

New York City Local Law 97: An Analysis of Institutional Response & Decision Making Towards Groundbreaking Carbon Emissions Legislation

by

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ABSTRACT

In May 2019, New York City (under Mayor Bill De Blasio) enacted its own version of the Green New Deal called the Climate Mobilization Act, a local law to amend its charter and administrative code to achieve certain reductions in greenhouse gas emissions by 2050. The Act comprises a series of ten bills passed by the New York City Council including a tax on paper bags, a green roof mandate, and a process to close oil and gas plants around the city, amongst others. One major portion of this Act is a bill to limit greenhouse gas emissions, caps, on tens of thousands of buildings in the City. This mandate, called Local Law 97 (LL97), is the first of its kind in any large city in the world.

This thesis focuses specifically on LL97, which limits carbon emissions on buildings over 25,000 square feet on real estate product types such as, commercial office spaces, healthcare facilities, residential co-ops, condos, and rental apartment buildings. It examines the characteristics and impacts of the law on real estate owners, as well as the city. It diagnoses how owners are responding to the law and where improvements can be made as this model becomes replicated globally through industry surveys. Since its approval in the Spring of 2019, a number of cities have expressed interest in promulgating similar regulations, though little research analysis has been undertaken to fully evaluate the implications of LL97, whether or not the policy falls short of our goals, or if it's even achievable. It finds and later recommends, that amendments to the law, such as carbon credit portfolio trading, the incorporation of additional asset types, and green leases, amongst others, can help to achieve Local Law 97 goals with enhanced success and mitigated burdens on New York City real estate owners.

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01 THESIS INTRODUCTION

Introduction

Converging evidence has told us that humans have very likely had an impact on the climate and that most of these impacts are negative for the future of our planet. Cities, recognizing the contribution of the built environment to climate change, have identified buildings as a lead culprit in greenhouse gas (GHG) emissions. In response, some cities have put forth legislation to curb their impacts. City-specific legislations and code requirements have existed for years, but recently, New York City has emerged on the forefront as a national and possibly a global leader with its recent Climate Mobilization Act. Passed soon after the United States pulled out of the Paris Accords in 2017, this legislation is aimed at achieving an 80% reduction in its GHG emissions by 2050. One piece of this legislation, called Local Law 97, sets carbon emissions caps for energy use in New York City's large buildings starting in 2024 with lower emission thresholds to be set in 2030.

Like most new legislation this program comes with its own set of opportunities, yet some inherent risks and consequences. While many recognize the need to combat climate change, the allocation of burdens, costs, and alignment of incentives are highly disputed. Legislators, developers, owners, and occupiers of the New York City built environment, as expected, have varying opinions about how to take, and who should take, responsibility over a collective contribution to climate change. In response this thesis is a study of the environmental, social, and financial implications of Local Law 97, and is aimed at understanding how New York City developers and investors are responding to, and preparing for, the legislation set to impact them over the years to come.

Studies analyzing the city-scale approach to mitigating climate have become increasingly important as the burden of global climate change falls evermore on local leaders. Already, cities around the globe are analyzing this model and promulgating ideas for replication. Given that these decisions affect our health, livelihoods, and overall well-being of our planet, it is imperative that we understand how those most directly impacted by new legislation react to

them. Therefore, this thesis attempts to survey parties about the degree of impact, and response plans to the law, so that we can better understand management decision-making and craft new iterations of legislation that align incentives, unlock and acknowledge the co-benefits of sustainable practices, and finally, to help to achieve our climate goals.

This chapter begins with an overview of the context and background that frames the Local Law 97 and this thesis at large. Following this is a problem statement, a statement of purpose, and accompanying research questions. Also included in this chapter is a discussion around the research approach, the researcher's perspectives, and the researcher's assumptions. The chapter concludes with a discussion of the proposed rationale and significance of this research study and the definitions of some of the key terminology used.

Background and Context

In May 2019, Bill De Blasio held a rally in the lobby of the 5th Avenue Trump Tower. There, he publicly endorsed and expressed his commitment to New York City's own version of the Green New Deal. Called the Climate Mobilization Act, this local law amends the New York City charter and administrative code in order to achieve a specified 80% reduction in greenhouse gas emissions by 2050, based on 2005 level emissions. The Act comprises a series of ten bills passed by the New York City Council including a tax on paper bags, a green roof mandate, and a process to close oil and gas plants around the city, amongst others (New York City Council n.d.). One major inclusion in this Act is a bill to limit greenhouse gas emissions, referred to as caps, on tens of thousands of buildings in the City. This mandate, the first of its kind in any large city in the world is called Local Law 97 of 2019 and is the legislation under investigation throughout this thesis.

To provide additional detail, Local Law 97 is a groundbreaking climate legislation that limits carbon emissions on private buildings over 25,000 square feet. It sets thresholds (caps), on a per square foot (refer to Figure 1) basis, for greenhouse gas emissions from buildings beginning in 2024, with increasingly stringent limits set in 2030. It provides qualifying buildings with a set

carbon budget, measured in kilograms of carbon dioxide per square foot (kgCO₂/ft²) and varies depending on building code occupancy-group classification. For example, a healthcare facility (classified as B-Ambulatory Health), which is typically a more intense energy-user is allocated 23.81 kgCO₂/ft² per year in 2024, versus an office building (B-Business) which has been allocated 8.46 kgCO₂/ft² per year. Buildings that exceed the carbon budget beyond the provided thresholds for both the 2024-2029 and 2030-2034 periods will be required to pay fines based on how much they surpass their thresholds on a per square foot basis. As of the time of this writing, New York is the only city in the United States that has capped greenhouse emissions in this manner.

Occupancy Classification	2024-2029 Limit (kg CO ₂ sf/yr)	2024-2029 Limit (kg CO ₂ sf/yr)
B-Ambulatory health, emergency response	23.81	11.93
Assembly	10.74	4.20
B - Business	8.46	4.53
R2 - Residential Family	6.75	4.07
R2 - Residential Family	9.87	5.26
F - Factory	5.74	1.67
S - Storage	4.26	1.10

Figure 1. Local Law 97 Greenhouse Gas Emissions Thresholds by Occupancy Group

Fines are calculated by subtracting the allowed energy usage from the actual usage measured in kgCO₂/ft² and multiplying that number at a rate of \$268 for each square foot documented for that building. Let's take a hypothetical building case study to illustrate how this works. Say that we have a two million square foot office tower located somewhere within the five boroughs of New York City. This building currently has a greenhouse gas intensity of 12.5 kgCO₂/ft² per year. Let's make two key assumptions. One, the owner does not intend to make capital improvements dedicated to improving energy efficiency over the next decade, and two, New

York City's energy grid power supply remains as it is today. In 2024, using Table 1. Greenhouse Gas Emissions Thresholds by Occupancy Group - above we can see that the target cap is 8.46 kgCO₂/ft² per year for the B-Business classification. The penalty amount is calculated by subtracting target emissions from current emissions and converting kilograms of carbon dioxide per square foot (kgCO₂/ft²) to tons by dividing by 1000. This number is then multiplied by the building's gross floor area (the two million square feet), and then also multiplied by the per square foot fine of \$268.00. This calculation looks slightly different for 2030 when the emissions threshold is lowered from 8.46 to 4.53 kgCO₂/ft² for our same office tower. You will see that this penalty, per year, is in the millions of dollars. Calculation for this hypothetical two million square foot office tower using 12.5 kgCO₂/ft² per year is below:

Annual Fine in our Case Study with No Energy Retrofits

$$((12.5 \text{ kgCO}_2/\text{ft}^2 - 8.46 \text{ kgCO}_2/\text{ft}^2)/1,000) * (2,000,000 \text{ ft}^2 * \$268)$$

$$= \sim\$2,500,000 \text{ (annual penalty from 2025-2029)}$$

$$((12.5 \text{ kgCO}_2/\text{ft}^2 - 4.53 \text{ kgCO}_2/\text{ft}^2)/1,000) * (2,000,000 \text{ ft}^2 * \$268)$$

$$= \sim\$4,250,000 \text{ (annual penalty from 2030-2034)}$$

Though this fine represents an extreme scenario for the implication of the law, it is nevertheless a sum similar in magnitude to many cases currently being grappled with by development firms across the city. That said, it is estimated that the average building violation could reach approximately \$162,772 by 2024 and the total value of fines faced by all affected buildings will reach approximately \$330.4 million by 2024, and \$695.6 million by 2030 (CANY 2020). The calculation above is done for the more than 50,000 buildings in New York City impacted by Local Law 97 and represents approximately 3.15 billion square feet of space across the five boroughs. As it stands, the 2024-2029 limits will affect the most carbon-intensive 20 percent of the 50,000+ buildings impacted by that law while the 2030-2034 limits will cover 75 percent of the impacted properties across the occupancy-type spectrum. You'll notice that this legislation is defined until 2034, but what happens afterwards? Though we know that New York City has an 80 percent emissions reduction by 2050 goal, a path to meet that target through building regulation has yet to be defined. However, according to the legislation itself, by January 2023 the New York City Department of Buildings (DOB) must establish limits for compliance periods

from 2035 through 2039, 2040 through 2049, and then for 2050 and beyond - hopefully making research like this all the more relevant.

In order to meet the energy emissions threshold requirements impacted buildings will, at a minimum, need to make energy efficiency retrofits or seek alternate compliance methods which I'll discuss later on. Common retrofits, or the low hanging fruit in the energy consumption mitigation arena, can include repairing heating system leaks, replacing window units with higher insulation values, converting indoor lighting from incandescent to LED, sealing, and weatherization of building envelopes, etc. According to Energy Star reports, the amount of average wasted energy in a typical commercial building is 30 percent of its overall use and it is possible to reduce energy consumption by 10% with little to no cost through simple changes such as adjusting temperature settings or turning off lights if not needed (Energy Star 2020). The more comprehensive, deep energy retrofits (DER) include capital projects, such as ice storage systems to help shift cooling demands to off-peak hours when it is possible to access more sources of renewable energy (like at night versus during the day at high-peak energy use hours) or comprehensive heating system upgrades, in addition to, cogeneration systems which capture excess heat from fuel combustion to boil water, create steam, and/or heat buildings. Given that this law impacts existing buildings, another level of complexity is added to the execution of capital improvements because most buildings will need to be occupied and safe while also minimizing disruptions to tenants.

Despite the described restrictions of Local Law 97 above, integrated into the legislation is some flexibility for building owners. Retrofits are one path to compliance, but the law lays out alternative methods for compliance. Some paths include carbon trading between buildings. Typically, this entails the transfer of carbon credits between buildings that perform well and those don't, and can happen at a development firm's portfolio level or between building owners. Though a route suggested in the legislation, the protocol for this option has yet to be defined by the city as of the time of this writing. Alternatively, the city has hinted that owners can receive up to a 100% reduction in annual emissions for the purchase of credits for renewable energy in the city. Owners can also seek deductions for the purchase of greenhouse gas offset and peak energy storage. In addition, there will be potential adjustments for building more than 40% over

the 2024-2029 limits based on occupational density and other factors that have yet to be clearly defined by legislators.

Not all developers and owners have the means or capacity to carry out implementation plans for their units, let alone absorb the costs for the necessary capital improvements needed to meet compliance. Understanding this challenge, Local Law 97 also addresses support systems in both guidance and loan programs. The Property Assessed Clean Energy (PACE) program created under Local Law 96, for example, provides low- or no-interest loans to finance improvements through a special assessment on a building's property tax bill. Owners that opt into this program receive loans based on the equity value of their building and pay back those loans alongside the property tax payment that is passed on from one owner to the next if you decide to sell your building. The owner of the building will then pay back the loan through the annual energy savings observed in your annual energy audit until it is fully paid off. While this seems like a viable option for many, the cost of institutional borrowing of money is so low for some developers at the moment that the likelihood that they will participate in this program is quite small. Finally, in addition to financial support programs, New York City has also created logistical assistance measures like the Retrofit Accelerator program which offers free and building-specific advisory services to aid in assisting organizations in streamlining a path to energy efficiency compliance.

Local Law 97 requirements will be enforced by the creation of a new city-sponsored organization. The New York City Office of Building Energy and Emissions Performance will be headed by an appointed licensed/registered design professional (architect or engineer has yet to be determined) who will report to the Department of Buildings (DOB) commissioner. The duties required of this position include oversight of the energy emissions laws and the policies for existing buildings, new construction, and major renovation. The Department will monitor the energy use of buildings each year (which will continue to be reported annually by building owners) to track building performance with the goal of reaching the 40% reduction (using 2005 emissions as a benchmark) by 2030. In addition, it will validate the emission assessment of individual buildings, determine the penalties for non-compliant buildings, review applications for alternative compliance methods (including the purchase of renewable energy credit), ensure the

participation of other city departments connected with the building industry, and finally, collect fines. Beyond the \$268.00 per square foot penalty, there are additional aspects of the law that building owners should be careful not to violate. So far these include, failure to report carbon emissions which can create fines up to \$.50 per square foot per month for non-compliant owners, and filing a false report, which can cause a one-time fine of \$500,000 and/or potential time spent in jail.

Local Law 97, as stated earlier, impacts most commercial buildings over 25,000 square feet. However, there are some exceptions. Alternative requirements and standards are set specifically for New York City government buildings which have a required 40 percent emissions reduction mandate by 2025 and 50 percent by 2030. Though I've thrown many numbers at you, you may want to note that New York City government buildings actually have a slightly more ambitious goal when stacked up against their commercial peers. There is a slight distinction though, as government buildings do not include city-owned buildings, such as schools, police stations, and sanitation buildings, etc. under Local Law 97. Houses of worship, rent-regulated housing (including those with just one or two rent-regulated units) and properties owned by the New York City Housing Authority (NYCHA) are also excluded from the law. However, rent-stabilized and rent-subsidized residential buildings, as well as houses of worship are still required to implement some prescriptive energy-saving measures while NYCHA has published its own sustainability program called NextGen NYCHA. The full scope of exceptions and alternative programs under Local Law 97 are beyond the scope of this thesis.

Rather, the thesis will examine the impacts of the law on local public and private (including public and private real estate investment trust) real estate developers and owners. It will attempt to diagnose how these players are responding to the law now while anticipating annual fines beginning in 2025. It will examine the social, environmental, and financial implications of this legislation on firms, and the city at large, while also attempting to address future considerations as this model becomes refined and replicated globally. Since the approval of Local Law 97 in the Spring of 2019, a number of cities have expressed interest in promulgating similar regulations. While the interest of an international group of mayors is promising for our collective climate change mitigation goals, Local Law 97 still faces much criticism in its tactics and is being

monitored closely by skeptics. Therefore, it is clear that research is needed to fully evaluate the implications of the legislation, what the collective response is, and ensure that we are making the best policy decisions to most effectively meet our goals.

Problem Statement

Climate change is perhaps the largest looming existential threat of our time and it is essential that we take immediate action to mitigate our human impacts through aggressive legislation. How legislation should be crafted, however, requires continual and extensive research, the incorporation of various perspectives, and at least a few iterations to get right based on what can be gleaned from practice. To date, thoughts, criticisms, and concerns about Local Law 97 have been collected from a small sample of news articles and op-eds. Often, they provide only abbreviated and biased points of views about the legislation and are not representative of the realm of real estate industry players so in effect, we cannot be totally sure how the real estate industry feels about the legislation. To the best of my knowledge, a broad and balanced collective representation of how building owners conceive of and respond to this law has not been analyzed. This thesis is aimed at collecting those perspectives for the first time. Given the complexity of the law, and the various possible approaches spanning from investing in capital improvements for full compliance to paying greenhouse gas emissions penalties, it is imperative that we better understand the most likely business responses to emissions laws. This will inevitably help us find the most appropriate pathways towards compliance and get closer to achieving our global climate goals while ensuring that we understand potential risks and unintended consequences early on. Understanding these reactions will also help to bolster the transferability of the law and its intentions. Let's examine a few of these reactions these building owner responses in the following paragraphs.

Local Law 97 takes an absolute, carbon emissions approach that defines the penalty payment on a per square foot basis. This means that every square foot in your building plays a role in the amount of greenhouse gas you can emit each year. Bigger buildings then can be bigger polluters. Though it is clear that our climate goals (in response to the already seen impacts of climate change) should be ambitious, and this penalty provides impetus to get the work done quickly, this per square foot parameter itself may be problematic. Why? Calculating fines in this way

adversely affects buildings densely occupied by people (tenants) when compared to their less well-occupied peers. One common argument from the building owner's side is that densely occupied buildings consume more carbon per square foot given that the additional occupants are utilizing plug loads, increasing the need for ventilation, and perhaps cooling. In fact, in commercial buildings in New York City, tenant-controlled spaces typically account for 40-60 percent of a building's energy use (NYC Mayor's Office of Sustainability 2017) so the argument concerning the role of use density may hold significant weight. Does this mean though that a building with a lower human-use density is necessarily more energy efficient? Maybe not, it could just be that fewer people are using plug loads making it appear that this building is not a high-energy user. How might a prudent developer then respond to weighing the costs and benefits of occupancy versus the payment of fines? What are the potential implications on the space market of New York City's commercial building stock if owners are hesitant to lease space to high-intensity energy users or if tenants refuse to pay higher rents and leave for space in a less expensive urban market? The answers to these questions provide some understanding as to why legislators are still amending Local Law 97 to consider the role of user density when reassessing the extent of future building penalties.

Another issue raised from the law deals with the path to compliance through certain capital improvements and energy retrofits. These include upgrades like better seals for windows and pipes and insulated building skin replacement with improved insulation and higher R-Values¹. All of which help to hermetically seal buildings and prevent heat loss or gain in interior spaces. The temperature regulation causes less strain on your heating, ventilation and cooling systems (HVAC). Though these retrofits are necessary, past literature on this topic reveals associations between making a building air-tight and the incidence of sick building syndrome². We've seen this before in the United States when energy prices were high in the 1970's and building owners

¹ An insulating material's resistance to conductive heat flow is measured or rated in terms of its thermal resistance or R-value -- the higher the R-value, the greater the insulating effectiveness. The R-value depends on the type of insulation, its thickness, and its density. The R-value of some insulations also depends on temperature, aging, and moisture accumulation. When calculating the R-value of a multilayered installation, add the R-values of the individual layers ("Insulation" n.d.).

² The term "sick building syndrome" (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone or may be widespread throughout the building. In contrast, the term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants (EPA 1991)

tried to reduce energy use by making these retrofits. When these spaces became airtight, they trapped fumes, gases, and vapors from volatile organic compounds (VOC) found in paint, or formaldehyde often found in furniture and other building materials. Indoor air quality was then found to be significantly worse, and building users occupying these spaces contracted acute respiratory healthy symptoms and regular discomfort from day-to-day use. Sick building syndrome is still a prevalent issue throughout the states, however, the New York City building codes have adopted the American Society of Heating, Refrigeration, and Air-conditioning Engineers³ (ASHRAE) minimum ventilation thresholds for interior spaces so this concern is somewhat mitigated. However, these are still ventilation minimums that do not optimize health outcomes, and despite a call for more efficient buildings New York City's code required ventilation rates stick with the status quo ASHRAE 90.1-2013 rates. Indoor air quality should still be a concern for owners and occupants due to potential impacts on health, cognitive performance, and in effect, productivity and associated costs (Allen et al. 2016; Lelieveld et al. 2015). In the case of Local Law 97, there is a concern that building owners will make these energy retrofits and lower ventilation rates inside their building to avoid fines. While LEED or Well-certified buildings have some of their own higher standards for indoor air quality, a bulk of New York City buildings are not certified and there is little surveillance and/or building commissioning standards to optimize indoor air quality as a whole in interior spaces - potentially posing concerns for future health of New York City's building occupants. For reference, a building not being commissioned is akin to you skipping an annual physical with your doctor.

An additional argument against the current writing of the law was encountered during the research phases on this study. The argument is driven by analysis of the New York City energy grid and the sources used to feed it. If New York City's energy grid electrical ran on 100% renewable energy and supplied carbon-free power then the carbon emissions limitations written into the law would largely be moot - aside from non-electric gas stoves, water heaters, and boilers in buildings. This may seem like a far-fetched and expensive infrastructure task, but 88 percent of electricity in the upstate grid (Zones A-E) already comes from carbon-free sources,

³ ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality and sustainability within the industry. Through research, standards writing, publishing and continuing education, ASHRAE shapes tomorrow's built environment today ("Mission and Vision | Ashrae.org" n.d.).

but downstate (Zones F-K) that figure drops to under 30 percent due to a bottleneck in the grid (Urban Green Council 2019b). This is represented in Figure 2 below as referenced from the New York Independent System Operator.

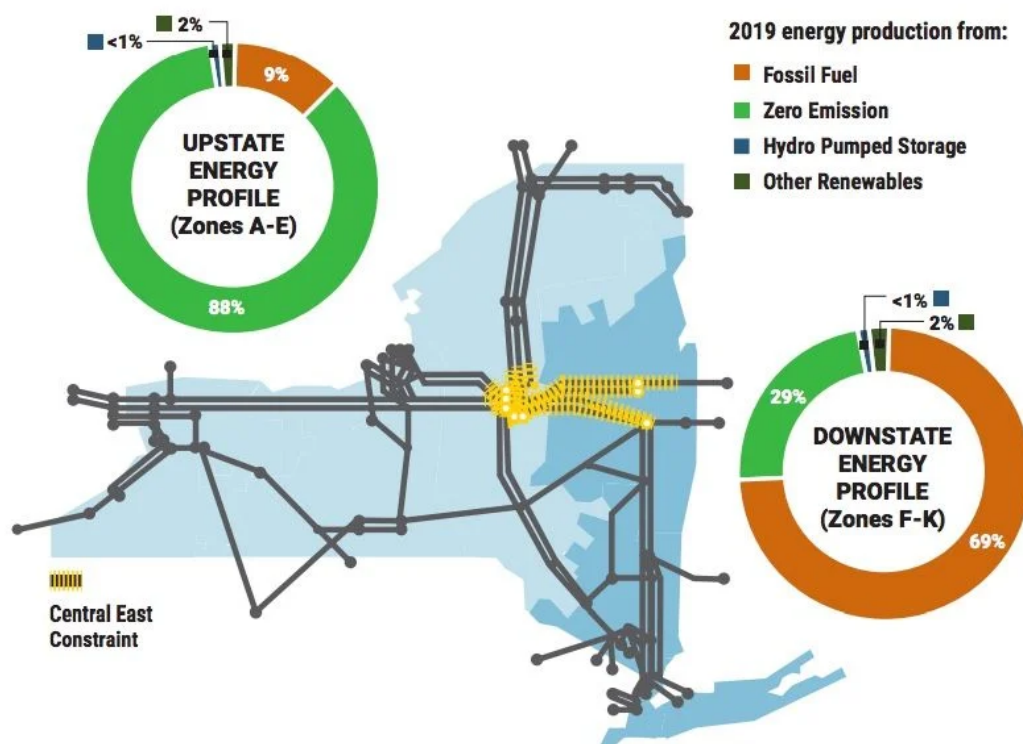


Figure 2. New York State Energy Grid. Source: New York Independent System Operator (NYISO)

It is expected though, due to the greater adoption of electrification in the built environment, that there will also be 36% increase in electricity demand by 2040, so energy efficiency measures may need to be adopted regardless. However, the other major concern is that the grid will get “dirtier” before a renewable energy supply is created. With the decommissioning of the Indian Point Nuclear Facility in north of New York City, additional fossil fuel sources (A discussion of nuclear waste versus fossil fuel emissions is beyond the scope of this thesis) will be integrated into the New York City energy grid to fill the gap, meaning the greenhouse gas emissions per square foot in New York City buildings will likely rise while developers are making their capital improvement to comply with Local Law 97. It remains an open question whether this lack of prediction is a source of anxiety for developers.

The law itself is incomplete and will require additional clarity over the coming months and years. Based on research and discussions with industry actors, legislators need to define these gaps quickly because their decisions will impact how owners plan to diagnose potential concerns and create strategies to reduce emissions. For example, for mixed-use buildings with mixed-occupancy classifications building owners currently don't know how to assess greenhouse gas thresholds because emissions threshold for these building types and mixes have yet to be created. Therefore, it is not possible to calculate what the fine could be and how much their capital improvements would need to curb emissions - though a blended occupancy rate has been discussed. Similar clarity on potential exemptions based on occupant density is needed, as discussed above, as well as, carbon credit trading between buildings.

In response to the many challenges addressed above, the purpose of the study is to explore the environmental (energy efficiency, outdoor and indoor environmental quality), social (health, happiness and productivity of occupants; as well as the developer/investor's social responsibility and social image), and financial (real estate performance) implications of Local Law 97, and understand how New York City developers, owners, and investors are responding to the legislation. It is anticipated that, through a better understanding of the responses, motivations, and needs of the industry, the issues and challenges they face, and the availability of resources, more informed decisions can be made by developers, tenants, and legislators. To frame the problems that have been addressed above, below is a summary research question intended to provide direction in a search to find some answers.

Main Thesis Question:

What are the environmental, social, and financial implications of Local Law 97, and how are New York City building owners reacting to the legislation?

Sub Question 1: Building Specific and Building Owners' Perception:

What is the current energy use of the major building types in New York City, and how big is the gap between existing levels and the Local Law 97 requirement? What will be the energy-related impacts if Local Law 97 is implemented, under the "business as usual"

scenario? How do building owners feel about those impacts, especially in terms of who will have to pay, or? the degree of burden. What are their primary concerns (if any) and what are the root causes of these concerns?

Sub Question 2: Demand-Side Responses and Building Owners' Perception

What will be the market responses (from the demand side, i.e., building occupants) around the city once Local Law 97 is enacted? Will the impacts of Local Law 97 make spaces, or New York City in general, a more attractive place to work and live, or will tenants leave seeking a less expensive or more comfortable space market outside of the city? Within the city, will there be a sorting process of tenants reshuffling across buildings after this legislation takes place?⁴ Who (or which types of buildings) stands to gain the most and who (or which types of buildings) will be left behind. In addition, can building owners foresee such market mechanisms at play, are they mindful of potential structural changes, and what are their perceptions?

Sub Question 3: Building Owners' Strategic Responses:

How do building owners plan to respond to strategically meeting the new requirements set in place by Local Law 97? Their decisions must be based on their understanding and expectation of their building's energy consumption patterns (sub question 1), market response mechanisms (sub question 2), and their own capacity (including engineering and financial feasibility) to make changes in response to the legislation requirements.⁵

⁴ Assessing specific impacts of Local Law 97 on tenants is difficult because the legislation is not yet implemented. However, this thesis will cite relevant literature on similar exogenous shocks to the real estate market to infer tenant responses to such legislation and the green building movement.

⁵ Currently, there are no success metrics because Local Law 97 has not been implemented yet. That said, I am able to cite literature on similar events to make some inference about what may occur (like the green building literature).

Sub Question 4: Policy Implication

Based on the analysis of the above three sub questions, I am able to draw some policy implications for the NYC policy makers on this Local Law 97. How should they make Local Law 97 “smarter” to maximize the social benefit of the entire city without incurring substantial market distortions? Particularly, considering the new uncertainties brought in by COVID-19, how can this Local Law be further improved, and more flexibilities be built in?

Research Approach

This research explored a defined legislative phenomenon through in-depth, mixed, qualitative and quantitative data-collection methods involving multiple data sources. With the approval of the university's institutional review board, the researcher's primary method of new data collection was through an online survey created by the author. This survey process began with topics encountered during the preliminary analysis and was executed in an effort to begin the synthesis of insights from those in the field that could be used to help answer the proposed research questions. Therefore, questions were derived from topics related to this research, and then tested on a select few industry professionals for quality, clarity, and external suggestions. After the survey question iteration process, the researcher contacted over fifty real estate development, investment, and management firms across New York City by phone, email, and professional social media platforms to seek willing participants. Individuals from these firms, such as development managers, sustainability leads, and any individual familiar with their organization's response to Local Law 97 were sought for participation in the survey. Overall, a small non-random sample of twelve was collected to respond to twenty-three survey questions. In addition to the online survey, additional unstructured interviews were conducted to provide additional clarity on an organization's strategy, response, and general position on the new legislation. As Local Law 97 is both new and a first of its kind, the research approach was informed by an original literature search of other climate policy evaluation as well as a content analysis of early reporting, criticism, and governmental communications about Local Law 97.

Given the convergence of the health-related implication of the law, and the emergence of the global novel coronavirus (COVID19) pandemic during the time of this writing, additional questions pertaining to institutional responses to this more immediate challenge were addressed in the same survey. These questions gave the researcher a better understanding of institutional response time to a looming crisis and serves as a potential proxy indicator for legislative reactivity, response time and adaptability of building owners to make change. In addition, the COVID19-related questions were used to evaluate how developers and owners respond to exogenous shocks now, in an effort to understand how they may respond to Local Law 97 in the future.

The case study methodology was also employed during this research investigation. The researcher explored over 60 real estate developer, owner, and manager websites to find roughly 30 publicly available building efficiency retrofit case studies, annual sustainability reports, and Environmental, Social, and Governance (ESG) policies. In addition, data was collected from the various governmental institutions and non-governmental organizations that have collectively contributed to the vast literature on the topic that assist in providing historical context leading up to Local Law, current retrofit and finance strategies, and future energy-related plans. Combined, the purpose of this approach was to seek the rich descriptions of each case in order to more thoroughly understand the complexity and diversity of industry compliance standards and sentiments to climate change, and where possible, Local Law 97.

The final data-collection methodology was the compilation of multiple open data sources made possible through New York City's Open Data portal. The primary source is a panel data set made accessible through the NYC Office of Sustainability Open Data Portal. This data set provides information from 2011-2017 on all buildings over 25,000 square feet in New York City. This dataset comprises a number of variables that range from locational data, like zip codes and addresses, as well as, quantitative data that measures greenhouse gas emissions per square foot and descriptive data like building occupancy classification type. As part of this research, the time series data was compiled for each year with the Primary Land Use Tax Lot Output (PLUTO) dataset which allowed for additional locational and categorical of the buildings like latitude and longitude, number of floors, built floor area ratio (FAR), etc. The compiled dataset features over

75,000 rows and 100 columns that allowed the research to introduce mixed-quantitative methods. Finally, datasets were also retrieved from New York City's Greenhouse Gas Emissions Inventory open access portal. This data provides the time series data, from 2005 to 2017, and compiles the list of sectors and energy sources to break down who and what contributes to the New York City greenhouse gas emissions. Together, the three methods of questionnaire, case study, and database analysis inform a critical analysis of Local Law 97, a discussion of major (likely) successes and barriers, and the series of implications and recommendations provided in the final chapter.

Rationale and Significance

The rationale for this thesis emanates from the researcher's desire to uncover the obstacles to meeting global climate goals and to argue that legislative action and other governmental decisions on climate need not necessarily put ecological, social, and economic goals at odds with each other. Understanding where organizations stand with this notion, and how they plan to respond to Local Law 97, can help craft future policies substantiated by analysis and continually evolving information. Laws informed by research can help provide routes to compliance which will ultimately then help us achieve our goals with less resistance and greater efficacy.

Understanding the environmental, social, and financial implications of Local Law 97, and how New York City owners and investors respond to the legislation is significant because communities of actors and city dwellers within the city of New York will be impacted by the decisions and actions made over the next decade. This law is likely to have an impact on rental prices, pollution levels, health outcomes, and potentially, overall urban livability, to name a few, and the outcomes will make or break future arguments to initiate positive change for our environment. In addition, without acknowledging the co-benefits of climate change mitigation, we are hampering our ability to encourage and motivate other cities to take similar actions.

Despite this, cities around the globe have expressed interest in creating their own versions of Local Law 97. Given that anthropogenic climate change governance is an area in which we have little historical experience, it is prudent that we adopt a learning oriented methodology to the creation of new legislation (Alves et al. 2020). Perhaps, these cities then should not replicate

blindly. Instead, they should learn, as New York City is, to adapt to criticism and comments, as we collectively aim to achieve our climate goals more efficiently. This thesis is just a part of that puzzle with a goal to better inform future amendments of, and future iterations of, Local Law 97.

Definitions of Key Terminology in this Study

Local Law 97 of 2019 - (Int. No. 1253-C) A Local Law to amend the New York city charter and the administrative code of the city of New York, in relation to the commitment to achieve certain reductions in greenhouse gas emissions by 2050.

Greenhouse Gases (GHG): The main greenhouse gases are water vapor (H₂O), carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

Deep Energy Retrofit (DER): the process that yields buildings that save at least 50% annual energy costs (compared with the average energy use of similar-type buildings with an attractive net present value (NPV). Deep retrofits are most economical when applied to buildings with overall poor efficiency performance and with multiple building systems (e.g., windows, cooling equipment and lighting) nearing their end of useful life (Zhai, LeClaire, and Bendewald 2011).

Sick Building Syndrome (SBS): The term "sick building syndrome" (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but no specific illness or cause can be identified. The complaints may be localized in a particular room or zone or may be widespread throughout the building. In contrast, the term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants (EPA 1991)

02 LITERATURE REVIEW

Overview

The purpose of this study is to better understand the environmental, social and financial implications of Local Law 97, and how New York City building owners are responding to a groundbreaking climate legislation that sets carbon emissions caps for the energy use of large buildings starting in the year 2024. Specifically, this research seeks to understand the risks and opportunities of the legislation, and aspects of policy that may enhance the efficacy of future climate change-related laws. To carry out this study, it was necessary to complete a critical review of current literature relevant to this analysis. The literature review related to this study was ongoing and iterative throughout the data collection, data analysis, and synthesis phases of the study to aid in the development of concepts and understanding of theories as they evolved.

This literature review explores the interconnectedness between global climate change, local legislation to mitigate this challenge, and those tasked with implementing new performance goals within their business operations. In light of this, a few major areas of literature were critically reviewed: (a) contribution of the built environment to climate change (b) city-specific climate change legislation (c) tenant and organizational response to national and local climate change legislation (d) the impacts of indoor and outdoor environmental quality on health and human performance and (e) the financial performance of energy efficient and healthy buildings. A review of the literature on the built environment and climate change, as well as, city specific climate change regulations provides an understanding of the context, history, and structures guiding our response to this crisis. Reviews of the social and financial reactions to climate change regulations help to shed light on the risks and opportunities of crafting policy change.

To conduct this literature review, this analysis used multiple information sources, including books, professional journals, and periodicals. These sources were accessed through internet resources such as Elsevier, Taylor and Francis Online, Springer, ASCE Library, and JStor, accessed through the MIT Library System. To focus the literature on related topics, only peer reviewed journals from respected publications and a time frame of literature from 2010-2020 to

the best extent possible, was used. However, some canonical literature in the form of white papers and published books on related topics outside of this set boundary were included. Throughout the review, the researcher attempted to point out relevant gaps and omissions in the body of works related to the thesis, in addition to where theories on the topics converged or became contested. The summary that concludes this chapter illustrates how literature related to the topic informed the structure of the analysis and how the material contributed to the development of this study's conceptual framework.

Topics Reviewed

Contribution of the Built environment to Climate change:

The climate is changing, and the impact of human activity is linked to that change. We witness the impacts of global climate change frequently, through extreme weather events like flooding, droughts, fire, and global rising temperatures, etc. The built environment, manifested through the construction of infrastructure, towns, and cities, contribute greatly to the impact of climate change through their extensive use of fossil fuels used to maintain energy grids, keep us mobile, and provide the elements of comfort that allow us to enjoy the spaces we occupy. Each brings with them the greenhouse gas emissions that have contributed significantly to historic increases in atmospheric concentrations.

Cities themselves contribute significantly to national and global greenhouse gas emissions (Sovacool and Brown 2010; Daniel Hoorweg, Sugar, and Trejos Gómez 2011; Dan Hoorweg 2012). Though this contribution varies from city to city, as the sources of energy and commonly used modes of transportation shift between them. Cities, recognizing the contribution of the built environment to climate change, have identified buildings as a lead culprit in greenhouse gas (GHG) emissions, and again from city to city, this number varies as the needs for heating, ventilation, and cooling, amongst other contextual factors changes based on occupant comfort, building energy sources, and the local weather conditions which may require additional control within and outside of buildings. In 2015, New York City buildings were responsible for approximately 67 percent of citywide greenhouse gas emissions through the use of natural gas,

electricity, heating oil, steam, and biofuel (Pasion et al. 2017; Urban Green Council 2019a) with the other top contributor being linked with transportation (cars, trucks, freight, and mass transit) which account for 30 percent. This percentage is so great for the city due to the following reasons: the building stock is dense (both in physical presence and human occupation), the energy sources that feed the New York City energy grid are largely not renewable (Urban Green Council 2019b), the average age of buildings is high, rendering many functionally obsolete, and the mid-Atlantic climate itself which has a range of very hot and humid days in the summer to very cold days in the winter, both requiring sufficient energy consumption to maintain safe and comfortable indoor air quality levels. However, despite increase in the population and the factors mentioned above, since 2005, greenhouse gas emissions have actually decreased in New York City by 14.8 percent (Pasion et al. 2017; “GHG Inventory - NYC Mayor’s Office of Sustainability” n.d.; Meng, Hsu, and Han 2017).

Crafting City-Specific Climate Legislation:

Climate policies are one essential tool for combating global climate change and require the crafting of legislation at global, national and local levels of governance. Recognizing the significance of global emissions, international agreements have pledged GHG emissions reductions through efforts like the Kyoto Protocol, the Doha Amendment, and the Paris Accords, all of which have their own set of goals and a variety of countries that have decided to commit to, or withdraw completely, from these agreements. The most recent Paris Accords of 2015 set to create absolute emissions reduction targets in an effort to limit global temperature increase to 1.5C above pre-industrial level, recognizing that this would significantly reduce the impact of climate change (UNFCCC 2015). None of these agreements, however, specifically address legislative actions on buildings.

Despite the agreements made, some original participants, including the United States, have pulled out - translating much of the burden of creating climate change policies to other realms. In response, cities, recognizing their own contribution to climate change, have generated over 6000 targets related to emission reduction (Daniel Hoornweg et al. 2010). Largely, the work of climate policies begins with creating building inventories. This is seen in the form of building

evaluations, through the annual benchmarking of energy use intensity, water use, and greenhouse gas emissions reported by individual buildings under jurisdiction implementing the requirement (Ibrahim et al. 2012; Alves et al. 2020). While these benchmarking frameworks are usually a precursor to future carbon mitigation-related legislation, the annual inventory itself has been linked to emissions reductions themselves (Pasion et al. 2017) as New York City has already recognized the 17 percent decrease in emissions for the time period between 2005 and 2017. These building inventory requirements, once analyzed, are later translated into emissions reduction targets as now seen through the Local Law 97 legislation.

Tenant Response to National and Local Climate Change Legislation:

Once these legislations are in place, what are the documented impacts of the policy changes on the tenant market in these affected cities? The literature on national and local climate change legislation and building emissions controls suggest that the capital expenditures and increased efficiency associated with retrofitting, green building development, and implementation are related to increases in rents (Reed and Wilkinson 2005), and that as green buildings becomes ever more mainstream, tenants predict the emergence of a non-sustainability discount (Kaplow 2008-2009) indicating that rent will be cheap in non-green buildings. In this sense, one potential hypothesis is that rents in New York City may rise with the introduction of retrofits required by Local Law 97, and tenants seeking that non-sustainability discount may migrate just outside of city limits where lower rents can be achieved. However, as these projects become more mainstream, their costs become saturated and may indicate that rents may eventually revert back to the mean. Additional financial implications will be discussed at the attend to this literature review.

Refocusing this section back to the tenant market, some of the literature suggests that building owners may have the opportunity to capitalize on a tenant's desire to occupy high-quality spaces (Filippova 2016). One reason being because tenants understand the potential of sustainability to be key to enhanced corporate social responsibility (CSR) and therefore contribute as a "value-add" in the image of a company (Livingstone and Ferm 2017). However, this may still not be the ultimate driver to occupy green buildings as additional literature suggests that micro-location and

subjectivity factors like building staff, marketing, and space flexibility are still of a higher value over green buildings (Levy and Peterson 2013; Rasila 2010; Appel-Meulenbroek 2008; Karhu et al. 2012).

While a green building's sustainability measures may be attributed to a tenant's higher willingness to pay, either through energy cost savings or corporate image, the additional cost burden associated with required policy changes may eventually draw a line in the sand as tenants may refuse to bear that increased cost. In effect, this may introduce unintended sorting consequences into the space market. For example, a New York City landlord, who is held accountable for their building's emissions, may choose to charge an increased rent to a potentially high energy consuming tenant. That prospective tenant may refuse and move to a different space market (this hypothesis will be tested in the thesis survey). To prevent this from occurring, the literature indicates that improved communication between landlord and tenant can contribute to the greater overall efficacy of the green building (Livingstone and Ferm 2017) - and is responsive to the literature that suggests the high contribution of tenants to the bottom line of building emissions (NYC Mayor's Office of Sustainability 2017). In some sense, building owners may currently view that the tenant is reaping the energy cost saving while the retrofit cost burden was placed on them. Besides avoiding penalties, the building owner is then not incentivized to make changes - perhaps helping to explain some of the frustration with the law. This then creates a circle of blame between tenant and building owner as to whom should bear the cost burden of the local policy - ultimately stifling climate change mitigation progress. To confront this concern, the literature suggests that improving sustainability outcomes is contingent upon owner-tenant collaboration and a recognition of the drivers that motivate corporate social responsibility on both ends (Andelin et al. 2015). This has precedent through the use of green leases which are becoming a new status quo in some cities, like Japan, Kuala Lumpur (Yasmin et al. 2017; Kaplow 2008-2009) helping to align incentives and increasing accountability for both tenants and owners.

The Impacts of indoor & outdoor environmental quality on health & human performance:

While the literature presented above suggests that tenants don't fully prioritize sustainability factors over other building attributes, new literature concerning the link between green buildings, healthy buildings, environmental quality, and human health outcomes may start to shift this perspective - especially as this knowledge becomes more mainstream. The links between energy consumption and greenhouse gas emissions determine outcomes beyond the health of our planet and that the pollutants linked to greenhouse gases take a toll on our physiological health as well.

The literature linking our health to the outdoor environmental quality is vast. It suggests that taking emissions out of the equation, potentially through political reforms that limit greenhouse gas emissions, can help decrease the incidence of asthma, hospital visits, and mortality rates (Anenberg et al. 2019; Lee and Park 2019). Greenhouse gases impact our health in different ways but much of the literature highlights air quality as the health of our outdoor environments is clearly important, most members of the developed world spend as much of 90 percent of their lives indoors. For this reason alone, our health outcomes may be even more dependent on our indoor environmental quality. In the past, and even today, efforts towards energy conservation measures have taken their toll on the operation of our buildings. In the 1980's, both residential and commercial ventilation requirements were lowered in order to reduce energy use (Persily 2015) as energy prices spiked. The capital improvements to accomplish these goals included the conversion to hermetically sealed buildings which lightened the load requirements for our HVAC systems. The combination of sealed buildings, and stagnating ventilation led to indoor environments of decreased air quality.

As a consequence, in the 1980's the first occupant illnesses related to sick building syndrome (SBS) were reported as ventilation rates decreased (Riesenberg and Arehart-Treichel 1986). This was later strongly correlated with annual costs and productivity losses due to health symptoms attributable to the indoor environment (Fisk and Rosenfeld 1997). More specifically, absenteeism of employees (Joshi 2008) rates of asthmatic incidences respiratory irritation (Du et al. 2020) etc. were associated with the quality of indoor work environments. Environmental

conditions, such as humidity, and building factors, such as ventilation rate; workspace factors, contribute to the quality of indoor environmental quality.

Acknowledging the contribution that improved indoor air quality has can continue our sustainability movements with more fervor. Improved indoor environmental quality empirically demonstrates improved health outcomes for short- and long-term occupants of buildings (Al Horr et al. 2016). Yes, even short-term visitors can have adverse health effects caused by poor indoor environmental quality. Entire published literature reviews themselves document the impact of Carbon dioxide, for example and its effect on occupant cognitive performance (Mishra et al. n.d.) This is an important part of the literature because not only does acknowledgement assist us in lowering our pollutant cause greenhouse gas emissions, but will come with co-benefits described extensive by Joe Allen and John Macomber and their work on healthy buildings and how indoor spaces drive performance and productivity (Allen and Macomber 2020), like improved health outcomes and the associated healthcare cost savings from the

The Financial Performance of Energy Efficient and Healthy Buildings:

Already, this literature review has discussed that our sustainability movements can be linked with energy consumption cost savings as well as healthcare costs savings for building occupants who benefit from the effect of increased outdoor and indoor air quality. In addition, the literature discussed above has acknowledged the relationship of healthy buildings, which consider factors like light, air, noise, movement, etc. has had on worker productivity leading an increased bottom line for businesses as their employees work marginally more efficiently, are retained at higher rates, and a generally more satisfied with their jobs. These co-benefits have hopefully contributed to the argument for the normalization of healthy buildings but there is an additional argument linked with the contributions to better quality buildings.

Ample research also shows that green and healthy buildings themselves performed better than their non-green and non-healthy peers. Green buildings alone seek rent premiums (Chegut, Eichholtz, and Kok, 2014; Leskinen et al. 2020; Fuerst et al. 2015) higher occupancy rates, rents and transaction prices, positively impacting the financial performance of their real estate assets

(Eichholtz, Kok, and Quigley 2013) and healthy buildings supply significant co-benefits to tenants and developers (MacNaughton et al. 2018) where research on them has been conducted in a number of global gateway cities discussing increased rates of cognition (Allen et al. 2016), performance and productivity (Satish et al. 2012; Park et al. 2011; Tham 2004), and general health outcomes for commercial real estate tenants.

Summary

The literature review presented in this section was aimed at providing a comprehensive understanding of the environmental, social and financial implications of LL97. In addition, it sought to promote a framework for how New York City owners might respond to a groundbreaking climate legislation in both the short and long term. In order to best understand the context of LL97 it was prudent to provide an environmental context that linked buildings and cities to global climate change through the Built Environment and Climate change section provided in the first section. This set the stage for underpinning the importance and impact of climate change policies on global, national, and local governance levels in section two of this chapter. Given the exogenous nature of climate change laws, and the variance in legislation at each one of these scales, a raft of global studies highlighted the impact of these legislative forces on the space and asset market of the places they impacted. While the potential cost and labor burden of these laws at first seem high, further analysis indicated that this is not necessarily the case. Shocks occur, but our cities revert back to their median line of progression, though some sorting mechanisms may still be at play as indicated in the Tenant and Organizational Response to National and Local Climate Change Legislation section of this chapter. However, as global gateway cities stay in the race to be relevant and compete with each other for livability and notoriety, city dwellers and visitors are expecting some mitigation when it comes to climate change. Partially, this is due to the perception and empirical evidence that these decisions greatly impact our health, happiness, well-being, and productivity. With regard to these factors at play, the perceived burden is actually mitigated due to the forecasted and documented co-benefits - as indicated in the impacts of indoor & outdoor environmental quality on health & human performance section of the literature review. Finally, the review explored not only the health benefits but the potential financial benefits of compliance, cleaner indoor environmental quality, and the benefits of being a first-mover in this playing field. In the financial performance of the

energy efficient and healthy buildings segment of the chapter the possibility of economic incentives for sustainable building was explored and indicated that making changes with regards to environmental sustainability is also a prudent investment strategy over the long haul.

03 RESEARCH METHODOLOGY

Introduction and Overview

The purpose of this study was to explore, with a sample of real estate owners, the responses and reactions to the task of complying with a building greenhouse gas emissions cap in the New York City-wide legislation called Local Law 97 of 2019. The researcher conducted this research under the belief that a better understanding of this unprecedented requirement, and how those impacted are responding to it, would allow building owners to learn from each other and allow legislators to proceed from a more informed perspective in terms of the design and facilitation of amended legislation in the future. In this sense, gathering the perspectives of those impacted would not only be beneficial for New York City, but for the numerous cities around the globe interested in replicating this type of legislation aimed at mitigating climate change through building efficiency and/or carbon emissions standards.

In seeking to understand this phenomenon, this study addressed five main areas of research: (1) The environmental, social and financial implications of Local Law 97, and how are New York City developers and investors responding to the legislation (2) The current energy use status of New York City buildings and their efficiency versus their peers and the Local Law 97 benchmarks, as well as, developer sentiment about its impacts in terms of who will pay, the degree of burden, and their level of concern (3) The potential “sorting” mechanism for tenants within buildings around the city due to landlord acknowledgement of high energy users versus a building occupants willingness to pay more to occupy a building in a cleaner environment (4) The strategic response by developers to Local Law 97 and an assessment of how their decisions are made. (5) Future climate policy and the methods for making Local Law 97 “smarter” to maximize the sustainability and human health co-benefits for the whole society.

This chapter describes the study’s research methodology and includes discussion around the following areas: (a) rationale for the research approach, (b) description of the research sample, (c) summary of information needed, (d) overview of research design, (e) methods of data collection, (f) analysis and synthesis of data, (g) ethical considerations, (h) issues of

trustworthiness, and (i) limitation of the study. The chapter concludes with a brief concluding summary of that methodology.

Conceptual Framework

This literature review and the subsequent critique of the body of work has contributed to the development of a conceptual framework for this analysis. Combined with the researcher's experience and familiarity with the industry and the geographical region of study, this conceptual framework helps to shape the process of the research and contributes to the methodological design for data collection. In effect, the theoretical framework provides structure for organizing the research, reporting findings, interpreting results, and synthesizing the findings within this thesis.

Categories defined for the conceptual framework are derived from the research questions outlined in Chapter 1 of this thesis. The main research question seeks to determine the environmental, social, and financial implications of Local Law 97, and how New York City building owners are responding to the legislation. Therefore, a logical conceptual strategy to capture the response to this question is "organizational reaction to local climate change regulations". The first research subquestion seeks to take a step back and identify the status of New York City buildings and their contributions to climate change versus the goal sought by new legislation. A category called "built environment and climate change assessment" helps to create a holistic understanding of current building energy use, the level of contribution to climate change, building energy efficiency, and the role of increased efficient standards on the environment.

The second research subquestion attempts to understand the "sorting" mechanism for tenants within buildings around the city. This topic was included in order to build knowledge concerning the potential implications of the legislation on the tenant/space market of the city. This understanding was sought to inform responses to questions like: Will tenants depart New York City because the additional costs to implement the law make the space market too expensive, or will tenants seek to live in New York City because they understand potential social and health benefits related to better environmental quality? In response to this question, a third category

called “social and economic predictions to climate legislation” will help contribute to a better understanding of how the space and asset markets are impacted by exogenous forces. The third and fourth research subquestions seeks to understand strategic responses by developers, investors, and building owners impacted by the law and how the law may adapt in the future. How does a building owner’s understanding of the risks and opportunities of the legislation on the market sway their decision to carry out change? To better understand this question, a logical addition to the conceptual framework is the category of “market mechanisms, financial feasibility, and cost benefit analysis under various scenarios.”

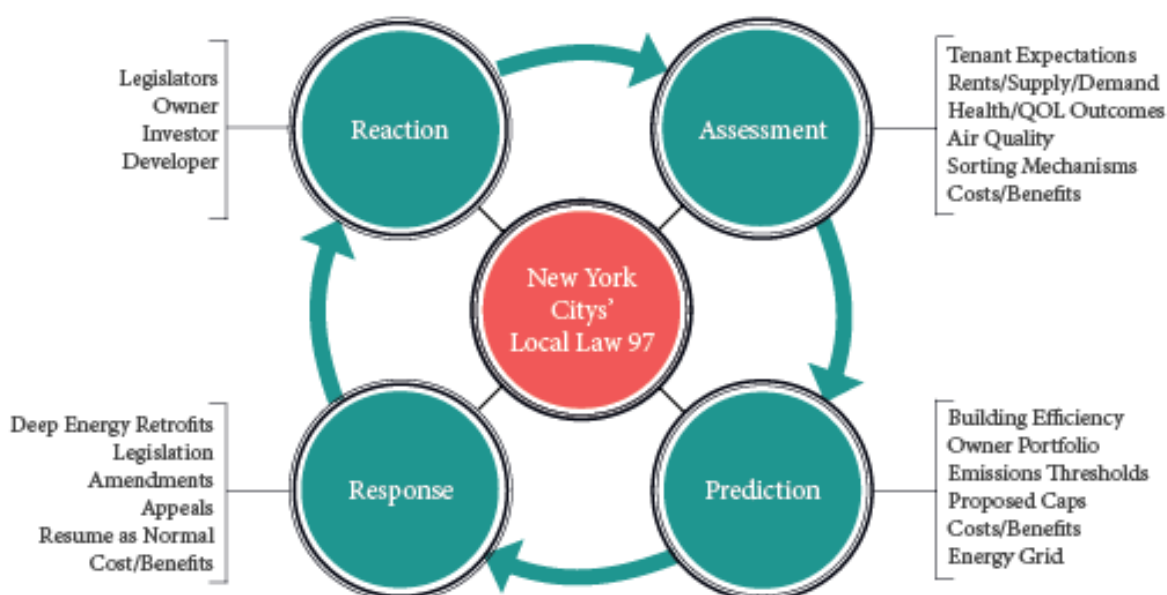


Figure 3. Conceptual Framework Diagram

Rationale for Mixed-Methods Research Design

In response to the questions addressed in the introduction of this thesis, and the corresponding conceptual framework, a mixed research methods approach was required to answer the various qualitative and quantitative questions because purely qualitative or purely quantitative methods alone were unlikely to elicit the rich data necessary to address the realm of proposed research inquiries.

In this thesis, the qualitative research analysis was used to understand the complexities inherent in how organizations are impacted by the law. This thesis was aimed at gathering information for both public and private owners with a variety of different management methods and internal resources to address new legislation. With purely quantifiable data, a few key features of the study would be impossible, including: (a) a more enriched understanding of the experiences and compliance approaches of individual organizations that are impacted in specific ways (b) interaction between the research and participants to facilitate an enhanced understanding of viewpoints and issues specific to practitioners that may not have appeared in the research phases (c) the adoption of new methods for thinking about the law from various perspectives which helped to inform and evolve this thesis from practitioners currently affected by the law and (d) capturing outliers (and specific concerns) outside of the data collection and literature review that could have only been captured through open-ended and free response qualitative survey questions.

The quantitative method was also used within this thesis for two reasons. First, many of the questions within the distributed survey contained a Likert Scale response section. While the individual questions illuminated quantitative and qualitative insights of their own, the connection between survey responses provided additional room for analysis in the form of linear regression and correlation analysis which can be found in the findings of this thesis. Second, additional questions concerning the current status of greenhouse gas emissions in New York City buildings required the use of the Office of Sustainability publicly accessible data source. This time series data provided the benchmarked energy-use intensity and subsequent greenhouse gas emissions for many of New York City's large buildings between 2011 and 2017. Findings relating to this large data set analysis can also be found in the findings' sections of this thesis.

Finally, the case study method was used as an additional data source for this study. It is common practice for building owners to highlight success stories on their websites, perhaps to build credibility with their clients as a leader in new sustainability initiatives and/or to share with other developers how their work is feasible and can be replicated. In that regard, case study data was collected to provide examples of previous projects converting building deep energy retrofits. This provided background information concerning the efficacy of green building-related capital improvements and acknowledged project feasibility with concern for some retrofits that will

need to occur in order to comply with Local Law 97. In some cases, it is also common, if not required, for companies to publish Environmental, Social, and Governance (ESG) reports. This information provided insights into how organizations think about these three pillars of organizational management holistically. While many ESG reports are codified with similar language, the deviations in practice reveal much about how organizations approach the issue of sustainability across various disciplines. In addition, the collection of case studies and reports went beyond organizations and subsequent data was compiled from a variety of governmental and non-governmental organization websites who have extensively covered topics related to energy use, energy consumption, and specifically Local Law 97 in New York City.

Research Sample

A purposeful non-random sampling procedure was used to select the participants for this study. To yield the most useful information about the legislation response under investigation here, it was necessary to seek individuals and practitioners, who either operate as developers, owners, or sustainability managers for their respective organizations which participate in the development and/or ownership of real estate in the five boroughs: Manhattan, Brooklyn, Queens, The Bronx, and Staten Island, of New York City. All of which are equally impacted by Local Law 97. In most cases, the individuals and teams responsible, or most knowledgeable about their organization's sustainability, environmental, social, and governmental (ESG) practices, and Local Law 97, do not publicly appear on their company website so beyond ample online searches for individuals, a network sampling strategy was used to recruit participants. This meant that part of the recruitment strategy entailed emailing members of an organization with a request to direct the researcher to the person or team most knowledgeable about the company response to the legislation. Due to the varying size and nature of organizations that own real estate in New York City, the criteria for the selection of participants was purposefully amenable to capture the range of potential individuals tasked with knowledge about their company's assets and relationship to Local Law 97. The main criteria used in participant selection is as follows:

- All participants must have been employed at the time by a real estate development, owner, investor, management firm with real estate assets located within the five New York City boroughs.

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- All participants must have had at least some familiarity with their organization's view and response methodology toward meeting the emissions threshold requirement set in place by Local Law 97.
 - All participants must have been willing to participate in a 15-20-minute-long online survey via the Qualtrics interface.

The research sample included 20 individuals familiar with their organization's response to Local Law 97. The sample included a range of executives, development managers, construction managers, asset managers, and sustainability managers. Individuals who responded to the survey had a range of tenure, from 10 to 30 years of experience in the real estate industry with an average of 17.5. Individuals represented a range of organizations with real estate assets under management from one to twenty-five million square feet representing ten to over two hundred and fifty buildings alone, in New York City. Overall, this sample represents roughly 750+ of the 50,000+ buildings impacted by Local Law 97. The names of organizations and the individuals who participated in the survey have been kept anonymous and aggregated to conserve privacy.

Information Needed to Conduct the Study

This study focuses on the perspectives of 12 different executives, development managers, construction managers, asset managers, and sustainability managers with building assets under ownership in New York City. In addition, it incorporates the use of big data sets and organization-specific case studies pertaining to greenhouse gas emissions and energy retrofits in building. In seeking to best understand the environmental, social and financial implications of Local Law 97, and how New York City developers and investors respond to the legislation, five research questions were explored to gather the information needed. The information required to answer the research question was determined by the conceptual framework and fell into three categories: (a) perceptual (b) empirical (c) theoretical. This information included:

- Owner perceptions of the law, what they needed to know about it, and how their organizations went about making decisions and implementing retrofits in buildings.

- Building-specific information pertaining to the energy use and emissions, the year of observation, and data about the type, age, location, and occupational density of the unit of analysis.
- Ongoing review of the literature to provide a grounding for the potential micro and macro social, environmental, and financial concerns of implementing this legislation.

Research Design

The following list summarizes the steps used to carry out this research. Following this list is a more in-depth discussion of each step.

1. Prior to the actual collection of data, a selected review of the literature was conducted to study the contributions of other researchers and writers in the broad areas of study related to the topics and questions thus far presented in the thesis.
2. Following the proposal defense in the fall of 2019, the researcher acquired approval from the MIT internal review board Committee on the Use of Humans as Experimental Subjects (COUHES) to proceed with the research. The approval process required outlining procedures and processes needed to ensure adherence to the standards put forth for the study of human subjects, including each participants' confidentiality and informed consent. The informed consent form can be found in (Appendix A)
3. Potential research participants were compiled from online searches of entities owning real estate in New York City and the companies, and where possible individuals, were contacted by telephone, email, and professional social media platforms in order to make preliminary introductions, and to ensure that this was not a third-party scam. Those who agreed to participate were then sent a questionnaire via email with a link to the Qualtrics platform to access the survey.
4. In some cases, unstructured interviews were conducted with approval from survey participants via telephone. These conversations were used to expand upon information not addressed in the questionnaire, and to clarify specific approaches to the Local Law 97

approach from that organization's perspective. In some cases, public agencies not impacted by Local Law 97, interviews were conducted via telephone in order to understand that organization's self-imposed pathway towards lowered building emissions. It is worth mentioning that these interviews were held in place of the Local Law 97 questionnaire as the survey was only intended to incorporate affected parties. However, some building-owning institutions shared their own internal strategies to mitigate their greenhouse gas consumption.

5. The Qualtrics platform questionnaire remained open for four weeks. Survey data responses were then analyzed within and between groups of interviewees through reports compiled by the Qualtrics data analytics summary. These data tables were later exported into statistical analysis software where they were prepared for analysis.
6. Large dataset collection was downloaded from the New York City Office of Sustainability open access website. Each downloaded dataset, from the years 2011-2017 were then merged into statistical software where basic analysis was conducted.

Literature Review:

Preceding the actual collection of data, a selected review of the literature was conducted to study the contributions of other researchers and writers in the broad areas surrounding the built environment's contribution to climate change. In addition, topics covering legislation related to the goal of mitigating climate change - specifically in the realm of the built environment, the impacts of indoor and outdoor air quality on human health, productivity and social well-being broadly, and finally, the market and financial implication of climate change itself were compiled and synthesized for a comprehensive review of the work of past research.

COUHES Approval:

The thesis proposal for this study covered the basic outline, literature review, anticipated research methodology and hypotheses related to the findings of the study. This proposal was approved in the fall of 2019. Following this approval, the researcher participated in the online MIT internal review board (COUHES) training to gain an understanding of the research ethics

associate with the study of individual human subjects. The approval process required outlining procedures and processes needed to ensure adherence to standards put forth for the study of human subjects, including participants' confidentiality and informed consent. The informed consent form can be found in (Appendix A)

Data Collection Methods

The use of three separate data collection methods were used to address the topics and questions posed in the introduction, they were: (1) surveys (2) big data collection (3) case studies. This triangulation of data served not only to inform the findings of specific questions in this thesis, following the conceptual framework, but reaffirmed the findings through the corroboration of findings between the three sources.

Phase I: Survey

A list of potential participants was first gathered through an extensive online search of real estate development, investment, and ownership firms within the five boroughs of New York City. This participant list was created by perusing the websites of each firm and searching team pages for relevant potential participants. When not available, the contact emails through the basic "contact us" portal of these firms was collected.

In addition to organization websites, the PLUTO database was used to find building owners with properties over 25,000 square feet. As some building ownership is disguised under many layers of limited liability corporations (LLCs) and/or private equity firms, additional searches were carried out to find the base levels of ownership and additional searches were conducted to seek who may be responsible for that building's compliance with Local Law 97. All points of contact information were collected in an Excel spreadsheet organized to keep track of the over one hundred and twenty-five potential points of contacts. From this full list, emails were sent to approximately one hundred individuals and organizations and were kept up to date by tracking each connection as it was made and later marked as replied or no response. Of those one hundred messages sent via email, telephone and professional social networking sites, approximately thirty-five responses were received. From those responses, survey links were sent for

participation and of those sent out, twelve participants took the survey, despite reminder emails sent one week after no participation. The low response rate may have contributed to the survey timeframe. During the survey response period, the COVID19 pandemic had been ongoing (and continues during the research and writing phases of this thesis) having been a time of potential hardship and disruption for real estate professionals. In addition to being in the midst of a pandemic, widespread ongoing protests against police brutality, anti-Blackness, and systemic oppression. The researcher acknowledges that this has not been the right moment to ask for participation in online survey questions.

The distributed survey questions were created by the researcher using the Qualtrics platform and supported through a license sponsored by the Massachusetts Institute of Technology. Questions were organized into categories that aligned with the construction of the theoretical framework and the thesis-specific questions included in the introductory chapter of this thesis. The following categories for questions posed included: (a) legislation consequences (b) organizational management (c) building management operations (d) macro social and economic conditions (e) COVID19 related operational management and preparedness, and finally, (f) identifying information about the organization's property portfolio.

Each group reflected at least one aspect of the conceptual framework topics and from each of the groups above and questions were generated to elicit findings for each. Questions were then specifically created to receive responses related to those asked in the general inquiry, with some additional qualitative bonus questions used for additional insights and clarity to understand owner perceptions of the law, and how specific organizations were impacted by the writing of the law. Drafts of the questions were later user-tested by peers and industry professionals to provide the researcher with feedback on clarity and conciseness. After a series of user tests and revisions over a three-week period, the bulk of survey questions were observed to be most clear when written as statements to be replied to against a Likert Scale matrix of questions. Therefore, for additional ease in taking the survey, questions were transformed in order to be answered using a 1-5 scale of possible responses in the following form: (1) definitely not, (2) probably not, (3) might or might not (4) probably yes, (5) definitely yes. Consequently, these decisions about question design also decreased the time needed for users to take the survey without comprising

the insights gained from participants. In the end, thirty-five questions related to the Local Law 97 legislation were created using the Likert Scale matrix. In addition, six questions related to the COVID19 pandemic (of which we are in the midst of as of the time of this writing) were developed in order to get a better sense of how exogenous shocks impact the real estate community using the same format. Finally, an additional fourteen questions were created to be answered through free responses. These questions were used to gather additional qualitative and quantitative data about firms and the individuals taking the survey - though this information was aggregated and anonymized.

Upon completion of the final user-tested set of questions, the survey was then published through the Qualtrics server and kept private for purposeful and targeted distribution. This published survey link was then sent to the individuals who responded to the initial request for participation.

Phase II: Big Data

The incorporation of large datasets was also selected as a primary method for data collection in this research. This method was chosen because it was felt that these sources of information had the potential to elicit rich and thick descriptions of the overall greenhouse gas emissions context of buildings impacted by Local Law 97. After all, the creation of this law was dependent on the legislation that required the tracking of building emissions, so it was prudent to incorporate these sources to provide greater context of historical building emissions and the potential impacts energy resulting from this law. In this regard, two large data set sources were downloaded, compiled, and synthesized from the vast New York City Open Data Portal.

The first data set was retrieved from the New York City Mayor's Office of Sustainability which has been retrieving benchmarking information from New York City buildings since 2005. The time series data tracks energy use intensity (EIU), water usage intensity (WUI), and greenhouse gas emissions (GHG). This information has been compiled by the Office of Sustainability in collaboration with the New York University Marron Institute of Urban Management and the Urban Intelligence Lab. The website includes a visually interactive GIS interface of this time series data superimposed on a map of the five boroughs, as depicted in the figure below, and

provides a downloadable comma separated file (CSV) which can be downloaded for each year of emissions data available. Though this information is fairly detailed, it is not a fully comprehensive database of all 50,000+ buildings impacted by Local Law 97 and its accuracy cannot be completely verified. A fully complete data set with all impacted buildings, as of the time of this writing, has not yet been made publicly available through the Open Data Portal.

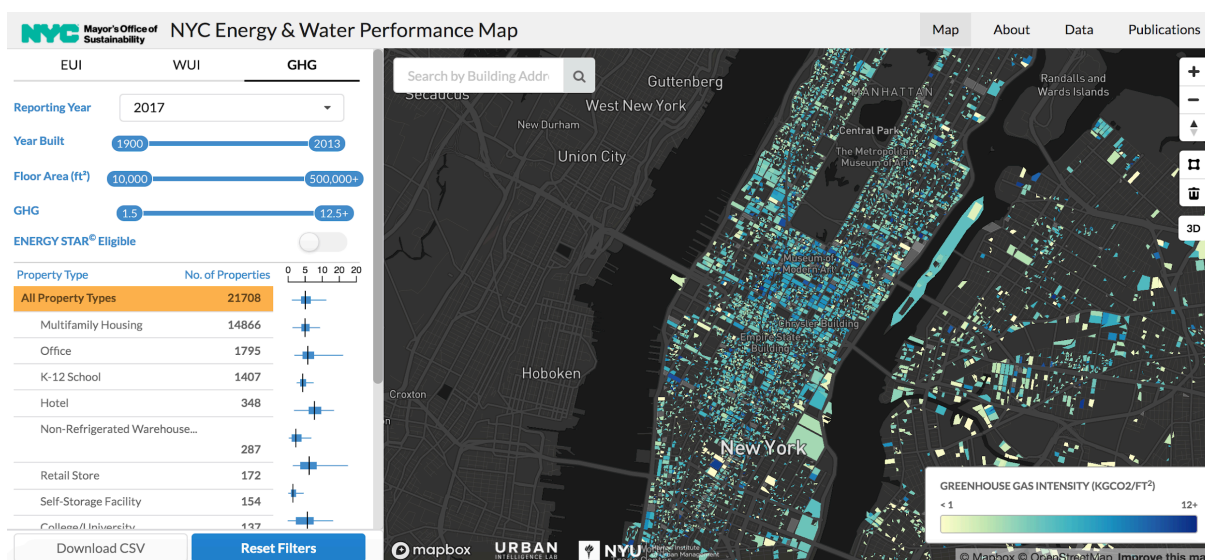


Figure 4. New York City Energy and Water Performance Map. Source: NYC Office of Sustainability

Complementing the Energy and Water Performance Map was a data set of the Greenhouse Gas Emissions Inventory also provided by the Office of Sustainability. This data set, rather than benchmarking individual buildings, changes scale, and examines the high level of New York City emissions from its three primary energy consumer sectors: stationary energy (buildings), transportation, and waste. The data set available for download features both 2005 and 2017 emissions for these sectors and addresses the overall greenhouse gas emissions for the five boroughs. Each of the three sectors included in this set has then been broken down to include subcategories. For example, the stationary energy (buildings) category provides emissions breakdowns over various commercial, manufacturing, and residential typologies, whereas the transportation category breaks down emissions by vehicle type, like freight and passenger cars. For the purposes of this study, this data set served to complement that analysis by providing

information to help illustrate the broad picture related to past and present carbon emissions, in addition to providing the baseline to calculate and more comprehensively interpret New York City's emissions goals for 2024, 2030, and 2050.

The final data set used for this study was made accessible through the New York City Department of City Planning Open Data Portal. The data set is the 20v3-2019 Primary Land Use Tax Lot Output (PLUTO) table and provided roughly 850,000 observations of the 1.1 million buildings located within the five boroughs. Some lots contain more than one building, which helps to explain why there are fewer observations than total buildings in the data set. This data set was used to corroborate the number of buildings over 25,000 square feet in order to assess the 50,000+ building number seen across many studies.

Phase III: Case Study and Governmental Reports Collection & Synthesis

Phase three of the data collection methods included the collection of case studies from various real estate owners and governmental reports aimed at divulging all the information individuals may need in an attempt to understand the implications and timeline of Local Law 97.

This case study method was selected with the intention of corroborating the survey and big data collection, and to allow the uncovering of strategies and perceptions that might not have been revealed through the other sources. This data was collected through the use of online search platforms and through the perusal of organization websites. Often, these case studies are found in the sustainability and or ESG sections of a company website interface and highlight past success stories and current organizational strategies that pertain to energy conservation, social impact, and the management strategy used to meet business goals. This data varied. In some cases, the case studies quite specifically pointed to deep energy retrofit developers have already made to their development complemented with the goals for the project, the execution strategy, and the performance metrics before and after making retrofits. This information was later synthesized to help identify current strategies and lessons learned which may be helping in building the efficacy of future projects for the building owners that learn from those insights.

The acquisition of governmental reports was also integrated into the data collection method of this thesis. Beyond the actual text of Local Law 97 (New York City Council 2019), governmental reports provided this context to help frame how and why this law was written. These reports range in size, from one-page summaries to hundreds of pages of text, from organizations including the New York City Urban Green Council, the Mayor's Office, and the Governor's Office etc., and provide the details residents and owners need to know about how these laws will impact them. The research and citations in these studies helped to corroborate findings and shed light on details not provided by purely reading the transcript of Local Law 97.

Methods for Data Analysis and Synthesis

The challenge throughout the data collection and analysis was to make sense of large amounts of data, reduce the volume of information, identify significant patterns, and finally, produce a conceptual framework. To reduce this burden, the data analysis and data collection phases occurred contemporaneously in order to avoid the risk of collecting unfocused and overwhelming data.

The formal process of data analysis began by following the categories and descriptors in the conceptual framework and assigning the various pieces of collected data as they related to each piece of the framework. These three categories were separated under the following headings: owners, buildings, and occupants, and pieces of the information sourced from one of the three data phases were separated into each. Upon completing this data separation into each respective category, new subcategories were created in order to capture themes as they emerged and potential parallels were then traced between the three main categories.

This step outlined above was used throughout all phases of the thesis and began with the categorization of the case study and governmental report data described in the data collections section. Once collected this data was synthesized and later dispersed as they responded to each of the three categories above. Eventually, as themes emerged during the collection phase, this information was also used to frame survey questions used to help corroborate the findings in these reports and find answers to topics left not responded to. In effect, each survey question would later fit into these categorical breakdowns.

The large data sets, once collected, were either analyzed using Excel software and/or compiled and merged and using the R Studio platform to help reveal findings. The data analysis process begins with a basic diagnostic run in Excel where the downloaded data sets were already cleaned. This process helped to corroborate findings in existing reports. Later, the datasets in R were compiled and cleaned to elicit information regarding relationships between energy use and buildings through regression analysis the reveal information highlighted in the findings of this thesis.

Finally, after closing the online Qualtrics survey, the data tables from this platform were cleaned to make the data more legible and later synthesized into tables to help interpret findings. Questions from the survey, as suggested early, were categorized into the three conceptual framework topics listed above to divulge new data which captured the collective response of individual owners of real estate in New York City. As a final step, to understand where certain variables could account for certain similarities or relationships, the R platform was used again to find potential explanatory variables in collective behavior of owners towards Local Law 97. This step aided the research in connecting collected data across the three pillars of this study and making predictions about future reactions and behaviors as a reaction to the legislation.

Based on analysis and synthesis of the data into the three categories and corresponding subcategories, the researcher was then able to move forward and think about the broader implications of this research. Towards the end of this synthesis, the major findings of this research were elaborated upon and discussed in the findings chapter of this theses. Finally, these findings were formulated into conclusions and framed against the literature review. From there the researcher developed various practical and research-related recommendations.

Ethical Considerations

In any research study, ethical issues that relate to the protection of participants are of a critical concern. In striving to keep to the highest quality of ethical considerations, all COUHES requirements were employed throughout the data collection period. For example, it was of utmost importance to both inform and protect respondents about the purpose and use of the

survey while ensuring that the information they provided was not held against them through anonymity and protection of the received data set from public view. The data collection method here required enlisting voluntary participation, and as a basic premise, all participants were informed about the study's purpose and intent, prior to taking the survey, in the informed consent form as shown in Appendix A.

Within this consent form was acknowledgement of how private information would be treated. Although it was anticipated that no serious ethical concerns or threats were posed to participate well-being (such as using their employer using survey participation and response towards specific questions against them), the study employed safeguards to ensure the protection, aggregation, and anonymity of participants. No direct identifiable quotes were used in this thesis; therefore, permission was not sought to include specific names from specific organizations by the research from the interviewee.

Prior to participating in the survey, participants were shown the informed consent from within the Qualtrics interface. The last line indicates that by pressing "submit" at the end of the survey in the Qualtrics platform, participants agreed to all the information informed consent requirements. To ensure protection of participant rights and interests, the researcher committed to keeping the names of organizations and individual identity characteristics of the sample confidential through multiple layers of password protection and two-factor identification. Cautionary measures have also been taken to secure anonymity in the shared data through the erasure of identifying information in data tables. Nobody, other than the research has access to the original data set.

Issues of Trustworthiness

Wherever possible, tools were put in place to control for potential bias that might be present in the design, execution and analysis of this study. In order to enhance the methodological validity of this study, the research made all attempts possible to triangulate the data sources and ensure that data collection methods could be replicated. In an effort to lend further credibility to this study, sourcing of all material has been discussed in great detail throughout the methodology chapter, and assumptions about Local Law 97 were written about as succinctly as possible in the

introductory chapter of this thesis. Finally, beyond the use of various sources of information, this process of documentation, review, and analysis of this study has been reviewed with professional colleagues along the way.

Limitations and Delimitations

One limitation in this study pertains to the survey data collected by a relatively small sample of New York City-based real estate developers and owners. Despite a significant effort put out to reach a diversity of small to large-scale building owners around New York City, this thesis would have been better informed by a wider range of owners. Enhanced success in obtaining a larger sample of participants would, nevertheless, improve prediction power and provide a more solid ground to make more informed recommendations about future policy and future Local Law 97 amendments. However, given the extensive qualitative data, the focus of the analysis has been centered on finding some consensus in reactions to Local Law 97 rather than seeking statistical significance in all of the quantitative responses.

In addition, the process of cold calling and emailing respondents likely led to some self-selection bias, as firms that reached out were potentially more willing to share their story because they actually had a plan with regard to Local Law 97. Others, either could not, or were unwilling to share their contribution because they felt there was none to be made - though that data itself would have been a powerful addition to the outcomes of the thesis. Regardless, this thesis had its limitations by not being able to incorporate and include a better range of survey participants representing large and small, as well as public and private, organizations. Bias may be inherent in this study because, for the most part, participants had the capacity to know and respond to their organization's strategy towards Local Law 97 legislation. Therefore, the sample presented here may represent a group of owners who can professionally manage buildings and absorb the costs and other side effects associated with the requirement to make energy retrofits to their assets. This hypothesis has been accounted for in both the findings and the recommendations section of this thesis.

Though over 100 contact attempts were made, in many cases, the actual owners of buildings are disguised through levels of limited liability company ownership and despite efforts to reach out

to as many owners as possible, this sample is not representative of a large number of the 50,000+ buildings currently impacted by the law. Future research on this topic should seek methods to extend interviews and surveys to a larger and more diverse representation of building owners, including institutions of higher education, cooperative housing residents, and commercial office space investor-owners. In addition, because nearly 40% of energy use is dependent on tenant consumption, additional research would benefit from a tenant-specific survey that analyzes transparency levels between tenants and their landlords.

Chapter Summary

In summary, this chapter provided a detailed description of this study's research methodology. A mixed qualitative and quantitative method was employed to illustrate, to as great of an extent possible, the litany of phenomena occurring in response to the enactment of Local Law 97 in New York City. Three data collection methods were employed including surveys sent out to individuals, big data collection and analysis, and finally, case study collection and analysis. The data was also retrieved against literature and emerging themes from newspaper articles, periodicals, and television interviews during all phases of the thesis research. The main data source, the research participant sample, was made up of twelve purposefully selected individuals representing their organizations who were willing to respond to the thesis-specific questionnaire. Ethical considerations, as well as the credibility and dependability of the research was accounted for and checked constantly, and through the collection of sources and triangulation of the three different data sets.

The creation of the conceptual framework stemmed from the review of the literature that was conducted during the proposal phase of this research and remained amenable as new related topics emerged from the full thesis writing process. This strategy enabled key themes to be identified and are now portrayed in the existing conceptual framework. Upon review of the literature and construction of the research design, the survey response, interpretations of the data, and final conclusions and recommendations were drawn, though with acknowledgement of research gaps and suggestions for future related research. The intent of this study was to make a contribution to the understanding of organizational response to local climate change laws. In addition, it is hoped that this study will be of value to building owners and legislators in practice

in New York City, but also serve to provide insights for amendments to the law for the city itself and for other cities interested in replicating similar legislation.

04 PRESENTATION OF FINDINGS + DISCUSSION

Introduction

This chapter presents the key findings obtained from twelve in-depth survey responses, large data sets compiled from building benchmarking requirements over the past decade as well as developer case studies and governmental reports. Five major findings emerged as part of this study:

1. As a result of the approval of Local Law 97 in 2019, annual building emissions levels will drop from 33.48 MtCO₂e in 2017 to ~25.4 MtCO₂e in 2030 (25 percent reduction) assuming full compliance. Potentially, emissions reduction will contribute to an increase in health outcomes for New York City Residents through increased environmental quality. Financially, Local Law 97 will spur an enhanced multi-billion dollar market related to deep energy retrofits and the bulk of these costs will fall upon buildings owners - leaving them reluctant and unenthusiastic about the law as their tenants will be the ones benefiting from monthly energy savings - though these split incentives may be mitigated through higher rent.
2. The current gap and annual energy emissions from 2017 levels are 5.9, 8.4, and 24.4 MtCO₂e for 2024, 2030, and 2050, respectively and it is estimated that roughly 55,000 buildings and over 3 billion square feet of real estate is impacted within the five boroughs of New York City. In light of this, the Urban Green Council forecasted a \$16.6B to \$24.3B energy retrofit market opportunity. As a response, New York City building owners expressed frustration, frequently citing decision-making toward the New York City energy grid source, relief from greater tenant occupancy and user density, the \$268 per square foot penalty dedication, and split incentives between tenant and landlord as key obstacles to confronting their own internal strategies.
3. As revealed from both the urban economics literature and the survey responses, New York City may see some tenant sorting, both between high and low-energy consuming tenants in addition to tenants who have a lower willingness to pay increased rents for mitigations as they relate to Local Law 97. The survey respondents show an

unenthusiastic acceptance to comply with the legislation and will more than likely pass costs to tenants in the future. The majority of building owners believe this will likely cause sorting within New York City, a migration of certain tenant types out of the city, in addition to new tenant-type agglomerations.

4. A majority of building owners in this survey have well-established Local Law 97 building retrofit strategies and internal teams dedicated to meeting requirements though face obstacles in their plans based on the obstacles mentioned in the first key finding.
5. In order to make Local Law 97 “smarter”, legislators should further examine the current obstacles in place for developers. These include: making infrastructural changes to the New York City energy grid so that it reflects as high a percentage of renewable energy sources as it does in upstate New York; aligning incentives between landlord and tenant to that both take responsibility for emissions mitigation and partner in the endeavor to do to; and providing relief for greater building density because we should not only be defining empty buildings as energy efficient ones - the highly dense buildings can be considered energy optimizing. Finally, New York City can use building owner’s immediate responses to COVID19 as a proxy for how they may respond to the exogenous shock of Local Law 97 in the future.

The following sections in this chapter include discussions of the findings with details that support and explain each. The emphasis throughout each finding is on allowing the surveys to speak for themselves, highlighting the responses gathered for each topic and allowing some questions to create predictions about others and/or future scenarios. Where appropriate, the large building benchmarking data set and case studies are integrated with the survey data to enhance the discussion and bolster the legitimacy of the findings. The chapter will end with a concluding summary of the findings.

Prior to responding to the specific topics posed in this question, it is necessary to provide an overview of the aggregated and anonymous sample of participant organizations included in this study. Overall, this survey received twelve responses. The respondents represent academic institutions, publicly traded real estate investments trusts (REITS), private real estate development organizations, and institutional owners and investors of real estate in New York

City. Individuals participating in the survey represented a wide range of working experience, from three to thirty years in practice, and represented positions from a range of job titles (job titles are not provided to preserve anonymity, but also because the hierarchy of titles is not standardized and differs from organization to organization in the real estate industry and therefore not relevant to the thesis findings). Assets under management (AUM) within the sample also incorporate a wide range of building ownership. Organizations represented in this study owned between 10 buildings to over two hundred and fifty by one single entity - just in New York City alone. Overall, roughly 775 buildings are incorporated into this sample and represent just over 126 million square feet of commercial, residential, and institution space in New York City. Of the LEED certified buildings, the sample incorporates ownership levels in the range of zero to over twenty-five LEED certified buildings (from Bronze to Platinum-rated) owned by one single entity as well. Overall, the sample represents over 82 LEED buildings and a total just shy of 53 million square feet of LEED certified space. Finally, of the 126+ million square feet in the sample, just over 98 million square feet, or 78%, were to be impacted by Local Law 97 in some form by 2024 or 2030. This translates to roughly 620 buildings impacted by the law from the 775, or roughly 80% of the sample.



Figure 5. Building Owner Representation in Distributed Survey

Finding - From the Main Thesis Question:

The overarching question in this thesis asked: What are the environmental, social and financial implications of Local Law 97, and how are New York City building owners responding to the legislation?

I will start the discussion of the findings here by first breaking down the main question and asking: What are the environmental implications of Local Law 97? To respond to this question, the Greenhouse Gas Inventory data set provided by the Mayor's Office of Sustainability Open Data Portal was used to provide a sense of 2005 emissions by sector and energy source compared with 2017 - the most up-to-date publicly accessible data set. Using the data as far back as 2005 is purposeful, as the Climate Mobilization Act, and in effect Local Law 97, uses 2005 greenhouse gas emissions as a benchmark against the goals set for 2024, 2030, and 2050. For example, when you see the term 80x50, this signifies an 80 percent reduction by 2050, "based on the 2005 emissions" as illustrated in the table below. For reference, these tables provide the data for both 2005 and 2017 and show that during this time period there has already been a significant reduction of greenhouse gas emissions from 61 million metric tons of Carbon Dioxide equivalent (MtCO₂e) in 2005 to roughly 51MtCO₂e in 2017. This already equates to a roughly 17 percent drop in greenhouse gas emissions over the 12-year period alone. To reach 40 percent reduction by 2030, annual greenhouse gas emissions will need to drop to approximately 36.6 MtCO₂e, and by 2050, to roughly 12 MtCO₂e. For further information on benchmarking and emissions information, a useful source, and helpful corroboration for this finding was published by the NYC office of Sustainability in their annual greenhouse gas inventory ("GHG Inventory - NYC Mayor's Office of Sustainability" n.d.)

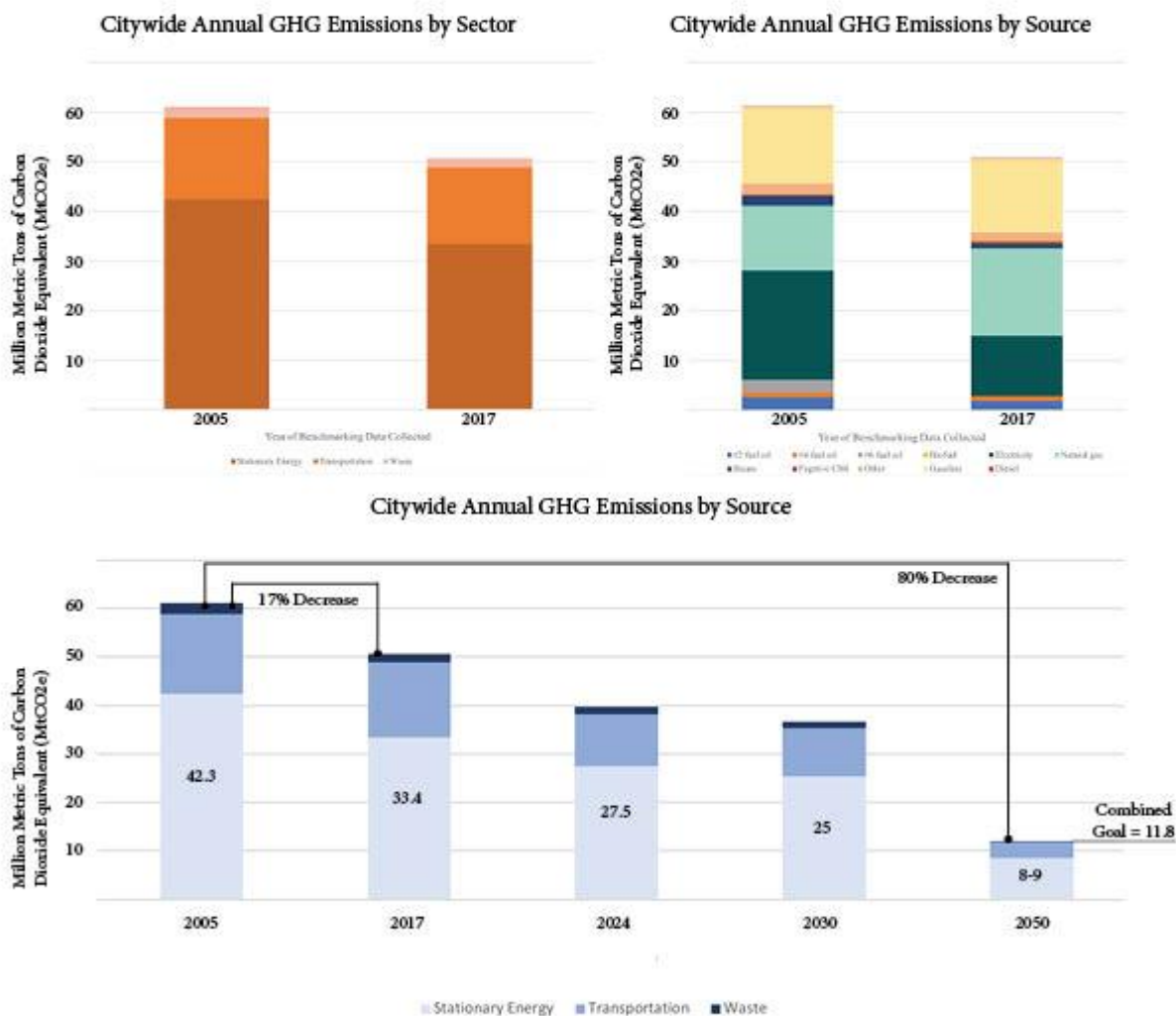


Figure 6. Citywide Greenhouse Gas Emissions by Sector and Source. Data source: New York City Greenhouse Gas Inventory Open Data

As you can see from the bar chart above, stationary energy (the term New York City uses to describe buildings) comprised approximately 42.3 MtCO₂e [\sim 69 percent] of New York City's total greenhouse gas emissions in 2005 - corroborating with studies from the City Mayor's Office. This level dropped to 33.4 MtCO₂e in the 12-year period from 2005 to 2017, yet still comprising \sim 65.8 percent of total greenhouse gas emissions in that year. Buildings have contributed largely to the decrease of overall greenhouse gas emissions, more so than the transportation and waste sectors. Potentially, this can be attributed to a previous legislation, Local Law 84, which has required large buildings to benchmark their greenhouse gas emissions since 2005. This legislation catalyzed a movement of building owners to assess their own

portfolio performance over that time while providing that opportunity for owners to stack themselves up against their peers through the open source data platforms, and a perhaps a bit of competition.

According to the New York City Roadmap to 80x50, the city is targeting an overall city emissions cap of 11.8 MtCO₂e (I rounded to 12 above MtCO₂e) by 2050 and includes all emissions from buildings, transportation, and waste combined. For buildings specifically, which comprise 33.4 MtCO₂e as of 2017, the goal is that with all combined New York City buildings, the threshold will be set to 8-9 MtCO₂e for 2050 and potentially lower moving forward, indicating that the waste and transportation sectors will need to continue to push emissions reductions during this time period as well. It is also worth mentioning that New York City is pushing for these goals while simultaneously projecting another 460 million square feet of real estate to be added to the market by 2050, making the task all the more challenging.

Though we have a roadmap to 2050, Local Law 97 is specifically targeted to 2024 and 2030 so let's look specifically at this time horizon. For each of these years the expected building emissions have been set to 27.5 and 25.4 MtCO₂e, respectively, for buildings alone. From a 2005 baseline, that is a removal of nearly 17 million metric tons of Carbon Dioxide (MtCO₂e) annually from the New York City five boroughs by 2030. According to the Environmental Protection Agency (EPA) greenhouse gas calculator, this will be the equivalent to removing 3.6 million cars off the road for one year (every year moving forward) - assuming the threshold goals are met. As a result of the approval of Local Law 97 in 2019, annual emissions levels from buildings will decrease by 8 MtCO₂ by 2030, compared to 2017 levels.

Breaking down another portion of the main research question, I'll present the finding for the social implications of Local Law 97. First, let's clarify the word "social" for this question and mention here that it specifically includes factors such as health and well-being as part of the analysis here. Now, why discuss social impact within a thesis focused on a climate emissions legislation? In short, greenhouse gas emission reductions are highly linked with increased air quality, and in effect, also linked with our health and happiness, as was alluded to in the

literature on co-benefits. Therefore, it is essential to make the point that cutting greenhouse emissions is not just tied to the health of the planet, but also the nearly 8 billion people on it.

The literature reviewed showed that pollution is the largest environmental cause of disease and premature death in the world today - responsible for an estimated 9 million premature deaths in 2015 - 16% of all deaths worldwide (Landrigan et al. 2018). New York City has very different sources and pollution and levels of pollution when compared to other global cities, but sufficient amounts of literature from the city alone points to the health impacts stemming from, or exacerbated by, pollution - buildings being a main contributor. Data from New York City Department of Health alone estimates that:

...each year, PM2.5 pollution in New York City causes more than 3,000 deaths, 2,000 hospital admissions for lung and heart conditions, and approximately 6,000 emergency department visits for asthma in children and adults. A modest reduction of 10% in current PM2.5 levels could prevent more than 300 premature deaths, 200 hospital admissions and 600 emergency department visits annually (NYCDOH 2019).

While this is significant, please note that the MtCO₂ unit discussed in the preceding paragraphs does not provide a one to one ratio with PM2.5 - the mass per cubic meter of air of particles with a size (diameter) generally less than 2.5 micrometers (Department of Environment, Food, and Rural Affairs n.d.). PM2.5 is just one of many types of air pollutants that impact human health and stem from the combustion of fuels - which often takes place in buildings (and cars). The impacts of each emissions source on human health are beyond the scope of this thesis but a comprehensive list of contribution emissions sources and their health impacts in New York City can be found in the Department of Health publication above. Interestingly, and thankfully, even more harmful pollutants that stem from the use of No.4 and No. 6 heating oil are already being targeted for phase outs by different legislations - creating more room for health benefits for New York City residents. To sum up, by reducing greenhouse gas emissions we can also benefit from a reduction in air pollution as we wean ourselves off of the need to utilize dirty energy sources.

Buildings, comprising the majority of energy use, have a role to play in this relationship and Local Law 97 will provide the impetus for owners to change energy consuming habits quickly.

Health benefits can also be linked with financial performance - relating the topic concerning financial impacts from the main thesis question. Linking lower emissions with increased air quality, and in effect lower mortality, less absenteeism from work, fewer respiratory illnesses etc. will have financial impacts on our city through efficiency and productivity. People who are not sick are less of a strain on our health care systems and employees who are missing fewer days of work are contributing in some way to their company bottom line. Companies that recognize this relationship seek New York City as a prime real estate location and seek to occupy its space market (this will be discussed in greater detail later on). The point here is that though these Local Law 97 decisions may have a significant cost burden up front, in the long term it will make the city a more desirable, and more financially resilient market.

The third part of the main thesis question addresses the financial impacts of Local Law 97. Let's take a look at this at various scales, starting with the city-level and then a discussion about the overall impact on firms based on the data collected. Finally, we will take a look at the sample collected to see where survey participants lie within this context, and how it measures up against the existing data.

This city-level financial impact of Local Law 97 will span decades. According to the Urban Green Council, if all building owners choose to meet the carbon caps, it is forecasted that by 2030 there will be \$16.6 billion to \$24.3 billion energy retrofit market opportunity in New York City and in 2018 along roughly \$235 million was spent on building improvements to save energy and, in addition, potentially 141,000 jobs, would be directly related to the creation of this legislation (Urban Green Council 2019a). That all said, these numbers assume that full compliance will be met from all New York City buildings impacted by the law, while also excluding the impact of a potential carbon trading market that may be put in place as part of an amendment to the legislation.

On a firm level, financial implications vary from owner to owner and as illustrated in our hypothetical case study from the introductory chapter, each asset under an owner's management must be evaluated individually. The financial implications then, of course, vary greatly. We've seen from our realistic case study in the thesis introduction that an individual building generated a \$2,500,000 annual penalty from 2025-2029 which bumps up to about a \$4,250,000 annual penalty from 2030-2034. Again, this is more extreme scenario, and as the data collected from various industry reports the average building violation could reach approximately \$162,772 by 2024 and the total value of fines faced by all affected buildings will reach approximately \$330.4 million by 2024, and \$695.6 million by 2030 (CANY 2020). These fines will be collected by the newly formed Office of Building Energy and Emissions Performance at the New York City Department of Buildings, but it is currently unclear what will be done with these fines.

Now that we have an environmental, social, and economic perspective of the impacts of the legislation, let's examine how participants responded to some questions regarding the financial implications of Local Law 97 in the disseminated survey. In each survey, building owners were prompted with statements and asked to mark their responses against a Likert scale. The results will be discussed here and further visualized in associated figures.

To start, when provided the statement: all buildings under my organization's ownership will meet Local Law 97 requirements by 2024, and 2030 the response were as follows: 22 percent and 55 percent of respondents answered "probably not" to "definitely not", and 11 percent and 33 percent answered "might or might not", respectively. Given that the Local Law 97 Limits will affect the most carbon intensive 20 percent of buildings from 2024-2029 and most carbon-intensive 75 percent of buildings from 2030-2034, despite the small sample size, there seems to be an alignment with the data on impacted buildings with the survey results. Correspondingly, these same participants acknowledged that their organizations will more than likely have to pay fines due to noncompliance in 2025 and 2030 with 37 and 67 percent, respectively, responding "probably yes" and "definitely yes" to this statement.

Financial Implications Survey Results

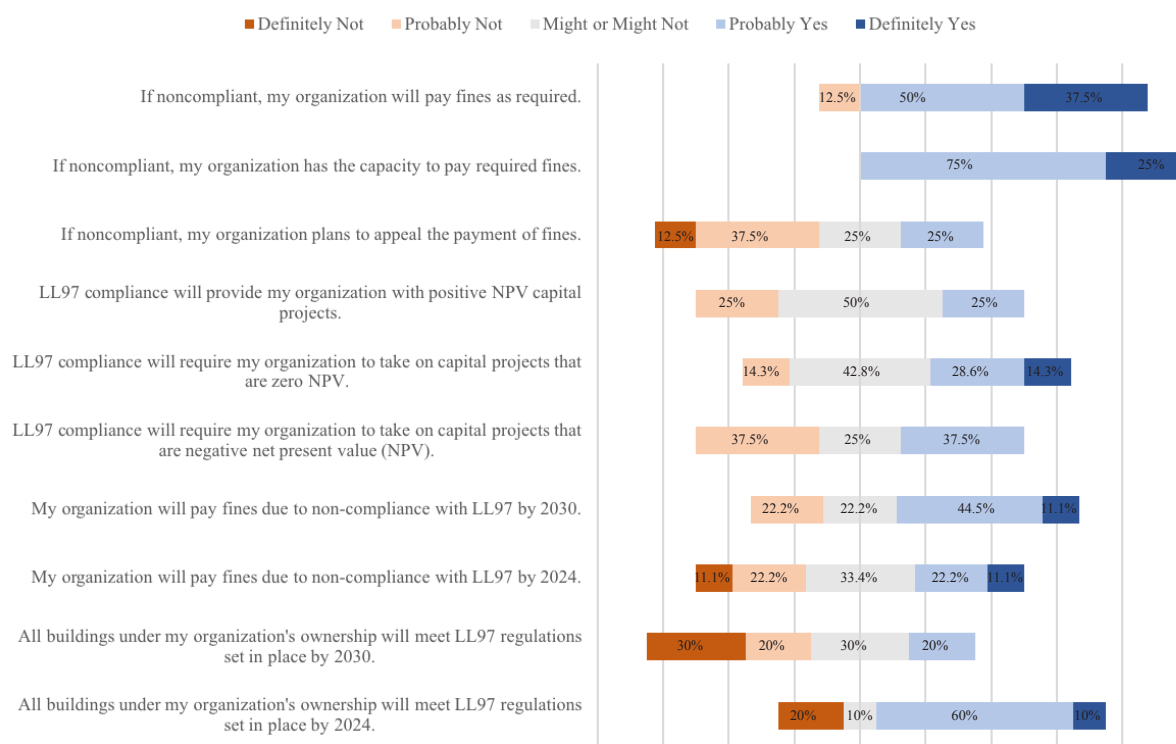


Figure 7. Financial Implications Derived from Thesis Survey Results

Interestingly, when it came to estimate the net present value (NPV) of capital improvements 0 percent of all participants responded, “definitely no” and “definitely yes” to statements regarding the potential negative, zero, and positive which may signal a few items for additional future inquiry. Perhaps, these companies have yet to evaluate the costs and benefits of capital improvement of the lifetime of that retrofit and simply are unsure. However, this is interesting because it may indicate that firms have not yet started to create strategies for retrofitting their buildings. A proper capital expenditure analysis, as has been indicated in just a few case studies, integrates the assumption of life-cycle cost and energy savings into the equation. Perhaps, awareness of their financial position as it relates to Local Law 97 is high, but it could also indicate that owners only have moderate analysis capabilities of how to properly analyze the pay back of retrofits.

Finally, let’s dig into the last part of the main research question which asked: How are building owners responding to Local Law 97? From the survey questions surrounding the topic of

building owner responses to Local Law 97, statements address the possibility of appeal, the ability to pay, and the requirement to pay for non-compliance. When provided the statement about appealing the payment, most responses were spread equally against the response scale except for “definitely yes”, indicating the no organization would outright attempt to avoid fines. However, 28% replied that they would “probably” do so, perhaps in response to future leeway in terms of occupational density, a demonstrated effort to make retrofits without full success, and/or potential carbon credit trading. A significant portion of this same sample would simply comply as required. Interestingly, 100 percent of the organization responded positively to their ability to pay fines; only 85 percent answered positively to the acceptance of fine payments for noncompliance.

Of course, this is not the full litany of findings explaining how New York City building owners are responding to this legislation. Related topics, questions, and their survey results will be discussed in greater detail as they relate more specifically to the subtopics in the following few sections of this chapter. The specificity of each question will help define further how owners are responding to Local Law 97, closely tying in each subquestion with the main question of this thesis.

Finding - From Thesis Subquestion 1 - New York City Building Specific:

The first subquestion in this thesis asked: What is the current energy use of the major building types in New York City, and how big is the gap between existing levels and the Local Law 97 requirement? What will be the energy-related impacts if Local Law 97 is implemented, under the “business as usual” scenario? What are the obstacles to compliance and how do building owners feel about those impacts, especially in terms of who will have to pay and the degree of burden? What is their current level of concern (or lack of concern) and what are the root causes of that concern?

Much of this information was actually covered quite extensively during the Within Finding 1 - From the Main Thesis Question. To break down and summarize quickly, the research and data analytics (corroborated by published New York City documents) uncovered that the current

emissions of New York City Buildings, as of 2017, is 33.4MtCO₂e and comprising ~65.8% of total greenhouse gas emissions for the city that year. Based on the Inventory of New York City Greenhouse Gas Emissions in 2016 and the 80x50 Roadmap, the goal is to reduce building emissions to 27.5MtCO₂e, 25 MtCO₂e by 2030 and 8-9 MtCO₂e by 2050. In effect the current gap and annual energy emissions from 2017 levels are 5.9, 8.4, and 24.4 MtCO₂e, respectively.

Using the PLUTO dataset, also available as an open access download from the New York City Department of City Planning website, the researcher estimates a total of over 1.1 million buildings in New York City as of 2017. From that set, it is estimated that roughly 55,000 buildings will be impacted by Local Law 97 in New York City (after cleaning the dataset for government owned buildings and accounting for properties with more than one building on a single lot). Of those buildings it is estimated that over about 3.1 billion square feet of real estate will be impacted by the legislation. According to the Urban Green Retrofit Council, if all buildings met the 2030 greenhouse gas emission thresholds, a forecasted \$16.6B to \$24.3B energy retrofit market opportunity would be available in New York City (Urban Green Council 2019a).

Now that we have a sense of what the numerical data is telling us about how building owners respond to the legislation, let us take a look at the related free-response questions for additional detail on the topic. To understand with more granularity how building owners react to Local Law 97 and without provoking too much of a projected response, this survey asks participants to state their potential obstacles to compliance in order to get a better sense of where their frustration was rooted.

All participants (8 of 8 [100%] respondents for this question) expressed some level of discontent and spoke poignantly about the obstacles they face in in terms of meeting the required thresholds: As some participants put it:

Heating buildings with electricity is not a simple measure. In addition, as there are little to no 'clean'/renewable energy sources within Zone J, the GHG coefficient associated with strategic electrification from the grid is currently not favorable

when compared to system efficiency. [anonymous]

There are several major obstacles to Local Law 97 compliance. 1) The emissions limit for 2030 and beyond were not determined based on building science. Building emissions from energy are affected by factors such as hours of operation, occupant density, energy-intensive businesses activities (media, finance), and weather. The Local Law 97 emissions limits are not adjusted for those factors, meaning it does not differentiate between wasteful emissions from inefficiency versus higher emissions due to longer business hours. Many of the most efficient buildings in New York City have already reduced emissions by 20-50% and have limited ability to further reduce emissions given current tenant energy use; 2) In commercial buildings, most emissions come from electric generation, not on-site combustion of fossil fuels. Buildings cannot control the emissions of electricity provided by the grid. Furthermore, Local Law 97 does not allow the use of renewable electricity generated in New York State (outside of NYC borders) or the rest of the country for compliance, which makes it currently almost impossible to procure renewable electricity for Local Law 97 compliance. [anonymous]

There are no considerations in the current writing of the law for tenant occupancy and power load, hours of operation and a more detailed and sophisticated analysis is necessary. Market, broker and legal acceptability are also obstacles of concern in addition to cost of capital to comply. [anonymous]

There are a few themes worth unpacking here as they showed up in additional free-reponses beyond just the few cited above: the energy grid, tenant occupancy, and user density. The first theme is that of that energy grid which was briefly mentioned in the introduction of this thesis. You'll note that in the first chapter it was mentioned that the grid would get "dirtier" before it got cleaner. It would be supplemented with fossil fuel after the decommissioning of the Indian Point Nuclear Facility in upstate New York (a discussion comparing emissions and waste in nuclear versus fossil fuels is beyond the scope of this study). To elaborate on why this is such a concern

for developers, their view is that despite their efforts to invest in greenhouse gas mitigation through capital improvement allocated towards retrofits, their energy emissions will nevertheless still go. In short, they will have to pay fines and/or pay for retrofits during the time it takes New York City to convert its energy grid to renewable sources. From the developer perspective, they feel they are getting hit with two waves of negative cash shocks in the form of retrofits and annual penalties, in the short term. So, what is the timeline?

You'll also remember that currently, 88 percent of electricity in the upstate grid (Zones A-E) already comes from carbon-free sources, but downstate (Zones F-K) that figure drops to under 30 percent due to a bottleneck just above New York City. According to the New York State Climate Council though, 70 percent of the State's grid will run on renewable energy by 2030 and 100 percent will be carbon free by 2040, which means that building owners have cause for concern for their balance sheet. The potential solution here though is a real conundrum because energy demand, and in effect emissions, are also expected to increase as space demand increases and as retrofits towards electrification will put more strain on the grid. This trifecta of shocks over the next decade makes the building ownership weary, as gleaned from the survey response.

The second theme that arose from these free response survey questions deal with tenant occupancy. This topic was discussed briefly in the literature review where it was mentioned that nearly 40-60 percent of building energy consumption could be attributed to tenant use. Of course, this varies from tenant to tenant, but it could be expected that a life-sciences office, which requires high-tech and energy consuming lab equipment, may emit more when compared to an architecture office where employees are on working on computers most of the day. Notably, Local Law 97 does not yet have a provision for the consideration of type of occupant. At the moment it is just a building occupancy classification which carries a very different consideration when seeking compliance with Local Law 97. For example, a hospital classification is different from a residence, but the life-sciences and the architecture firm are both under the B-office classification.

The third and final theme to be discussed from this survey question about potential Local Law 97 obstacles is that of user density. Here, we bring up the discussion concerning how New York

City should define energy efficient buildings. By not incorporating user density into the equation, it has been implied that New York City is defining an empty building as a more efficient building. These buildings, though they may have obsolete building systems and are still perceived to be less consuming of energy - and may still be under compliance with Local Law 97 regulations whereas a potentially densely occupied, energy certified building may face fines despite their efforts to build to these criteria. Though the merits of green-certified buildings can be discredited (after all how green is a certified building that is already 15 years old), the development community here is concerned with the burden of operating a well occupied building that may remain open for longer periods of time. By not considering the impact of user density into the fine calculator it is possible that the city is not incentivizing active use and efficiency - and potentially lead to adverse building operations from owners (like limiting use, hours of operations, or transfer of fines through rent which will be discussed during Finding 3.

Finding in Response to Subquestion 2:

Subquestion 2 asked: What will be the market responses (from the demand side, i.e., building occupants) around the city once Local Law 97 is enacted? Will the impacts of Local Law 97 make spaces, or New York City in general, a more attractive place to work and live, or will tenants leave seeking a less expensive or more comfortable space market outside of the city? Within the city, will there be a sorting process of tenants reshuffling across buildings after this legislation takes place? Who (or which types of buildings) will be the winners and who (or which types of buildings) will be the losers, and can our interviewees foresee such market mechanisms at play? Are our interviewees mindful of those structural changes, and what are their perceptions?

Let's start by breaking down parts of this question, starting with potential market responses from the demand side once Local Law 97 is officially in place in 2024. The literature tells us that commercial tenants are interested in and willing to engage in discussions about sustainability initiatives, but the process, costs and benefits need to be clear (Miller and Buys 2008). Despite this finding, the current writing of the law manufactures a split incentives platform between tenants and landlords that has not yet promoted a discussion on transparency between the two parties. To clarify, this means that while the building owner is the one obliged to make capital

expenditures paying for retrofits, the tenant will reap the benefits in future energy cost savings from efficiency-related retrofits. However, there is one New York City specific program found to align incentives here. The one institutionalized tool at this point is the New York State Energy Research and Development Authority (NYSERDA) Commercial Tenant Program. In this program, tenants and landlords work together to identify and plan for energy saving projects in tenant spaces throughout the entire leasing cycle, from space selection through occupancy (“Building Owners and Managers - NYSERDA” n.d.). Essentially, it is a consultative service for assessing energy use and working with tenants to make their commercial office space more efficient - helping both that tenant and the landlord simultaneously.

From the research conducted for this thesis, this was the only tool in place in New York City to align incentives whereas most other tenant-landlord agreements keep incentives split. For example, it is worth noting that the traditional lease structure in New York City between commercial tenant and landlord is a Triple-Net Lease. In this type of agreement, the tenant pays rent, in addition to all operating expenses including taxes and utilities (Friedman, Harris, and Bruce Lindeman 2017). In this scenario, with deep energy retrofits made, the tenant then walks away with lower monthly utility bills because the landlord paid for energy efficiency upgrades. In regard to Local Law 97 though, and in order to mitigate capital expenditure burdens, the owner will naturally try to recoup those losses through higher rents. When conducting their cost/benefit analysis and the net present value of the project, the higher rents are likely integrated into the calculation to the dissatisfaction of future tenants. These higher rents potentially cause some tenant sorting throughout the city and beyond. Alternatively, though, there is precedent for lease innovation - which will be discussed in detail in the conclusions and recommendations section of this thesis. Essentially though, this agreement is called a “green lease” between tenants and landlords in commercial office spaces used to help align emissions incentives. Something similar could be applied to residential buildings where tenants accrue similar benefits from retrofits in the form of monthly utility savings, meaning again, that rents or lease structures but residents could participate in the reductions as well.

To discuss the topic of sorting further, this thesis asked: How would a tenant market, both commercial and residential, respond to the potential economic shock in a city that is already rent

burdened on nearly all fronts? The literature on basic urban economic theory reveals the possibility of tenant sorting and the possibility that tenants will simply move further away, and perhaps out of the five boroughs all together where they won't be impacted by Local Law 97. A migration out of the tenant market is likely one of the unintended consequences of this legislation as building owners and legislators certainly don't want to force renters out of the New York City space market. At the same time, if developers are less willing to develop in a cost constrained market, it could potentially limit the supply of office and housing stock in the city. Both scenarios may create unintended rent-burdening reactions. With these theories in mind, let's take a look at how building owners are currently assessing tenant implications in the market and how the possibility of split incentives in energy retrofitting may be mitigated.

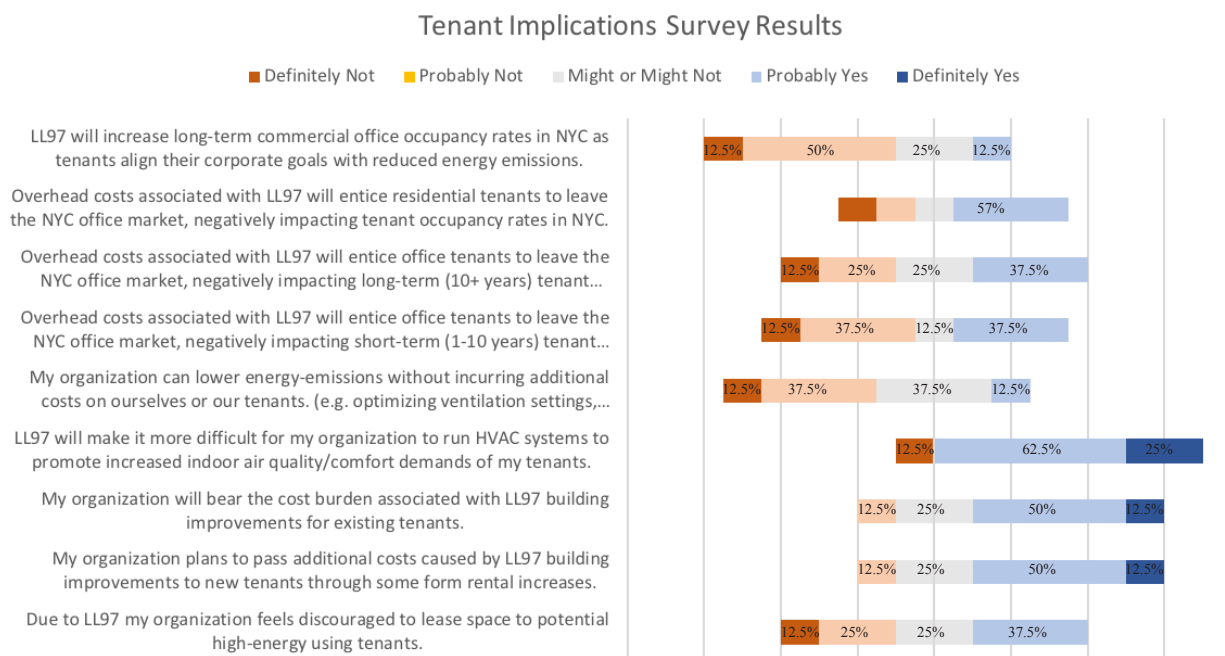


Figure 8. Tenant Implications Derived from Thesis Survey Results

Upon examining the prospects of the tenant market of New York City, when provided with the statement about long-term occupancy, the urban economics (like rent-curve gradients) theories are held up in practice. The majority of survey participants did not believe that Local Law 97 would help to increase occupancy to reduce their corporate goals, not completely aligning with the literature on the topic suggested otherwise. However, when asked about the short- and long-term implications of additional overhead costs about half of participants thought that increased

costs would negatively impact occupancy rates in the short term, while a majority of participants thought the increased cost burdens would cause tenant migration out of New York City in the 10+ year period. Potentially this signals that tenants are currently limited in terms of moving due to the term of their current lease status (which can be 10+ years long) but when given the option to seek a cheaper space market after expiration of that lease, building owners believed their tenants would do so.

In the short term, after analyzing the survey response, it seems as if building owners will be able to capture short term savings by limiting energy consumption. When provided with a statement about lowering energy emissions without incurring additional costs on themselves or their tenants, while roughly 50 percent said “might or might not”, about 40 percent indicated that this would not be a possibility, maintaining that retrofits would mean costs burdens, and potentially that the low hanging fruit items (like monitoring lights when rooms are not occupied, etc.) are not sufficient to meet Local Law 97 requirement (and have likely already been assessed from Local Law 84), pointing to the need now for deep energy retrofits.

Interestingly, when provided with the statement: Local Law 97 will make it more difficult for my organization to run HVAC systems to promote increased indoor air quality/comfort for my tenants, [7 of 8] or 87 percent of respondents for this question indicated that this would be the case. This is a concerning response for a few reasons. One, as shown in the literature review concerning the co-benefits of green and healthy buildings, indoor environmental quality played a role in tenant happiness, a decrease in health risks, and an increase in productivity - an active promotion of better indoor environmental quality was a key component of increasing these positive outcomes. This leads us to the second point. If building owners are not promoting increased air quality, or potentially lowering HVAC energy use, it is possible that indoor air quality in buildings affected by Local Law 97 will have decreased in indoor environmental quality. This will be of concern for tenants, as these decisions can have an impact on both long- and short-term health.

The final few questions related to potential tenant impacts address who will bear the potential cost impacts of retrofits for existing tenants. When prompted by this statement 5 of 8 [62.5

percent] of respondents indicated “probably yes” to “definitely yes” indicating that they will be the impetus for change to their own spaces, bearing the deep energy retrofit cost burden, but likely making it up in the future through rental increases. 2 of 8 [25 percent] indicated “might or might not” and 1 of 8 [12.5 percent] indicating “probably not”, potentially implying some sort of agreement with tenants, or a recoup of financial burden through new leases with new tenants as spaces get absorbed at various times in the market.

This follows logically with the next statement about increasing additional costs on tenants through some sort of rent increase. 5 of 8 [62.5 percent] responded “probably yes” and “definitely yes” meaning that at some point, the majority of landlords here intend to increase rent prices on tenants, representing both the commercial office and residential rental communities. Finally, in terms of sorting, it seems that building owners, across all respondents, are split about their discouragement to lease space to potential high-energy using tenants. Considering the possibility of increased rent burdens on tenants due to cost burdens from retrofits, this logic also seems to follow, as owners believe that they may be able to recoup the losses in some other form, despite the potential energy needs of the tenant.

Finding in Response to Subquestion 3:

How do building owners plan to respond to strategically meeting the new requirements set in place by Local Law 97? Their decisions must be based on their understanding and expectation of their building’s energy consumption patterns (sub question 1), market response mechanisms (sub question 2), and their own capacity (including engineering and financial feasibility) to make changes in response to the legislation requirements.

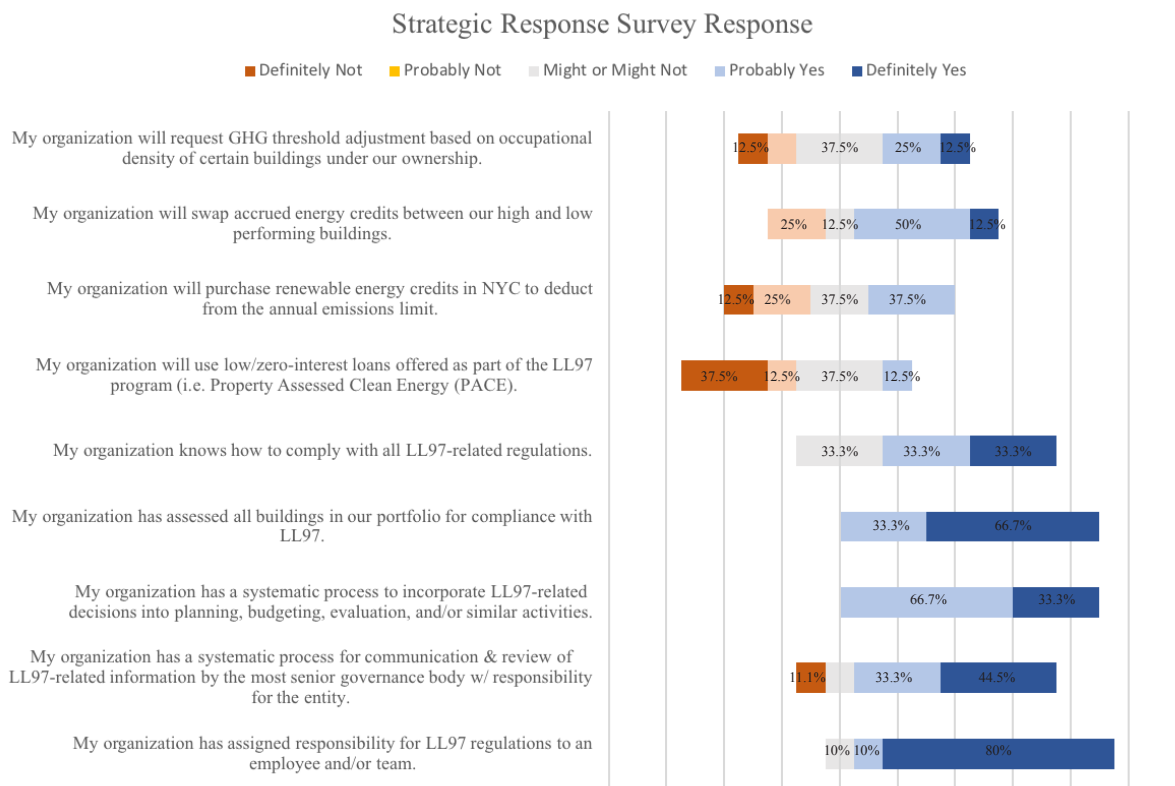


Figure 9. Strategic Response Analysis Derived from Thesis Survey Results

Let us break down the strategic response by building owners by analyzing the various survey responses pertaining to this topic. This first theme here will examine how building owners are thinking about seeking exceptions to the law, despite not knowing the exact routes they can take and given that these exceptions to the law have yet to be defined.

When presented with the statement: my organization will request greenhouse gas threshold adjustments based on occupational density of certain buildings under our ownerships, as would be expected, the answers varied across the board. To clarify first, occupational density is a measure of how full the building is with people at all times of the day. By asking this question, it is inferred that some financial offices are densely packed with workers at all times of the day as trading occurs internationally across time zones. This would then have high occupational density compared to another firm that operates with fewer workers the typical 9 to 6 workday schedules. Building owners simply do not know the full extent of the possibilities with regard to occupational density but we may be able to make some predictions about how legislators could adopt amendments concerning this legislation. 3 of 8 [37.5 percent] of respondents answered

“probably yes” to “definitely yes” in seeking density exceptions in their buildings. This indicates that this group from the sample sees occupational density, and the impact of tenant energy loads, as comprising a bulk of energy use within their buildings and that the split incentives in this regard here should, in some form, be aligned, because of the tenant impact on building energy consumption and energy emissions .

Another cost burden mitigation model is the potential energy credit swap between buildings by different owners or within companies and their own portfolios. When presented with the statement concerning swapping accrued energy credits between their high and low performing buildings, 5 of 8 [62.5 percent] of respondents indicated that they would take advantage of these options whereas 2 of 8 [25 percent] indicated that they’re unlikely to do this. The majority of participants are likely to take advantage of this option makes sense, as some of their buildings are likely better performers than others. By legislators allowing for energy swaps to occur, this would allow building owners to focus their deep energy retrofits first on their worst performing buildings, rather than having many projects going on at once - which could be a real operational issue for some of the respondents here because their portfolios in New York city are so vast. Most do not have the capacity, or would need to add capacity, to meet the new capital project demand. Realistically, to add, the decision to allow for energy credit trading may mitigate the burden on the engineering, architecture, and construction industries who may not be prepared, or have the capacity themselves, to complete the bulk of projects that need to be completed by 2023 and 2030.

While swapping accrued energy credits within their portfolios has some favorability here, the purchase of additional energy credits points to a less enthusiastic market within this response sample. When prompted with a statement about the purchase of energy credits to mitigate their fines, only 3 of 8 [37.5 percent] responded positively to participating in this plan. 2 of 8 [25 percent] indicated “might or might not” whereas another 37 percent reacted negatively to this possibility. Further research into this topic should potentially highlight the costs versus benefits of participating in the energy credit accrual market versus flatly paying Local Law 97 penalty.

In this section, as we continue to discuss various organization's strategic responses to Local Law 97, one important theme is the payment method to meet the costs associated with retrofits. New York City legislators, through Local Law 96, have set up the Property Assessed Clean Energy (PACE) program to provide access to capital needed by owners for retrofits. The statement for this topic prompted building owners to say: my organization will use low/zero interest loans offered as part of the PACE program. In response, 4 of 8 [50 percent] of respondents answered "probably not" to "definitely not", another 3 of 8 [37.5 percent] responded "might or might not", and only one respondent answered, "probably yes". This response was slightly surprising so in an effort to clarify, unstructured interviews brought up this topic through various phone call interviews to better understand how owners feel about this program. In short, their response was that the rates for this City-led program are too high when compared to current capital market conditions. Building owners currently have cheaper access to capital, in order to make energy retrofits, through other sources.

I want to pause in the analysis of the survey responses to discuss this response in slightly more detail. Developers with greater capacity to respond to the Local Law 97 shock have the capacity to carry out projects with cheaper access to capital. Given this capacity to absorb the shock, they are likely to be the real winners with regard to Local Law 97. These "winners" will make changes, potentially increase rents along the way, or find partnerships with their tenants that allow for aligned incentives and co-benefits that allow both parties to succeed. This is a fantastic outcome for those developers who are able to internalize the exogenous shocks and actually benefit from this law through positive externalities like better air quality, better health outcomes, and a more livable city that can be linked with higher tenant willingness to pay. From the other perspective, developers with fewer capabilities to carry out retrofit projects will either be burdened with annual penalties or will likely have to position themselves with the unfair situation of having to take on higher costs of capital versus the owners mentioned above. Potentially, this could lead to many distressed situations, and a weeding out of the mid-size to small developer without the capacity to absorb shocks like this one. As far as market predictions go, it can be hypothesized that properties in this scenario will become acquired by the "winner" owners who have the capacity to absorb even greater shocks. One potential helpful government

policy here could be lowering the cost of capital in the PACE program, which will be discussed further in the conclusion and recommendation chapter of the thesis.

Looking back at our sample, and in regard to the paragraph above, the theory about winners and losers here may not exactly hold up, or alternatively may present a potential bias in the survey responses in that participants from this survey represent organizations with a capacity to navigate this legislation. Respondents, when provided a statement about their knowledge in terms of compliance with Local Law 97, 6 of 9 [66.6 percent] answered “probably yes” and “definitely yes” stating that their organization knows how to comply with all Local Law 97 regulations, and 3 of 9 [33.3 percent] said “might or might not. Bolstering this idea is the following statement that promptly responses concerning building assessment. 9 of 9 [100 percent] of respondents marked “probably yes” and “definitely yes” stating that each had assessed all of the buildings in their portfolio for compliance with Local Law 97, indicating both knowledge of the wall, and a first step in putting together a strategy: assessment.

Looking at statements relating to internal management responses, we see similar patterns within our sample. When prompted with the statement: My organization has a systematic process to incorporate Local Law 97--related decisions into planning, budgeting, evaluation, and/or similar activities, 9 out of 9 [100%] of respondents answered, “probably yes” and “definitely yes” to systemic responses pertaining to this topic. This may indicate an exceptionally well-prepared sample, and a biased selection, of established firms within New York City. One suggestion for future research on this topic is to find a potentially more representative crowd of building owners without such capacity to get a more comprehensive sense of how a full population of owners are strategizing with their internal organization to resolve Local Law 97-related issues. This further research inquiry can also be applied to the last two remaining internal strategy questions. The first, concerning organizations that have a systematic process for communication and review of Local Law 97-related information by the most senior governance body w/ responsibility for the entity. In response to this statement, 7 of 9 [77.8 percent] of respondents answered, “probably yes” and “definitely yes”. This further indicates the level of preparedness within the sample, in that the deep retrofit or response-strategies towards Local Law 97 are fed throughout the hierarchy of the organization in a systematic decision-making process. Finally, in responding to

the last question concerning the allocation of responsibilities to a team and/or individual, 9 of 10 [90 percent] of respondents to this question indicated that there are specific point-people tasked with resolving their organizations response - indicating the building owners are both mindful of structural changes that need to be accounted for within their organization to meet the Local Law 97 requirements. They perceive the challenges here to be comprehensive, and by having a dedicated response strategy they may be more likely to mitigate the burdens imposed by the law, and potentially find and capitalize on the benefits. Either this study represents too many “winners” or is actually representative of a bulk of real estate owners - a larger sample size corroborating this should be integrated into future work in this area.

Finding in Response to Subquestion 4:

Based on the analysis of the above three sub questions, I am able to draw some policy implications for the NYC policy makers on this Local Law 97. How should they make Local Law 97 “smarter” to maximize the social benefit of the entire city without incurring substantial market distortions? Particularly, considering the new uncertainties brought in by COVID-19, how can this Local Law be further improved, and more flexibilities be built in?

Let’s first address: How should policy makers make Local Law 97 “smarter” to maximize the sustainability and human health co-benefits for the whole society without incurring substantial market distortions and still meeting or exceeding our emissions goals? So far, we have discussed the potential environmental, social, and financial impacts of Local Law 97 in an attempt to understand how buildings owners respond to this legislation. From the survey we gauged, hesitation, reluctance, and a bit of frustration from this community of owners as gleaned from analysis of the survey responses. Despite this frustration, the owners represented in this survey have already formed teams and created strategies for compliance with the law and are willing through reluctant to accept payment of potential fines.

Now we are concerned with how amendments to this legislation can become “smarter” or forge greater favorability with those impacted by it. Let’s start by reviewing some of the specific free-response questions from our participants when asked which amendments they would recommend for the legislation:

“Include Tenant related responsibilities and equity, provide incentives to those exceeding Local Law 97 compliance, provide time of day carbon and roadmap for Landlords to make complicated decisions” [anonymous]

“Find ways in which not penalize landlords for the usage patterns and habits of their tenants; clear guidance from city agencies (e.g. DOB) on best practices for implementation, delineating a clear path forward” [anonymous]

“The limits and fines should be scrapped. They have no relation to reality or to the goals of the bill” [anonymous]

“To make a real impact the law needs to incorporate more rent stabilized buildings. Any building with 1 rent stabilized unit has to do prescriptive measures but faces no real threat of a fine in 2024. The majority of the existing building stock has at least 1 rent stabilized unit. Additionally, most of the older pre-war building stock has at least 1 rent stabilized unit. Moreover, rent stabilized buildings need operating expense efficiencies to stay above water. If there was a way to fund (PACE on steroids) for buildings with 30% or more rent stabilized units to achieve these goals or stricter that would help everyone.” [anonymous]

Some of the responses from building owners here reflect on the themes that have been presented earlier in this thesis, in terms of the current obstacles in place. These include: making infrastructural changes to the New York City energy grid so that it reflects as high a percentage of renewable energy sources as it does in upstate New York; align incentives between landlord and tenant to that both take responsibility for emissions mitigation and partner in the endeavor to do to; and provide relief for greater building density because we should not only be defining empty buildings as energy efficient ones - the highly dense buildings can be considered energy optimizing. In the response to what should change in terms of policy though, the high-level theme captured here, was that these developers are more in favor of keeping the facets of the law

but aligning the legislation so that it fits a cohesive, well-documented, and scientifically supported narrative.

The first critique I want to highlight is the one regarding the \$268 fine, which speaks to this point. This critique was new compared to the ones found previously, and as a result has not yet been addressed thoroughly in this thesis. It calls into question the legitimacy, derivation, and specificity of this number. Where does it come from and should it be scrapped? From the literature, a range from just under \$33 to over \$220 per ton of carbon is the social cost of carbon by various measurement standards (Moore and Diaz 2015). Though the cost is higher in NYC, it may be set at this level in order to have many more mitigation measures pass a cost-benefit analysis undertaken by building owners.

Another issue I'd like to examine from these quotations concerns the integration of additional types of buildings into the legislation. One respondent mentioned that rent-stabilized apartment buildings should be incorporated under the legislation in order to make a real impact. To provide some context, New York City rent-stabilized apartments are those regulated by legislators who vote on percentage rent increases on an annual basis. Usually, these percent increases range from 0-2 percent from the existing rent on a one or two-year lease term. These units are found dispersed within residential buildings around the city, and while an entire building can be rent-stabilized, it is also the case that as few as one unit, in a market rate building, can be the lone apartment in an otherwise non-stabilized unit. When this condition exists in a building that may otherwise be impacted by Local Law 97, then that building is exempt. Though an analysis was not executed to determine the number of buildings falling within this context, it seems to be, from this building owner's perspective, that this exception applies to many buildings within the city. It can also be hypothesized that, if possible, residential building owners may try to convert some units in their buildings to rent-stabilized in order to avoid the potential cost burdens of certain buildings impacted by Local Law 97. In response, future research should analyze the possibility and potential consequences of incorporating some rent-stabilized buildings into Local Law 97.

The final finding to be addressed in this thesis relates to the looming COVID19 crisis taking place as of the time of the writing and throughout the research and development phases. During the survey generation phase of the thesis, additional questions were integrated to better understand how building owners view the crisis, and how they responded to its shocks. For months now, office tenants have been physically separated from their coworkers and many office spaces around the city have been closed. In addition to a large majority of people working from home, many have lost their jobs and in effect, the ability to pay rents and mortgages. In short, this shock has impacted nearly all real estate products. In light of this, companies and real estate owners are also addressing the question of how to keep occupants safe, especially when the workforce returns to their offices, and what precautionary measures can be taken to mitigate a resurgence of the virus spread. In response to this situation described above, a number of COVID19-related questions can help us to better understand how developers respond to and absorb exogenous shocks. These questions can help us to better understand a building owner's adaptability to change in the immediate term. Assessing their agility now may be a useful proxy for addressing their capacity to absorb shocks, like Local Law 97, in the future. The questions in the figure below helps us visualize their response.

From the COVID19-related questions, we can see that a 6 of 8, or 75% of respondents believed that capital investments made in response to COVID19 will help to attract and/or retain residential and commercial tenants. The type capital improvements here are further detailed through additional parts of the survey and these results can be seen in Figure 10. Interestingly, 7 of 8 [87.5 percent] of respondents answered negatively towards a statement regarding the relationship between capital investments in relation to COVID19 and Local Law 97, saying that the improvements in response to COVID19 today will not contribute to the goal of meeting the legislation in the future. Most COVID19 responses have been increased hand sanitizing stations, and touchless doors and elevators, etc., so it makes sense that there would be little relationship. However, COVID19 responses are also calling for increased desk space (citing the common six feet apart theory), or increasing ventilation and air circulation, both of which may potentially impact the space market negatively through decreased density and more sprawl in addition to energy-consuming HVAC usage to keep air quality high.

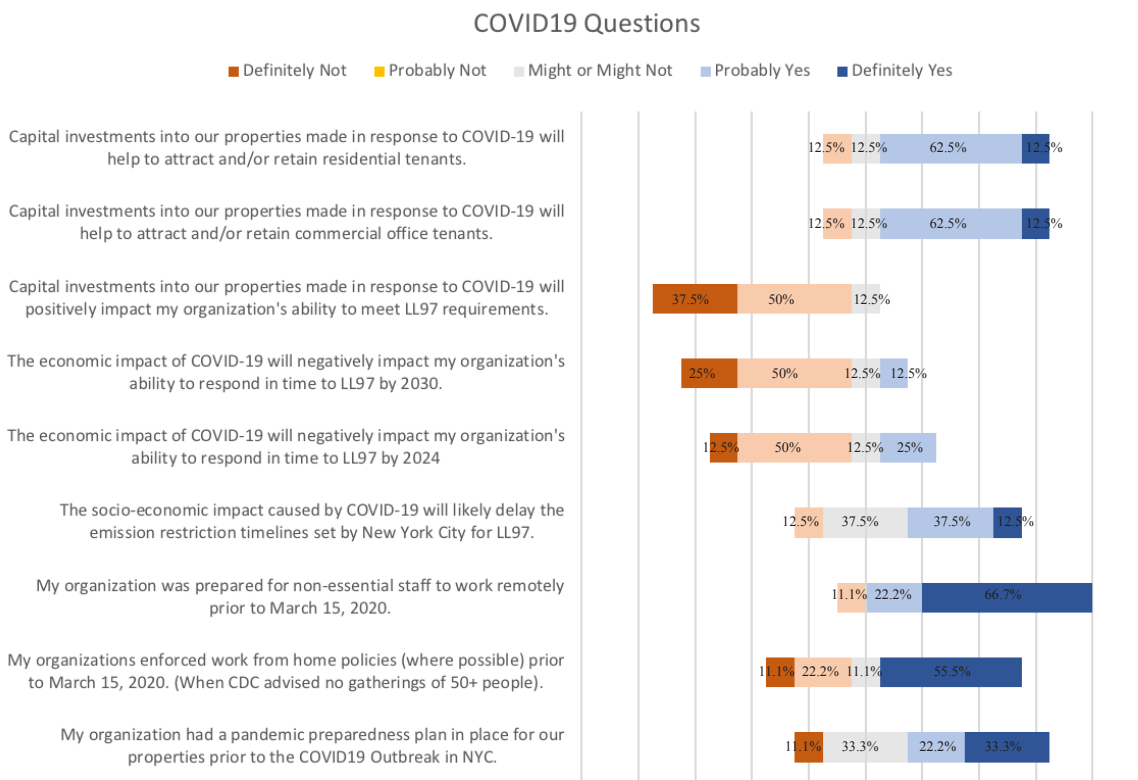


Figure 10. COVID19 Implications Derived from Thesis Survey Results

When prompted with the statement: the economic impact of COVID19 will negatively impact my organization's ability to respond to 2030 and 2024, the majority of these building owners believed that that could absorb the operational and financial impacts of this shock and the next. This response, again, may indicate that this sample is overwhelmingly representative of well-prepared group owners with an enhanced business capacity when compared to their city-wide peers.

With regard to how legislators may react to COVID-19 with proposed adjustments to Local Law 97, a majority 8 of 9 [88.8 percent] indicated that hardships caused by the virus may actually impact the timeline of Local Law 97, pushing back the compliance dates for 2024 and 2029. This perspective from building owners is interesting because no indication for this has been reported on, despite having an alerts notification activated during the writing of this thesis. Though we don't have this year's energy data yet, with fewer people commuting and working in our office building stock it could be predicted that emissions in New York City, one of the epicenters if the outbreak, are significantly lower than previous years.

The last two statements addressed in Figure XX above, and in Figure XX and XX below are more closely aligned with an organization's internal response to COVID19 to get an even greater idea of their operational agility and response time. When provided with a statement concerning work from home policies when suggested by the Center for Disease Control that group's best limited to below 50 people, roughly 50 percent of organizations indicated that they acted immediately, allowing their employees to work from home and meaning that their workforce also had the adaptability to leave and to resources to work remotely. And finally, with regard to pandemic preparedness, 5 of 8 respondents to this question indicated that their company had one and was prepared to make quick decisions based on that policy. 25 percent answered, "might or might not" and 12 percent answered negatively, pointing to the fact that a pandemic threat may not have been on their radar.

Chapter Summary

This chapter presented five findings uncovered by the study. Findings were organized according to each research question in sequential order. The five major findings discussed were: (1) Annual building emissions levels will drop from 33.48 MtCO₂e in 2017 to ~25.48 MtCO₂e in 2030 assuming full compliance and will contribute to an increase in health outcomes for New York City Residents through increased environmental quality. Financially, Local Law 97 will spur an enhanced multi-billion dollar market related to deep energy retrofits and the bulk of these costs will fall upon buildings owners (2) The current gap and annual energy emissions from 2017 levels are 5.9, 8.4, and 24.4 MtCO₂e for 2024, 2030, and 2050, respectively, estimated to impact roughly 55,000 buildings and over 3 billion square feet of real estate space. The Urban Green Council forecasted a \$16.6B to \$24.3B energy retrofit market opportunity. As a response, New York City building owners expressed frustration over the obstacles they face. (3) As revealed from both the urban economics literature and the survey responses, New York City may see some tenant sorting, both between high and low-energy consuming tenants in addition to tenants who have a lower willingness to pay increased rents for mitigations as they relate to Local Law 97. (4) A majority of building owners in this survey have well-established Local Law 97 building retrofit strategies and internal teams dedicated to meeting requirements though face obstacles in

their plans based on the obstacles mentioned in the first key finding. (5) In order to make Local Law 97 “smarter”, legislators should further examine the current obstacles in place for developers. These include: making infrastructural changes to the New York City energy grid aligning incentives between landlord and tenant to that both take responsibility for emissions mitigation and partnering in the endeavor to do to; and providing relief for greater building density because we should not only be defining empty buildings as energy efficient ones - the highly dense buildings can be considered energy optimizing. The next chapter will present recommendations in response to the findings discussed above.

05 CONCLUSION AND RECOMMENDATIONS

The purpose of this mixed methods analysis was to explore with a sample of New York City building owners their perceptions of, and response to, the recent climate legislation Local Law 97. The conclusions from this study follow the research questions and their findings and therefore address five areas: (a) market and building owner responses (b) energy implications (c) tenant market sorting mechanism (d) internal strategic management (e) policy responses.

Through this chapter, I will draw abstract conclusions from this study after an analysis of each findings followed by some actionable recommendations in response to each. This section will conclude by offering a final reflection of this study.

Conclusion and Recommendation to Main Thesis Question:

Many of the findings in the main research question corroborate the stories and research found in reports published by New York City and the non-governmental organizations that have written about the topic. From research and findings, we see that already, since 2005, New York City has seen a 17% drop in overall emissions, which could be attributed to Local Law 84, which has required large buildings to track their energy use for years. Using this base benchmarking as a tool large building owner have been required to assess their own portfolio, making a combination of deep energy retrofits and basic low hanging fruit energy conservation enhancements to their buildings. Now that that conservation curve has started to flatten, more stringent requirements in the form of Local Law 97 were put on the table.

As discussed in the findings, Local Law 97 specifically targets years 2024 and 2030. For each of these years the expected building emissions have been set to 27.5 and 25.4 MtCO_{2e}, respectively, for buildings alone. From a 2005 baseline, that is a removal of nearly 17 million metric tons of Carbon Dioxide (MtCO_{2e}) annually from the New York City five boroughs by 2030. According to the Environmental Protection Agency (EPA) greenhouse gas calculator, this will be the equivalent to removing 3.6 million cars off the road for one year (every year moving forward) - assuming the threshold goals are met. As a result of the approval of Local Law 97 in 2019, annual emissions levels from buildings will decrease by 8 MtCO₂ by 2030, compared to

2017 levels. When you compare these numbers to the 80x 50 goals, we see that buildings will still be significantly far away from the 8-9MtCO₂ ambition in place for 2050. A conclusion drawn from this finding is that though pro-active, Local Law 97 is less than half of the story. Beyond 2030-2034, to reach its goals New York City will likely need to create additional building legislation to cut greenhouse gas emissions to meet defined goals. In this sense, it is all the more relevant to create studies such as this one to analyze responses to the law and how it can be made “smarter”. In this sense, it is recommended that New York City run annual surveys to 1.) assess where they are as they relate to their carbon emissions goals, 2.) listen to the potential obstacles faced by building owners. As gauged from this thesis, this community faces unique obstacles in practice that can only be drawn from the people working on the problem in the field. From listening to those perspectives, we may be able to better refine legislation.

Within the main thesis question, the topic concerns the social implications of Local Law 97 indicating the relationship between decreased emissions, increased air and environmental quality and the potential health, well-being, and productivity co-benefits that may occur between having a more sustainable building stock and better health-related outcomes. In reading of the current law, and within many of the governmental publications distributed by New York City pertaining to Local Law 97, health impacts are rarely integrated into the studies, if at all. Therefore, it is recommended that additional research be conducted in this area to further understand the types of benefits to be accredited through enhanced environmental quality. Because emissions are so hyper-localized, these studies could analyze the benefits neighborhood by neighborhood, nicely complementing the epidemiological research citing health concerns in various New York City neighborhoods. The potential disparity between class and race, as many of the impacted buildings are in Manhattan - impact of air pollution on mortality - community of color will continue to be impacted without a particular focus on communities of color who are already more susceptible to worse air quality and premature death. By undertaking this type of research, we could better estimate the financial impacts of a decrease in the mortality rate, decreases in absenteeism from work, fewer hospital visits etc. and tie these benefits into enhanced building performance required by Local Law 97.

These findings will tie in nicely, and potentially change the conversation around the financial implications of Local Law 97. As presented in the findings, the financial implications occur on the city scale, impacting job growth due to a greater need for a building energy sector-related workforce and the billions of dollars of deep energy retrofit-related work that will be required by the legislation. At another scale, this law impacts the financial performance of individual building owners and their organizations, with the average fine being in the hundreds of thousands of dollars for a typical firm.

Concluding on the question concerning how New York City developers are responding, it can be concluded from the Likert scale and free response range of questions that building owners have general favorability towards the current writing of the law. That said, the resistance didn't come from the ambitions of the law, as it seems like most building owners understand the immediacy of reacting to climate change and the potential opportunities embedded within limited greenhouse gases into the atmosphere. Their reluctance was more geared towards the alignment of incentives between themselves and tenants, as well as with the goals of the state, such as the retrofitting the New York City energy grid zone.

In response to this, it seems like the greatest challenge is already won getting owners on board with why it is important to mitigate energy emissions. In regards to their other concerns, one recommendation would be for New York City to provide amendments to Local Law 97 that more succinctly fit the narrative of the law, in terms of shared responsibility, the alignment of incentives, and the other major infrastructure projects occurring contemporaneously with this law, such as studies and status updates to retrofit the grid, and where the city itself is with its own progress as they relate to building emission mitigation. More specific recommendations will be provided in later paragraphs as they relate to each subtopic.

Completing this section on the conclusion drawn from the main thesis questions, the following recommendations are: (1) New York City should conduct annual assessment of Local Law 97 to explain where the city is in relationship to its annual goals, and combine surveys from building owners into the publication to potentially highlight successful case studies, but also incorporate building owner feedback (as this thesis has done) to make the legislation assessment more

cyclical and self-reflecting in an effort to meet goals more efficiently. (2) In response to the social implications, the relationship between decreased emissions and increased health outcomes needs to be addressed. Addressing the co-benefits of this legislation may help it gain some favorability between building owners and tenants who are likely to also be impacted. (3) Regarding the financial implications, the City needs to provide transparency about what is to be done with the potentially hundreds of millions of dollars of fines collected. (4) Increased transparency provided by the city in the publication of research and status updates as they pertain to issues like the energy grid and the compliance to regulations for city-owned properties.

Conclusion for Subquestion 1

The conclusions drawn here respond to subquestion 1 of the thesis which speaks to building specific energy levels and the current concerns of New York City building owners who are impacted by the financial burden caused by this legislation.

Within this finding, the current and projected emissions requirements discussed the level to which buildings, as a whole, must contribute to meeting the 2024, 2030, and 2050 deadlines. Here, we saw points of view from building owners to get a better sense of the obstacles that are hindering their efforts to meet the Local Law 97 requirements. To reiterate, it was not the ambition of the emissions that were the obstacle or the cause of the unfavourability of the law, but rather the cohesion of the text of the law with whom is actually responsible for emissions. These obstacles will be touched upon briefly in this section and recommendations will be provided to address building owner concerns

As has been discussed, tenants are responsible for between 40-60 percent of overall building energy consumption and building owners are concerned with the energy usage that they have no control over. This percentage for overall building energy consumption varies because some tenants are more intense energy users than others. Again, a life sciences firm with their ventilation requirement and lab equipment commitments are much heavier energy users when compared to perhaps a law firm that requires plug loads for computers and typical HVAC standards. This, as has been discussed, is concerning for landlords because the potential fines

they face are dependent on a tenant who is, under the current writing of the law, not committed to or required to be held accountable for their own participations in a building's energy emissions output. This concern is meaningful because of the potential sorting mechanism discussed in the preceding chapter. Landlords who don't want to be burdened by a high energy consuming but otherwise good tenant would likely choose to sign a lease with the firm most likely to consume less energy drawing out potential firm agglomeration in New York City unable to find spaces that fit their needs. In response to this challenge, one recommendation would be a legislative amendment that provides exceptions to landlords if their tenant is from an industry with a high need to consume more energy. Meaning, within the B-Office occupancy classification, there would be a subclassification for tenant type. While this may please some of the building owners, one caveat to making this recommendation is, of course, the level of specificity then needed to make the new penalty payments. One other major concern for providing this exception then would be how it would impact the overall ambition of the law. Further analysis would have to be undertaken to understand how these exceptions may hinder this goal and where emissions would need to be cut elsewhere in order to ensure Local Law 97 meets its end goals.

An additional burden lying along similar lines to the one above is the concern of occupant density. Some office and residential units are simply denser than others. Either office workers simply don't need as much desk space, so it is easier for employers to squeeze more employees into a space, or residential units are denser than designed for simply based on the high cost of living in New York City. Either way, some spaces contain a higher density of people, and in effect, may require additional energy use per square foot, and some buildings have more foot traffic throughout the day than others. The question then is: should these spaces be penalized as if space-usage efficiency wasn't a potential sustainable success metric? From the survey responses, building owners do not think so. In response to this reaction, an additional legislative amendment recommendation would be to allow for density exceptions in highly occupied buildings. This would provide for lower potential penalty payments from landlords who are impacted high-density occupancy tenants. A similar concern here though is that while landlords may be more favorable towards the law by providing this exception, it must be ensured that by providing leeway in terms of occupant density does not hinder the end ambition of the law.

Conclusion for Subquestion 2

The conclusions provided for subquestion two correspond with some of the concerns presented in the paragraphs above. Again, the topic of tenant responsibility for 40-50 percent of energy consumption arises. This is of deep concern for real estate owners because one top of building system efficiencies, tenants are responsible for the bulk of energy emissions in buildings. The current writing of Local Law 97 does not address this statistic. In effect, building owners who have to make expensive deep energy retrofits feel like there is a split incentive and conflict of interest here (Janda et al. 2016; Kaplow 2008-2009). The owner has to make improvements, but the tenant will be the beneficiary of the benefits received through lower energy bills. The current triple net lease of most commercial properties requires tenants to pay their own utility bills, so monthly savings are seen by tenants and not landlords. In response to this split incentive, one recommendation we can pull stems from some of the literature on “green leases”.

A green lease would look like other lease agreements between landlords and tenants but help to align incentives between the two parties when it comes to energy consumption, space renovations, and potential deep energy retrofits where both parties stand to gain. One example of a green lease benefit is through capital project execution by landlords. One example of a green lease provision would be that upon the capital improvement, the landlord could amortize and recover capital costs associated with sustainable improvements to building and common areas. In addition, tenants in these lease structures often agree to pay for a portion of capital costs for specific types of efficiency projects that can be proven to reduce operating costs, as they stand to benefit from decreased energy costs as well. These costs could be derived from monthly saving projections and apply to office, residential, and retail spaces, among others. Assuming there are local tax benefits for energy saving programs, green leases could also be designed to distribute these savings as agreed upon between owner and tenant. The literature on the success of these lease types is substantial as there are sufficient precedents and case studies available that speak to the efficacy of this model.

There are some advantages that may be seen by both parties as they enter into a green lease agreement including: higher productivity and better occupant health as discussed in the literature

review on the subject, reduced environmental impacts and associate cost savings due to a reduction in energy use, higher future rent and building occupancy rates and improved public image useful for marketing by both parties

Conclusion for Subquestion 3

The finding from subquestion three addressed strategic responses as they related to the requirement of Local Law 97. In this finding, it was discussed how developers have put together internal management teams to address the issues and have created hierarchies of communications within their organizations to make sure the chain of command is knowledgeable about the work to be done in response to the legislation. From the survey responses, it was found that the majority of the participants here understand their responsibility on an individual building level and are equipped to pay the potential fines they face in the coming years. This finding may have been attributed to potential bias in the sample, as it may have represented firms with greater capacity to absorb exogenous shocks in the form of climate change legislation, but nevertheless, it is possible to make recommendations based on their responses from both the Likert scale and free response questions.

Despite the capacity of these firms to absorb shock, the survey found that one potential legislative amendment may benefit the landlord community greatly without impeding on the overall goals of Local Law 97. In this sense, one recommendation for legislative change would be to integrate a carbon credit trading policy between portfolios of buildings owned by single entities. To provide clarity, say a building owner's portfolio contained 85 properties (the average number of buildings owned in the sample). For each building, a certain amount of greenhouse gas emissions would be allocated and could be based on the thresholds allotted from Local Law 97 requirements. Within this portfolio, it is safe to assume that some buildings are better energy performers than others but let us say that 40 of them do not meet emissions requirements for 2024. Under the current writing of Local Law 97, the building owner may need to conduct 40 energy retrofit projects before that time. Though our sample seems to have a high capacity to absorb shock, even this is a pretty ambitious undertaking that may require the formation of new teams to tackle. Under a carbon credit system, the building portfolio owner would need to meet

their overall emissions allotment, but in this case, they would be able to prioritize the poorest performing buildings first, prioritizing projects that would have the greatest impacts. The deep energy retrofits for the smaller amount of buildings could potentially offset emissions from other buildings in their portfolio, and still meet emission cuts required by the legislation, though just not on an individual building level. This amendment may make the law more favorable to developers who would not also have to expand their teams to conduct 40 separate projects at once and allow for more comprehensive retrofits to occur where it will really make an impact. Based on the survey response collected from building owners 5 of 8 [62.5 percent] of survey participants would participate in this kind of program

Another major finding in the building owner strategy section discussed the possibility of market sorting by building owners who would likely find themselves in distressed situations due to the cost burdens of Local Law 97. It was hypothesized that building owners with high capacities to absorb shocks would benefit from the long term with regard to the environment, social and financial implication of the law. Building owners without that capacity may be required to sell their assets for their inability to make deep energy retrofits and/or pay penalties. In this scenario, building owners with an even high capacity to absorb shock may absorb distressed properties and benefit from making opportunistic investments to reposition the property so that it is more energy efficient and in compliance with Local Law 97.

This potential disparity became even more apparent with regard to the New York City PACE loan program. A majority of survey respondents said they would likely not participate in this program. When asked for additional clarity after the survey these owners citing having access to cheaper forms of capital elsewhere was their chief factor in deciding not to participate in this program. As it stands, PACE offers loans with 5.5 to 7.5 percent interest rates depending on the type of project to be executed. Organizations citing access to cheaper capital gave interest rate numbers in the 2 to 4% range. This means that the well-equipped and high-capacity organizations can undertake projects with a slightly smaller financial burden than their peers who may have no other option than through PACE - create a pretty disparate and unequal playing field for New York City building owners. In response to this disparity, an additional recommendation for this legislation may be to provide cheaper access to capital within the PACE program. Some major institutions with huge real estate portfolios also use what is called a Green

Revolving Fund which may work in the New York City context. Using a green revolving fund, organizations that receive loans repay the fund through savings achieved by project-related reductions in utility consumption or other operating costs and have a payback period of 1 to 11 years depending on the size and complexity of the project.

Conclusion for Subquestion 4

The findings from question 4 addressed the question of how to make Local Law 97 smarter through additional policy amendments, in addition to how the COVID19 pandemic may be a useful proxy in determining how organizations respond to exogenous shocks. These findings were mainly absorbed through building owner free response questions that asked what amendments to the legislation they would make themselves. Many of these amendments have shown up throughout the thesis, with a few specifically mentioned through recommendation here, but few others showed up specifically in this section as well.

One specific recommendation from those survey responses is a suggestion to amend Local Law 97 so that it provides time of day carbon and a roadmap for landlords to make complicated decisions. This recommendation is made because energy prices change with demand and therefore fluctuate throughout the time of the day and year. For example, during the workday, when demand is high, it is more expensive to cool your building than it would be at night. This scenario related to the energy storage deep energy retrofits mentioned in the introductory chapter. This retrofit helps the building to store energy when it is cheaper to consume and disperse it during those high-demand times of the day. When calculating the present value of a project such as this, those savings are calculated into the equation to understand the payback period of that type of equipment. The recommendation to provide a for time of day carbon information and a roadmap for complicated decisions making is in response to this information possibly not being readily available to the industry and may relate to some of the responsibility of the recently formed Commercial Tenant Program (CPT) mentioned previously. Perhaps this recommendation should be addressed by the CPT with additional transparency and guidance provided through this entity to landlords.

One additional finding in for the subquestion four pertaining to “smarter” legislation strategies pertains to the \$268 fine implemented on a per square foot basis. Despite layers of research and review, it is not clear where this number was generated. This lack of transparency has, as seen through the survey response collection and analysis, caused frustration with the building owner community due to lack of scientific evidence and justification for the number. Once simple recommendations to prove that justification and transparency in regard to the derivation of the \$268 per square foot penalty.

The final recommendation also pertained to a direct quote from the free response portion of the distributed questionnaire. In one response, the need to incorporate rent stabilized buildings under Local Law 97 was addressed as under the current writing of the legislation, if a building has at least one rent-stabilized unit it is given an exception to emissions thresholds. Given that many market rate residential buildings in New York fall under this exception because some integrate rent-stabilized units (of which there are over 2 million in New York City), this greatly limits the number of additional buildings that could fall under this legislation and likely still have the capacity to absorb the additional cost shocks. Perhaps, given some potential pushback to this recommendation, and given that so many New York City residents are already rent burdened there could at least be some leeway, or lower penalties for buildings falling under this situation, if impacted by legislative amendments that impact rent stabilized buildings.

Throughout this discussion of conclusions and recommendations, the topics have been structured to correspond with order of presentation of topics in the previous chapters. Recommendations as they pertained to each topic were addressed above but below, these same recommendations have been transposed, and abbreviated, as they correspond to three different parties: legislators, landlords, and tenants. This was done in an effort to synthesize recommendations per impacted party.

Recommendations for Legislators -

- It is recommended that New York City run annual surveys to 1.) assess where they are as they relate to their carbon emissions goals, 2.) listen to the potential obstacles faced by building owners find alternatives to the PACE program so that building owners can retrieve a borrowing cost of capital that is more competitive the current rates for pace are above 6%, whereas most companies can borrow money for cheaper, giving them an advantage in completing their projects and potential absorbing new building along the way because they have greater capacity for change.
- Provide transparency for what is to be done with the fines collected by the new Office of Sustainability with the Department of Buildings.
- Provide legislative amendment accounting for occupant type, for example, the type of tenant occupying a B-Office classification who may have different energy consumption patterns. In addition, allow for building density exceptions for buildings that have higher foot traffic. That said, ensure that too many exceptions hinder the goals of the law.
- Create a carbon trading portfolio that would allow for building owners to assess the emissions portfolio-wide and focus on their poor performing buildings first.
- Some suggestions for legislative change in regard to Local Law 97 calls for the establishment of a grading system for tenants based on their energy efficiency levels. This recommendation would be aligned with LL33 2018 where Buildings are required to post an energy efficiency letter grade in their lobbies. In an effort to help landlords decide if the tenant will potentially jeopardize their building's energy grade tenant letter grades should also be provided. This kind of amendment would also ensure that tenants are held more accountable to their own energy consumption in similar ways the building benchmarking laws did within Local Law 84. With this legislative change, corporations could contribute to the goal of meeting 80x50 too.
- PACE is potentially going to serve new construction - yes if cost of capital can be assessed against market competition.
- Place some responsibility on tenants. If corporations want to work here, and their decisions directly impact 40-60 percent of buildings emissions, they should be accountable too. In response, legislators could sponsor the programs the enhance the

willingness to accept green lease strategies (discussed further in building owner recommendations)

- Make time of day carbon information and guidance more easily accessible through the Commercial Tenant Program and expand this program to accommodate for real estate product types beyond commercial offices.
- Consider integrating some rent-stabilized buildings into the Local Law 97 legislation spending on the market versus rent-stabilized ratio of the buildings.

Recommendation for Building Owners

- Building owners and the Real Estate Board of New York should phase out the triple net lease in exchange for a green lease which favors greater transparency on energy usage between tenants and landlords and encourages these entities to partner in deep energy retrofits. In effect, incentives are aligned in that both share in energy savings and/or penalties depending on their levels of compliance with Local Law 97 requirements (Kaplow 2008-2009)
- Implement retrofits driven by data: Ensure to document before and after situations of retrofits programs and share these documents as you would a Sustainability or ESG report. to cut energy costs and achieve a faster payback period. In addition, implement retrofits that allow for the monitoring of retrofits in real time, helping the building manager to make decisions related to performance optimization.

Recommendation for Tenants

- Accept accountability in meeting Local Law 97 requirements as 40-60% of building energy consumption is determined by tenants.
- Work collaboratively with landlords to address sustainability measures upon move in, renovation of existing spaces, and move out potentially consulting the Commercial Tenant Program for best practice steps to energy consumption mitigation.
- Participate in the crafting of a green lease.

Final Conclusion:

The purpose of this thesis has been too deeply understanding the environmental, social and economic consequences of a legislation that places emissions caps on building in New York City. As of the time of this writing, this is one of the most aggressive local climate policies globally, and the only policy to assess fines in this way. It has been made clear that cities, and in effect buildings, contribute greatly to overall greenhouse gas emissions and that policies should spearhead our obligation to create a more efficient built environment. Local Law 97 is not the first piece of legislation of its kind to create that impetus for change.

Despite its ambitions there is, of course, criticism of the new legislation that needed to be research and analyzed in greater detail. In doing so, we can help craft future policies substantiated by analysis and continually evolving information. Given that so many cities around the globe are looking at replicating this, or similar, models it is imperative that we better understand the potential implications of the law by discussing it when the groups impacted by these legislative decisions. By gathering their input and addressing policy change, we can further refine legislation and ensure that we meet our climate change mitigation goals with greater efficacy moving forward.

In response to the research and analysis performed and the survey information synthesized, this thesis has discussed the many owner, tenant, market scenarios that could impact the city. In response to the discussion brought up here, the results were explained in detail with follow up conclusions, and finally, recommendations to policy-makers, building owners, and tenants who can move forward as a team to get a bit closer to meeting requirements, hopefully, with least resistance, and greater motivations.

06 APPENDICES

APPENDIX A:



QUESTIONNAIRE INFORMATION:

INFORMED CONSENT – Massachusetts Institute of Technology

QUESTIONNAIRE INFORMATION. The goal of this study is to gain an understanding of how public and private landlords/developers are responding to the New York City Local Law 97. We are interested in understanding the incentives and barriers to retrofits to affected buildings and what public policy amendment can be made in conjunction with the law. We aim to understand how this law will operate in context as it will likely serve as a model for cities around the globe. Therefore, I am speaking with a small number of planners, landlords, and developers in New York City to gain an understanding of the current response to the law.

The questionnaire contains scale questions, multiple-choice questions, and questions that ask for a written response. The full questionnaire should take between 10 and 15 minutes of your time.

COMPENSATION: Four survey participants will be randomly selected from a lottery. Each of the four winners will receive a \$100 Amazon gift card.

PRIVACY. We know that you value your privacy. All the responses that we collect will be aggregated and so your own responses will be analyzed with those of many other people. Select quotations may be used if they contain exemplary relevance or clarity, but your name or workplace will not be identified. However, since the record of your worksites exists in the public record, you may be identified through the site's morphology or procedural elements, though we will not disclose the location of the worksite. You will not be identified as an individual in any scientific report of this research. Only the researcher and the advisor will have access to identifiable data. Your identifiable data will be stored securely on password-protected files.

DISCUSSION OF RESEARCH IDEAS. Feel free to ask questions at any time during the study. I will be happy to talk with you about our research ideas and theories. Some of your questions may be redirected to the end of the interview.

WHAT WILL HAPPEN? This study involves an interview of 10 to 15 minutes; you will be free to skip any question or discontinue your participation at any time.

BY PRESSING "SUBMIT" AT THE END OF THIS SURVEY YOU AGREE TO THE FOLLOWING:

"I have read the description of the research project and hereby agree to participate. I am aware that the results will be used for research purposes only, that my identity will remain confidential, and that I can withdraw at any time if I so wish."

This research is conducted by Kristopher Steele under the supervision of MIT professor Siqi Zheng. Contact kssteele@mit.edu for more information.
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APPENDIX B: Survey Response (Official Counts)

	Statements	Definitely Not	Probably Not	Might or Might Not	Probably Yes	Definitely Yes	Total
1	All buildings under my organization's ownership will meet LL97 regulations set in place by 2024.	2	0	1	6	1	10
2	All buildings under my organization's ownership will meet LL97 regulations set in place by 2030.	3	2	3	2	0	10
3	My organization has assigned responsibility for LL97 regulations to an employee and/or team.	0	0	1	1	8	10
4	My organization has a systematic process for communication & review of LL97-related information by the most senior governance body w/ responsibility for the entity.	1	0	1	3	4	9
5	My organization has a systematic process to incorporate LL97-related decisions into planning, budgeting, evaluation, and/or similar activities.	0	0	0	6	3	9
6	My organization has assessed all buildings in our portfolio for compliance with LL97.	0	0	0	3	6	9
7	My organization knows how to comply with all LL97-related regulations.	0	0	3	3	3	9
8	My organization will pay fines due to non-compliance with LL97 by 2024.	1	2	3	2	1	9
9	My organization will pay fines due to non-compliance with LL97 by 2030.	0	2	2	4	1	9
10	My organization will use low/zero-interest loans offered as part of the LL97 program (i.e. Property Assessed Clean Energy (PACE)).	3	1	3	1	0	8
11	My organization will purchase renewable energy credits in NYC to deduct from the annual emissions limit.	1	2	2	3	0	8
12	My organization will swap accrued energy credits between our high and low performing buildings.	0	2	1	4	1	8
13	My organization will request GHG threshold adjustment based on occupational density of certain buildings under our ownership.	1	1	3	2	1	8
14	LL97 compliance will require my organization to take on capital projects that are negative net present value (NPV).	0	3	2	3	0	8
15	LL97 compliance will require my organization to take on capital projects that are zero NPV.	0	1	3	2	1	7
16	LL97 compliance will provide my organization with positive NPV capital projects.	0	2	4	2	0	8
17	If noncompliant, my organization plans to appeal the payment of fines.	1	3	2	2	0	8
18	If noncompliant, my organization has the capacity to pay required fines.	0	0	0	6	2	8
19	If noncompliant, my organization will pay fines as required.	0	1	0	4	3	8
20	Due to LL97 my organization feels discouraged to lease space to potential high-energy using tenants.	1	2	2	3	0	8
21	LEED buildings in my organization's portfolio do not currently meet GHG thresholds set by LL97 for 2024.	4	0	1	1	1	7
22	LEED buildings in my organization's portfolio do not currently meet GHG thresholds set by LL97 for 2030.	1	0	2	2	2	7
23	My organization's current sustainability goals are more aggressive than those put in place by LL97.	2	4	0	2	1	9
24	My organization's current sustainability goals are more aggressive than those of the top 10% of developers/owners in New York City.	0	2	2	3	2	9
25	My organization plans to pass additional costs caused by LL97 building improvements to new tenants through some form rental increases.	0	1	2	4	1	8
26	My organization will bear the cost burden associated with LL97 building improvements for existing tenants.	0	1	2	4	1	8
27	LL97 will make it more difficult for my organization to run HVAC systems to promote increased indoor air quality/comfort demands of my tenants.	1	0	0	5	2	8
28	My organization can lower energy-emissions without incurring additional costs on ourselves or our tenants. (e.g. optimizing ventilation settings, HVAC settings, filters, etc.)	1	3	3	1	0	8
29	Debt lenders require my organization to comply with LL97 regulations for existing developments in NYC.	2	1	4	1	0	8
30	Debt lenders require my organization to comply with LL97 regulations for planned developments in NYC.	2	1	4	1	0	8
31	Equity investors require my organization to comply with LL97 regulations for planned developments in NYC.	2	1	5	0	0	8
32	Overhead costs associated with LL97 will entice office tenants to leave the NYC office market, negatively impacting short-term (1-10 years) tenant occupancy rates in NYC.	1	3	1	3	0	8
33	Overhead costs associated with LL97 will entice office tenants to leave the NYC office market, negatively impacting long-term (10+ years) tenant occupancy rates in NYC.	1	2	2	3	0	8
34	Overhead costs associated with LL97 will entice residential tenants to leave the NYC office market, negatively impacting tenant occupancy rates in NYC.	1	1	1	4	0	7
35	LL97 will increase long-term commercial office occupancy rates in NYC as tenants align their corporate goals with reduced energy emissions.	1	4	2	1	0	8

APPENDIX B: Survey Response (Official Counts - Continued)

My organization has issued an energy mitigation plan, internal to our organization , with regard to:		Definitely Not	Probably Not	Might or Might Not	Probably Yes	Definitely Yes	Total
1	Indoor Temperature Thresholds	1	0	1	2	3	7
2	Indoor Ventilation Thresholds	0	0	1	3	3	7
3	Energy-efficient Lighting Fixtures	0	0	0	2	5	7
4	Energy-efficient Lighting Controls	0	0	0	3	4	7
5	Low-Emission Transit Incentives	2	0	1	1	3	7

My organization has issued an energy usage mitigation plan to our tenants with regard to		Definitely Not	Probably Not	Might or Might Not	Probably Yes	Definitely Yes	Total
1	Indoor Temperature Thresholds	1	1	3	1	1	7
2	Indoor Ventilation Thresholds	1	1	3	0	2	7
3	Energy-efficient Lighting Fixtures	0	1	3	1	2	7
4	Energy-efficient Lighting Controls	0	1	3	1	2	7

APPENDIX B: Survey Response (Official Counts - Continued)

	Statements	Definitely Not	Probably Not	Might or Might Not	Probably Yes	Definitely Yes	Total
1	My organization had a pandemic preparedness plan in place for our properties prior to the COVID19 Outbreak in NYC.	1	0	3	2	3	9
2	My organizations enforced work from home policies (where possible) prior to March 15, 2020. (When CDC advised no gatherings of 50+ people).	1	2	1	0	5	9
3	My organization was prepared for non-essential staff to work remotely prior to March 15, 2020.	0	1	0	2	6	9
4	The socio-economic impact caused by COVID-19 will likely delay the emission restriction timelines set by New York City for LL97.	0	1	3	3	1	8
5	The economic impact of COVID-19 will negatively impact my organization's ability to respond in time to LL97 by 2024	1	4	1	2	0	8
6	The economic impact of COVID-19 will negatively impact my organization's ability to respond in time to LL97 by 2030.	2	4	1	1	0	8
7	Capital investments into our properties made in response to COVID-19 will positively impact my organization's ability to meet LL97 requirements.	3	4	1	0	0	8
8	Capital investments into our properties made in response to COVID-19 will help to attract and/or retain commercial office tenants.	0	1	1	5	1	8
9	Capital investments into our properties made in response to COVID-19 will help to attract and/or retain residential tenants.	0	1	1	5	1	8

	My organization has issued a strategic plan, internal to our organization, in response to COVID-19 for:	Definitely Not	Probably Not	Might or Might Not	Probably Yes	Definitely Yes	Total
1	Increased Sanitation Measures	0	0	0	0	9	9
2	Additional Cleaning Regulations	0	0	0	0	9	9
3	Increased Ventilation	1	0	1	2	5	9
4	Thermal Body Scanning for Fever detection	1	1	3	3	1	9
5	Touchless/Motion Sensor Devices	1	0	2	3	3	9
6	Physical Distancing Measures	0	0	1	1	7	9
7	Increased Filtration	1	0	2	1	5	9
8	Humidity Control Levels	1	1	3	4	0	9

	My organization has issued a strategic plan to our tenants in response to COVID-19 for:	Definitely Not	Probably Not	Might or Might Not	Probably Yes	Definitely Yes	Total
1	Increased Sanitation Measures	0	0	1	1	6	8
2	Additional Cleaning Regulations	0	0	1	1	6	8
3	Increased Ventilation	1	0	2	2	3	8
4	Thermal Body Scanning for Fever detection	1	2	2	2	1	8
5	Touchless/Motion Sensor Devices	1	0	3	2	2	8
6	Physical Distancing Measures	0	0	1	1	6	8
7	Increased Filtration	1	0	2	2	3	8
8	Humidity Control Levels	1	1	3	3	0	8

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