriers: Energy-efficiency program administrators lack market data for program design** – Program administrators such as the NYC's Mayor's Office, New York State Energy Research and Development Authority (NYSERDA), Con Edison, National Grid, the Long Island Power Authority (LIPA), and the New York Power Authority (NYPA) may lack the market-wide relative energy usage data that would allow them to most effectively design programs for optimal effectiveness. Improved understanding of the building stock in their territory would allow them to design programs that more effectively target certain sectors or niches with the most apparent opportunity.

2.1.2 Policy Activities to Overcome Barriers

Policy activities are policy and non-policy interventions designed to overcome the previously listed barriers as part of implementation. In NYC, these activities include the following:

- **Develop and implement benchmarking and transparency policy** – this is the process by which the City creates, consults, revises, and eventually promulgates the formal benchmarking policy, now known as LL84.
- **Conduct outreach and training for building owners and tenants** – this includes all efforts via websites, social media, and stakeholder engagement (e.g., the Urban Green Council) to raise awareness and create understanding of LL84's processes and intended outcomes, as well as to train building owners to conduct benchmarking activities.
- **Facilitate communications with benchmarking service provider** – these are active efforts on the part of the City to maintain relations with consultants and service providers who can help building owners to successfully collect accurate energy performance data and comply with all aspects of the policy.
- **Collect and disclose benchmarking data to the public** – these are the activities by which the City collects building data through ENERGY STAR Portfolio Manager and disseminates this energy performance information to the public.

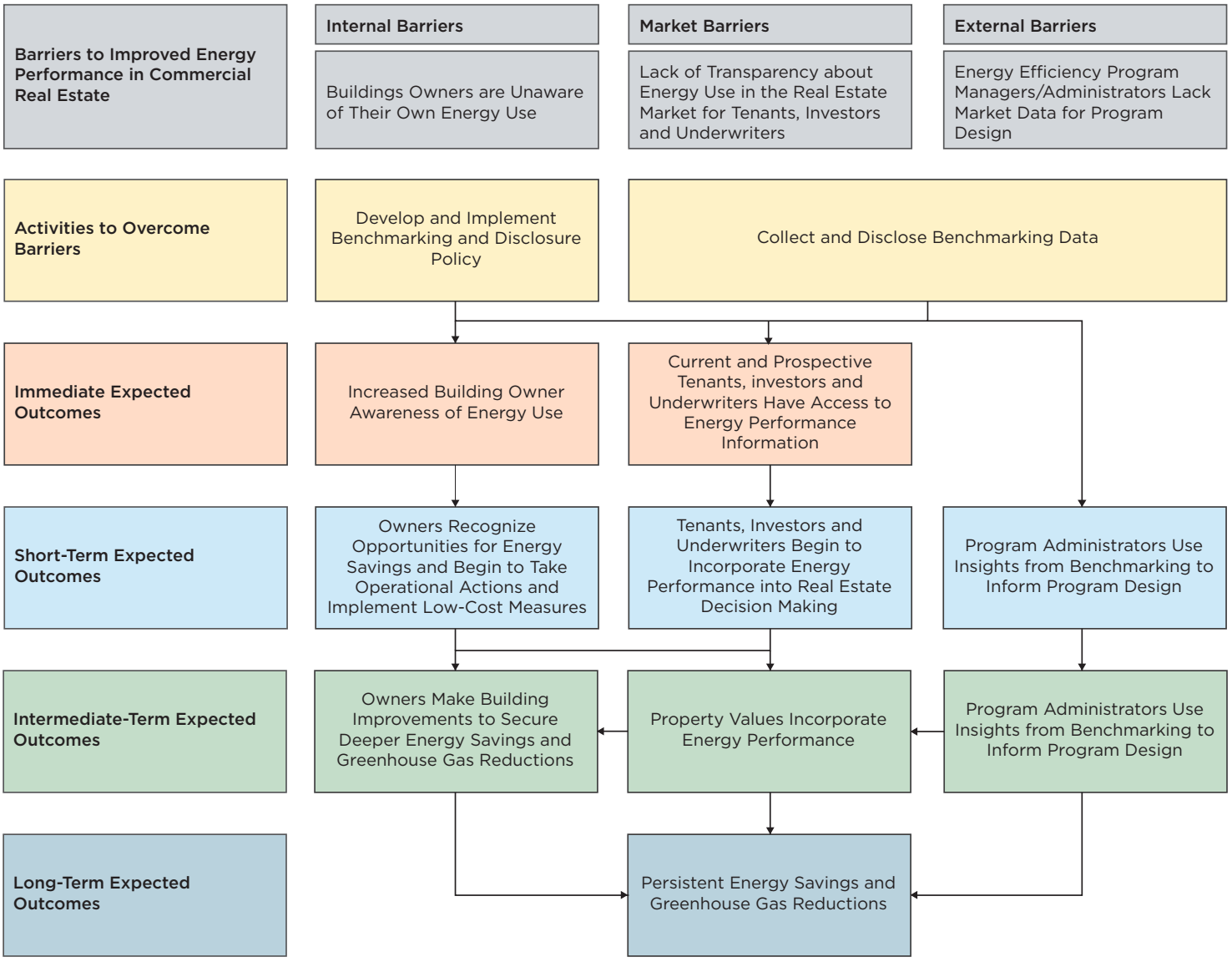
2.1.3 Expected Outcomes from Activities

The previously noted City activities are intended to result in certain outcomes. These outcomes represent the changes in market structure or market actor behavior that LL84 hopes to achieve. In general, immediate and short-term outcomes focus on the earliest effects upon awareness and the initial actions taken towards saving energy.

Intermediate outcomes are the intended changes to market structure or market actor behavior. Long-term outcomes are the intended market effects that follow on from the erosion or elimination of identified barriers.

In Figure 2-1, we present the NYC policy logic model, which graphically shows linkages among a) the barriers the City policy is intended to overcome, b) the activities the City is taking (at the current time and planned into the future) to overcome those barriers, and c) the hoped for outcomes of the policy related to market transformation, energy, and non-energy impacts.

Figure 2-1. New York Benchmarking and Transparency Policy Logic



2.2 Market Transformation Indicators

As can be seen from Figure 2-1, the City's policy has wide-ranging and ambitious goals. In Appendix A we present in detail the MTIs that are used in this report as "markers" or potential "milestones" for assessing the market transformation progress impacts of the policy. These MTIs act as signposts by which evaluators assess the extent to which NYC's policy has transformed, and potentially will continue to transform, the commercial real estate market.

Because this transformation happens slowly, energy impacts from market transformation typically are not found to be immediately apparent. In this context, quantifying the early progress of market transformation efforts may

rely upon qualitative changes in market structure or market actor behavior as evidence that the eventual, intended energy savings outcomes are likely to take place. Such qualitative evidence of market change can provide immediate feedback on the progress of the policy in meeting its early market transformation goals – even without direct measurement of energy savings impacts. The tables presented in Appendix A show specific NYC policy MTIs as well as a discussion of the possible evolution of these indicators over time, the data sources and collection methods, and the suggestions for remedial action when the MTIs are not found to be present in the marketplace.

3 Market Transformation Progress

3.1 Market Transformation Progress Methodological Approach

The assessment of NYC policy market transformation progress impacts was based on the MTIs noted in the previous section and delineated in Section 5 and their presence in the NYC marketplace. Market actor interviews were the leading data collection technique used to identify evidence, or non-evidence, of the presence of the indicator.

As noted in Section 2, the NYC logic model identified the following three barriers:

1. Building owner lack of awareness of their own energy use
2. Lack of transparency about energy use in the real estate market for tenants, investors, and underwriters
3. Energy-efficiency program managers and administrators lack of market data for program design

These barriers served as an intermediary step to identifying MTIs and related interview questions that were used by the project team to compare findings from market actor interviews to the expected outcomes and MTIs – and thus assess the degree of market transformation progress and the likelihood of its sustainability. The MTIs identified from the logic are classified as internal, external, or societal MTIs. Each market indicator was developed and assigned an expected time frame (immediate/short-term, intermediate-term, or long-term) in which the market would be expected to show evidence of "completion" (or progress) in meeting the policy indicator goal, or "non-completion" (or lack of market movement passed progress) in meeting these milestones.

Data collection took place through a limited number of market actor interviews with three distinct groups of market actors: building owners and property managers, real estate brokers and investors, and energy-efficiency program administrators. Each of the three interview guides asked tailored questions designed to understand the presence of various MTIs for interviewees in order to assess their progress in the market transformation process, as well as to assess the relative impact of the policy in the NYC market to date.

The major focus of this initial NYC assessment was to both test the interview instruments in a "real world" situation with market actors to determine the efficacy of the questionnaire in identifying key market trends—which later could be compared to MTIs—and in determining whether interview questions were adequate to the task or needed to be expanded. This focus provided the backdrop for interviewing a small number of market actors from key companies[10] in each market segment. Participants were selected from an initial list of target audience members compiled by the project team staff and coordinated with NYC staff. Table 3-1 shows the number of interviews conducted for each group.

Table 3-1 Market Actor Interviews

Interview Guide	Number of Interviewees
Building Owners and Property Managers	8
Real Estate Brokers and Investors	4
Energy-Efficiency Program Administrators	4

[10] *Future iterations of market transformation progress impacts interviews are encouraged to develop sampling plans with statistically significant representative samples of numbers and strata /types of interviewees.*

Data collected during the interview process was qualitatively analyzed and compared to the expected outcomes and MTIs identified through the logic model. Appendix D provides copies of the interview guides and survey instrument used to assess the market's transformation status for three types of market actors: 1) building owners and property managers, 2) real estate professionals and investors, and 3) energy-efficiency program providers, utilities, and agencies.

3.2 Illustrative Example of Results of Market Actor Interviews to Determine Market Transformation Progress

Table 3-2, Table 3-3, and Table 3-4 present a comparison of MTIs to market responses with a summary of interview findings in the last column of each table.[11] As noted, these tables provide a limited "real world" summary of market actor findings related to market transformation progress to date.

[11] *Narrative descriptions of interviewee discussions, query responses, and recommendations for future policy improvements can be found Appendix B.*

Table 3-2. Illustrative Report-out of Building Owner and Property Manager Interviews

	Outcome	Internal MTIs	Market MTIs	External MTIs	Interview Findings
Immediate	Increased building owner awareness of energy use.	Building owners are aware of annual energy spent per building or leased space for all fuels.	N/A	N/A	There is a high level of awareness among building owners and managers. All eight owners interviewed were tracking before the policy, and five out of eight were already benchmarking. For four interviewees, the policy improved their understanding of energy use, while for others it had no impact other than changing their behavior to meet the law.
Short Term	Owners recognize opportunities for energy savings and begin to take operational actions and implement low-cost measures. Tenants, investors, and underwriters begin to incorporate energy performance into real estate decision making.	Building owners can identify specific energy savings opportunities in their own buildings. Building owners can describe implementation of specific low-cost measures within their own buildings.	Tenants are increasingly aware of benchmarking disclosure information and their understanding of this information increases over time. Investors and underwriters are increasingly aware of benchmarking and disclosure information.	N/A	All eight interviewees were already participating in NYSERDA or ConEd programs before the enactment of the policy. The B&T policy was not a strong influence in building owners' decisions to participate in energy efficiency programs, but tenants, investors, and underwriters are beginning to request energy data more often.
Intermediate Term	Owners make building improvements to secure deeper energy savings and greenhouse gas reductions. Property values incorporate energy performance.	Building owners are increasingly aware of annual energy spend trends for all fuels. Building owners include energy savings as a component of retrofit/renovation planning. Retrofits and renovations preserve and expand upon previously installed measures.	Tenants incorporate disclosure information into lease negotiations. Investors and underwriters begin to include disclosure information as valuation criteria.	N/A	For seven out of eight building owners and property managers, the policy did not influence their decision to make energy efficiency improvements. All interviewees were "very likely" to invest in energy efficiency upgrades, though not necessarily due to the B&T policy. Demand for efficient or green-labeled buildings has increased, and building owners expect to see more investors requesting benchmarking data in the future. For most owners and managers, compliance with the ordinance was the most influential reason for benchmarking.
Long Term	Persistent energy savings and greenhouse gas reductions.	Building owners increasingly incorporate B&T data into energy management decisions. Building owners increasingly incorporate kWh and therm costs into expansion and retrofit design and construction practices. Building owners deliberately strive toward improved energy performance as a management metric.	Tenants require consistent energy improvements as a standard lease offering. Investors and underwriters include improving energy performance as a standard valuation metric.	N/A	Most interviewees have hired full-time staff or consultants dedicated to energy efficiency in their buildings, but have not quantified the benefits of their energy management efforts to date. Energy efficiency is not a large draw for tenants, but those that have drawn new tenants cited cost savings and public image as drivers.

Table 3-3. Illustrative Report-out of Real Estate Broker and Investor Interviews

	Outcome	Internal MTIs	Market MTIs	External MTIs	Interview Findings
Immediate	Increased building owner awareness of energy use. Current and prospective tenants, investors, and underwriters have access to energy performance information.	Building owners are aware of annual energy spent per building or leased space for all fuels.	N/A	N/A	Tenants and investors rarely request information regarding energy performance, and while they have access to building energy performance data, it is not easily located or necessarily analyzed in depth. Reasons that prevent building owners and managers from improving energy performance include a low return on investment, reluctance to engage with public administration, staffing, money, and tenants with high-energy consumption.
Short Term	Owners recognize opportunities for energy savings and begin to take operational actions and implement low-cost measures. Tenants, investors, and underwriters begin to incorporate energy performance into real estate decision making.	Building owners can identify specific energy savings opportunities in their own buildings. Building owners can describe implementation of specific low-cost measures within their own buildings.	Tenants, investors, and underwriters are increasingly aware of benchmarking disclosure information and their understanding of this information increases over time.	N/A	Two out of four real estate professionals said building owners changed their behavior due to the B&T policy, and one said benchmarking consultants became popular. Tenants, investors, and underwriters ask for benchmarking data infrequently, but real estate professionals expect this to increase over time.
Intermediate Term	Property values incorporate energy performance.	N/A	Tenants incorporate disclosure information into lease negotiations. Investors and underwriters begin to include disclosure information as valuation criteria.	N/A	Real estate professionals vary in their assessment of the marketplace value of efficient properties. Some identify corporate sustainability policies and energy savings opportunities as drivers of value, while others note that the cost of the buildings in New York City eliminates efficiency as a factor. Investors may use the ENERGY STAR score as part of the building valuation checklist.
Long Term	N/A	N/A	N/A	N/A	N/A

Table 3-4. Illustrative Report-out of Energy-Efficiency Agency/Entity Interviews

	Outcome	Internal MTIs	Market MTIs	External MTIs	Interview Findings
Immediate	N/A	N/A	N/A	N/A	N/A
Short Term	Program administrators use insights from benchmarking to inform program design.	N/A	N/A	Energy efficiency program administrators begin to include benchmarking and disclosure information in their new program design.	Energy efficiency entities offer a variety of short- and long-term programs including prescriptive measures, systems improvements, and sector-specific programs. Barriers include staff resources, funding constraints, and approval process.
Intermediate Term	Owners make building improvements to secure deeper energy savings and greenhouse gas reductions. Property values incorporate energy performance. Program administrators use insights from benchmarking to inform program design.	Building owners are increasingly aware of annual energy spend trends for all fuels. Building owners include energy savings as a component of retrofit/ renovation planning. Retrofits and renovations preserve and expand upon previously installed measures.	Tenants incorporate disclosure information into lease negotiations. Investors and underwriters begin to include disclosure information as valuation criteria.	Energy efficiency program administrators increasingly include benchmarking as a standard input to their current and future program design.	Energy efficiency entities who work with commercial customers use the B&T policy to increase awareness and sales of energy efficiency programs. Energy efficiency entities are working with governments to improve programs for customers, and developing voluntary B&T policies for other jurisdictions. All three interviewees are still in the process of determining how to incorporate the benchmarking and disclosure policy into their programming, and are actively working with other entities to incorporate and implement B&T.
Long Term	N/A	N/A	N/A	N/A	N/A

3.3 Findings: Market Transformation Progress

Analysis of the interview findings suggests that the MTIs for immediate and short-term outcomes are present in NYC.

3.3.1 Immediate Outcomes and MTIs

Of the group of those interviewed, building owners and managers in NYC were savvy about issues of energy management As well, larger building owners interviewed stated that they have sophisticated building management systems to monitor energy use in real time. Other comments from property managers related to the fact that for some large commercial clients the policy resulted in publicity, causing them to pay closer attention to energy usage. Additionally, the requirement for building owners to comply with LL84 led to a better understanding of tracking energy usage and the various metrics involved in normalizing data to allow for comparisons and benchmarking. Several interviewees noted that while the policy has not explicitly affected owners' views about energy-efficiency in most cases, there is a growing understanding that issues of energy-efficiency and sustainable management are now standard in the building management industry. Table 3-5 summarizes immediate period MTIs present in the NYC market.

Table 3-5. Immediate Outcomes and MTIs

Outcome	MTI	MTI Present?
Increased building owner awareness of energy use	Building owners are aware of annual energy spent per building or leased space for all fuels.	Yes

3.3.2 Short-Term Outcomes and MTIs

All eight owners interviewed were already taking advantage of existing energy-efficiency programs prior to the ordinance; compliance with LL84 did not change this activity.[12] While all respondents were very likely to or planning to invest in energy-efficiency upgrades within the next year, the policy was not necessarily the driver in all cases. Rather, building owners and managers frequently chose to undertake energy-efficiency upgrades for financial savings and other internal reasons.

Regarding the role of the policy in real estate decision making, the limited number of interviews undertaken for this research suggest that tenants and investors are growing in their awareness and attention to energy use. Three of the four real estate professionals interviewed have already begun to see an increase in tenant and investor requests for data, and one interviewee mentioned that secondary market lender Fannie Mae and other banks have started to incorporate energy-efficiency metrics into their valuation criteria. All four real estate professionals expect to see tenants, investors, and underwriters use benchmarking data as part of their decision-making process more frequently in the next three years.

Energy-efficiency program administrators in NYC are actively working with the City to provide needed data to customers, as required under LL84 to benchmark their buildings. All of the entities interviewed were in the process of determining how best to incorporate policy data into their longer-term program processes and strategies, with one having begun to incorporate this information into their sales and program strategies and others being in earlier stages of implementation. Table 3-6 summarizes short-term period MTIs present in the NYC market.

[12] *As noted previously, the focus of these interviews was on testing the interview questions and approach and thus included a limited pool of interviewees, seven of which were commercial property owners or managers and one of which was a multi-family building owner.*

Table 3-6. Short-Term Outcomes and MTIs

Outcome	MTI	MTI Present?
Owners recognize opportunities for energy savings and begin to take operational actions and implement low-cost measures.	Building owners can identify specific energy savings opportunities in their own buildings.	Yes, but not necessarily due to policy
	Building owners can describe implementation of specific low-cost measures within their own buildings.	Yes, but not necessarily due to policy
Tenants, investors, and underwriters begin to incorporate energy performance into real estate decision making.	Tenants are increasingly aware of benchmarking information and their understanding of this information increases over time.	Yes
	Investors and underwriters are increasingly aware of benchmarking and transparency information.	Yes
Program administrators use insights from benchmarking to inform program design.	Energy-efficiency program administrators begin to include benchmarking and transparency information in their new program design.	Yes

3.3.3 Intermediate and Long-Term Outcomes

From interviewee comments, it does not appear that MTIs associated with intermediate and long-term outcomes are currently present in the NYC real estate market. Several interviewees did note, anecdotally, that LEED and ENERGY STAR do seem to see slightly higher demand among large corporate tenants, but not on a consistent basis. Additionally, while those interviewed had participated in efficiency programs in the past, interviewees stated that to their knowledge New York City building owners at large are not yet making capital improvements for deeper energy savings in any way that would indicate a large pool of owners are undertaking this kind of effort. While there is evidence of some early market transformation, the relationship between property values and a building's energy performance does not appear to have changed yet.

Additionally, building owners do not yet appear to be making wide-scale capital improvements for deeper energy savings due to the policy. However, further research into linkages between the policy's influence and the recorded savings from 2010 to 2012 may more directly show increased influence. The lack of wide-ranging direct policy impacts in this area could be expected, given that these are the early years of NYC's policy implementation. Interviewees do point to the likelihood that the policy's influence in the marketplace will grow in future years and have a wider influence on owner decisions.

4 Energy Impacts

4.1 Energy Impacts Methodological Approach

In theory, the actual energy savings achieved by a benchmarking and transparency policy should be equal to the difference between the amount of energy used by buildings subject to the policy and the amount of energy they would have used had the policy not been adopted. This baseline is called the "counterfactual" scenario – what would have happened if the policy was not implemented. As the counterfactual scenario does not exist and cannot be directly measured, defining an approach that approximates it is the fundamental challenge to estimating energy impacts and documenting the benefits of policies.

4.1.1 Gross and Net Energy Impacts

The principal energy impact metrics are known as gross energy impacts and net energy impacts. DOE's Uniform Methods Project provides definitions of gross energy and net energy impacts for energy-efficiency policies and programs that are widely accepted by the industry.[13] The following are adapted for benchmarking and transparency policies:

- **Gross Impacts**: The change in buildings' energy usage over time inclusive of actions taken to improve their Portfolio Manager scores or reduce energy consumption, as well as their participation in other energy-efficiency activities or programs.
- **Net Impacts**: The subset of measured gross energy changes attributable to the B&T policy. That is, the net savings after taking into account natural market forces and the impacts from other local, state, federal, and utility energy-efficiency program and tax credit initiatives.

4.1.2 Baselines and Net Savings

The definition of the counterfactual is intertwined with net savings through this question about the correct baseline: what would have occurred in the absence of the policy? Attribution is the extent to which the B&T policy may be seen as directly or indirectly responsible for the measured energy and non-energy impacts. The definition of attribution in this context is the acknowledgement that the impacts can be attributed to one or more policies, programs, or market forces that theoretically could be responsible for the measured result.[14]

As noted in the logic model, it is premature at this time to conduct a full-fledged attribution analysis until the City reaches the intermediate or long-term outcome stage. At that point historical tracing, combined with expert panel-based adjustments, can be used to attribute savings across policies and programs. Historical tracing involves reconstructing the events (such as the launch of a product or the passage of legislation) that led to the outcome of interest. An example of this would be developing a "weight of evidence" conclusion regarding the specific influence or role of the program in question on the outcome. Although this qualitative analysis method has rarely been applied to energy-efficiency programs, it is well suited to an attribution analysis of major events, such as adoption of benchmarking and transparency policies. It is also well suited to attribution given multiple, overlapping energy-efficiency programs and policies. To facilitate future attribution analyses, this section contains an initial historical tracing of the universe of energy-efficiency policies and programs affecting NYC buildings that are subject to the policy.

4.2 Source Energy Savings

Benchmarking data was available for Year 1 (2010), Year 2 (2011), Year 3 (2012), and Year 4 (2013) from New York's LL84 ordinance. As a result, the gross energy impacts were calculated between Year 1 and Year 2, Year 2 and Year 3, as well as Year 3 and Year 4.

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[13] *Information on The Uniform Methods Project: Methods for Determining Energy-efficiency Savings for Specific Measures can be found at http://energy.gov/oe/services/electricity-policy-coordination-and-implementation/state-and-regional-policy-assistan-10.*

[14] *Readers interested in understanding both the theory and practice of net energy impacts estimation across policies, regulations, and energy efficiency programs and technologies should refer to Violette and Rathbun (2014) as that Uniform Methods Project Chapter includes several methodologies that are not specifically relevant to B&T policies.*

4.2.1 Methodology

The gross energy impacts were calculated by analyzing iterative energy use intensity (EUI) outputs from Portfolio Manager. At the most basic level, this methodology uses the formula shown in Equation 4-1.

Equation 4-1. Basic Equation for Calculating Gross Energy Impacts

$$Gross\ Energy\ Savings = Baseline\ Energy\ Use - Reporting\ Period\ Energy\ Use$$

$$= (EUI_{Year\ 1} - EUI_{Year\ 2}) * Gross\ Floor\ Area$$

Below is a high level overview of how the gross energy impacts were calculated:

1. Isolated buildings that complied in both years being compared (e.g. Year 1 & Year 2).
2. Removed outliers from the data.
3. Calculated the change in source EUI between Year 1 & Year 2 for each building.
4. Multiplied the change in source EUI by the building square footage for each building.
5. Summed the source energy savings for all of the buildings (Savings = Δ Source EUI x Building Square Footage).

The two primary factors that this method requires are the weather-normalized source EUI (an output from Portfolio Manager, units of kBtu/ft^2) and gross floor area (an input to Portfolio Manager, units of ft^2). The source EUI output from Portfolio Manager takes into account the total amount of raw fuel required to operate a building, including the amount of energy lost through the transmission, distribution, and production process.

Data Cleaning

The population of buildings that comply with the policy each year varies, which is why an iterative approach was used in the gross energy impacts analysis. The basic concept is that for any given two-year period being evaluated (e.g., Year 1 and Year 2) the same population of buildings will be compared. For example, if four buildings comply in Year 1 and five buildings comply in Year 2 then only the buildings that complied in both Year 1 and Year 2 will be evaluated. Further, for calculating the savings between Year 2 and Year 3, only the buildings that complied in both Year 2 and Year 3 will be evaluated.

The following steps were taken in order to clean the dataset for each of the comparison years (e.g., Year 1 and Year 2):

1. Removed all buildings with gross floor areas that were zero or blank.
2. Removed all building with building types that were zero or blank.
3. Removed all buildings with site EUIs outside of a reasonable range (5-1,000 kBtu/ft^2).[15]
4. Removed all buildings with abnormal changes in site EUIs between the two years being compared. Specifically, buildings that had site EUIs that increased or decreased more than 50 percent were removed.[16]
5. Determined which buildings appeared in both years being compared (e.g., Year 1 and Year 2). The savings should only be attributed to buildings that complied in both years; otherwise buildings that were not impacted by the policy may sway the savings. In order for a building to be included, the gross floor area and the building type had to be the same between the two years being compared.

[15] *These bounds were taken from the data cleaning steps used in the 2013 New York City Benchmarking Report. Source: City of New York, "New York City Local Law 84 Benchmarking Report September 2013," http://s-media.nyc.gov/agencies/planyc2030/pdf/ll84_year_two_report.pdf.*

[16] *Buildings that had a greater than 50 percent increase or less than 50 percent decrease in site EUIs between the two years being compared were removed because changes beyond these thresholds were likely due to reasons other than the policy (change in occupancy, erroneous data entry, change in space usage, etc.).*

6. Removed all duplicate entries.

Energy Savings Algorithm

As energy savings can vary depending on how they are grouped together for analysis purposes, the savings were calculated based on three different building segments: building type, building vintage, and building size (floor area). The total savings are the same for each method; however, the savings for individual building segment vary based on the method.

Equation 4-2 and Equation 4-3 demonstrate how the EUIs were calculated by one of these segments—building type. The calculations for the building vintage and building size classifications use analogous formulas.

Equation 4-2. Average EUI for Building Type "x" in Year "z"

$$EUI_{Avg,Building\ Type\ x,Year\ z} = \sum_{i=1}^{n} \left(EUI_{Building\ i,Year\ z} * \frac{Gross\ Floor\ Area_{Building\ i,Year\ z}}{Total\ Gross\ Floor\ Area_{Building\ Type\ x}} \right)$$

Equation 4-3. Average of Gross Energy Impacts for All Building Types between Year "z" and Year "z+1"

$$Gross\ Energy\ Impacts = \sum_{x=1}^{X} \left[\left(EUI_{Avg,Building\ Type\ x,Year\ z} - EUI_{Avg,Building\ Type\ x,Year\ z+1} \right) * \frac{Total\ Gross\ Floor\ Area_{Building\ Type\ x}}{Total\ Gross\ Floor\ Area_{All\ Building\ Types\ X}} \right]$$

4.2.2 Results

Table 4-1 provides a high-level summary of the source energy savings from the first four compliance years of LL84, whereas Table 4-2 provides a breakdown of the savings by fuel type. It is important to note that Table 4-1 contains weather-normalized energy savings values at the source level and Table 4-2 contains non-weather-normalized energy savings values at the site level. The raw data output did not include weather-normalized energy usage data by fuel type at the source level.

As seen in Table 4-1 and Table 4-2, the savings steadily increased between Year 1 and Year 4. Although this evaluation cannot necessarily attribute these energy savings to LL84, these early results are consistent with the notion that energy savings will occur even in the early stages of policy adoption.

Table 4-1. Weather-Normalized Source Energy Impacts over Time

Category	Savings (Million Btus) 2010 to 2011	Savings (Million Btus) 2011 to 2012	Savings (Million Btus) 2012 to 2013	Cumulative Savings (Million Btus)
Source Energy *(Weather Normalized)*	335,371 0.3%	12,067,456 3.7%	9,564,756 4.4%	21,967,583 5.7%

Table 4-2. Non-Weather-Normalized Site Energy Impacts over Time

Category	Energy Savings 2010 to 2011	Energy Savings 2011 to 2012	Energy Savings 2012 to 2013	Cost Per Unit	$ Savings 2010 to 2011	$ Savings 2011 to 2012	$ Savings 2012 to 2013	Cumulative Energy Savings 2010 to 2013	Cumulative $ Savings 2010 to 2013
Electricity *(kWh)*	80,119,255 (1.4%)	432,015,234 (2.3%)	328,368,003 (2.6%)	$0.15	$12,017,888	$64,802,285	$49,255,201	**840,502,492**	**$126,075,374**
Natural Gas *(therms)*	-574,148 (-0.4%)	22,248,309 (3.9%)	-34,456,686 (-8.8%)	$0.77	$-441,352	$17,102,442	-$26,487,112	**-12,782,525**	**-$9,826,022**
District Steam *(Million Btus)*	132,177 (2.3%)	1,644,497 (9.9%)	-1,216,546 (-10.7%)	$0.03	$3,734	$46,456	-$34,367	**560,128**	**$15,823**
Oil #2 *(Million Btus)*	157,263 (14.7%)	-5,066 (-0.1%)	-1,171,078 (-42.7%)	$19.83	$3,118,275	$-100,448	-$23,220,594	**-1,018,881**	**-$20,202,767**
Oil #4 *(Million Btus)*	260,676 (12.1%)	435,546 (8.6%)	-1,105,130 (-35.2%)	$19.83	$5,168,791	$8,636,181	-$21,912,952	**-408,908**	**-$8,107,980**
Oil #5&6 *(Million Btus)*	937,754 (8.7%)	5,062,099 (20.4%)	2,973,071 (24.1%)	$19.83	$18,594,162	$100,373,286	$58,951,228	**8,972,924**	**$177,918,676**
Diesel *(Million Btus)*	1,000 (60.6%*)	3,536 (54.2%)	50,261 (98.4%)	$28.70	$28,688	$104,528	$1,485,826	**54,796**	**$1,619,043**
Totals					**$38,490,187**	**$190,964,731**	**$38,037,230**		**$267,492,147**

**** The diesel savings are high because there were a limited number of buildings (less than 10) in each of the three compliance years that contained diesel consumption data. As a result, a few buildings with high percent savings swayed the total savings significantly.***

Figure 4-1, Figure 4-2, and Figure 4-3 show the source energy savings broken out by the various building segments. Specifically, Figure 4-1 presents the percentage savings broken out by building type, Figure 4-2 presents the percentage savings broken out by building vintage, and Figure 4-3 presents the percentage savings broken out by building floor area. The blue bar represents the percentage savings between 2010 and 2011, the red bar represents the percentage savings between 2011 and 2012, and the green bar represents the percentage savings between 2012 and 2013. The savings are calculated using the source EUI output from Portfolio Manager, which is the change in the amount of total energy required to operate a building, and takes transmission, delivery, and production losses into account. A similar metric is site energy, which is the amount of energy consumed by a building; however, it is not represented in these figures.

The following number of buildings were included for each of the comparison periods: 3,606 buildings were included in the 2010-2011 savings analysis; 10,218 buildings were included in the 2011-2012 savings analysis; and 7,553 buildings were included in the 2012-2013 savings analysis. The reason why the datasets were the not the same each year is because a different number of buildings complied each year and the data quality varied between the comparison periods.

Figure 4-1 shows the source energy savings based on the building type entered in Portfolio Manager. Note that there were over 30 different building types submitted into Portfolio Manager; therefore, they were consolidated

into a few building types for reporting purposes.[17] As seen in Figure 4-1, the building types that were most positively impacted by the policy were College/University and Office. There was not enough raw data for the Hotel building type in 2010 to 2011 to draw a meaningful conclusion about the negative savings because only 12 of the 2,000 buildings analyzed between 2010 and 2011 were classified as "Hotel."

Figure 4-1. Energy Savings by Building Type

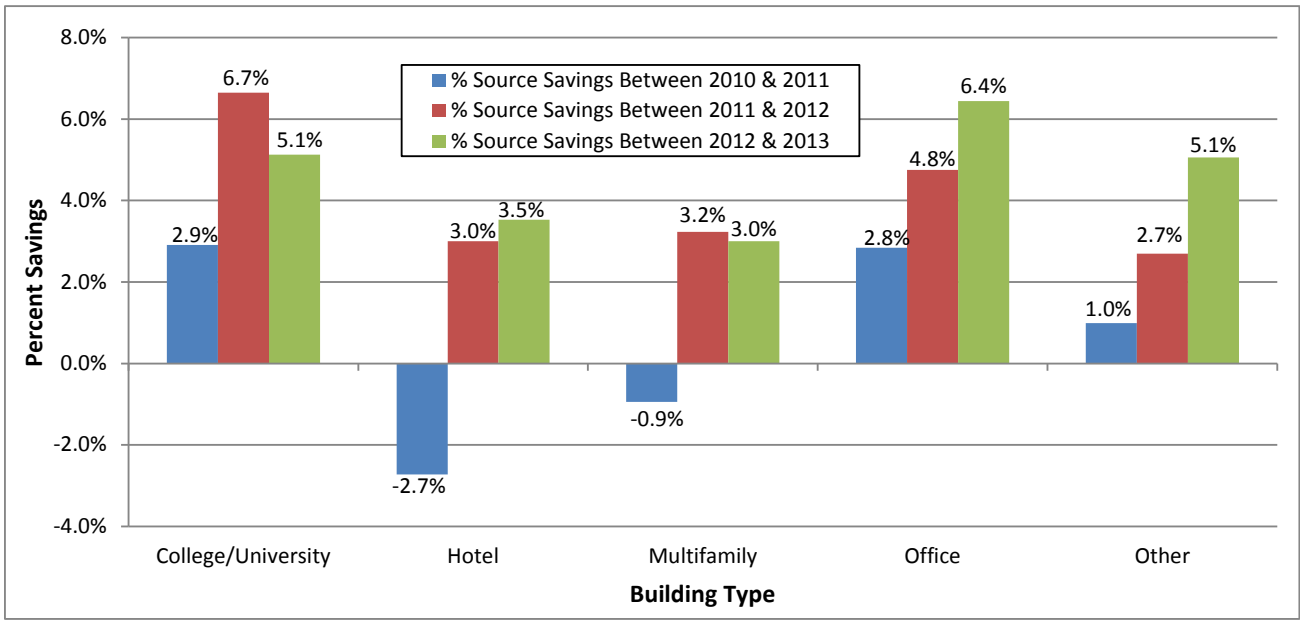


Figure 4-2 presents a comparison of the source energy savings based on building vintages entered in Portfolio Manager. One of the trends shown is that the source energy savings between 2010 and 2012 are higher for older buildings and lower for newer buildings. This is likely the case because older buildings are more likely to have older systems that need replacing and building managers may decide to do other efficiency projects in tandem, such as upgrading lighting or improving the building envelope. Older buildings are also more likely to have residual oils (#4 and #6 heating oil), which is being phased out by the city legislation and typically replaced by natural gas, which is a cleaner, more efficient fuel. This trend did not hold true between 2012 and 2013; therefore this trend should be monitored in future years. Another expected finding from the policy logic model is that the percentage savings increased between 2010 and 2013, with the exception of the building vintages less than 1950. It is unclear why the trend reversed from 2012 to 2013 for building vintages less than 1950; therefore, this trend should be monitored when additional compliance data comes available.

[17] *The building types were consolidated based on the building types that had the highest gross floor area. The top four building types were College/University, Hotel, Multifamily, and Office. All other building types were grouped into "Other."*

Figure 4-2. Energy Savings by Building Vintage

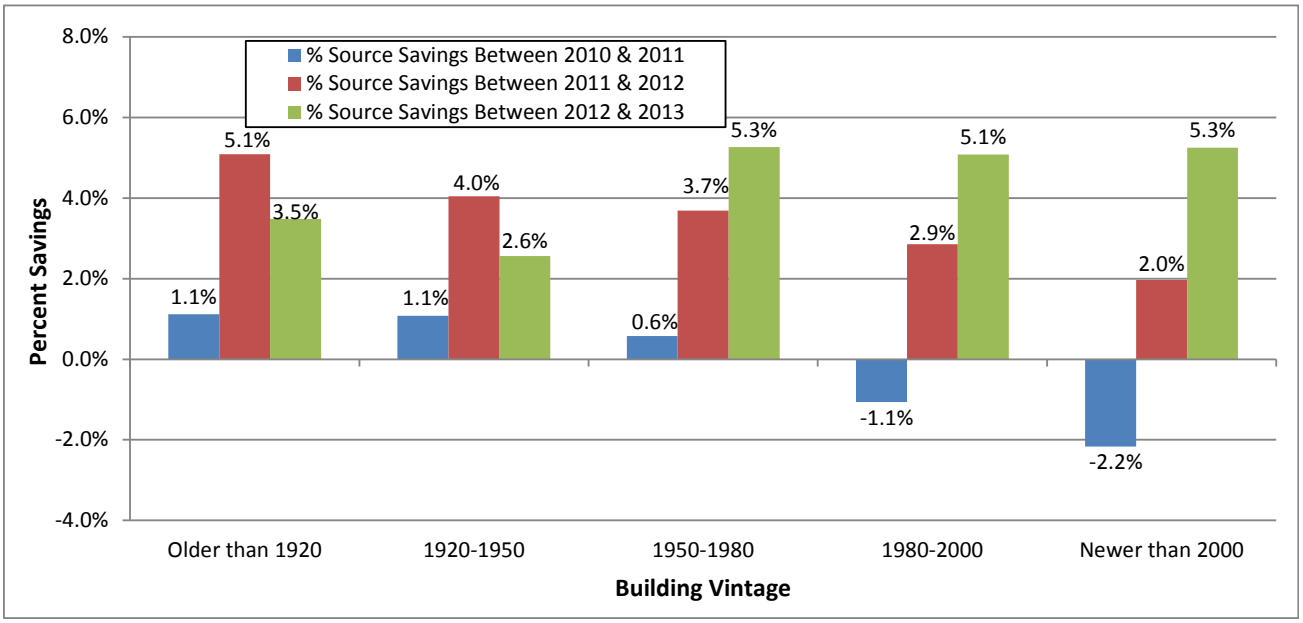
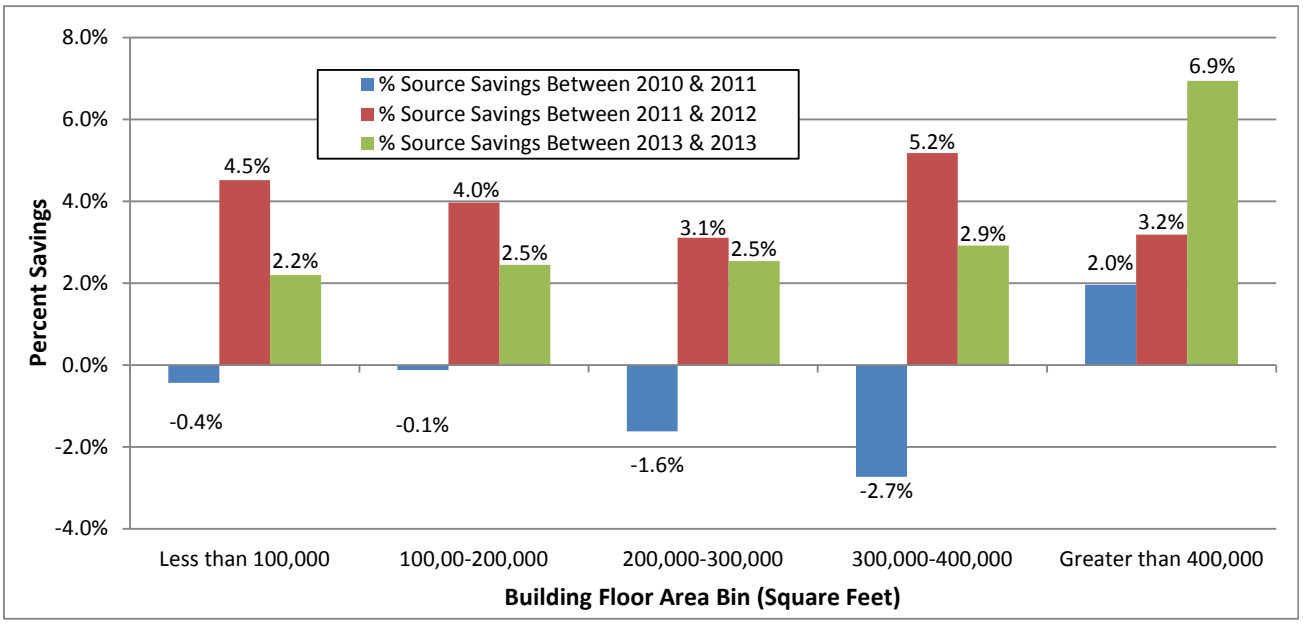


Figure 4-3 shows the variation in energy savings based on different types of building floor area bins. It is important to note that the "Less than 100,000 ft^2" bin only includes private buildings greater than 50,000 ft^2 and public buildings greater than 10,000 ft^2. This is due to the compliance requirements outlined in LL84.[18] It is interesting to note that the savings percentage increased for all floor areas between 2010 and 2013; however, this trend reversed between 2012 and 2013 for all floor areas, except for buildings with a floor area greater than 400,000 square feet.

Figure 4-3. Energy Savings by Building Size



4.2.3 Summary of Results and Conclusions

The gross energy impacts saw a steady increase between 2010 and 2013. The savings percentage between 2010 and 2011 was 0.3%, as compared to 3.7% between 2011 and 2012 and 4.4% between 2012 and 2013. For typical program evaluations, it is common for a trend like this to occur. It usually takes a few years for significant savings

[18] *Building owners with multiple private buildings that have a collective square footage greater than 100,000 ft2 are also required to comply with LL84.*

to be achieved from a new program because there are external influences, such as building managers or consultants inputting erroneous data into Portfolio Manager, which may wash out the initial gross energy impacts. Over time, increasing automation of data input, more familiarity with the data, and more rigorous tracking may lead to both inputs and outputs that are more reliable. As a result, there may be fewer outliers that skew the data and tend to obscure the gross energy impact savings from the policy.

4.3 Historical Tracing and Attribution Issues for Future Consideration

Historical tracing is the recommended approach to begin to understand the impacts of the various market influences on the expected outcomes identified in the logic model. In particular, historical tracing helps in the often-challenging task of attributing energy savings to various market influences. By developing a historical tracing diagram, evaluators (and expert judgment panel members) can often begin to answer the questions of "what," "where," "when," and "who" have been involved in promoting energy-efficiency in the same market that the policy is attempting to influence and transform – thus providing insight into attribution of policy energy and non-energy impacts and savings.

By way of background, historical tracing diagrams and their content have been used extensively to provide panel members with a common framework and background from which to make important decisions. Historical tracing diagrams may be used by panel members to assess attribution of savings to various market activities from and outside the realm of the policy. This allows for a clearer perspective on the true impacts of the policy and the savings that can be fairly attributed to the policy as opposed to other, related policy initiatives.

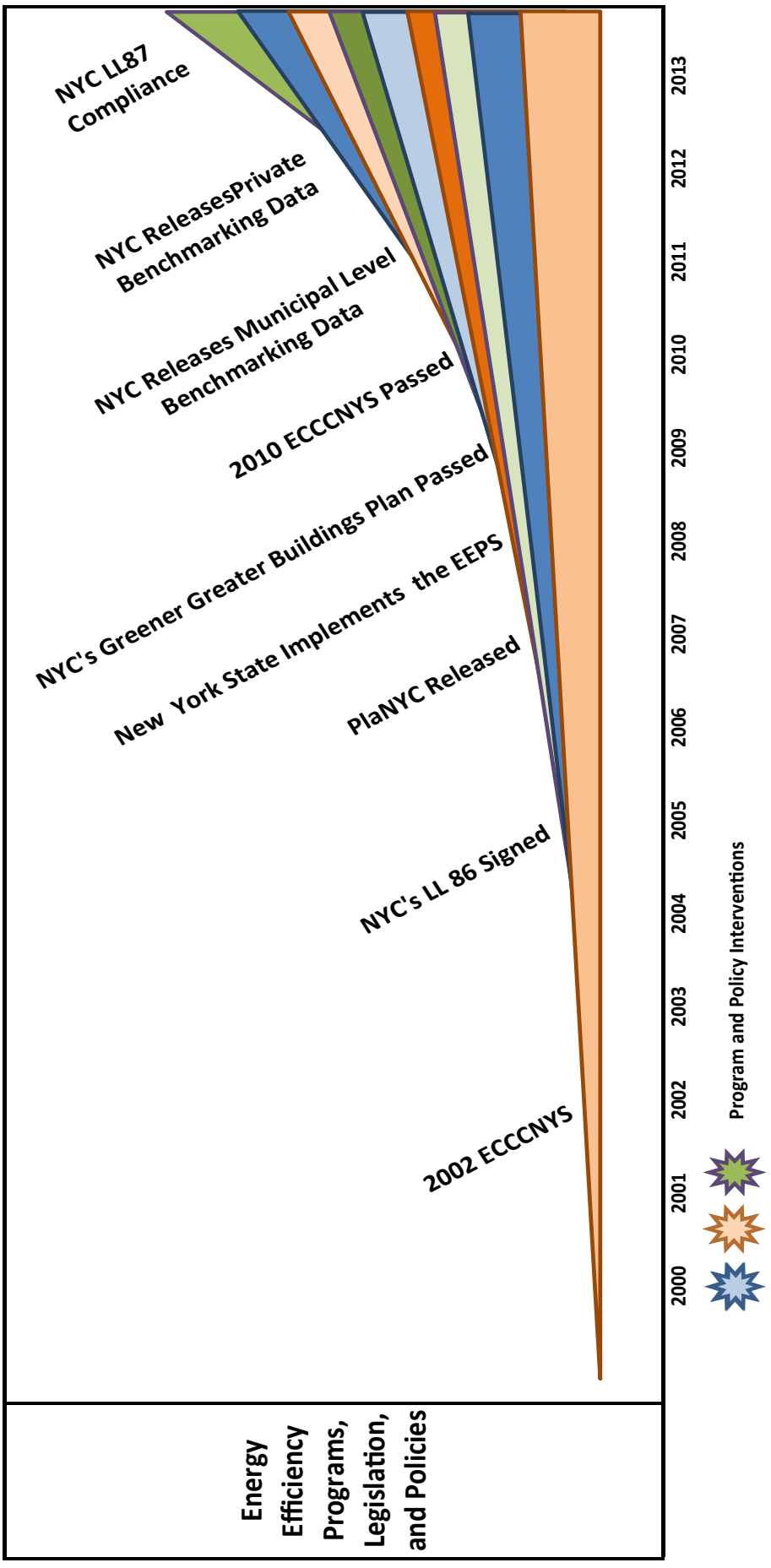
Figure 4-4 provides a benchmarking and transparency policy historical tracing diagram that displays various policy influences on NYC's commercial sector markets and actors from the year 2000 to the present. Although it is premature to conduct an attribution analysis for the City at this time, this diagram—and future updates—may be used in the future to assess and attribute market transformation progress, as well as energy and non-energy impacts to the various market actors and events. Historical tracing incorporates important market events influencing commercial energy-efficiency in the City related to the following five key market-influencing elements:

1. State energy planning
2. Utility programs and activities
3. Construction energy codes
4. NYC planning efforts
5. Growth of LEED and ENERGY STAR in the marketplace

When combined in a historic tracing analysis, these elements tend to reveal major and minor shifts or influences in energy efficiency uptake that may be attributed to these activities —which include adoption and/or implementation of key programmatic, regulatory and voluntary market mechanisms. Once developed, historical tracing analysis is used in general to provide a background basis for structured expert judgment panel decision making that takes into account the relative influences of efficiency regulatory, market and utility programs prior to adoption of the benchmarking and transparency policy.

Appendix C provides a detailed narrative discussing each of these aspects and presenting chronological historical data that describes the key component elements of Figure 4-4.

Figure 4-4. Historical Tracing of Energy Efficiency Influences in the NYC Commercial/Multifamily Market (2000-2014)



5 Non-Energy Impacts

Non-energy impacts refer to benefits potentially resulting from the policy in three areas: GHG emissions, job creation and economic growth, and real estate values. GHG reductions are calculated directly from the reduction in energy usage following the policy's implementation. The recommended methods to calculate emissions are well documented with precedent set at the federal level, and in a number of states and municipalities.

Job creation and economic growth from the policy result from direct, indirect, and induced impacts. Direct impacts are derived from commercial building owners and managers hiring staff necessary to meet policy requirements and investing in energy savings measures and technologies. Indirect impacts reflect revenue flows across industries, and in the context of benchmarking and transparency policies, are generated from the net inflow of funding to industries that support equipment and services needed to invest in energy-saving measures and technologies. Induced impacts are derived from economic "multipliers" that draw on the interrelationships between job creation, economic growth, and energy-efficiency.

Changes in real estate value resulting from policy impacts on energy-efficiency are derived from standard real estate appraisal practices and other methods designed to isolate energy-efficiency from other building features. The focus here is on whether the strength of the relationship between building energy-efficiency and valuation increases due to the policy.

This section describes methodologies for calculating non-energy impacts and presents preliminary findings for NYC's benchmarking and transparency policy. The non-energy impact areas – GHG emissions, jobs analysis, and building valuation – are divided into three separate sections with each section containing a methodological discussion, application of the methodology to LL84 non-energy impacts, and findings.[19]

5.1 Impacts on GHG Emissions

5.1.1 GHG Emissions Methodology

Changes in GHG emissions can be calculated from benchmarking data disclosed by Portfolio Manager. Portfolio Manager uses reported energy consumption data to calculate GHG emissions in three different categories: direct emissions, indirect emissions, and total emissions. Total emissions are the sum of direct and indirect emissions. The following analysis was performed on the same buildings analyzed in the energy impacts section (Section 4).

First, emissions data was collected from Portfolio Manager for the baseline year and current year. The total GHG emissions output for each building, as calculated by Portfolio Manager, was used in the analysis. Only buildings with at least two full years' worth of data were included. Next, GHG emissions data were normalized by building area for each year, as seen in Equation 5-1 and Equation 5-2. This is necessary to ensure calculations account for changes in the building area, and is similar to the normalization for calculating energy impacts as discussed in Section 4.

Equation 5-1. Normalized GHG Emissions

$$Normalized\ GHG\ emissions\ \left(\frac{MtCO2e}{sq.ft.}\right) = \frac{Citywide\ GHG\ emissions}{Citywide\ gross\ floor\ area}$$

Equation 5-2. Adjusted Building Emissions Baseline

$$Adjusted\ building\ emissions\ baseline(MtCO2e) = [Normalized\ GHG\ emissions_{Year\ 0}] \times [Citywide\ gross\ floor\ area_{Year\ x}]$$

[19] *See Appendix E for further observations related to this non-energy impacts analysis*

The final step requires calculating the difference between the emissions data for the baseline year and the analysis year, as shown in Equation 5-3.

Equation 5-3. Gross GHG Emissions Impact

$$Adjusted\ GHG\ emissions\ impact_{Year\ 1} = Adjusted\ building\ emissions\ baseline_{Year\ 0} - Citywide\ buildings\ GHG\ emissions_{Year\ 1}$$

5.1.2 Results

The analysis presented here was performed using the method described in the previous section. The data shown in Table 5-1 is comparing the years 2010-2011, 2011-2012, and 2012-2013.[20] The following analysis used GHG emissions values reported by Portfolio Manager to calculate GHG savings. A negative value indicates an increase in emissions; a positive value indicates a reduction in emissions. The results show reductions in emissions were least significant from 2010-2011 and most significant from 2011-2012. The estimates are similar to the source energy impact estimates shown in Section 4.

Table 5-1. Gross Energy Impacts and GHG Emissions Summary

Category	Savings 2010 to 2011	Savings 2011 to 2012	Savings 2012 to 2013	Cumulative Savings
Source Energy *(Weather Normalized)*	335,371 MMBtu 0.3%	12,067,456 MMBtu 3.7%	9,564,756 MMBtu 4.4%	21,967,583 MMBtu 5.7%
GHG Reductions	30,947 MtCO2e 0.7%	809,617 MtCO2e 6.3%	204,082 MtCO2e 2.5%	1,044,646 MtCO2e 9.9%

Figure 5-1, Figure 5-2, and Figure 5-3 show the changes in GHG emissions between the 2010 to 2011 period, the 2011 to 2012 period, and the 2012 to 2013 period, based on three different breakdowns: building type, building vintage, and building floor area, the same breakdowns used in Chapter 4. The GHG reduction findings are similar, with a similar pattern emerging for the building vintage classification: through 2012, the greatest impacts were found in older buildings. After 2012, newer, larger buildings saw the greatest reduction in emissions while all other categories showed a decline in reductions. It is unclear why reductions declined for several building categories between 2011-2012 and 2012-2013; this trend should be monitored in the future.

In the 2011-2012 and 2012-2013 periods, all building size, type, and vintage bins achieved GHG emissions reductions. GHG emissions reductions may not exactly match the energy savings calculated in Chapter 4 because some fuels release more emissions per Btu than others do. Between 2010 and 2012, many buildings in NYC switched from fuel oil #6, an emissions-heavy fuel, to fuel oil #2, a cleaner fuel. Buildings that switch to a cleaner fuel can reduce their GHG emissions even if they do not reduce the amount of energy they consume.

[20] *Some Borough, Block, and Lots (BBLs) did not have GHG emissions reported in all years. The cumulative savings figure is based on eliminating these situations where data was not reported in both years.*

Figure 5-1. Gross GHG Emissions Reductions by Building Type

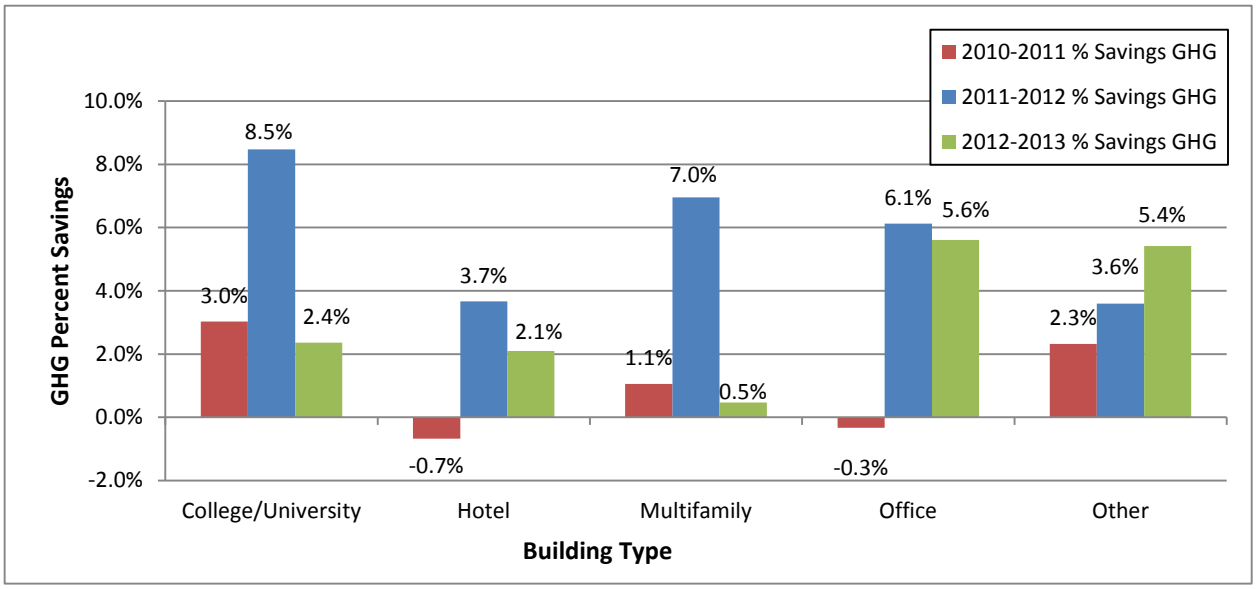


Figure 5-2. Gross GHG Emissions Reductions by Building Vintage

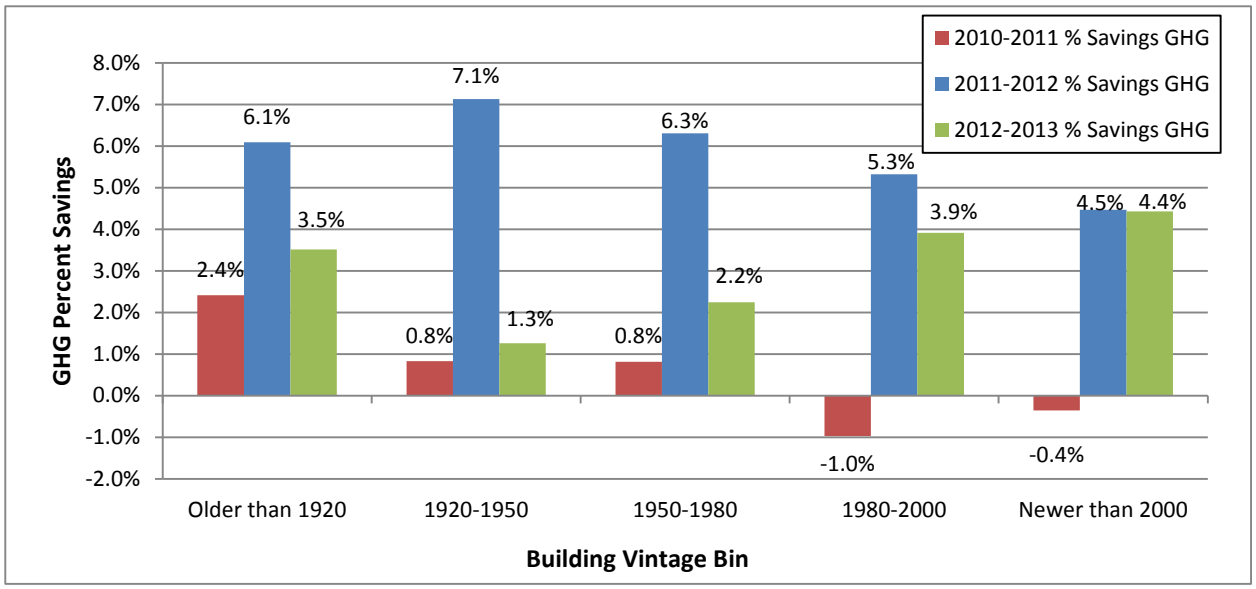
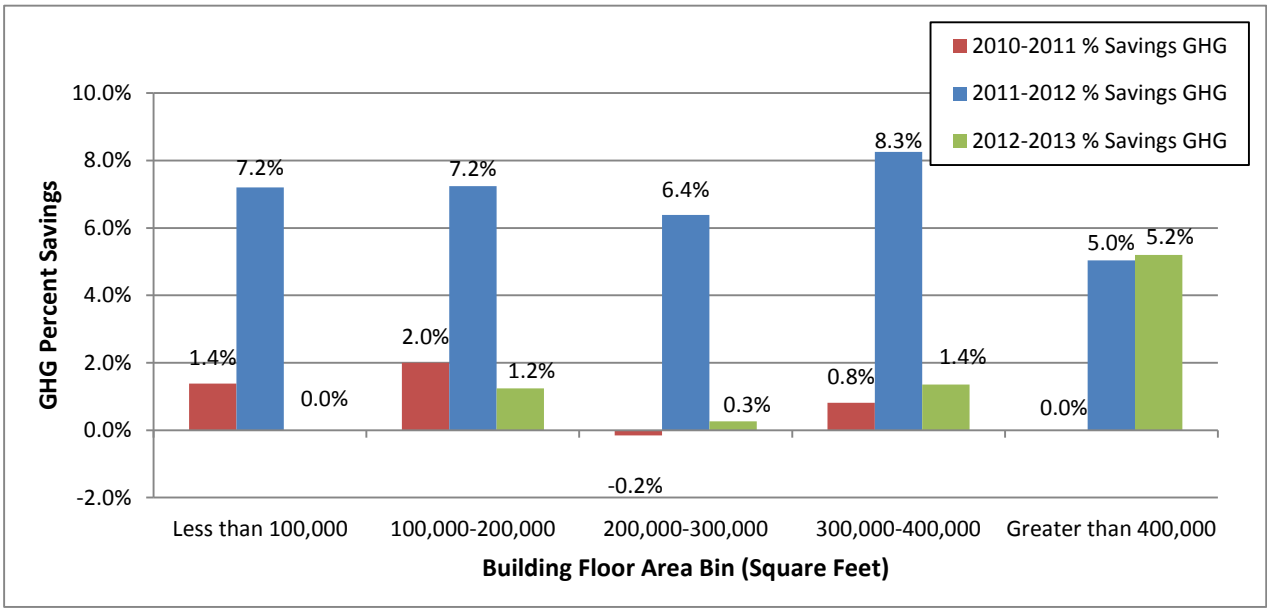


Figure 5-3. GHG Emissions Reductions by Building Floor Area



5.2 Impacts on Job Creation

5.2.1 Job Creation Methodology

Two approaches are provided to view job creation: through the labor required to benchmark properties each year, and through estimated economic activity resulting from energy-efficiency improvements. Combining the outputs from these approaches can provide the total job creation.

Employment from Benchmarking

The first category of jobs derived from an energy use benchmarking and transparency policy is a function of the labor required to benchmark the properties. Whether through in-house analysis or the hiring of a third-party consultant, benchmarking a property requires the following series of steps:

1. Gathering physical data on the building for Portfolio Manager inputs
2. Compiling utility data
3. Entering data into Portfolio Manager
4. Releasing data to jurisdiction

Equation 5-4 summarizes how this information is translated into jobs on a full-time equivalent (FTE) basis.

Equation 5-4. Basic Equation for Calculating Jobs from Benchmarking

$$\text{Direct Benchmarking FTE} = \frac{(\text{Number of Buildings Benchmarked} * \text{Y Hours of Benchmarking per Building}}{2080 - \text{Hours Unavailable for Analysis (e.g., holidays, vacation, sick time, administrative time)}}$$

In NYC's case, "buildings" equate to Borough, Block, and Lot (BBL) combinations as these are the units of property covered by LL84. Some BBLs contain multiple buildings. Six hours of work per BBL combination was assumed for this evaluation and was kept consistent throughout this analysis. The total of six hours per BBL combination consists of three hours to gather the information (physical building characteristics, utility bills), and three hours for inputting the data into Portfolio Manager and submittal, as based on experience in NYC's market and current average consultant pricing.

The actual hours can fluctuate between more complex commercial buildings and simpler buildings with only a handful of meters and spaces. Nonetheless, there is a fixed amount of labor involved in benchmarking properties big and small, and estimating a set period per building is not unreasonable considering some consultants submit hundreds of properties per year. In NYC for example, over the first two years of its policy, 30 service provider firms handled two-thirds of all submittals.[21]

Employment from Efficiency Actions – Input-Output Modeling

The second approach is to use input-output analysis (I-O modeling) to determine the direct and indirect economic impact of building energy-efficiency upgrades. The concept is that a benchmarking and transparency policy can lead to related public sector initiatives and market responses, and additional energy-efficiency improvements.

The I-O model estimates how economic activity in one sector affects other sectors in a region or nation, analyzing between industries and consumers. This type of model takes into account how industries can produce goods and services that drive demand for other goods and services.

Two related studies, *Analysis of Job Creation and Energy Cost Savings from Building Energy Rating and Disclosure Policy*[22] and *Employment Estimates for Energy-Efficiency Retrofits of Commercial Buildings*[23], took into account a wide range of economic and survey data to determine appropriate job creation multipliers in regards to building energy-efficiency. These studies' methodologies are used for the I-O modeling.[24]

The studies' job creation multipliers predict the number of jobs that result from the energy-efficiency expenditure activities, and include three types of job creation[25]:

- *Direct Jobs*: Jobs generated from a change in spending patterns resulting from an expenditure or effort (e.g., construction jobs for an energy-efficiency retrofit project or operations and maintenance job directed toward efficiency improvements)
- *Indirect Jobs*: Jobs generated in the supply chain and supporting industries of an industry that is directly impacted by an expenditure or effort (e.g., the production components in efficiency related mechanical equipment or trucking of materials)
- *Induced Jobs*: Jobs generated by the spending of received income resulting from direct and indirect job creation in the affected region (e.g., workers added in the direct and indirect job categories spend money in the economy on housing, retail goods and services, healthcare, food, etc.)

The previously listed three types of job creation result from three categories of multipliers:

- *Operational Expenditures and Improvements*: Job growth multipliers for this category result from improved building operations through facility support services and environmental controls.
- *Capital Upgrades*: Much of the energy savings in buildings is expected to result from capital upgrades. These upgrades to lighting, heating, ventilation, and air-conditioning (HVAC); envelope; and appliances carry their own job impacts.
- *Spending Shifts from Energy to Non-Energy Goods and Services*: Additional job creation results as owners' spending shifts away from energy costs to non-energy goods and services. Note that this category is recognized in this study but job figures are not calculated.

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[21] City of New York, "New York City Local Law 84 Benchmarking Report September 2013," http://s-media.nyc.gov/agencies/planyc2030/pdf/ll84_year_two_report.pdf

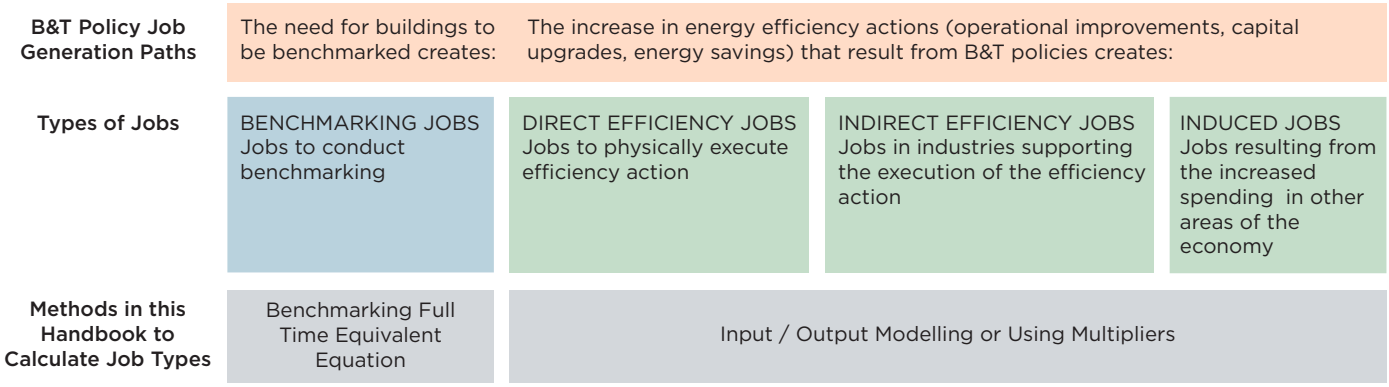
[22] Heidi Garrett-Peltier, Andrew C. Burr, "Analysis of Job Creation and Energy Cost Savings from Building Energy Rating and Disclosure Policy", Institute for Market Transformation, Political Economy Research Institute, March 2012

[23] Heidi Garrett-Peltier, "Employment Estimates of Energy Efficiency Retrofits of Commercial Buildings", Political Economy Research Institute, 2011

[24] It should be noted that the project team had no access to NYC cost data and therefore labor and other costs are taken from national studies. Thus, the studies' estimates of job creation may differ from those in this report and actual numbers may be lower due to local labor costs in NYC possibly being higher than this report's estimates.

[25] These types of job creation from increased energy-efficiency are further detailed in an American Council for an Energy-Efficient Economy white paper, available here: http://www.aceee.org/files/pdf/white-paper/energy-efficiency-job-creation.pdf.

Figure 5-4. Job Creation Categories



The job creation from operations and maintenance (O&M) improvements and capital upgrades are calculated separately as they require different types of labor, spending, and support industries. As such they have different multipliers.

The IMT/PERI and Garrett-Peltier studies calculate this job creation by estimating the total impacted square footage of buildings that save energy. The studies then estimate a distribution of energy savings across multifamily and commercial properties, sum the square footage of each building type that saves energy within this distribution, multiplies the square footage by estimated costs per square foot to achieve these savings, then multiplies the dollar amounts by multipliers to result in jobs figures. The model uses assumed, nation-wide cost per square foot figures for achieving levels of energy savings through O&M and capital upgrades, by property type. In short, the higher the energy savings, the higher the costs per square foot to achieve the savings through O&M work or capital upgrades. The figures also differ between multifamily and commercial properties.

This report uses the latter portions of that methodology, but first starts with the actual gross energy savings observed as analyzed in Section 4. The data from the 2012-2013 period is highlighted in detail for the remainder of the chapter.

Table 5-2 below shows the actual distribution of energy savings by building type in the 2012-2013 period for all buildings that saved energy. The "Gross Energy Savings" column contains ranges of gross energy savings. The "Multifamily," "Medium Commercial," and "Large Commercial" columns show how many square feet of each building category achieved these savings, along with the percentage of each range of all buildings that saved energy.

The 25-29% and 25-50% ranges differ between the property types for later calculations. The "Multifamily" and "Medium Commercial" categories use the 25-29% range and 30-50% range, while the "Large Commercial uses the 25-50% range, to mimic the methodology used in the IMT/PERI and Garrett-Peltier studies.

Buildings with savings exceeding 50% in one year are not included in the analysis, because these high percentage savings are assumed to be the result of data entry errors or major changes in the building's economic and energy use profile, occupancy, or both.

Square footages in these figures are then scaled up to account for the properties that complied in both years, regardless of having good or bad data. The reason for this is that the buildings with bad data likely still saw energy savings because they were made aware of their energy consumption through the B&T policy and likely made adjustments to their energy usage. As a result, the square footages, and thus the energy savings, were scaled up to include all buildings that complied in both years, regardless of whether they had good or bad data.

Table 5-2. Energy Savings Distributions by Property Type, 2012-2013 Period

Gross Energy Savings	Multifamily Square Footage	% of total	*Medium Commercial	% of total	**Large Commercial	% of total
1-4%	170,266,497	35%	6,961,184	28%	75,789,131	28%
5-9%	137,149,228	28%	7,341,514	30%	101,962,105	38%
10-14%	56,305,055	12%	3,650,360	15%	44,417,829	17%
15-19%	37,772,679	8%	1,727,360	7%	13,508,345	5%
20-24%	15,787,555	3%	1,410,306	6%	9,865,261	4%
25-29%	9,198,887	2%	1,163,556	5%	n/a	n/a
25-50%	n/a	n/a	n/a	n/a	19,899,928	7%
30- 50%	52,859,711	11%	1,898,941	8%	n/a	n/a
50% + (Excluded)	3,328,006	1%	309,513	1%	624,257	0%
Total ft² of Buildings Saving Energy	482,667,618	100%	24,462,732	100%	266,066,856	100%

** Commercial Buildings between 50,000 to 100,000 square feet in size.*
*** Commercial Buildings over 100,000 square feet in size.*

As noted, job creation figures from O&M improvements and capital upgrades use different cost per square foot figures and different multipliers for direct, indirect, and induced jobs. Thus, the square footages above must be split in some way to attribute job growth between O&M and capital upgrades.

For the purposes of this job analysis, it is assumed on average for the buildings that saved energy the first 12.5% of energy savings was accomplished through O&M. National research suggests that savings between 5-20% are common for O&M improvements, and O&M improvements are likely to be pursued before capital upgrades given their lower cost typically.[26,27,28] For buildings saving more than 12.5%, it is assumed on average the balance is accomplished through capital upgrades.

For example, the total square footage of properties which save 19% source energy must be divided between O&M and capital upgrade attribution. In this case, 12.5% savings is attributable to O&M and the remaining 6.5% savings belong to capital upgrades. The corresponding cost per square foot value for O&M savings is applied to 66% of the square footage (as 12.5 is 66% of 19) and the remaining 34% of square footage is multiplied against the corresponding capital cost per square foot value. These dollar amounts are then summed in this manner for every percentage level of savings, and finally used with the appropriate multipliers.

Employment from Benchmarking Results

Data from each of NYC's policy information releases (2010, 2011, 2012, and 2013) were organized to quantify the number of BBL combinations benchmarked. The number of BBL combinations for each period was observed with reported data, and Equation 5-4 was then populated with the values for NYC. The result of these calculations is shown in Table 5-3. Note that FTE jobs are not additive from year to year. The number of FTE jobs supported each year increased until 2013, when it dropped to 39 from 40 the previous year.

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[26] *U.S. Department of Energy Federal Energy Management Program, "Operations & Maintenance Best Practice Release 3.0", August 2010*

[27] *Energy Star "Operations and Maintenance Reports", http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/comprehensive-approach/operations-and*

[28] *Pacific Northwest National Laboratory, Assessing the Potential for a FEMP Operations and Maintenance (O&M) Program to Improve Energy Efficiency, October 2002*

Table 5-3. FTE Calculations for Benchmarking Labor

Calculation	Reporting Year 2010	Reporting Year 2011	Reporting Year 2012	Reporting Year 2013	Total
Number of BBLs	4,395	11,695	13,189	13,138	42,417
Benchmarking Jobs	13	35	40	39	39

Employment from Efficiency Actions Results

Similarly, the reported NYC data were used to prepare estimates of on the job creation from operations and maintenance (O&M) improvements and capital upgrades.

Operations and Maintenance Job Creation Results

The distribution of energy savings by property type from Table 5-2 are applied to assumed cost per square foot figures. The methodology of assigning 12.5% energy savings to O&M and marginal savings beyond that to capital upgrades is also applied here. As shown in Table 5-4, higher energy savings assumes a higher cost per square foot. Again, the 25-29% and 30-50% ranges are used for "Multifamily" and "Medium Commercial" while the 25-50% range is used for "Large Commercial."

Table 5-4. Project Cost Estimates for Operational Improvements, 2012-2013 Period

Gross Energy Savings	Multifamily		* Medium Commercial		** Large Commercial	
	Cost/Sq Ft	Spending	Cost/Sq Ft	Spending	Cost/Sq Ft	Spending
1-4%	$0.01	$3,148,965	$0.01	$127,959	$0.01	$1,182,313
5-9%	$0.04	$5,485,969	$0.04	$293,661	$0.03	$3,746,327
10-14%	$0.10	$5,501,687	$0.10	$355,750	$0.07	$3,027,802
15-19%	$0.10	$2,883,134	$0.10	$131,529	$0.07	$719,475
20-24%	$0.10	$910,140	$0.10	$81,966	$0.07	$410,873
25-29%	$0.10	$432,439	$0.10	$56,099	n/a	n/a
25-50%	n/a	n/a	n/a	n/a	$0.07	$564,485
30- 50%	$0.10	$1,834,102	$0.10	$62,902	n/a	n/a
Total		**$20,196,437**		**$1,109,865**		**$9,651,274**

**** Commercial Buildings between 50,000 to 100,000 square feet in size.***
***** Commercial Buildings over 100,000 square feet in size.***

Lastly, these total project cost estimate dollar amounts for each property type are applied against standard multipliers. The calculations result in the job creation figures shown in Table 5-5. Note that the dollar amounts from the two groups of commercial properties are combined and used with the same multipliers.

Table 5-5. Project Cost Estimates and Multipliers for Operational Improvements, 2012-2013 Period

Annual Spending	Direct Jobs per $1 Million (Multiplier)	Calculated Direct Jobs	Indirect Jobs per $1 Million (Multiplier)	Calculated Indirect Jobs	Induced Jobs per $1 Million (Multiplier)	Calculated Induced Jobs	Total Jobs
Multifamily							
$20,196,437	6.92	140	4.32	87	4.5	91	318
Commercial							
$10,761,139	6.92	74	4.32	46	4.5	48	169
Total Jobs	**-**	**214**	**-**	**134**	**-**	**139**	**487**

Capital Upgrade Job Creation Results

The same process that was previously described for O&M job creation is carried out for economic activity from capital upgrades: the impacted square footages are multiplied against dollar per square foot costs and complementary multipliers.

Table 5-6. Project Cost Estimates for Capital Upgrades, 2012-2013 Period

Gross Energy Savings	Multifamily		* Medium Commercial		** Large Commercial	
	Cost/Sq Ft	Spending	Cost/Sq Ft	Spending	Cost/Sq Ft	Spending
1-9%	$1.00	$-	$1.00	$-	$1.00	$-
10-14%	$1.50	$1,288,182	$1.50	$92,859	$1.50	$1,163,521
15-19%	$2.75	$8,941,343	$2.75	$412,068	$2.75	$3,230,126
20-24%	$3.25	$8,374,244	$3.25	$747,210	$3.25	$4,578,267
25-29%	$3.75	$10,378,760	$3.75	$1,144,497	$3.75	$14,491,854
30-34%	$4.25	$67,681,672	$4.25	$1,382,576	$4.25	$11,168,836
35-39%	$4.75	$16,109,853	$4.75	$1,014,420	$4.75	$1,997,190
40%-50%	$6.00	$39,245,355	$6.00	$2,438,526	$6.00	$7,857,573
Total		**$152,019,409**		**$7,232,156**		**$44,487,367**

**** Commercial Buildings between 50,000 to 100,000 square feet in size.***

***** Commercial Buildings over 100,000 square feet in size.***

Finally, the project cost estimate dollar amounts are applied against standard multipliers, as presented in Table 5-7.

Table 5-7. Project Cost Estimates and Multipliers for Capital Upgrades, 2012-2013 Period

Annual Spending	Direct Jobs per $1 Million (Multiplier)	Calculated Direct Jobs	Indirect Jobs per $1 Million (Multiplier)	Calculated Indirect Jobs	Induced Jobs per $1 Million (Multiplier)	Calculated Induced Jobs	Total Jobs
Multifamily							
$152,019,409	5.36	815	4.22	642	3.83	582	**2,039**
Commercial							
$51,719,523	5.12	265	4.12	213	3.69	191	**669**
Total Jobs	**-**	**1,080**	**-**	**855**	**-**	**773**	**2,707**

Spending Shifts from Energy to Non-Energy Spending Job Creation Results

Lastly, there may also be jobs created through the shift in spending away from energy used in buildings to more labor intensive industries. This calculation is a function of dollars saved and various multipliers. This handbook does not go into depth on this scope of jobs created through energy bill savings. Instead, we limit our methodologies to more conservative estimates that focus on the jobs created through the labor needed to execute energy efficiency improvements.

5.2.2 Summary of Results and Conclusions – NYC Jobs Creation

The first estimate of benchmarking jobs resulted in supporting or creating as many as 40 FTE over the three benchmarking periods analyzed (see Table 5-8). As noted previously, FTE jobs are not additive from year to year. The number of FTE jobs supported each year increased until 2013, when it dropped to 39 from 40 the previous year.

Table 5-8. Total Number of Benchmarking FTE

Calculation	Reporting Year 2010	Reporting Year 2011	Reporting Year 2012	Reporting Year 2013	Total
Benchmarking Jobs	**13**	**35**	**40**	**39**	**39**

The I-O model exercise calculates jobs from three activities: O&M improvements, capital upgrades, and energy savings. These results for the 2010-2011,2011-2012, and 2012-2013 periods are shown in Table 5-9.

Table 5-9. Total Number of Estimated Jobs Created, I-O Modeling

Calculation	Calculated Jobs 2010 to 2011	Calculated Jobs 2011 to 2012	Calculated Jobs 2012 to 2013	Total 2010 to 2013
I-O Modeling Direct Jobs	382	1,456	1,294	**3,132**
I-O Modeling Indirect Jobs	290	1,098	988	**2,377**
I-O Modeling Induced Jobs	269	1,021	912	**2,202**
Total	**941**	**3,576**	**3,195**	**7,711**

Job creation calculations from fuel reductions were not included in these totals due to New York City's phasing out of heating oils, resulting in large spending swings from fuel-switching, and the inability to weather normalize the data.

5.3 Real Estate Valuation Methodological Approach and Findings

Observing the relationship between public energy usage information and property values over time can help inform jurisdictions if benchmarking and transparency policies can improve property values. To observe the strength of the relationship, if any, between the value of properties and the reported energy usage from LL84, a statistical linear regression analysis methodology can be employed.

The results from this analysis suggest that there is not yet a statistically significant positive relationship between markets' increasing awareness of the energy-efficiency of properties and growth in real estate valuations. This is not a surprising finding as the benchmarking and transparency logic model does not anticipate policy-driven property valuation increases until several years after the policy is adopted (e.g., the intermediate and long-term). The inconclusive results of the analysis performed in this evaluation are provided in Appendix E for the interested reader. The comparison should continue for consecutive years to observe in the strength in the relationship increases.

Appendix A
Market Transformation Indicators of NYC's Benchmarking and Transparency Policy

Table A-1, Table A-2, and Table A-3 provide descriptions of the NYC policy MTIs. The MTIs in these tables are organized around the following three key barriers needing to be overcome:

1. Lack of owner awareness of their building's energy use
2. Lack of transparency about energy use in the real estate market for tenant, investors, and underwriters
3. Energy-efficient program administrators' lack of market data for program design

The descriptions focus on whether evidence of these "indicators" of market transformation progress are present in relation to these barriers.

Table A-1. Building Owner Awareness Market Transformation Indicators

Immediate/ Short-Term MTI (1 to 3 Years)	Intermediate-Term MTI (4 to 6 Years)	Long-Term MTI (7 to 10 Years)	Primary Data Sources	Supplemental Data Collection Methods	Potential Actions in the Case of Absent or Partially Absent Indicator
Building owners are aware of annual energy performance per building or leased space for all fuels	Building owners are increasingly aware of annual energy performance trends for all fuels	Building owners incorporate benchmarking data into energy management decisions as a matter of standard practice	ENERGY STAR Portfolio Manager inputs and outputs	Secondary research of trade periodicals from associations in NYC	The absence or partial absence of this indicator would justify additional educational outreach to building owners
Building owners can identify specific energy performance opportunities in their own buildings	Building owners include energy performance as a component of retrofit/ renovation planning	Building owners increasingly incorporate energy performance into expansion and retrofit design and construction practices	Interviews and surveys of building owners and property managers	Surveys of NYSERDA, LIPA, NYPA program administrators	The absence or partial absence of this indicator would justify additional educational outreach to building owners by both the policy sponsor (local municipality) as well as local utilities

Table A-2. Transparency of Energy Use in the Real Estate Market

Immediate/ Short-Term MTI (1 to 3 Years)	Intermediate-Term MTI (4 to 6 Years)	Long-Term MTI (7 to 10 Years)	Primary Data Sources	Supplemental Data Collection Methods	Potential Actions in the Case of Absent or Partially Absent Indicator
Tenants are increasingly aware of benchmarking transparency information and their understanding of this information increases over time	Tenants incorporate transparency information into lease negotiations	Tenants expect improving energy performance as a standard practice by building owners	Interviews with real estate professionals operating in NYC; lease contract documents	Survey of tenants; survey of commercial real estate brokers	If tenants are unaware or uncertain of the value of benchmarking transparency information, their transition from awareness to understanding to incorporation of the information into real estate decisions will stagnate or cease.
Investors and underwriters are increasingly aware of benchmarking and transparency information	Investors and underwriters begin to include transparency information as a valuation criteria	Investors and underwriters include improving energy performance as a standard valuation metric	Interviews with real estate professionals operating in NYC; lease contract documents	Survey of tenants; survey of commercial real estate brokers	If investors or underwriters do not incorporate benchmarking and transparency information into their valuation process, it may mean that they have not observed sufficient demand for buildings with improved energy performance or that they lack a methodology to monetize any demand that they do observe. Programming that demonstrates tenant demand and/or valuation techniques to quantify this demand would be viable options to address these challenges.

Table A-3. Availability of Market Data for Energy-Efficiency Program Design

Immediate/ Short-Term MTI (1 to 3 Years)	Intermediate- and Long-term MTI (4 to 10 Years)	Primary Data Sources	Supplemental Data Collection Methods	Potential Actions in the Case of Absent or Partially Absent Indicator
Energy-Efficiency Program Administrators begin to include benchmarking and transparency information in their new program designs	Energy-Efficiency Program Administrators increasingly include benchmarking and transparency information as a standard input to their current and future program designs	Interviews with program administrators (NYSERDA, LIPA, NYPA); publicly available program designs	Secondary research on public testimony from energy-efficiency program administrators in the State of New York on links to the policy	If energy-efficiency program designs do not include insights from benchmarking and transparency market data, a mitigation technique is facilitated dialogue between policy makers and program administrators.
Investors and underwriters are increasingly aware of benchmarking and transparency information	Investors and underwriters include improving energy performance as a standard valuation metric	Interviews with real estate professionals operating in NYC; lease contract documents	Survey of tenants; survey of commercial real estate brokers	If investors or underwriters do not incorporate benchmarking and transparency information into their valuation process, it may mean that they have not observed sufficient demand for buildings with improved energy performance or that they lack a methodology to monetize any demand that they do observe. Programming that demonstrates tenant demand and/or valuation techniques to quantify this demand would be viable options to address these challenges.

Appendix B
Narrative Description of NYC Market Actor Interviews

B.1 Market Actor Interviews Narrative Summary and Interviewee Recommendations for Improving Benchmarking and Transparency Policies

In the following sections, we present the narrative results of the market actor interviews. This content can better inform City staff of key market actor perspectives and views on current policy market impacts and future direction.

B.1.1 Building Owners and Managers

General Energy Use Awareness

The first set of questions to building owners and managers investigated their level of awareness of energy usage in their properties before and after LL84, and their participation with energy-efficiency programs.

First, commercial managers and owners tend to be sophisticated with energy management in NYC. Properties often contain building management systems (BMS) coupled with real time data monitoring and constant operations and maintenance (O&M) occurring with systems.

The commercial market's response to the transparency of data was more contentious than in the multifamily sector. The data can actually result in publicity for high profile commercial buildings, both negative and positive. The big impact is the knowledge that public scrutiny of the submittal will result. One interviewee's experience was a large press issue on the efficiency reported in LL84. The building manager argues that their building is much more energy intensive due to its use type and more categories are needed in Portfolio Manager.

Most of the multifamily owner and managers also already had some understanding of energy usage in their properties before LL84, but with a range of depth. If the organization was not mission driven to monitor and manage energy closely, there was often at least a monetary impetus to track costs. Even those who were tracking usage were often tracking costs only, or not normalizing data in significant ways. The requirement to comply with LL84 led to a better understanding of tracking energy usage and the various metrics involved in normalizing data to allow for comparisons, and ultimately, benchmarking.

Most of both types of owners and managers interviewed were already taking advantage of existing energy-efficiency incentives programs; compliance with LL84 did not change this activity. One owner, however, felt LL84 did coincide with other initiatives on the city and state level, and their participation in these other energy-saving initiatives increased (not just participating in incentives but voluntary programs to reduce consumption). Further, one multifamily manager noted that the City's laws introduced them to more energy-efficiency consultants to help them comply with the laws. While the laws themselves did not explicitly change their views on energy-efficiency, they did require third-party consulting, which opened their eyes to more options for building upgrades and programmatic options.

Lastly, one multifamily owner noted that for the first time, a bank servicing one of their loans is now requesting a Portfolio Manager Statement of Energy Performance for each loan review. This was the first time this owner had received this request.

How Energy Use Has Changed since the Policy Was Enacted

This next set of questions probed how actual energy-efficiency actions were impacted by LL84. All respondents were very likely to or planning to invest in energy-efficiency upgrades within the next year. While they were planning to do the work, the policy was not necessarily the driver. In two cases, however, owners felt the law offered some encouragement, both through knowledge that energy usage would be public and thus worth improving, and through increased exposure to energy-efficiency options. Table B-1 provides an overview of interviewee responses related to efficiency upgrades. Most of the 'No' answers were the result of the owner having already conducted much of the work during construction or initial gut rehabs.

Table B-1. Building Owner and Manager Responses to Queries Related to Efficiency Upgrade Planning

Question	Interviewees								Count
	#1	#2	#3	#4	#5	#6	#7	#8	
a. Training	Y	M	Y	Y	Y	Y	N	Y	6.5/8
b. Lighting	Y	Y	N	Y	Y	Y	Y	Y	7/8
c. HVAC	N	Y	N	Y	Y	N	Y	Y	5/8
d. Water Heating	N	Y	n/a	Y	Y	N	Y	Y	5/8
e. Motors/Drives	N	Y	Y	Y	N	Y	Y	Y	6/8
f. Office Equipment	n/a	n/a	n/a	n/a	Y	n/a	n/a	n/a	n/a
g. Environmental Controls	n/a	n/a	n/a	Y	Y	n/a	n/a	n/a	2/8
h. Envelope	M	Y	N	Y	N	N	Y	Y	4/8

All the companies have at least one staff member assigned to energy-efficiency. Most were not reported to have been hired directly because of the policy – as reported in Table B-2.

Table B-2. Building Owner and Manager Response to Queries on Job Creation

Jobs	Interviewees							
	#1	#2	#3	#4	#5	#6	#7	#8
EE & O&M Staff	1	7	0	3	1	1	1	4
Year of Hire	2012	n/a	n/a	2013	2007	TBD	~2010	~2008
Benchmarking Submittal	Consultant	Consultant	In House	In House	In House	Consultant	In House	TBD

There is also the growing understanding that issues of energy-efficiency, both as a business practice and a municipal requirement, are now part of doing business. Benchmarking is now a minimum baseline and owners and managers' teams are growing to handle these issues full time, and ultimately, become more proactive with energy usage matters.

Policy Effects upon Real Estate Values, Tenant Occupancy, and Price

This last set of questions inquired into interviewees' opinions on the policy and general energy-efficiency on property values.

For multifamily owners who buy property, part of the acquisition process is doing due diligence on the efficiency or a property. In addition, buildings that are not operating to full potential can be viewed as an investment opportunity to make them more efficient.

Multifamily owners with market rate properties do see demand for ENERGY STAR® or Leadership in Energy and Environmental Design (LEED) labeled properties. Owners of affordable properties, however, cannot see any sort of

difference among energy-efficiency ratings; the demand is too high for affordable properties and there is always a waitlist regardless of energy-efficiency label.

A commercial owner found that smaller tenants care more about operating costs; large tenants care more about publicity from ENERGY STAR and LEED labels.

Lastly, per Table B-3, interviewees were questioned, on a scale of 1-5, whether certain reasons for benchmarking were influential in their decision making.

Table B-3. Building Owners and Managers' Reasons for Benchmarking

Question	Interviewees								Average
	#1	#2	#3	#4	#5	#6	#7	#8	
Compliance w/ LL84	5	5	1	5	5	5	5	1	4
Improving Building Energy Performance	5	1	1	4	5	5	2	2	3
Information of Value	5	1	1	3	3	n/a	2	3	3
Creating Added Value	5	1	1	3	4	5	1	1	3

B.1.2 Real Estate Professionals

How Energy Use Has Changed since the Policy Was Enacted

This first category of questions asked interviewees how energy management has changed as a result of LL84's enactment. Specifically, interviewees were asked if the policy led to actual changes in behavior, beyond reporting data.

Owners and managers in the NYC commercial real estate, particularly Class A real estate, were already fairly sophisticated regarding their understanding of energy usage in their buildings prior to LL84. It was said a few times that high quality real estate and energy-efficiency go hand in hand, as a result of informed management of a real estate asset.

Two identified hurdles for installing measures in multifamily buildings are the potentially low return on investment and the time and hassle involved with filing permits and other requirements.

Policy Effects on Real Estate Values

The second category of questions investigated any relationships between the release of publicly available energy data resulting from LL84 and demand for properties. It also questioned the impact of ENERGY STAR labeling and LEED certification, separate from LL84's data release, and real estate professional's access to and awareness of energy performance information.

First, NYC real estate, especially commercial real estate, comes with very high costs. Whether through real estate costs, operating expenses, or tenant demand for modern spaces, these acquisition and operating expenses can often dwarf the impact of energy expenses. As such, building performance is often not the leading driver, and may not even play a large role, in interest in a property.

For commercial properties, there is definitely market demand for ENERGY STAR and LEED; they represent a clear label that people understand. Firms like to see these labels on their buildings for marketing purposes as much as anything else. Sometimes it is as simple as a corporate policy that prioritizes labeled buildings.

Also for commercial properties, investing in real estate does include an analysis and understanding of energy usage of a building, often three years' worth of bills, and a deep understanding of mechanical systems. The operating expenses of a building are part of the value. Although in some cases it may not be a determining factor, depending on the goals of an investor. A poor performing building can be improved, which could then increase its value and result in a better investment.

Lastly, questions were asked on the understanding of the usage of public energy usage data currently by the market, and how that is expected to change in three years. With regard to the market's awareness of energy usage data, access was not considered an issue; it is just a matter of the interest in it from investors, underwriters, and tenants. Overall, the utilization of energy usage data is expected to increase in the next three years from a low or moderate amount of usage to a higher amount of usage, for tenants, investors, and underwriters. That being said, there was not a consensus on who uses the data the most. Some felt that tenants were the most interested in the data, for marketing purposes, while others felt that it was actually the underwriting community who will most value the data as it becomes required more often as part of financial transactions. Table B-4 provides an overview of interviewee responses.

Table B-4. Most Likely Users of the Policy Data in the Future

Category	Question	Interviewees				Average
		#1	#2	#3	#4	
Tenants	RE8a (Current Use)	3	1	2	1	2
	RE8b (Future Use)	4.5	3	3.5	1	3
Investors	RE8c (Current Use)	1	1	3.5	1	2
	RE8d (Future Use)	1	3	4	3	3
Underwriters	RE8e (Current Use)	2	n/a	1	2	2
	RE8f (Future Use)	2	n/a	4.5	3	3

Appendix C
Historical Tracing and Attribution Issues for Future Consideration

LL84 is part of a larger planning and policy context in New York State. The following sections briefly describe five categories of institutional developments across the state: New York State planning, state and city energy code updates, utility programs, growth in ENERGY STAR® and Leadership in Energy and Environmental Design (LEED) certification in the marketplace, and NYC policy.

C.1 State Planning

The New York State Energy Research and Development Authority (NYSERDA) was created in 1975. It initially focused on research and development for reducing petroleum consumption across the state. By 1995, its focus shifted to meeting the state's energy goals through incentivizing energy-efficiency, providing research and analysis, and encouraging the use of renewable energy.[29]

In 1998, NYSERDA's funding source shifted as it became the administrator of the System Benefits Charge Program (SBC).[30] The New York State Public Service Commission (PSC) implemented the rate-payer funded SBC to finance public policy efforts not addressed by the state's competitive electricity markets. In the first four years of its existence, roughly 75 percent of the SBC funding was allocated to NYSERDA programming.[31]

In 2004, the PSC adopted a Renewable Portfolio Standard (RPS) to encourage renewable energy usage and generation in New York State. The current target is for 30 percent of state electricity consumption to come from renewable sources by 2015. The RPS was born out of a 2002 State Energy Plan warning of the state's overreliance on fossil fuels, and the State's 2003 Greenhouse Gas Task Force recommendations to create an RPS and to participate in the creation of a regional greenhouse gas (GHG) cap-and-trade program.[32]

Following the adoption of the RPS, New York State became a charter member of the Regional Greenhouse Gas Initiative (RGGI) in 2008, an effort by nine states to create the first American mandatory, market-based program to limit greenhouse gas emissions.

Also in 2008, the Energy-Efficiency Portfolio Standard (EEPS) was established by the PSC to reduce electricity usage statewide by 15 percent by 2015.[33]

In 2012, Executive Order 88 was signed to create Build Smart NY, which mandates a 20 percent improvement in energy-efficiency of executive government buildings by 2020.

C.2 Utilities

C.2.1 Con Edison

Consolidated Edison Company of New York (Con Edison) is the electricity utility for NYC, except for a small part of Queens County and a part of Westchester County, and the natural gas utility for Manhattan, the Bronx, and parts of Queens and Westchester. Con Edison also operates the world's largest district steam system, covering most of Manhattan.[34]

The large coverage area means that a very large percentage of aggregated energy data requests for LL84 are submitted to Con Edison.

[29] http://www.nyserda.ny.gov/About/History-of-NYSERDA.aspx
[30] http://www.nyserda.ny.gov/About/History-of-NYSERDA.aspx
[31] http://www3.dps.ny.gov/W/PSCWeb.nsf/All/58290EDB9AE5A89085257687006F38D1?OpenDocument
[32] http://energy.pace.edu/sites/default/files/publications/RPS%20Report.pdf
[33] http://www3.dps.ny.gov/W/PSCWeb.nsf/All/06F2FEE55575BD8A852576E4006F9AF7?OpenDocument
[34] http://www.coned.com/aboutus/

From the late 1980s through to 1997, Con Edison offered a variety of efficiency programs in both the residential and commercial and industrial (C&I) markets. During that period, C&I programs focused large C&I building and industrial electric, natural gas, steam, and lighting savings. With the introduction of a statewide system benefits charge (SBD) in 1998, programs shifted from Con Edison's lead to NYSERDA. NYSERDA ran all C&I programs in Con Edison territory from 1998 through to 2009.

However, with the opening of the statewide EEPS proceeding at the New York Public State Public Service Commission (NYPSC) in 2009, Con Edison began again to offer programs into the C&I market. Current programs offerings include the following:

- Electric rebate – prescriptive
- Gas rebates – prescriptive
- Electric rebate – custom
- Gas rebate -- custom

These programs will continue through the first and second cycles of the EEPS, proceeding to December 31, 2014.

C.2.2 Long Island Power Authority/PSEG Long Island

PSEG Long Island is the operator of the electricity system owned by the Long Island Power Authority (LIPA). PSEG Long Island provides service to the counties of Long Island in New York State, but this coverage area also includes the Rockaways in Queens, NYC.

In 1999, LIPA launched the Clean Energy Initiative (CEI), which included programs for residential and commercial customers, as well as renewable energy incentives. The programs targeted homeowners and commercial occupants, as well as contractors, retailers, manufactures, and distributors.[35]

The CEI was closed in 2008, but many programs continued into the Efficiency Long Island Program (ELI). These include the Commercial Efficiency Program (CEP), a comprehensive collection of energy-efficiency incentives to commercial customers, the Energy-Efficient Products Program (EEP), which incentivize purchases and use of energy-efficient appliances and lighting for residential customers, multiple programs to increase the energy-efficiency of single-family homes, and renewable energy programs.

C.2.3 National Grid

National Grid is a privately owned energy company, which provides natural gas to parts of NYC not covered by Con Edison. National Grid supports LIPA's energy-efficiency programs by providing day-to-day management of contractors.[36] The utility also provides rebates for high efficiency gas equipment and controls; has prescriptive incentives for some measures: furnaces, condensing unit heaters, hydronic boilers, condensing boilers; and also provides incentives for thermostats, boiler reset controls, insulation measures, steam traps; and some custom incentive for energy monitoring systems, insulation for non-building envelope improvements, and process improvements.

C.2.4 New York Power Authority

The New York Power Authority (NYPA) is the largest state public power organization in the United States. NYPA's infrastructure includes 16 generating facilities and over 1,400 circuit-miles of transmission lines.[37]

Since the early 1980s, NYPA has financed various energy-efficiency projects throughout the state.[38]

In 2010, NYPA released its Sustainability Action plan to support energy-efficiency and renewable energy in its coverage area. In 2012, NYPA initiated two Market Acceleration Programs to expand the use of solar power

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[35] *1999-2008 Clean Energy Initiative (CEI) Assessment Report, Opinion Dynamics Corporation, May 2010, pg 4*
[36] *From email discussion*
[37] *http://www.nypa.gov/about.html*
[38] *http://www.nypa.gov/services/esp.htm*

projects and speed the development of commercial energy products and systems not currently available.[39] NYPA is also responsible for providing $450 million in low-cost financing for energy-efficiency projects under the state's Build Smart NY program.[40]

C.2.5 New York State Energy Research and Development Authority

NYSERDA was created as a public benefit corporation in 1975 with multiple energy responsibilities. When the New York State Energy Office was closed in 1995, NYSERDA took on critical energy-efficiency, energy assessments, energy planning, and policy analysis functions. NYSERDA's funding structure changed in 1998 when the New York State Public Service Commission approved the ratepayer-supported SBC program, which designated NYSERDA as the program's administrator.

Starting in 1998 with introduction of the SBD, NYSERDA became responsible for delivering all commercial building efficiency programs into the NYC market. This lasted to 2009, with the initiation of the statewide Energy-Efficiency Portfolio proceeding, which specified utility offering of programs alongside NYSERDA's commercial building programs to the largest customers. Beginning in 2008, Con Edison and National Grid began (again) to offer commercial programs in NYC. These utility program efforts serve incentive programs for up to 75 units. Customers with multifamily buildings with over 75 units go to NYSERDA programs.

NYSERDA is expected to continue offering its efficiency program offerings through to December 31, 2015 - the end period for the second cycle of the EEPS proceeding at the PSC - and beyond.

C.3 Construction Energy Codes

The Energy Conservation Construction Code of New York State (ECCCNYS) was implemented in 1979. It was amended to include residential buildings in 1989. Updates were passed in 1991, 2002, 2007, and 2010 to keep pace with model energy codes and ASHRAE standards.[41]

The current energy code for NYC was adopted in 2009 as part of the Greener Greater Buildings Plan (GGBP), which also included the policy, LL84. This was passed to follow the 2007 ECCCNYS implementation and close a loophole that excluded most renovations in NYC. The code was strengthened in 2010 to meet more energy-efficiency targets and compliment the 2010 ECCCNYS updates.

C.4 New York City Planning Efforts

In 2005, NYC adopted Local Law 86, which was one of the nation's first green building laws. The law required all new buildings, additions, and reconstruction work in capital projects that receive city funds to be built following LEED guidelines.[42]

In 2007, NYC released PlaNYC, a comprehensive plan to address population growth, climate change, and aging infrastructure. The plan included a wide range of categories to meet the challenges of climate change and emphasized the need to address the energy usage of the City's larger buildings.

To assist in meeting some of PlaNYC's targets, the NYC Council passed the GGBP in 2009. The City found that almost half of the City's building square footage and 74 percent of its GHG emissions were in properties over 50,000 square feet. The GGBP targets these properties with the following four pieces of legislation:

- Local Law 84: Benchmarking, annual requirement to benchmark energy and water consumption
- Local Law 85: NYC Energy Conservation Code (NYCECC), NYC's local energy code
- Local Law 87: Energy Audits & Retro-Commissioning, requirement to conduct an energy audit and perform retro-commissioning once every 10 years

[39] http://www.nypa.gov/about/history5.htm
[40] http://www.nypa.gov/services/energygoals.htm
[41] http://energycodesocean.org/state-country/new-york
[42] http://www.nyc.gov/html/oec/html/green/green.shtml

- Local Law 88: Lighting & Sub-Metering, requirement that by 2025, the lighting in the non-residential space be upgraded to meet code and large commercial tenants be provided with sub-meters[43]

The City's chapter of the U.S. Green Building Council, Urban Green Council, released the NYC Green Codes Task Force report in 2010. The report is the culmination of a joint effort between city government, industry, and non-profits to develop specific green building code recommendations. To date, 51 of the 111 recommendations have been signed into law.[44]

C.5 Growth of LEED and ENERGY STAR in the Marketplace

NYC has seen growth in ENERGY STAR labeled buildings and LEED certified buildings over the past decade. The U.S. Environmental Protection Agency (EPA) ranks NYC as 4 out of the top 10 cities containing the most ENERGY STAR certified buildings.[45] It is interesting to note that in 2007, Manhattan was not only outside the top 10 of most ENERGY STAR labeled buildings nationally, but was also trailing national averages. Since that time, there has been considerable growth in the number of properties labeled. While the passage of LL84 is not proven to be the direct cause, the trend does follow the presence of the law.[46]

The first LEED certified building was 30 Hudson Street, certified in Manhattan in 2005.[47] LEED registered and certified commercial projects in New York State grew from 0 to nearly 3,000 between 2000 and 2013.[48]

[43] http://www.nyc.gov/html/gbee/html/plan/plan.shtml
[44] http://urbangreencouncil.org/GreenCodes
[45] http://www.energystar.gov/buildings/sites/default/uploads/tools/Green-Building-Adoption-Index-2014_Final.pdf?fda9-2ce6, pg 16
[46] http://www.energystar.gov/buildings/sites/default/uploads/tools/Green-Building-Adoption-Index-2014_Final.pdf?fda9-2ce6, pg 16
[47] http://www.energystar.gov/buildings/sites/default/uploads/tools/Green-Building-Adoption-Index-2014_Final.pdf?fda9-2ce6, pg 16
[48] http://www.usgbc.org/sites/default/files/Combined%20Package_New%20York_0.pdf

Appendix D
Market Actor and Efficiency Agency Interview Guides and Owner/Property Manager Survey Instrument

Benchmarking and Transparency Policy Interview Guide – Energy Efficiency Agencies and Entities

Interview Initiation	Q1 – Q4
Interviewee's Role and Responsibilities	RR1 – RR2
Expected Outcomes of Interviewee Organization's Programs	EO1 – EO2
Barriers to Interviewee's Program Success	BA1 – BA4
Market Changes Since Enactment of Policy	E1 – E3
Policy Influence on Interviewee's Programming	PI1 – PI3
Closing	CC1 – CC2

Interview Initiation

These questions are only to develop rapport with the respondent and create a conversational tone. Other questions may be substituted individual respondents as appropriate. If the interviewer has a relationship with the respondent, these questions may be revised or omitted.

Intro*: Hello, my name is < >. Thanks for taking time with us today. I'm calling from Navigant Consulting, and am conducting research on the topic of energy performance in commercial real estate and multifamily buildings. In particular, we want to gather information on your views of the benchmarking and transparency policy recently passed and implemented by New York City. We are seeking input from* <Organization Name> *to better understand not only your perspective on the ordinances impact on commercial real estate in New York City, but also any ways that you might be considering using the information gathered and revealed through the policy's implementation process in improving and/or enhancing current commercial and larger multifamily programs, or developing new programmatic offerings based on the existence of the policy. To get started:*

Q1. *We are interested in hearing your views on New York's benchmarking and transparency policy. Are you familiar with of this policy and how it works?*

(If "yes" continue, if "no", ask ***Q1a****: Is there someone else in at* <Organization Name> *who is knowledgeable about the policy and how they may relate to your energy efficiency program offerings? Say thank you after obtaining the contact information and terminate the interview.*

Q2. *What is your current position at* <Organization Name>*?*

Q3. *How long have you been in that role, and how long have you been with* <Organization Name>*?*

Q4. *What responsibilities do you have in your day-to-day job?*

Programming and Activities

These questions identify the commercial and multifamily sector programs offered by the interviewee's organization in the jurisdiction area of influence as a pre-policy influenced baseline for future comparison.

RR1. *What programs does your organization offer in the energy-efficiency in commercial real estate sector in NYC, including, large multifamily buildings?*

RR2. *Can you tell us a bit about the specific program offerings that your organization undertakes to promote greater energy performance in commercial real estate?*

Expected Outcomes of Interviewee Organization's Programs

These questions focus on outcomes that the respondent's organization planned to achieve as well as the path to those outcomes – with a focus on establishing a current "baseline" understanding of the organization's goals from which we can compare future integration and use of the policy, if any, into the utility/organization's goals.

EO1. *Do the programs you described above have specific energy-efficiency market transformation or resource savings goals (short, intermediate and long-term)?*

EO2. *Can you tell us a bit about the milestones you are targeting to achieve over these implementation periods?* ***[Probe for specific events, deliverables, and contracted outputs]***

Barriers to Interviewee's Program Success

These questions focus on barriers that impede the interviewee's programs from improving energy performance in commercial real estate – once again as a baseline from which to compare future integration of policy concepts and impacts in improved program design.

BA1. *What market characteristics prevent the improvement of energy performance of commercial real estate in your service area? i.e., What barriers are your programs targeted to overcome?*

BA2. *How do you address this challenge?*

BA3. *Are there institutional, regulatory or other barriers that exist in the commercial real estate market that prevent the improvement of energy performance of commercial real estate in your service area and have caused challenges for your program offerings to overcome?* ***[Probe for the names of organizations, types of challenges and other relevent information e.g., timesline if relevant]***

BA4. *How did you address these challenges?*

Market Changes Since Enactment of the Policy

These questions probe deeper into both observed impacts of the policy in markets where the EE organizations offer programs, and any energy conservation and efficiency actions taken with these entities since the enactment of the policy that would identify immediate or planned program improvement impacts from the policy.

E1. *In your view, how has the policy affected the commercial real estate market in New York?*

E2. *In relationship to the policy, have your program folks seen any changes in management of commercial building energy use in New York since passage of the policy?*

E3. How has this affected the market's response to your program offerings?

Policy Influence on Interviewee's Programs

These questions focus on the effect of the policy on the interviewee's program design.

PI1. *Did the implementation of the policy change your programs' goals, strategies, or tactics?*

PI2. *If so, in what ways? How has your organization adapted or modified your program designs, financial incentives, marketing and outreach, and other aspects of program delivery?*

PI3. *I would now like to read a series of FIVE statements regarding* <Organization Name>*'s programming as it relates to New York benchmarking and transparency policies. Please let me know which ONE of these statements most accurately represents your organization.*

1. *We are aware of the New York policy but this does not affect planning or implementation of programs.*
2. *We are in the process of determining how to best incorporate benchmarking and transparency inputs and outputs into our current and future programs.*
3. *We have begun to plan programs for future implementation that include benchmarking and transparency inputs and outputs.*
4. *We have revised existing programs for the commercial building sector to incorporate benchmarking and transparency inputs and outputs.*
5. *We work cooperatively with the City of New York to include benchmarking and transparency policies in both our current program implementation and future program design.*

Closing

These questions allow the interviewee to learn more about this project and provide an opportunity for the interviewer to ask more questions in the future.

Thank you for your time.

CC1. *Are there any questions that you have for me?*

CC2. *If we have more questions, may I contact you again?*

Benchmarking and Transparency Interview Guide – Building Owners and Property Managers

Interview Initiation	Q1 – Q3
General Energy Use Awareness Questions	G1 – G8
How Energy Use has Changed	E1 – E8
Policy Affects upon Real Estate Values, Tenant Occupancy and Price/Sq. Ft.	RE1 – RE6
Interviewee Advice	AA1 – AA2
Closing	CC1 – CC2

Interview Initiation

These questions are only to develop rapport with the respondent and create a conversational tone. Other questions may be substituted individual respondents as appropriate. If the interviewer has a relationship with the respondent, these questions may be revised or omitted.

***Intro**: Hello, my name is < >. I'm calling from < Navigant or SWA >, and am conducting research on behalf of NYC to help them better understand how the City's energy benchmarking and transparency policies are affecting building owners and property managers. This is not a sales call, nor will I be asking for contributions or donations.*

Q1. <Organization name> *listed you as the person responsible for submitting the benchmarking data for the < building information from database (type, location)>. Are you the person most knowledgeable about the policies?* ***[If yes, continue. If no, ask for another contact.]***

Q2. *How long have your been in your current position at* <Organization Name>*?*

Q3. *What other responsibilities do you have in your day-to-day job?*

General Energy Use Awareness Questions

These questions identify and quantify any jobs created among building owners, building managers and benchmarking consultants.

G1. *Thinking back to before the City enacted the policy, were you aware of this building's annual energy use and costs? On a scale of 1 to 5, where 1 means "not at all aware" and 5 means "extremely aware," how would you gauge your level of awareness?*

G2. *What about other buildings you own or manage?*

G3. *What techniques did you use to monitor energy performance in your building(s)?*

G4. *Were you performing benchmarking at that time? If so, what tools did you use? If not, what was it that prevented you from benchmarking?*

G5. *How did the enactment of the City's policy affect your knowledge of energy consumption and energy savings opportunities?*

G6. *Did you participate in utility, state, or city energy-efficiency programs, or take advantage of tax credits, prior to the enactment of the policy? If so, which ones?*

G7. *Did you participate in utility, state, or city energy-efficiency programs, or take advantage of tax credits, after the enactment of the policy? If so, which ones? Did the policy influence your decision to participate, and if so, how?*

> ***G7a.*** *Following on the previous question, specifically, has the policy's provision for energy transparency to prospective tenants or investors influenced your thinking about energy-efficiency in the buildings you own?*

G8. [If the responded answers in the negative to any of G4 - G7, ask]*What prevented you or your organization from taking part/pursuing <benchmarking, energy savings opportunities, energy-efficiency programs, etc.>?*

How Energy Use Has Changed since the Policy Was Enacted

These questions probe deeper into the energy conservation and efficiency actions taken by building owners and building managers since the enactment of the policy.

E1. *Has your organization/firm changed how it manages energy since the implementation of the Policy?*

E2. *How has the management of building energy use changed?*

The following lists potential interview prompts:

a. *More frequent monitoring (of controls, thermostats, buildings, electrical/steam usage)*
b. *Identify areas or buildings for reducing energy use*
c. *Installing energy-efficient lighting/lighting upgrades*
d. *Reduce energy use*
e. *HVAC upgrades*
f. *More awareness in managers/organization as a whole*
g. *Benchmarking Implemented automated controls*
h. *Changes in business practices/energy-efficiency policy*
i. *Retrofits/upgrades to maintain Energy Star requirements*
j. *Lack of staff/personnel to continue monitoring*
k. *Other*

E3. *On a scale of 1 to 5, where 1 means "extremely unlikely" and 5 means "extremely likely," how likely is your organization to invest in operational or energy-efficiency upgrades.?* ***[Probe how the policy influenced this.]***

E4. *I am going to read a list of seven equipment and operations & maintenance improvements. Would you please tell me which, if any, you plan to undertake in the next 12 months? Please answer "yes" or "no" to each:*

a. *Provide training to facility managers on ways they can save energy in our building*
b. *Lighting upgrades*
c. *Heating, ventilation, and air-conditioning (HVAC) upgrades*

d. *Water heating upgrades*

e. *New motors and drives for building energy systems*

f. *Office equipment upgrades*

g. *Environmental controls*

h. *Building envelope improvements*

E5. [Ask for each item in E4 to which the Interviewee responded "yes"] *On a scale of 1 to 5, where 1 means "no influence at all" and 5 means "significantly influential," how influential was the policy on your organization's decision to implement these/this improvement?*

E6. *Have you been able to quantify the benefits of your energy management efforts to date? If so, would you share this with me?*

E7. *Have you hired staff directly related to the EE and O&M process?*

a. *If so, how many and are these part time or full-time jobs?*

b. *When did you hire these staff?*

c. *What are their duties related to energy-efficiency and/or operations & maintenance?*

E8. *Have you attracted new tenants as a result of a property being more energy efficient?*

Policy Effects upon Real Estate Values, Tenant Occupancy and Price

These questions assess the effect of energy-efficiency and the policy upon real estate values.

RE1*. How much does the energy use or energy efficiency of a property play a role in your real estate investment decisions?* ***[Probe on both]***

RE2. *To what extent do more efficient properties see improved value in the marketplace?*

RE2a. *Do you see a relationship between increased occupancy and energy-efficient properties?*

RE3. *In what ways has the policy in your jurisdiction impacted real estate transactions?*

RE4. *What role does labeling, such as ENERGY STAR or LEED, or other "green" features play in driving demand for a property, separate from transparency of energy usage data?*

RE5. *To what extent has your organization attempted to isolate energy-efficiency of a property as a driver of value or demand, separate from other factors such as location, age, etc.?*

RE6. *I would now like to read five statements to you regarding benchmarking your building and I would like you to rate them on a scale of 1 to 5 where 1 indicates "this was not an influential reason for benchmarking" and 5 indicates "this was a very influential reason for benchmarking:"*

- *Compliance with New York ordinances*
- *Improving building energy performance*
- *Creating information of value to tenants, real estate professionals, investors and underwriters*
- *Creating added value to your building*
- *Increasing operating revenues*

Interviewee Advice

These questions attempt to capture any final thoughts from the respondent that might inform our understanding of their organization and how the policy influences it.

AA1. *What advice would you have for the City or other jurisdictions in implementing a successful benchmarking and transparency program?*

AA2. *What advice do you have for building owners/building managers in jurisdictions that are about to implement benchmarking and transparency policies?*

Closing

These questions allow the interviewee to learn more about this project and provide an opportunity for the interviewer to ask more questions in the future.

Thank you for your time.

CC1. *Are there any questions that you have for me?*

CC2. *If we have more questions, may I contact you again?*

Benchmarking and Transparency Interview Guide – Real Estate Brokers and Investors

Interview Initiation	Q1 – Q4
How Energy Use has Changed	E1 – E2
Policy Affects upon Real Estate Values	RE1 – RE8
Interviewee Advice	AA1 – AA2
Closing	CC1 – CC2

Interview Initiation

These questions are only to develop rapport with the respondent and create a conversational tone. Other questions may be substituted individual respondents as appropriate. If the interviewer has a relationship with the respondent, these questions may be revised or omitted.

***Intro**: Hello, my name is < >. I'm calling from S. Winters &Associates and am conducting research on behalf of NYC to help them better understand how the City's energy benchmarking and transparency policies are affecting building owners and property managers. We are seeking the perspective of select real estate professions regarding the effect of these policies on the market. This is not a sales call, nor will I be asking for contributions or donations.*

***Q1.** We are interested in hearing your views on New York's benchmarking and transparency policy. Are you familiar with of this policy and how it works?*

> ***If "yes" continue, if "no", ask Q1a:** Is there someone else in at* <Organization Name> *who is knowledgeable about this policy and how it may relate to your EE program offerings? Say thank you after obtaining the contact information and terminate the interview.*

***Q2.** How many years of experience do you have as a real estate professional?*

***Q3.** How long have you been in that role, and how long have you been with* <Organization Name>*?*

***Q4.** What responsibilities do you have in your day-to-day job?*

How Energy Use Has Changed since the Policy Was Enacted

These questions probe deeper into the energy conservation and efficiency actions taken by building owners and building managers since the enactment of the policy.

E1.** Are you aware of any building owners or managers who changed how they manage energy since the implementation of the Policy?* ***[If "no," skip to E3]

***E2.** What prevents building owners and managers from doing more to improve the energy performance of their buildings?*

Policy Effects upon Real Estate Values

These questions assess the effect of energy-efficiency and the policy upon real estate values.

RE1. *How much does the energy use or energy efficiency of a property play a role in your real estate investment decisions?* ***[Probe on both]***

RE2. *To what extent do more energy-efficient properties see improved value in the marketplace?*

> ***R2a.*** *What reasons that energy-efficient properties may not see improved value?*

RE3*. In what ways has the policy impacted real estate transactions in your jurisdiction?*

RE4. *What role does labeling, such as ENERGY STAR or LEED, or other "green" features play in driving demand for a property, separate from transparency of energy usage data?*

RE5. *To what extent has there been an attempt to isolate energy-efficiency of a property as a driver of value or demand, separate from other factors such as location, age, etc.?*

RE6. *Do tenants, investors and underwriters have acess to building energy performance information?*

> ***R6a.*** *What prevents access to this information?*

RE7. *To what extent have tenants, investors or underwriters expressed awareness of or interest in building energy performance in selecting a property?*

> ***R7a.*** *What prevents greater awareness of building energy performance?*

RE8. *I would now like to ask about the use of benchmarking data by tenants, investors and underwriters. On a scale of 1 to 5, where 1 indicates "this information is never used" an 5 indicates "this information is always used,"*

> ***RE8a.*** *How often do tenants in New York use benchmarking data in their leasing decisions?*
>
> ***RE8b****. Do you expect tenants' use of benchmarking data to be more, less or about the same in the next three years?*
>
> ***RE8c****. How often do investors in New York use benchmarking data in their funding decisions to purchase or retrofit a building?*
>
> ***RE8d.*** *Do you expect investors' use of benchmarking data to be more, less or about the same in the next three years?*
>
> ***RE8e.*** *How often do underwriters in New York use benchmarking data in their decision-making process?*
>
> ***RE8f.*** *Do you expect underwriters' use of benchmarking data to be more, less or about the same in the next three years?*

Interviewee Advice

These questions attempt to capture any final thoughts from the respondent that might inform our understanding of their organization and its response to the policy.

AA1. *What advice would you have for the City or other jurisdictions in implementing a successful benchmarking and transparency program?*

AA2. *What advice do you have for building owners/building managers in jurisdictions that are about to implement benchmarking and transparency policies?*

Closing

These questions allow the interviewee to learn more about this project and provide an opportunity for the interviewer to ask more questions in the future.

Thank you for your time.

CC1. *Are there any questions that you have for me?*

CC2. *If we have more questions, may I contact you again?*

Benchmarking and Disclosure (B&T) Policy Survey Instrument for Building Owners, Property Managers

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Primary Information Objective:

- Determine if and how the Benchmarking and Development (B&T) policy influenced or impacted the owner's energy efficiency actions

Secondary Information Objectives:

- Determine owner's energy efficiency inclinations and actions prior to policy passage e.g., was the owner/ manager already benchmarking and taking EE actions
- Determine owner's energy efficiency inclinations and actions post-policy passage and implementation e.g., did the owner take new energy efficiency actions due to the passage of the B&T policy

Research Questions:

Pre- Policy Awareness and Energy Efficiency Actions	PRP1 – PRP4
Post - Policy Awareness and Energy Efficiency Actions	POP5 – POP7
Perspectives on the Benefits and Challenges of Increased Awareness of Energy Efficiency due to the passage of the B&T policy	PBC8 – PBC10
Closing: A Big Thank You!	CC1 – CC2

Pre-Policy Awareness and Energy Efficiency Actions

PRP1. Prior to passage of the < local policy name > were you undertaking benchmarking type activities related to awareness of energy usage in your building?

□ Yes □ No

PRP 2. If yes, what types of benchmarking activities did you take?

□ a. Monitored monthly energy performance

□ b. Compared my building to others in terms of energy performance

□ c. Shared energy performance data with current and prospective tenants

□ d. Other _____

PRP3. Did you take any energy efficiency upgrade actions prior to passage of the City's B&T policy?

□ Yes □ No

PRP4. If yes, please check those actions that apply:

□ a. Provided training to facility managers on ways they can save energy in our building

- □ b. Lighting upgrades
- □ c. Heating, Ventilation, and Air Conditioning (HVAC) upgrades
- □ d. Water heating upgrades
- □ e. New motor upgrades and drives for building energy systems
- □ f. Upgraded office equipment
- □ g. Installed environmental controls
- □ h. Building envelope improvements
- □ i. Increased involvement in energy management planning
- □ j. Daily operational and maintenance improvements approaches
- □ k. Other _____

Post - Policy Awareness and Energy Efficiency Actions

POP5. Now that the B&T policy is in place, how much has the policy impacted your awareness of energy performance in your building?

□ Greatly □ Somewhat □ Not at All

POP6. If the answer above is "Somewhat" or "Greatly," please tell us the areas most impacted in your thinking by passage and implementation of the B&T policy. Please check all items that apply.

Since the B&T policy was implemented I am now more likely to…

POP7. Beyond the basic benchmarking requirement of the City's policies, which of the following energy efficiency actions have you implemented or begun implementing due to passage of the B&T policy. Please check all item that apply.

Since the B&T policy was implemented I am currently/have begun…

- □ a. Training for facility managers on ways they can save energy in our building
- □ b. Lighting upgrades
- □ c. Heating, Ventilation, and Air Conditioning (HVAC) upgrades
- □ d. Water heating upgrades
- □ e. New motor upgrades and drives for building energy systems
- □ f. Upgraded office equipment
- □ g. Installed environmental controls
- □ h. Building envelope improvements
- □ i. Increased involvement in energy management planning
- □ j. Daily operational and maintenance improvements approaches
- □ k. Other _____

Benefits and Challenges of B&T Policy Passage

PBC8. Now that you've had time to work with the B&T policy, as a building owner, what would you say are the benefits of the policy?

- □ a. Continued to support already existing (pre-B&T policy) focus on energy efficiency in my building(s)
- □ b. Brought me in touch with new thinking about meeting the policy benchmarking requirements
- □ c. Increased my knowledge of the enhanced energy efficiency opportunities existing within my building(s)
- □ d. Led me to begin developing approaches and plans for increasing energy savings in my building(s)
- □ e. The policy did not add to my existing practice or focus on energy efficiency in my building(s)
- □ f. Other _____

PBC9. Now that you've had time to work with the B&T policy, as a building, owner can you tell us about the challenges you faced associated with the policy's implementation?

- □ a. I've been very interested in Energy Efficiency and I've done all I thought was economically feasible, and now I have to rethink my approach
- □ b. The policy is too costly for me to implement.
- □ c. It requires me to hire new staff or contractors to fill out the forms
- □ d. I am concerned that my building will look less attractive to potential tenants based on my disclosed energy performance.
- □ e. This puts my building under public scrutiny and forces me to decide how I will position my building in the market place
- □ f. I do not like the City telling me that I have to tell others about the energy efficiency status of my building(s)
- □ g. Other _____

PBC10. Do you have any suggestions or insights that can help the city/county enhance the policy's implementation efforts? If so, please note them below.

Closing: A Big Thank You!

CC1. The City of is very interested in your responses and we very much appreciates your time in filling in this brief survey. With your input, we can know best how to continue improving the program for all.

CC2. If you have further comments, please feel free to note them below.

Appendix E
Additional Comments on Non-Energy Impacts

E.1 Additional Comments on the GHG Process for Energy Specific Emissions

The conversion factors for fuels that produce direct emissions – emissions generated at a building – can be found in EPA's Portfolio Manager Technical Reference: Greenhouse Gas Emissions. These conversion factors are physical constants specific to each fuel type; they are not region-specific and do not change from year to year. The conversion factor for electricity, which produces indirect emissions, can be found in the EPA's emissions & Generation Resource Integrated Database (eGRID). This conversion factor varies by region and is subject to change from year to year. eGRID's database is available to the public and displays the electricity emissions factor for each region and each year.

E.2 Additional Comments on the FTE Calculation from Direct Benchmarking Employment

The time required to benchmark the same building year-to-year may shorten as time goes on. Once the Portfolio Manager account is set up, in many cases releasing benchmarking data year after year is primarily a function of uploading new data. Changes in building usage and the manner in which utility data is gathered (whether through aggregated data requests from utilities or through changes to bill formats), however, may result in more than a simple exercise year-to-year. As such, a consistent amount of time per building may be prudent.

Default values, rather than specific utility data, may be permitted by a jurisdiction. This method requires simple calculations, as opposed to gathering real data. If there is reason to believe that a large number of buildings' reports are based on this method, then one to two hours, which would otherwise be used for data gathering, could be subtracted from buildings' full-time equivalent (FTE).

E.3 Additional Comments on the Real Estate Valuation Analysis

Four sample comparison groups were created based on property type, location, and age – the data available in the public release of LL84 data. The intent is to minimize other factors that may impact value in order to compare like properties, as shown in Table E-1.

Table E-1. Valuation Comparison Group Composition

Name	Type	Location	Age	Number of Properties
A	Office	Midtown – Zip 10019	Pre-1939	15
B	Office	Midtown – Zip 10019	Post-1939	21
C	Office	Midtown – Zip 10022	Pre-1939	11
D	Office	Midtown – Zip 10022	Post-1939	43

The comparison groups were selected to create logical groupings using available data. Office properties were chosen and Weather Normalized Source EUI was analyzed. The zip code selections are two midtown Manhattan

areas with high concentrations of office properties. The age groupings are before and after World War II, a common delineation in NYC property. The buildings that are in the four groups are those that had full data reported in both the 2011, 2012, and 2013 datasets. Continued categories could be selected based on height, use, and so on. Further breaking down groups will result in comparing properties that are more similar.

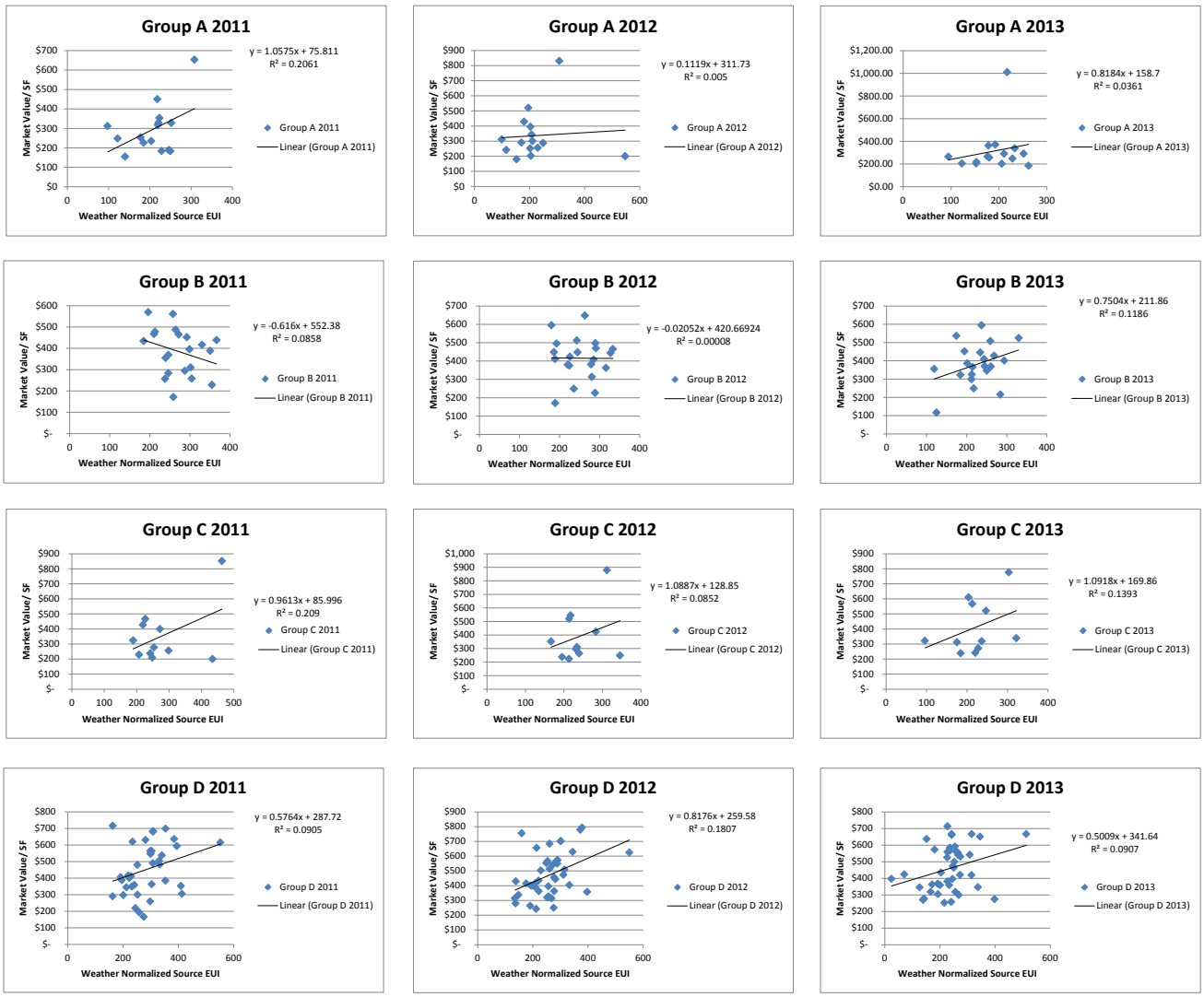
The addresses of the comparison groups used were matched to the NYC Department of Finance assessment rolls for the years following the respective data releases. The "Market Value" field was used as the indicator of property value. This data is not an ideal indicator of sale prices in the marketplace, but is free and readily available annually. There are admittedly shortcomings with the data, as each property's value is based on the property's classification, New York State law requirements, and actual reported data. Real market data from private sources, such as rental rates or purchase prices, will more accurately represent actual value. It is expected that as better data is gathered and more time passes, longer periods of time can be compared and awareness will grow within the marketplace.

The data was plotted on a scatter plot with the EUI as the independent variable and the market value figure, normalized by square footage, as the dependent variable. The same group of buildings within the comparison groups were then plotted using the public data available from 2011, 2012, and 2013. The intent is to see, with the same comparison groups, if the strength of the relationship between value and publicly released EUI improves as time goes on. An increase in the strength of the relationship over time could point to a growing public awareness. The resulting R-squared values and scatterplots are shown, respectively, in Table E-2 and Figure E-1.

Table E-2. Sample Comparison Groups R-Squared Values

Name	2011 R2 Value	2012 R2 Value	2013 R2 Value
A	0.2061	0.005	0.0361
B	0.0858	0.00008	0.1186
C	0.209	0.0852	01.393
D	0.0905	0.1807	0.0907

Figure E-1. Sample Comparison Groups Scatterplots



First, the direction of the slope should be noted. A negative slope would appear when lower EUIs correspond to higher values. All four groups, however, show positive slopes by the final year.

R-squared values, in the simplest sense, explain how closely the data matches the regression line. In other words, how well does the model explain the variability of the real estate valuations. The comparison groups shown have very low R-values; however, this is as much of a function of a simple test with incomplete data as any real relationship between energy-efficiency and value. Separately, the focus is on the change in the value from year to year. The R-squared value decreased in group A. Groups B, C, and D actually saw an increase in R-square values. The relationships and measures can grow in complexity and rigor over time with improved and refreshed market data, more annual data with which to compare, and the further breaking down of comparison groups, as appropriate.

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