EVALUATING THE EFFECT OF LOCAL HISTORIC PRESERVATION AND CLIMATE CHANGE ACTION POLICY ON THE PROMOTION OF OPERATING ENERGY EFFICIENCY IN HISTORIC BUILDINGS

Ethan Boote

Advisor: Kim Yao

Submitted in partial fulfillment of the requirement for the degree
Master of Science in Historic Preservation

Graduate School of Architecture, Planning, and Preservation
Columbia University

May 2018

Dedicated to my grandpa, Lynn Frederick Brumm.

Acknowledgments

There are a number of people to thank that have helped me with the completion of this thesis. Kim Yao, for her immense support as an advisor. Erica Avrami, for her research insight and commentary. Paul Bentel and Cory Herrala, who provided both verbal and written comments as readers. Michael Adlerstein, Will Cook, Jorge Otero-Pailos, and Cory Rouillard for attending my mid-review and providing feedback to me throughout the process. All of the building professionals who allowed me to interview them. And finally, Allison Arlotta, Allison Fricke, Morgan O'Hara, and Siri Olson, for providing "therapy" throughout the thesis writing process.

Table of Contents

Abbreviations

ASHP - Air-Source Heat Pump

ASHRAE - The American Society of Heating, Refrigerating and Air-Conditioning Engineers

CBECS - Commercial Building Energy Consumption Survey (Energy Information Administration)

CEQA - California Environmental Quality Act

CES - Clean Energy Standard (New York)

CHC - Cultural Heritage Commission (Los Angeles)

CPED - Department of Community Planning and Economic Development (Minneapolis)

DOE - U.S. Department of Energy

EIA - Energy Information Administration

GHG - Greenhouse gas

GSA - General Services Administration

HCM - Historic-Cultural Monument (Los Angeles)

HPC - Heritage Preservation Commission (Minneapolis)

HPOZ - Historic Preservation Overlay Zone (Los Angeles)

HVAC - Heating, Ventilation, and Air-Conditioning

IECC - International Energy Conservation Code

LEED ND - Leadership in Energy and Environmental Design Neighborhood Development

LPC - Landmarks Preservation Commission (New York City)

MEP - Mechanical, Electrical, and Plumbing

NHPA - National Historic Preservation Act

NPS - National Park Service

OHP - Office of Historic Preservation (California)

OHR - Office of Historic Resources (Los Angeles)

SBSP - Small Building Small Portfolio

SHPO - State Historic Preservation Office

SOI standards - Secretary of the Interior's Standards for Rehabilitation (unless otherwise noted)

TPS - Technical Preservation Services (National Park Service)

80x50 - reducing greenhouse gas emissions 80% by 2050

Glossary

Building Professionals - Architects, engineers, consultants and other professionals that work in the context of historic building projects.

Climate Change - The change in global and regional climate attributed to increased atmospheric levels of carbon dioxide produced by the use of fossil fuels.

Conventional Energy Retrofits - Isolated system upgrades that include lighting and HVAC equipment, generally in a simple, quick project timeline.

Deep Energy Retrofits - A whole building analysis and construction process that's purpose is to achieve high levels of energy savings, typically resulting in 30% more energy efficiency or more.

Energy Efficiency Improvements - Improvements to the energy efficiency of a building through changes to the building's envelope (including windows and insulation).

Energy Efficiency Retrofits - Any interventions that increase the operating energy efficiency of the building.

Energy Efficiency Upgrades - Upgrades to energy-consuming systems in the building to reduce energy consumption.

Existing Buildings - The wide encompassing group of buildings that are already built.

Green Building - Building projects that prioritize environmentally responsible decision-making in planning, design, construction, operation, maintenance, renovation, and demolition.

Historic Buildings - The group of buildings that have received some level of designation, either on a local, state, or federal level, and require additional review for projects involving alterations.

Old Buildings - Buildings that are not historically designated, but fit the fifty-year age requirement for listing on the National Register of Historic Buildings.

Sustainability - A broad encompassing term that reflects the act of persistently and dynamically approaching a common ideal of social, economic, and environmental needs without compromising the ability for future generations to meet their own needs. In this thesis, sustainability will refer specifically to environmental concerns associated with greenhouse gas emissions and climate change mitigation.

Image [1]
Grand Central Terminal, New York City

1. Introduction

1.1 - Research Rationale

The built environment offers significant potential for achieving climate change mitigation goals. Located within these goals is the strategy to drastically reduce of greenhouse gas (GHG) emissions through renovating and reusing existing buildings. As a small portion of existing buildings, designated historic buildings play an important role in reducing emissions in urban environments in addition to their role of providing architectural and cultural value. The 2015 Paris Climate Agreement marked an urgent change in urban policy to target greenhouse gas emissions, with fast approaching deadlines. As preservation expands the number of buildings designated on local, state, and federally historic building lists, the number of existing buildings deemed historic will continue to grow, creating the need for historic buildings to contribute meaningfully to energy efficiency improvements and climate change mitigation goals. Operating energy efficiency fits into the larger climate change narrative as an opportunity to reduce long-term building energy consumption and switch to renewable energy sources. Preservationists already use historic building operating energy consumption as an advocacy approach, citing the building's inherent energy saving features alongside embodied energy saved and sustainable land use opportunities. However, historic buildings consist of a diverse group of buildings that do not necessarily feature inherently sustainable design features. Additionally, current policy frameworks do not back up these claims, often incentivizing historic building reuse projects through ease in energy regulations, specifically energy conservation code exemptions. Conflicts exist among preservationists surrounding historic buildings and energy efficiency due to the potential negative impacts energy retrofits could have on architectural and material character, and the debate has remained remarkably stagnant for the past forty years. Through close evaluation of local regulatory conditions, climate change action initiatives, and project level decision-making, this thesis defines opportunities for changes in the regulatory environment to improve the promotion of operating energy efficiency in historic buildings. By forging the conversation between regulatory officials, historic preservationists, building professionals, and sustainability advocates, this thesis supports further exploration of how historic preservation can serve the present-day need of climate change mitigation.

1.1.1 - Historic Preservation's Discrepancy with Energy

Historic preservation and energy sustainability are intertwined in two categories involving historic building reuse: embodied and operating energy. Embodied energy is the energy expended in the material extraction, transportation, and construction of the building, while operating energy comes from the energy consumed through heating, cooling, lighting, and other electrical uses. Operating energy is also affected by the performance of the exterior envelope, where lower amounts of energy are required to heat and cool when the envelope functions to a high degree. In the past, it was common belief that reusing a building meant conserving the energy that went into the original construction; however, exact historic energy expenditures are difficult to calculate. Nevertheless, past energy does not necessarily matter to building reuse in the present because the energy has already been spent, and therefore not saved through building reuse. A more modern take on embodied energy comes from recent research by the Preservation Green Lab and the environmental benefits – including energy benefits – of building reuse. The energy spent from a building reuse project is far less than the energy spent from tearing down an existing building in order to build a highly operating energy efficient new building. So in a sense, there is energy "saved" through building reuse, however the focus is on the energy spent in the present (Preservation Green Lab 2011).

On the other hand, there is a popular claim that old buildings were designed with certain energy conserving features that make them inherently energy efficient. This stems from the idea that buildings built before modern building and energy codes were designed in a way that maximizes the building's environmental context, including design that captures light, air, and shading that regulate interior climate. This claim is applied to all historic buildings and disregards the fact that historic buildings are a large and diverse group. It ignores the possibility that some buildings are not inherently energy efficient, and that the building's urban context and use have evolved over time. The National Register of Historic Places has a fifty-year requirement, making buildings built before 1968 eligible for historic designation, and modern era buildings lack these classic inherently efficient qualities. Reports by the General Services Administration (GSA) as well as the U.S. Energy Information Administration (EIA) support the inherent efficiency claim through their study of operating costs and energy consumption per square foot (EUI). However, closer analysis of these reports suggests that the data is not convincing for proving this claim (Webb 2017). In addition, operating energy accounts for up to eighty percent of a building's overall energy consumption over the course of its lifetime, making operating energy an important target for necessary building emissions reductions (Avrami 2016).

Aside from the debate on potential energy benefits of preservation, current policies regulating historic buildings do not promote operating energy benefits at the project level. Specifically, the Secretary of the Interior's Standards for Rehabilitation (SOI standards) and energy conservation code exemptions detract from implementing energy efficiency improvements. At the same time, historic buildings abide by historic preservation policy on a local, state, and federal level that protect aesthetics of the buildings. The relationship between the aesthetic review and energy efficiency enhancements in historic building reuse projects is complicated, and the freedom granted through energy conservation code compliance exemption makes the procedures and decision-making at a project level unclear.

1.1.2 - Climate Change Urgency

The nexus of historic preservation and climate change mitigation is an evolving subject. The historic preservation field is simultaneously dealing with mitigation efforts on behalf of GHG emissions, preparation for inevitable sea level rise, and changing climates that affect historic resources around the world. The built environment as a whole plays an integral role in reducing greenhouse gas emissions as buildings accounts for 44.6 percent of greenhouse gas emissions (Architecture 2030 2017). The recent 2015 Paris Climate Conference gathered international representatives to unify strategies to address climate change. The major take away points were that global temperature warmth needs to be held below two degrees Celsius, and greenhouse gas emission reduction is key to achieving this goal with peak emissions occurring as soon as possible. As it stands currently, the global temperature is expected to reach this two-degree Celsius mark by 2030, and a 2013 panel on climate change ran feasible scenarios to counteract this from occurring. The only scenario that kept the earth below the two degree mark required emissions to peak by 2020 and fossil fuels were to phase out completely by 2055 (Strain 2016). This urgency should not be understated. This is an important time for action, and historic buildings need to be included in strategies for mitigating the causes of climate change, as they represent an expanding group of buildings in the United States.

1.1.3 - Local Focus

Across the country, 386 mayors representing over 68 million Americans have made pledges to abide by the 2015 Paris Climate agreement (Mendelson 2017). The local emphasis on climate change mitigation correlates to powerful regulatory policies for historic buildings. In addition, within cities most greenhouse gas emissions come from existing buildings, and recent climate change plans formed by cities across the country are leading by example in reducing their emissions. For example, New York City’s Mayor’s Office of Sustainability has partnered with the New York chapter of the Urban Green Council, a green building advocacy group, to educate building professionals about electrification technology that will reduce dependency on GHG-emitting heating technology that and increase reliance on renewable energy in order to address the largest portion of GHG emissions in the city (Mayor’s Office of Sustainability 2016). On the other hand, recent policy research by Columbia University's Erica Avrami showed that of eighty-seven cities throughout all fifty states, only two include energy as a part of their public policy mandate for historic preservation. In addition, there are no requirements regarding tracking or requiring certain levels of energy performance as a part of historic building designation, and local regulatory bodies have insufficient capacity to address energy performance concerns, as no heritage commissions are required to include energy efficiency experts (Avrami 2017).

The opportunity for historic preservation to play a meaningful role in climate change mitigation warrants on-the-ground operational research involving historic building regulation and building professionals' decision making. This will clearly illustrate what role historic building operating energy performance currently plays in addressing climate change mitigation goals. By analyzing the strengths, weaknesses, challenges and opportunities for promoting operating energy efficiency in historic buildings, this thesis will address a growing concern among policy makers, building professionals, and advocates for historic preservation and sustainability with regards to how historic buildings can be better crafted to align with wider societal goals for reducing the human-caused effect on the earth's environment.

1.2 - Methodology

1.2.1 - Literature Review

The literature review in Chapter 2 grounds this thesis to the existing base of knowledge surrounding this topic. Primary and secondary sources, policy, and presentations were all used to understand different points of view on operating energy efficiency in historic buildings. The sources explore the history of energy conservation codes, policy and government-published guidelines, present-day research and advocacy efforts, and quantitative energy consumption data analysis. These topics all contribute to contextualizing this thesis in relation to the current discussion, and how this discussion came about over the past forty years.

1.2.2 - Municipal Case Studies

In order to gain understanding of local activities surrounding historic preservation and operating energy efficiency, this thesis will examine three municipal case studies. These case studies were selected based on a specific set of criteria. Although case study locations may vary greatly in size, population, and historic building typology, close analysis of the effects of historic preservation policy and climate change action policy on historic building projects is meant to provide generalizing local level commonalities and opportunities for regulation processes improvements.

There were four criteria for municipal case study selection. The first criterion requires the municipality to be a Certified Local Government through the National Park Service, establishing strong historic preservation policy for the city, including the requirement for an historic preservation commission to review projects. The second criterion necessitates that the municipalities must be located in varying climate regions. The continental United States is made up of six temperature-based climate zones, with those zones receiving varying levels of humidity not dependent on temperature. For this reason, old buildings across the U.S. will achieve energy efficiency differently and respond to specific climate conditions associated with the municipality. Having varying climate regions for the case study municipalities will provide a more holistic sense for how historic buildings are responding to their specific climates through their reuse in relation to energy efficiency. The third criterion requires the municipality to have energy benchmarking mandates. This shows that the municipality is serious about environmental sustainability and will be more likely to have experience with the topic of operating energy efficiency and its relation to climate change mitigation. Finally, the fourth criterion requires the municipalities to be located within a state that exempts designated historic buildings from energy code compliance. The designation levels may vary from state to state, and in some cases, cities may adopt versions of the state energy code, however the exemption must exist. The exemption is important to note because it allows inconsistent approaches to improving energy efficiency, making it unclear how historic buildings are implementing or maintaining operating energy efficiency on a broad scale.

Through these four criteria, the case study municipalities of Los Angeles, CA, Minneapolis, MN, and New York, NY were selected for research.

1.2.3 - Policy research

For each case study municipality, historic preservation regulation, climate change action, and incentives codified in local and state policy were researched. Local historic preservation ordinances, regulatory bodies, and alterations procedures were examined in addition to the organization of state historic preservation offices, and their role in regulating historic buildings within each case study municipality. Local, state, and federal historic building reuse financial incentives were included in this policy research, as well. In addition to historic preservation policy, local and state climate change policies were researched, including city sustainability plans, and their specific goals and strategies. Regulatory maps for each municipality can be found in Appendix C.

1.2.4 - Interviews

On-the-ground research consisted of interviews of building professionals working in Los Angeles, Minneapolis, and New York City. Interview questions were standardized and asked of all interviewees in order to obtain qualitative data. The interview questions targeted the strengths, weaknesses, opportunities, and challenges associated with energy efficiency interventions in historic buildings and their respective review processes. In addition, questions pinpointed the interviewee's own experience with energy efficiency integrations, guidelines used to inform decisions, project collaborators, and property owner characterization. Interviewees were also asked about what technology they use to model or predict operating energy consumption in historic buildings. Interviewees' backgrounds ranged from architecture, historic preservation, and green building, and analysis of their interviews directly contributed to the recommendations in Chapter 7. A complete list of the questions can be found in Appendix A, and the list of interviewees can be found in Appendix B.

Image [2]
The Title & Trust Insurance
Company Building, Downtown LA

2. Literature Review

Through a critical analysis of existing literature focused on policy, government, advocacy, private research and quantitative energy consumption data reports, there can be a deeper understanding of the issues with the promotion of operating energy efficiency in historic buildings. In this chapter, Section 2.1 examines more closely the history and rationale of the energy conservation code compliance exemption. Section 2.2 focuses on the existing federal policy and government-published guidelines that inform project decision-making. Section 2.3 evaluates existing research and advocacy efforts that define the present-day conversation, and Section 2.4 analyzes quantitative energy consumption data to present a more nuanced understanding of the energy performance of older buildings.

2.1 - Background

The 1973 Organization of the Petroleum Exporting Countries (OPEC) oil embargo had outstanding effects in the treatment of building energy use. The first large-scale international scarcity of energy triggered the development of new standards, analysis, and applications to improve building energy performance, spearheaded by engineers (Smith and Elefante 2009). The newly developed standards were largely prescriptive requirements focused on building envelope, lighting, heating, ventilation, air conditioning, and water heating systems meant to conserve energy. These prescriptive requirements posed threats to historic buildings' architectural and material significance, as the majority of historic buildings were built before modern mechanical systems, with local material and vernacular construction techniques (Webb 2017).

Coupled with the development of building energy conserving treatments for new construction emerged initiatives to understand how older buildings can contribute to energy conservation. This was in part due to the threat of older building demolition due to the prevailing narrative of their energy inefficiency (Webb 2017). The Advisory Council on Historic Preservation (ACHP) during the late 1970s commissioned studies focused on embodied energy within buildings about to be rehabilitated, energy needed for construction and rehabilitation, energy needed for demolition, and energy needed to operate a rehabilitated or newly constructed building (P. J. Frey 2007). The goal for gathering this information was to develop a quantitative formula to predict the amount of energy savings involved in old building preservation. In 1979, the ACHP published a brief informational booklet outlining its findings entitled *Preservation and Energy Conservation*. In the booklet, there are direct comparisons between OPEC oil sources, U.S. Energy Consumption by sector, and the results of the quantifiable formulas used to predict the amount of energy savings in a project. One case study calculation shows that an 80,000 square foot rehabilitation project would save 90 billion british therman units (Btu) of energy, or the equivalent of 700,000 gallons of gasoline. Emphasis was placed highly on the simplicity of the ACHP's techniques and how they can be used to analyze any energy savings amount for any preservation project (The Advisory Council On Historic Preservation 1979).

The increased interest in understanding old buildings' embodied energy caused new recognition of the inherently sustainable features existing within old buildings. Preservation experts used intuitive and documented findings to conclude that old buildings offer many opportunities for saving energy simply because they were built when there was a lack of modern day building systems (Smith and Elefante 2009). The concept of inherent sustainability became a driving notion to historic building guidelines, as exemplified through the 1977 U.S. Department of the Interior preservation guidelines for historic buildings in Washington D.C. The guidelines explain that because historic buildings in D.C. were constructed before modern HVAC, they contain inherent energy conservation features like “operable windows, transoms, shutters, porch roofs, ceiling fans, awnings, attic vents, dormers, high ceilings and party wall construction” as well as “trees and landscaping to maintain a comfortable environment inside the building.” The guidelines go on to state that “maintaining these and other inherent energy conserving features of historic buildings and landscapes not only helps to reduce energy consumption, it also preserves the character of historic buildings and districts" (U.S. Department of the Interior 1977, p.1).

The concept of inherently sustainable features was heavily biased by preservationist observation rather than substantive data (Smith and Elefante 2009). This lack of data sparked efforts to study the operating energy consumption of older buildings throughout the 1970s and 1980s. These efforts produced results that generally revealed older buildings had the lowest operating energy consumption per square foot compared to other existing buildings. Although limited in scope, the findings from these studies were packaged alongside embodied energy calculations and documentation of inherently energy sustainable features to create the argument that preserving old buildings is a necessary practice for nationwide energy conservation. This argument was solidified at the National Trust for Historic Preservation's 1981 symposium *New Energy from Old Buildings*, where findings from the past decade of research on preservation and conservation were presented in order to enact better policy more targeted towards easing the relationship between prescriptive requirements for new construction energy conservation versus old building energy retrofits (Webb 2017).

Although the old building energy conserving argument depicts a positive picture for old buildings and their potential contributions to reducing U.S. energy consumption, the fact remained that energy conservation codes were prescriptive threats to historic building fabric. Unfortunately, the changing political climate in the United States in 1981 diminished the efforts to enact policy directed towards historic building energy regulation after the election of Ronald Reagan in 1980 (P. J. Frey 2007). Energy code exemption for historic buildings became the norm while the narrative of inherently energy efficient historic buildings persisted throughout the following decades, and continues to prevail as an advocacy method for climate change mitigation strategies (Webb 2017).

2.2 - Policy and Guidelines

Multiple levels of historic preservation government agencies throughout the United States have issued justifying literature to support the notion that historic buildings can offer adequate energy performance. The policy framework and literature produced by governments on the federal, state, and local levels creates a building project decision-making environment heavily focused on voluntary energy efficiency interventions framed through traditional material and design focused preservation guidelines.

On a federal level, the National Historic Preservation Act (NHPA) clearly states in its purpose that the United States' irreplaceable heritage is important to public interest because "its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of America."[1] This legislation from 1966 pre-dates the 1970s energy crises and the subsequent increase in awareness and regulation of building energy consumption. The inclusion of energy alongside more highly emphasized aspects of historic preservation seems mismatched. Over the course of the decades following the NHPA, cultural, educational, aesthetic, inspirational, and economic benefits all became fortified by federal policy through review and financial incentive processes, with few corresponding incentives for energy.

Section 106 of the NHPA clearly outlines a review process that forces potential adverse effects to federally listed historic resources to be avoided, minimized, or mitigated.[2] Section 4(f) of the Transportation Act offers similar review processes with more direct language for minimizing impacts and avoiding any negative diminished environmental impact associated with Federal Highway Administration and Department of Transportation agency projects.[3] The Federal Historic Tax Credit offers financial incentive for building reuse, triggering regulation of aesthetics while also providing feasible financing. All of these processes require listing on or eligibility for the National Register of Historic Places, which evaluates buildings for their cultural, educational, aesthetic, and inspirational attributes. Throughout all of these policies, energy in general is left out despite inclusion in the NHPA's purpose.

The absence of explicit energy policy and inclusion in regulatory processes, combined with the blanket exemption from energy code compliance, allows for preservationists to control operating energy efficiency interventions in historic buildings by providing energy sustainability guidelines for voluntary decision-making. These guidelines piggyback on the SOI standards to provide opportunities for compliance and energy retrofits. Created in 1979, the SOI standards were adopted by federal, state, and local regulatory bodies to unify treatment standards for historic properties. The standards were initially purposed to enable a creative environment for design solutions in historic buildings that were undergoing adaptive reuse projects, however over time, their regulatory power has encouraged more unified solutions to building rehabilitation because of the certainty they provide for regulatory approval. Their heavy emphasis on repairing versus

---

1 National Historic Preservation Act, 54 U.S.C. § 100101 (1966).
2 National Historic Preservation Act, 54 U.S.C. § 306108 (1966).
3 The U.S. Department of Transportation (USDOT) Act, 49 U.S.C. § 303 (1966).

replacing has potential to only extend the service life of various building parts to a time when replacement is the only option. Baird Smith and Carl Elefante discuss this problem and argue that "sustainable-design technologies developed in the broader design and construction industry may have little application in historic properties unless the Secretary's Standards can be revisited"(Smith and Elefante 2009, p. 21).

In 2011, the National Park Service Technical Preservation Services (NPS TPS) updated *Preservation Brief 3: Conserving Energy in Historic Buildings*, including a stronger focus on emerging energy saving technologies and alternative energy sources. The brief elaborates on technical guidelines for improved efficiency through occupant behavior, mechanical system upgrades, insulation in the attic, roof, and basement, storm windows, insulated ducts and pipes, weather-stripped doors and shading devices. Although there is a heavy focus on inherent design features of historic buildings, the brief includes recommendations for reasonable technological upgrades, including programmable thermostats, CFL and LED lights, motion sensors, and upgraded mechanical systems (Hensley and Aguilar 2011). Overall, the strategy presented avoids alterations that would alter the historic fabric as much as possible, in lieu of minimally invasive interventions coupled existing inherent energy saving design features.

Alongside *Preservation Brief 3: Conserving Energy in Historic Buildings* the NPS TPS released "The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings." The illustrations depict recommended and not recommended strategies for approaching building maintenance, windows, weatherization, insulation, HVAC, solar technology, wind power, roofs (cool roofs/green roofs), water efficiency, and day lighting, similar to the strategies presented in the preservation brief. The recommendations follow the SOI standards as well as offer a more analytical and less invasive approach to buildings, considering their historic materiality (Gimmer et al. 2011).

Despite widespread discussion of energy efficiency in historic buildings, the current policy environment promotes a voluntary decision-making process that puts most pressure on the building project level to increase operating energy efficiency. The basis of these voluntary decisions is heavily focused on meeting the SOI standards, placing more emphasis on passing through regulatory processes and copying rehabilitation strategies for more predictable approval. Sustainability guidelines coupled with the SOI standards offer positive solutions, however not when alterations like window replacements compromise the standards. Erica Avrami points to these issues when she argues that the "disconnect between rhetoric and practice suggests that the energy consumption benefits of historic buildings is used to rationalize the cause of historic preservation, but has yet to substantively realign preservation's goals toward a more sustainable built environment " (Avrami 2016, p.3).

2.3 - Research and Advocacy

As mentioned in Section 2.1, the narrative that historic buildings carry embodied energy savings, adequate operating energy performance, and inherent design qualities has been used to encourage more robust preservation activity, while substantive data to support these claims was lacking. Over the past 40 years, the claims have been influenced by various new trends in research, and most recently by the discussion of the built environment's role in exacerbating the cause of climate change; however, until recently, underlying assumptions have not drastically evolved.

One of the most influential reports of recent years for preservation sustainability advocates is the Preservation Green Lab's "The Greenest Building: Quantifying the Environmental Value of Building Reuse" from 2011. The findings state that building reuse almost always yields fewer negative environmental impacts than building new; it takes between 10-80 years for a new building that is 30% more efficient than average performing existing buildings to overcome the negative climate change impacts related to a construction project; and the quantity and type of materials used in a building renovation can either reduce or negate the environmental benefits of reuse. This takes into account material life cycle assessments that show how some materials could contribute to negative environmental impacts, which if used, could outweigh other positive environmental impacts of building reuse (Preservation Green Lab 2011). This report is important because it provides a holistic foundation for claiming the environmental sustainability of old building reuse, but the report still relies on the narrative of old buildings having inherently energy saving features, pairing it with positive environmental benefits in other building industry areas like land and material use.

Continuing their research two years later, the Preservation Green Lab released "Realizing the Energy Efficiency Potential of Small Buildings" to address a significant portion of the building stock: The Small Buildings Small Portfolios sector (SBSP). The SBSP sector represents 4.4 million buildings containing 7 million businesses, of which 84% of these businesses are small businesses. In working with the Commercial Buildings Energy Consumption Survey (CBECS), they identified that there is a possibility for 45% energy savings, which is around 17% of the energy consumption in the commercial sector as a whole. These buildings are characterized by being less than 50,000 square feet (with an average of 8,000 square feet), and most of them have owners that are heavily involved in the operational decision-making (Preservation Green Lab 2013). The Preservation Green Lab's 2013 report differs from the 2011 report in that it takes a more economic route to building preservation, with the ultimate goal of reducing building sector energy consumption. They group together a disparate group of commercial buildings (whether or not they are historic) and address the needs of reducing energy costs by opening up the potential for owners to reduce energy consumption, using data from the CBECS to analyze different typologies and uses. However, both of them exhibit the opportunities that building reuse plays into environmental impacts. Although not necessarily focusing entirely on operating energy, the ability for old and existing buildings to use less energy and the potential environmental benefits of their increased efficiency are demonstrated by the research in both reports.

Along the lines of the two Preservation Green Lab reports, The Consortium for Building Energy and Innovation released "Federal Historic Preservation and Energy Efficiency Policies: Exploring Alignments and Conflicts" in 2013 to assess where alignments and conflicts exist between federal energy efficiency standards and the SOI standards. Researchers interviewed a wide variety of building professionals involved in the historic preservation field to gather information on improvements like windows, insulation, heating/cooling systems, and renewable energy sources. Overall, the findings suggest that these improvements depend highly on the specific building and location, and that there is no direct conflict between making historic buildings compliant with federal energy efficiency standards and the SOI standards. They note that there is a lack of knowledge of historic preservation professionals about green building policy, and there need to be large efforts in creating flexible policy that would allow for historic buildings to be more receptive to potentially future, more resilient, energy policy (Mason et al. 2013).

Combining embodied and operating energy benefits with broader environmental sustainability approaches is common when advocating for historic building reuse. This approach has been captured by U.S. Green Building Council's LEED program, a voluntary certification program that awards buildings for incorporating green building tactics. Historic buildings often seek LEED certification during reuse projects because of the flexibility allowed in the certification process to integrate environmentally sustainable features. For example, the LEED for Neighborhood Development (LEED ND) offers accredidation points for historic building reuse because of their location within an already existing land use pattern that favors sustainability. This is based on the observation that historic building neighborhood context can become green neighborhoods characterized by their small-scale mixed-use typologies, however this doesn't necessarily offset building energy inefficiencies. The U.S. Green Building Council states that historic building reuse is environmentally beneficial because "they are generally located in areas that are already served by transportation and utility infrastructure" and were "developed before the rise of automobile, [are] human scale [and] by necessity denser, more compact, and walkable" (U.S. Green Building Council 2013, p.6).

In 2009, the Ohio State Historic Preservation Office funded a study to see how LEED ND could successfully be applied with the SOI standards in Cincinnati's Over-the-Rhine neighborhood in order to evaluate the ability for historic buildings to become environmentally sustainable and pass through historic preservation project review processes. The study examined four historic properties and focused on the design, local commission or SHPO review, and LEED accreditation green building approaches. All four properties reused the building as residential, and found that they would both be able to meet the SOI standards – thus passing various review processes – and receive some level of LEED ND accreditation (Morgan and Matts 2009). LEED ND offers accreditation points for reusing existing and historic buildings if at least fifty percent of the building is reused. In addition, points for location (walkable streets), brownfield redevelopment, mixed-use centers, and tree-lined (shaded) streets can be awarded (U.S. Green Building Council 2013). Nonetheless, operating energy efficiency is not stringently targeted in this process, as a number of broad environmental benefits are grouped together to certify an historic building as environmental sustainable.

At the 2017 Association for Preservation Technology – National Trust for Canada Joint Conference, Edward Mazria and Carl Elefante reframe the preservationist standpoint in the climate change action debate. They plead for preservationists and architects to be the leaders in reducing GHG emissions in their projects.

Their argument centers on recent urbanization trends and the fact that most buildings built today will have to serve future populations. They wrestle with the balance between advocating for building material and cultural value and incorporating heritage into urban growth, arguing that heritage professionals need to be a stronger voice in these matters for closer case-by-case analysis. They redefine the preservationist sustainability argument to prioritize carbon emissions through life cycle assessments and energy consumption, strongly advocating for the widespread implementation of net-zero energy conservation codes in order to successfully meet the goals of the 2015 Paris Climate Agreement (Elefante and Mazria 2017).

These research and advocacy efforts shape the broader narrative for how historic buildings contribute to modern day efforts for energy sustainability. Patrice Frey, former Director of Sustainability Research at the National Trust for Historic Preservation, takes a strong stance over the necessity that building reuse can positively contribute to climate change mitigation goals because of the noted greenhouse gas emissions savings through embodied energy, embodied carbon, land use, and operating energy. In this way, she frames the building reuse issue as an economic one, claiming that building reuse often faces economic feasibility challenges, rather than energy regulatory challenges (P. Frey 2008). More recently, Stephanie Meeks and Kevin C. Murphy spend a chapter advocating for historic preservation's permanent incorporation into climate change mitigation goals in their book *The Past and Future City*. Meeks and Murphy focus on the need to make embodied energy savings and operational energy savings more easily integrated into sustainability policy and advocacy. Specifically with regards to energy codes, they advocate for reforming inflexible prescriptive energy code to outcome-based codes for actual measured operating energy performance (Meeks and Murphy 2016).

2.4 - Quantitative Energy Data Analysis

Research focused on operating energy in old buildings comes from a variety of sources, ranging from public to private, however preservationists have tilted results to frame old buildings' operating energy efficiency in a better light. In 1999, the General Services Administration (GSA) released the report "Financing Historic Federal Buildings: An Analysis of Current Practices" which found that GSA-owned commercial buildings listed on the National Register of Historic Places had 27% less utility costs than other GSA-owned commercial buildings considered "non-historic". The GSA argued that these findings resulted from inherent energy efficient design features of their historic buildings, including thick, solid walls for greater thermal mass, as well as transoms, high ceilings, and large windows for day lighting (Ramirez and Horn 1999).

In 2003, the Energy Information Administration's Commercial Building Energy Consumption Survey (CBECS) found that buildings constructed before 1920 use less energy per square foot than any other building in any other decade until the year 2000. Granted, the difference between the energy consumption per square foot of buildings built before 1920 and between 1946 and 1959 is minimal, this continues to support the narrative that old buildings operate with some level of efficiency over other buildings built throughout

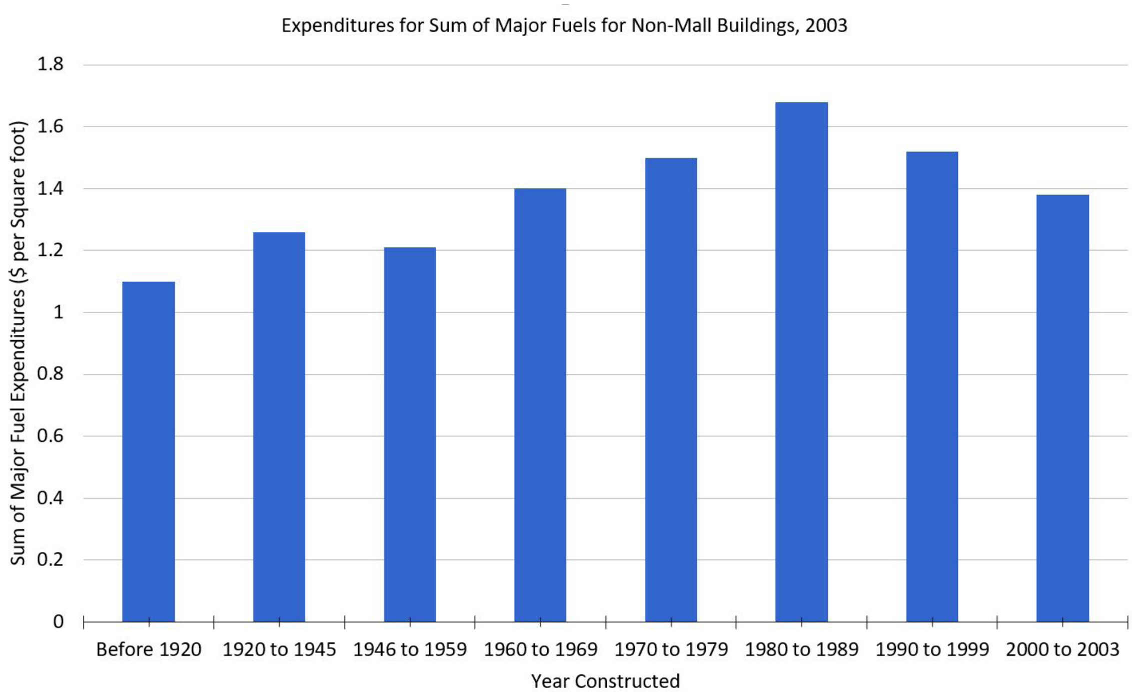


Figure [1]. Average energy consumption per square foot based on building construction date.

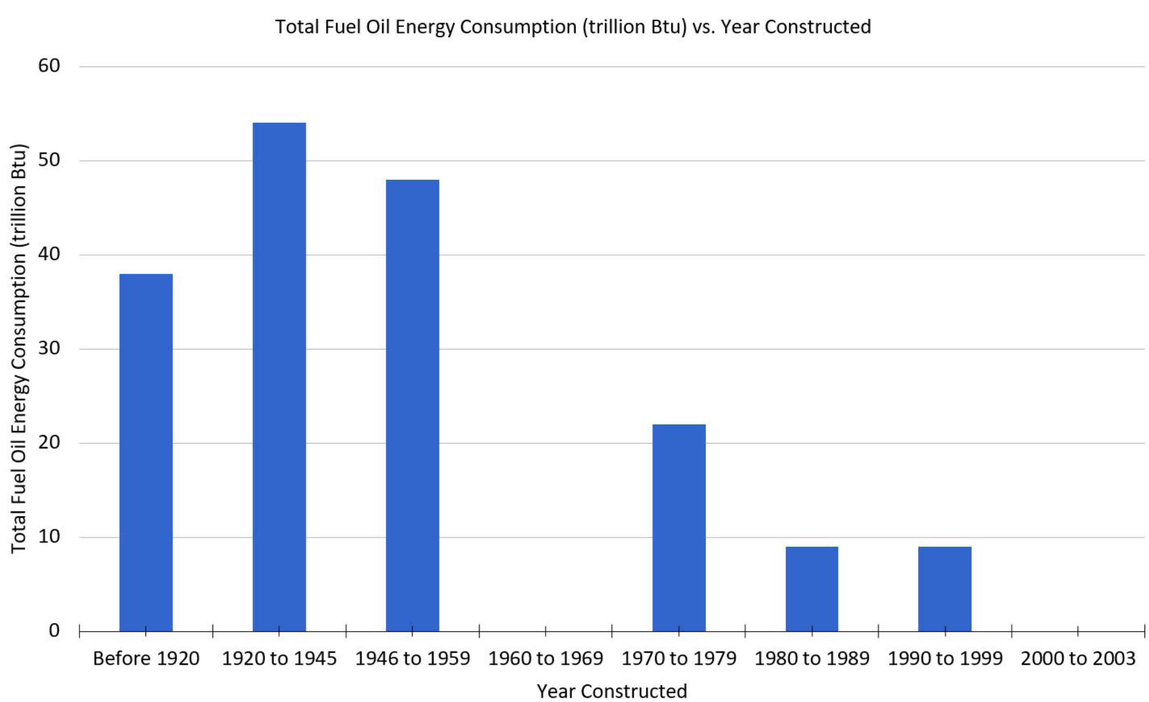


Figure [2]. Total fuel oil consumption compared to building construction date the twentieth century (U.S. Energy Information Administration 2003).

The survey also gathered operating energy expenditures per square foot, and there is a clear pattern of cheaper operating costs per square foot for older buildings, especially those built before 1960. As a source, fuel oil accounts for much higher rates of building energy for buildings built before 1959. The fuel oil data for 1960-69 and 2000-2003 was inconclusive (U.S. Energy Information Administration 2003).

These data reports have been widely cited by preservationists to support the narrative of historic buildings' inherent energy sustainability. However, closer examination of the EIA report shows a more complicated relationship between old buildings and energy performance that debunks the widespread preservationist claim about their inherent energy sustainability. Data analysis confirms that the relationship between the year-built and energy unit intensity (EUI) variables is weak. Amanda Webb pointed out in her dissertation that EUI is not necessarily accurate when comparing the energy performance across a wide set of buildings. She notes that her findings challenge the widespread preservation inherent sustainability advocacy narrative with a "more complex, nonlinear trend impossible to describe as succinctly as preservation conserves energy" and argues for more accurate energy performance based on a cubic area and energy consumption (Webb 2017, p.30). Practitioners recognize this discrepancy as well, noting that EUI does not accurately capture the whole picture for building performance, agreeing that it ignores the physical space provided for an activity (Carroon 2012).

2.5 - Conclusion

The fairly vague and consistent approach preservationists take for claiming the energy sustainability of historic buildings needs closer evaluation. While some reports statistically show that buildings built 100 years ago have better performance based on energy consumption per square foot, closer analysis and numerous reports continue to show that this claim falters. Inherently energy efficient features and the 1920 year-built discussion limit historic buildings to a niche group of buildings. Meanwhile, preservation is not exclusive to this niche group of buildings, as buildings are eligible for designation if they are fifty years or older, and take into account socially significant dimensions separate from building design. Research focused on sustainability and preservation incorporates widespread topics like embodied energy and land use with operating energy to create a stronger advocacy argument, while the research scale has largely been on the national policy level. The narrative of energy improvement retrofits and historic buildings being at odds must change to acknowledge that more sufficient retrofits will enable long-term future use and adaptability of the building as needed by the demanding onset of inevitable climate change.

3. Energy Codes

3.1 Introduction

While energy codes throughout the United States vary in organization and standards, historic buildings are consistently exempt from compliance. Energy codes serve the purpose to hold new and existing buildings to higher standards of energy performance, and their continual updating creates an evolving relationship between new energy conservation techniques and the building industry. However, historic building exemptions inhibit the relationship between historic buildings and new energy conservation strategies by providing a path for non-compliance. The straightforward blanket exemption for all historic buildings repeats itself in local codes across the country, making this the norm for the treatment of operating energy efficiency in historic buildings.

3.2 Model Energy Codes

Energy codes throughout varying jurisdictions can be adopted based on model codes, which are developed and maintained by a third party organization. Updates to the codes occur every couple of years to ensure the requirement of new energy conserving technologies, and more stringent standards. Model codes are not law, however they provide guidance for states in adopting and customizing their energy codes to fit their unique environment (Martin 2010). The United States does not have a nationwide energy code, however through the Building Energy Codes Program, the U.S. Department of Energy (DOE) provides technical assistance to state and local governments to help facilitate the adoption process (U.S. Department of Energy 2013). When developing model codes, third party organizations allow for open and transparent processes through multiple public comment periods, and the DOE is required to participate in these conversations. Federal law requires that the DOE publish their determinations for whether or not new updated additions to model codes will improve energy efficiency, while also publishing full disclosure of methodologies and public input solicitation for how their determinations were made (U.S. Department of Energy 2014).

Two of the model code development organizations that provide technical baseline standards for most states and jurisdictions are the International Code Council (ICC) and the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) (Alliance Commision on National Energy Efficiency Policy 2013). Although the model codes create a uniform source for local adoption, no two states and local jurisdiction's energy codes are alike, as they are customized based on local conditions, climate, building practices, materials, union rules, and political considerations. With over 40,000 political subdivisions enforcing codes, there are significant variances (Martin 2010).

3.2.1 International Energy Conservation Code (IECC)

The International Code Council (ICC) develops model codes for buildings in a number of different contexts. Within their family of codes is the International Energy Conservation Code (IECC), which is written to encourage energy savings through envelope design, mechanical systems, and lighting systems using new materials and techniques. The code is applied to commercial, residential, new construction and additions, alterations, renovations, and repairs to existing buildings. Compliance can take the form of either abiding by prescriptive requirements or proving energy performance (Martin 2010).

The IECC has released new editions every 3 years since 2000, with the first edition from 1998. IECC 2015 is the most recent edition, while IECC 2018 is still in development. Each edition is meant to increase the energy efficiency of the buildings they regulate. According to the DOE, the difference between the 2006 and the 2009 editions is that the 2009 edition will be 18-22% more energy efficient than the 2006 edition (Martin 2010). That being said, there are various trends in the development of the energy codes to make buildings more energy efficient, as identified by a representative from the ICC, Shawn Martin:

i. Expanded adoption (by states, federal, federal housing initiatives, energy efficient mortgage programs, etc.)
ii. Increases in mandatory fenestration and insulation values
iii. More extensive efforts to plug leakage points in the envelope
iv. Improved controls for HVAC systems
v. Enhanced duct and system sealing
vi. Increased emphasis on equipment sizing and efficiency
vii. Move toward more holistic views of sustainability (Martin 2010)

These trends are coupled with advancements in technology, as well as research indicating the need to reduce greenhouse gas emissions in buildings through higher energy efficiency and more robust use of renewable energy sources (New Building Institute 2013).

Efforts to improve energy efficiency in new buildings can easily incorporate new technologies, however energy efficiency requirements in existing buildings are not as obvious. At the ICC level, different provisions applied to additions, repairs, or alterations are not always recognized due to the lack of clarity in the definitions of each type of building work. The lack of application of IECC to historic buildings through compliance exemption across many jurisdictions has caused energy conservation advocates to claim the exemption as a missed opportunity for energy savings. The most recent 2015 IECC codes approved a collaborative proposal by the American Institute of Architects, Preservation Green Lab, the Washington Association of Building Officials, the Institute for Market Transformation, and the New Buildings Institute to clarify the definition of "historic building" and to limit the exemptions from IECC compliance. This involved requiring new additions to historic buildings to comply with IECC, and make other IECC provisions in historic buildings "contingent on the submission of a report detailing why the provision would be detrimental to the historic character of the building"(International Code Council 2015). Therefore in the 2015 IECC, historic buildings are still exempt from compliance, however their exemption is contingent upon a report submitted to the code official "signed by the owner, a registered design professional, or a representative of the State Historic Preservation Office or the historic preservation authority having jurisdiction, demonstrating that compliance with that provision would threaten, degrade, or destroy the historic form, fabric or function of the building" (International Code Council 2015). Although the 2015 IECC approved this proposal, the new provisions' adoption into state and local energy code rests upon decision-makers at those levels, and it is unclear how many jurisdictions will begin to make these changes.

3.2.2 The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is similar to the IECC in that it seeks to create more energy efficient buildings through both prescriptive and performance based strategies, however ASHRAE is more limited in scope to commercial buildings and high-rise residential buildings. Beginning in 1975, ASHRAE published Standard 90.1 for Energy Conservation in New Building Design. ASHRAE 90.1 and its regularly updated versions have been widely adopted as standards for building energy efficiency. In 1992, the federal Energy Policy Act mandated that all states adopt ASHRAE 90.1 as the minimum requirement for commercial and high-rise multifamily residential buildings. However, various versions of ASHRAE 90.1 exist, and there is no direct federal enforcement law. Instead, federal government resources are supplied to states and local jurisdictions in order to demonstrate their energy compliance (Alliance Commission on National Energy Efficiency Policy 2013).

The most recent update to ASHRAE 90.1 is ASHRAE 90.1-2016, with a total of 121 addenda. The changes to ASHRAE 90.1-2016 include format changes for easier use, revised climate maps, and a new performance-based compliance path. In addition, 49 of the 121 addenda specifically have energy efficiency improvement impacts. The revised climate map incorporates global warming trends, with the addition of a Climate Zone 0 for "Extremely Hot". Ten percent of the counties in the U.S. were reassigned to warmer climate zones as a result of the map revisions. Similar to the IECC, trends in ASHRAE 90.1-2016 revolve around envelope improvements, including more stringent fenestration prescriptive requirements. There are also new requirements for HVAC equipment efficiency and lighting, with higher attention paid to unoccupied spaces and sensors (Phoenix 2015).

Finally, Appendix G of ASHRAE 90.1-2016 gives a new path to compliance that relies on the Performance Cost Index (PCI), which is equal to the ratio of the proposed building performance to the baseline building performance. This compliance path is meant to increase flexibility in design options, reduce energy modeling costs, encourage software creation to automate performance modeling, and provide credit for good design practices. These design practices include having suitable HVAC systems, right-sizing HVAC systems, optimized in building orientation, and utilizing thermal mass (Hart 2017). These updates to the code face similar challenges as the IECC with adoption processes varying across the country between state and local levels.

ASHRAE's relationship with historic buildings, however, differs from the IECC. ASHRAE's past focus on new buildings has shifted in recent years to focus on existing buildings, including historic buildings. ASHRAE President Tom Watson (2012-2013) called for ASHRAE to "provide guidance for a variety of building applications, including historic buildings" arguing "they are too valuable and leave too large an environmental footprint to be neglected or abandoned"(Phoenix 2015, p. 13). The result of this effort is the creation of ASHRAE's Guideline 34P "Energy Guideline for Historical Buildings and Structures." Guideline 34P is not part of the official code, however it offers advice and procedures for improving energy efficient operations and maintenance, while increasing efficiency of the building's energy-using systems and equipment. The advice and procedures are meant to limit the effect on historic building preservation goals and include advice about:

i. Needs for envelope rehabilitation and restoration to control heat and light transfer and limit air infiltration
ii. The need for HVAC system energy efficiency while providing acceptable indoor envi ronmental quality
iii. The need for lighting systems that provide energy efficient solutions while maintaining historic qualities.(Phoenix 2015, p. 14)

Included in the scope of Guideline 34P are buildings listed on the National Register for Historic Places or buildings defined as historic by local codes. At the time of this thesis, no ASHRAE 90.1 version has made specific mandates for historic buildings.

3.3 - Local Adaptations of Energy Codes

3.3.1 Los Angeles, CA

Los Angeles energy codes comply with the California State level through Title 24’s Part 6 in the California Code of Regulations. Title 24 outlines the standards for building energy efficiency for both residential and nonresidential buildings in Part 8, and is presently based on IECC 2012 and ASHRAE 90.1-2010. Adopted first in 1976, the standards have been periodically updated by the California Energy Commission, which was established in the 1975 Warren-Alquist Act to give specific direction to the areas the standards address, specify the criteria that must be met in the standards' development, and provide implementation tools, aids, and technical assistance. Since 1976 the codes have evolved to reflect changing strategies for improving building energy efficiency, including the option for complying with prescriptive or performance standards. The Public Resources Codes Sections required the Energy Commission to develop performance standards in addition to the more typical prescriptive standards. The purpose of these performance standards were to establish a more flexible building design and construction process, that allows more freedom given that proof of the overall efficiency of the building is the same as if the building met prescriptive code requirements. The performance requirements are set up using energy budgets, which are measured in terms of the amount of energy consumed per square foot of floor space (California Energy Commission 2016a).

The codes break down the requirements into eight different sections delineated as mandatory requirements and performance versus prescriptive approaches. Most sections of the chapters in Building Energy Efficiency Standards do not apply to qualified historic structures as defined by the California State Historic Building Code, however certain sections about prescriptive lighting requirements do require qualified historic structures to comply (California Energy Commission 2016b).

> **<u>Title 24, Part 6, Subchapter 1, Section 100 - Scope</u>**
> EXCEPTION 1 to Section 100.0(a): Qualified historic buildings, as regulated by the California Historic Building Code (Title 24, Part 8). Lighting in qualified historic buildings shall comply with the applicable requirements in Section 140.6(a)3Q.[1]

Qualified historic structures are defined as:

> As defined in Health and Safety Code Section 18955 as "Qualified Historical Building or Property." Any building, site, object, place, location, district or collection of structures and their associated sites, deemed of importance to the history, architecture or culture of an area by an appropriate local, state, or federal governmental jurisdiction. This shall include historical buildings or properties on, or determined eligible for, national, state or local historical registers or inventories, such as the National Register, State Historical Landmarks, State Points of Historic Interest, and city or county registers, inventories or surveys of historical or architecturally significant sites, places or landmarks.[2]

However, certain sections about prescriptive lighting requirements do require qualified historic structures to comply.

> **<u>Title 24, Part 6, Subchapter 5, Section 140.6(a)</u>**
> Prescriptive Requirements for Indoor Lighting Exceptions (Q): If lighting systems in qualified buildings contain some historic lighting components or replicas of components, combined with other lighting components, only those historic or historic replicas are exempt. All other lighting systems in qualified historic buildings shall comply with Lighting Power Density Allowances.[3]

> **<u>Title 24, Part 6, Subchapter 5, Section 140.7</u>**
> Requirements for Outdoor Lighting Exceptions (12): Outdoor lighting systems for qualified historic buildings, as defined in the California Historic Building Code (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.[4]

---

1 Cal. Code Regs. tit. 24, part 6, sub chp. 1 § 100.0(a)
2 Cal. Code Regs. tit. 24, part 8, chp. 8-2 § 8-201.
3 Cal. Code Regs. tit. 24, part 6, sub chp. 5 § 140.6(a)
4 Cal. Code Regs. titl. 24, part 6, sub chp. 5 § 140.7

The State Historic Building Code has a wide-encompassing definition of a "qualified historic building". The definition expands the grouping of buildings beyond buildings officially designated by a governing body, but also to those included in historic resource surveys. However, in Subsection 5's indoor and outdoor prescriptive lighting requirements, there is clear language about new lighting not in character with historic lighting and its compliance. It is the only instance in the energy codes that requires qualified historic buildings to comply with standards.

3.3.2 Minneapolis, MN

The most recent version of energy conservation codes for buildings in Minneapolis comes from the state level with the 2015 Minnesota Building Code, which includes the Minnesota Energy Code. The code's purpose is to create a clear, uniform, and predictable process to construct a safer environment. This means that the overarching codes are adopted from nationally recognized safety and health codes while allowing innovative technologies that work together to lower costs and ease development (Minnesota Department of Labor & Industry 2017).

The Minnesota Energy Code exists within this large group of codes, with the most recent version adopting IECC 2012 and ASHRAE 90.1-2010. Historic buildings are exempt from compliance as stated within the overarching Minnesota State Building Code Administration, requiring direction to Chapter 1311, the Minnesota Conservation Code for Existing Buildings.

> **<u>2015 Minnesota Building Code Administration – 1300.0040 Scope</u>**
> Subpart 2. Compliance Exception: The following structures that meet the scope of Chapter 1305 shall be permitted to be designed to comply with Minnesota Rules, Chapter 1311(MN Conservation Code for Existing Buildings):
> ......
> 2. historic buildings.[5]
>
> **<u>2015 Minnesota Building Code Administration – 1300.0070 Definitions</u>**
> Subpart. 12a. Historical building.
> "Historical building" means any building or structure that is listed in the National Register of Historic Places, designated as a historic property under local or state designation law; certified as a contributing resource within a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Register of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or Keeper of the National Register of Historic Places.[6]

The historic building exception in the administrative scope that redirects compliance to Chapter 1311 (Minnesota Conservation Code for Existing Buildings) provides the energy code exemption. Chapter 12 of the Minnesota Conservation Code for Existing Buildings outlines the required codes for repair,

5 Minn. Building Code Administration. 1300.0040 (2015).
6 Minn. Building Code Administration, 1300.0070 (2015).

alteration, relocation, and change of occupancy for historic buildings, without requiring energy conservation compliance.

> **<u>2015 Minnesota Conservation Code for Existing Buildings – Chapter 12 - Historic Buildings</u>**
> Section 1201 – General 1201.1 – Scope. It is the intent of this chapter to provide means for the preservation of historic buildings. Historical buildings shall comply with the provisions of this chapter relating to their repair, alteration, relocation and change of occupancy.[7]

3.3.3 New York, NY

New York City enacted its own energy code through Local Law 85 of 2009 after authorization from the New York State Energy Law. The most recent update to the energy codes came into effect in March 2016. The New York City Energy Conservation Code (NYCECC) is more stringent than the New York State Energy Conservation Code (NYSECC), and is based on the IECC 2015 for commercial and residential. It also adopts ASHRAE 90.1-2013 with amendments as the energy standard for non-low-rise residential buildings. These most recent updates are meant to align with Mayor Bill de Blasio's climate change mitigation plan to reduce the city's greenhouse gas emissions by eighty percent by 2050 (City of New York 2016).

> **<u>Title 28, Chapter 10 - New York City Energy Conservation Code Residential Provisions</u>**
> Chapter R2 - Definitions Section ECC R202 - General Definitions: Historic Building. Any building that is (a) listed on the national register of historic places or on the state register of historic places, (b) determined by the commissioner of parks, recreation and historic preservation to be eligible for listing on the state register of historic places, (c) determined by the commissioner of parks, recreation and historic preservation to be a contributing building to an historic district that is listed or eligible for listing on the state or national registers of historic places, or (d) otherwise defined as an historic building in regulations adopted by the state fire prevention and building code council.[8]

> **<u>Chapter R5 - Existing Buildings R501.6 Historic buildings.</u>**
> No provisions of this code relating to the construction, repair, alteration, restoration, and change of occupancy shall be mandatory for historic buildings.[9]

> **<u>Commercial Provisions Chapter C2 - Definitions. Section ECC C202 - General Definitions.</u>**
> Historic Building. Any building that is (a) listed on the national register of historic places or on the state register of historic places, (b) determined by the commissioner of parks, recreation and historic preservation to be eligible for listing on the state register of historic places, (c) determined by the commissioner of parks, recreation and historic preservation to be a contributing building to an historic district that is listed or eligible for listing on the state or national registers of historic places, or (d) otherwise defined as an historic building in regulations adopted by the state fire prevention and building code council.[10]

> **<u>Chapter C5 - Existing Buildings C501.6 Historic buildings.</u>**
> No provisions of this code relating to the construction, repair, alteration, restoration, and

---

7 Minn. Conservation Code for Existing Buildings, 1201.1 (2015).
8 N.Y.C. Admin. Code, tit. 28, § 10 (2016).
9 Ibid.
10 Ibid.

change of occupancy shall be mandatory for historic buildings.[11]

3.4 – Deep Energy Retrofits versus Conventional Energy Retrofits

When dealing with energy retrofits in historic buildings, there are a multitude of different approaches varying in scale that have a number of different implementation challenges in historic building regulation. These retrofits fall into two different categories: deep energy and conventional energy retrofits. Deep energy retrofits consist of whole building interventions in a large construction project that seeks to achieve upwards of fifty percent more energy efficiency. Mechanical, HVAC, and lighting upgrades combined with building envelope design, and on-site renewable power generation are included in a whole building assessment. Conventional energy retrofits are smaller in scale, and consist of isolated system upgrades like lighting and HVAC equipment, and are completed quickly (Rocky Mountain Institute and General Services Administration 2015). Within the context of these different scales of interventions, deep energy retrofits are often the source of conflict between historic building reuse projects and historic preservation regulation. The perceived threat to the architectural and material significance of historic buildings has roots in deep energy retrofits that encompass replacement materials and equipment installation.

There are number of different interventions that have different connotations within the realm of improving overall energy efficiency. Changes to the building's envelope most commonly include window replacements and increased insulation. Depending on the building, windows can have a number of sustainability advantages, most largely dealing with avoiding the environmental impact of producing new windows. Old windows can typically be easily repaired, while new windows usually come in one-piece units that require complete replacement if broken. When combined with insulation techniques, there can be significant energy improvements throughout the whole building, however it depends on the placement of the insulation. Roof and attic insulation are typical in historic building processes, and have been approved by regulatory bodies; however, wall insulation can change the breathability of the building and cause accelerated deterioration of original fabric (Mason et al. 2013). While windows and insulation play a role in larger energy efficiency improvements, the ultimate decision for the approach is left to the judgment of the project team depending on the unique characteristics of the building.

Equipment changes in both deep and conventional energy retrofits play an important role in reducing the overall energy consumption, and also varies depending on the scale of the project and the building typology. Upgrading the heating, ventilation, and air-conditioning (HVAC) equipment rarely conflicts with preservation guidelines, while historic lighting fixtures often are compatible with new energy efficient lights. Historic buildings have also had success with solar panel and green roof installation that increase renewable energy use and regulate interior temperature more efficiently; however, their success depends on the building's location for ample solar light and structural integrity to support the heavy green roof material (Mason et al. 2013). The combination of different equipment upgrades and physical improvements to the

11 Ibid.

building take during differently scaled projects, but their exemption from the energy conservation codes applies no unifying requirements. As witnessed by the inconsistent basis of energy efficiency interventions within historic buildings, energy efficiency requirements have to be tailored to fit the unique plethora of building construction dates and typologies.

3.5 Discussion

Throughout these three municipalities, historic buildings are freed from stringent requirements that limit their energy consumption and improve their energy efficiency. This exemption is understood through policy in varying ways, as differing energy conservation codes are adopted and organized through administrative codes. Definitions also range in how many buildings are encompassed. However, within these regulatory frameworks there is still opportunity for changes towards mandating increased energy efficiency in historic buildings.

California, Minnesota, and New York have specific energy codes referencing varying standards. Within their obvious differences in actual versions of energy conservation codes is the similarity that in each place, specifications for energy efficiency are determined due to numerous state and local factors. Although Minnesota and California have adopted energy efficiency standards equivalent to the same model code editions (ASHRAE 90.1-2010 and IECC 2012), their organization into administrative code is dependent on their unique locations. California's Title 24 outlines clear paths for performance and prescriptive energy code compliance, with an instructional purpose outlining how to go about performance based versus prescriptive based approaches, while also separating buildings more evenly by size, rather than use. On the other hand, Minnesota's adoption of the IECC 2012 comes in the form of a redaction and addition method, where model codes are edited and customized for Minnesota's discrete conditions. This method is less clear instructionally, however differs from California in that it is separated very clearly into commercial versus residential codes. New York is more unique, among the three examples, due to its large built environment. The NYCECC has adopted more up-to-date model codes, but the organizational technique is similar to that of Minnesota with clear commercial and residential provisions. Understanding how these codes are organized and understood helps to provide a better sense of the range of possibilities resulting from two major model codes.

The exemption is fairly straightforward in each of the example locations in terms of the clear non-compliance requirements for historic buildings, however the definitions vary in each case. California's definition of "qualified historic building" is extremely inclusive, including any local, state, and federally designated "building, site, object, place, location, district or collection of structures and their associated sites, deemed of importance to the history, architecture or culture of an area."[12] This definition, however, does not come from model energy codes, but rather from California's Historic Building Code, which requires a more overarching definition. Even though it comes from the building code, the extension of the definition to include sites identified on historic resource surveys differs from the Minnesota and New York examples,

12 Cal. Code Regs. tit. 24, part 8, chp. 8-2 § 8-201.

where the scope is more limited to formal designation. New York's definition is the least encompassing, as locally designated properties are excluded. This means that unless they are not deemed historic by the state fire and building code council, locally designated buildings in New York City must comply with energy conservation code. However, if the building becomes listed or eligible for State or National registers, the building becomes exempt from NYCECC compliance.

Throughout blanket exemption of historic buildings, there are opportunities in the works to begin requiring more of historic buildings. California's historic building indoor and outdoor prescriptive lighting requirements is an example of this. Although original and replica lighting are exempt from compliance, non-historic lighting is required to comply with prescriptive allowances. The overarching exemption that exists in other locations does not specify reasonable regulations for historic buildings that have minimal interference with historic fabric, however there is an opportunity to align more specific historic building energy regulation to trends at the model code level. Efforts afoot in changing requirements for compliance exemption at the IECC level combined with trends in increased equipment efficiency and size, occupant controls and sensors, and more holistic viewpoints for energy efficiency could provide excellent compromises to current historic building energy regulations.

3.6 Conclusion

Historic buildings offer tremendous energy savings, however their exemption from energy codes across state and local levels creates a missed opportunity. Although third party model codes are beginning to look into how historic buildings can be made more energy efficient through code modifications and guidelines, the adoption process through federal, state, and local jurisdictions makes it difficult for more immediate change in historic building energy regulation. However, successful examples of mandating certain aspects of historic building energy use can be replicated in codes throughout the country, as the conversation begins to trickle down into policy decision-making.


Image [3]
Forefront: Griffith Observatory
Background: Los Angeles skyline

4. Los Angeles, CA

4.1 - Introduction

As the second largest city in the United States, Los Angeles boasts an abundance of historic resources within its built environment. The city's warm climate allows for buildings to operate very efficiently, as there is a limited need for space heating. There is a strong ethic amongst building practitioners towards ensuring that energy efficiency and sustainability concerns are taken into account in historic building reuse projects. However, inconsistency at the local, state, and federal level regulatory stages has inhibited the ability for historic buildings to fully contribute to high levels of energy efficiency. That being said, energy policy and creative technological strategies in adaptive reuse projects are emerging, as Los Angeles seeks to drastically reduce GHG emissions.

Los Angeles has increased its population from 100,000 to four million, largely in the latter half of the 20th century. With the increase in population after World War II, and economic strength from the United States' defense spending, the Los Angeles area boomed with development, with 1.9 million people by 1950. Over the next sixty-seven years, the population would nearly double, with the population surpassing four million in 2017 (Grad 2017). The city occupies 468.8 square miles, with most buildings built in the mid-twentieth century. According to the Preservation Green Lab's Atlas of Reurbanism, an estimated 2.9% of buildings are locally designated, while 0.8% of the buildings are designated on the National Register of Historic Places (Preservation Green Lab 2017).

Los Angeles is located in Los Angeles County, which is within IECC Climate Zone 3 (labeled "Hot") and Moisture Regime B for "Dry". This climate combination is described as being a "region that receives less than 20 inches of precipitation a year and where the monthly average outdoor temperature remains above 45º F throughout the year" (Baechler et al. 2015, p. 3). Temperatures remain fairly consistent through the seasons with an average high and low in January of 67º F and 51º F, respectively, and an average high and low for July of 77º F and 62º F, respectively (U.S. Climate Data 2018a). Los Angeles also experiences a copious amount of sunshine, averaging around 70% of the days throughout the year having sun hours (World Weather & Climate Information 2018).

4.2 - Historic Preservation

Dating back to 1958, Los Angeles' formal historic preservation regulation began to take shape during a time of increased development and building destruction. A group from the Los Angeles chapter of the American Institute of Architects (AIA) Historic Building Committee started drafting an ordinance to create a regulatory board to survey, identify and protect historic sites in Los Angeles. By 1962, the Cultural Heritage Ordinance was passed, establishing a five-member Cultural Heritage Board and the ability to locally designate historic buildings as Historic-Cultural Monuments (HCMs). By 1980, the Board became a full-fledged City Commission requiring City Council to confirm any Historic-Cultural Monument designations (City of Los Angeles 2018c).

More recently, Los Angeles' historic preservation staff underwent reorganization, which revitalized the city's efforts to include heritage preservation into city planning. Before the reorganization, the Cultural Heritage Commission (CHC) and the designation of HCM's fell within the authority of the city's Cultural Affairs Department, while administration of historic districts (also known as Historic Preservation Overlay Zones, or HPOZ's) was staffed within the City Planning Department. In 2006, the Office of Historic Resources was created within the Department of Planning, creating a unified office for managing the CHC, HCM regulation, and HPOZs (City of Los Angeles 2018a). From its creation, the Office of Historic Resources' (OHR) has had a tremendous impact on the promotion of historic preservation in Los Angeles. As of 2007, the city achieved Certified Local Government status, integrated historic preservation into overarching planning initiatives, and provided resources for project review approval (City of Los Angeles 2018e).

From 2010-2017, Los Angeles undertook the most ambitious historic resource survey in the country called SurveyLA. The survey was partially funded by the J. Paul Getty Trust and covered over 880,000 legal parcels within the 500 square miles in the entire city of Los Angeles in order to compile a unified source of the city's historic resources (City of Los Angeles 2018f). In addition to SurveyLA, the city launched HistoricPlacesLA, a website dedicated to promoting public information about Los Angeles' historic resources. The website features Historic-Cultural Monuments, Historic Preservation Overlay Zones, properties from National and California registers, and information gathered through SurveyLA (City of Los Angeles 2015). These recent initiatives have bolstered the energies surrounding historic preservation in LA, making it an integral part of the city's planning and development strategies, as well as perceived cultural importance.

4.2.1 - Local Regulation

The Department of Planning is largely responsible for regulating projects involving historic buildings in Los Angeles. The OHR and the Cultural Heritage Commission (CHC) are responsible for approving demolition, substantial alteration, or relocation applications for HCM's in order for projects to receive a permit. The CHC is required to be composed of five members that have "demonstrated interest, competence or knowledge of historic preservation." In addition, at least two of the Commissioners are recommended to meet qualifications defined by the Secretary of the Interior for "history, architecture, architectural history, planning, pre-historic and historic archeology, folklore, cultural anthropology, curation, conservation and landscape architecture or related disciplines, such as urban planning, American studies, American civilization, or cultural geography."[1]

As a part of the local regulatory process, historic building projects must comply with the California Environmental Quality Act (CEQA), which requires public projects and projects requiring public agency

1 Los Angeles Administrative Code, Chp. 9 § 22.171.1.

approval to regulate any adverse effects on the environment (California Natural Resources Agency 2014). The review process requires an initial study, which determines whether or not the project will have any significant impacts on the environment. These impacts cover a range of topics, including biology, greenhouse gas emissions, and air and water quality, traffic, views, noise, and the combination of these impacts cumulatively over time. Historic building projects undergoing restoration or rehabilitation can become exempt from further review through a class 31 categorical exemption, which requires proof of the project's compliance with the SOI standards for the Treatment of Historic Properties.[2] This exemption assumes that there will be no further environmental impacts after the initial study because of the project's compliance with the SOI standards, however projects still must undergo the initial study to ensure there are no negative environmental impacts associated with the work.

In order to obtain project permits for major alterations, demolition, and relocations of HCMs, projects must work with the OHR and the CHC to comply with both the SOI standards and the review required by CEQA.[3] The Manager of the OHR works closely with the projects for approval, and normally projects can get by without having to present to the CHC; however, complicated projects with high levels of public interest usually do present at the CHC. There is no certificate of appropriateness for HCMs, however approval from the OHR is necessary in order for the project to go forward. As a result, having a good relationship and working with the OHR throughout the project is important (Chattel 2018).

Otherwise known as historic districts, Historic Preservation Overlay Zones (HPOZ's) are meant to preserve the architectural character of Los Angeles' neighborhoods. There are thirty-five HPOZ's throughout the city, and a five-person board manages each HPOZ. The Mayor, the City Council, Cultural Heritage Commission, and the Board itself appoint the members. Members of the board are required by the city administrative code to include someone with real estate or construction experience and a California-licensed architect, as well as three renter or owners of property within the zone. All of the members must have knowledge and interest in the "culture, building structures, historic architecture, history and features of the area encompassed by the Preservation Zone," and have experience in historic preservation.[4] Depending on the scope of work, projects within HPOZs must receive approval through the Department of City Planning. Routine maintenance, exterior painting, and landscaping projects are approved by the Planning Department as "Conforming Work." Significant projects require a Certificate of Appropriateness, administered through the Planning department, and dependent upon compliance with the SOI standards for preservation. These regulations apply to contributing structures, which are defined as buildings built within the HPOZs period of significance that retain historic character. The HPOZ board holds a public hearing and makes recommendations to the Director of Planning regarding the approval of the project's application. The CHC is also involved in making recommendations in some instances (City of Los Angeles 2018g). Projects are evaluated based on the design guidelines set forth by the HPOZ Preservation Plan, and take into account the

---

2 Ca Code of Reg, Chp 3, Art 19 § 15331.
3 Los Angeles Administrative Code, Chp. 9, § 22.171.11.
4 Los Angeles Municipal Code Chp 1, Art 2, § 12.20.3.

SOI standards.

4.2.2 - City Incentives

Although project regulation plays a major role in preventing the destruction and preserving the architectural character of the city's historic resources, local incentive programs promote reuse of old buildings. The Mills Act Historical Property Contract Program is a state level legislation from 1972 that grants participating local governments authority to grant property tax relief to owners who actively restore and maintain their qualified historic property. In order to qualify, the building must be an HCM or a contributing member of an historic district, and be under a specific property tax value. The city of Los Angeles adopted this legislation in 1996, and 900 different properties have benefited from the program (City of Los Angeles 2018g).

On top of the Mills Act program, Los Angeles' Downtown Adaptive Reuse ordinance serves to rehabilitate older, economically distressed, or historically significant buildings into residential live/work units or visitor-serving facilities.[5] Buildings qualified under this ordinance need not be historically designated, as the overarching program was originally meant to revitalize downtown through the reuse of vacant older buildings. Participation in the adaptive reuse program provides relaxation of parking, density, and other zoning requirements that would be otherwise stringent on these properties. Originally the ordinance was approved in 1999, but it was extended to other neighborhoods in Los Angeles in 2003, creating thousands more housing units (City of Los Angeles 2018b).

4.2.3 - California State Regulation

At the state level, the California State Office of Historic Preservation (CA OHP) manages state and federal historic preservation initiatives. The current office was established in 1975 in light of the passing of the NHPA in 1966 (California State Parks 2018). The State Historic Preservation Officer (SHPO) and the State Historical Resources Commission (SHRC) are responsible for administering the policies set forth in the NHPA, including designating places on the National and State Register of Historic Places and Section 106 review. The CA OHP has multiple divisions in responsibility associated with various regulatory procedures, including local government and environmental compliance, architectural review and environmental compliance, archaeology and environmental compliance, and fiscal, grants and information management (California Office of Historic Preservation 2018b). Environmental compliance in this case refers to both Section 106 of the NHPA and the California Environmental Quality Act (CEQA), while architectural review covers compliance with the SOI standards for the administration of Federal Rehabilitation Tax Credits, as well as assistance with compliance with the California State Historical Building Code (California Office of Historic Preservation 2018a). Projects in Los Angeles work with the CA OHP to ensure environmental compliance and when seeking federal historic tax credits.

5 Los Angeles Municipal Code, Subsection A, Subdivision 26 § 12.22

4.3 - Climate Change Action

Climate change mitigation through increased building energy efficiency and increased renewable energy sources has been one of Los Angeles' main strategies to reduce city's carbon footprint. Climate change awareness efforts have promoted the importance of higher energy efficiency in buildings, and technologies that rely on the electrical grid to be sourced by renewable energy, as exemplified through climate change action plans and the state energy conservation code, Title 24 Part 6. Although there is no clear connection in any policy language between climate change mitigation and historic preservation efforts, it can be assumed that building reuse projects and their teams are aware of the urgency surrounding increased building energy efficiency as a tactic to reduce GHG emissions due to the widespread awareness of the building industry's contribution to the causes of climate change.

Los Angeles is an immense city with the economic power necessary to heavily invest in climate change mitigation. In 2014, Los Angeles enacted a sustainability plan, entitled "pLAn" to help combat climate change through local policy decision-making guidelines. pLAn includes a holistic approach to improve social, environmental, and economic conditions of the city, with specific inclusion of building operating energy efficiency as a top policy focus for reducing the city's GHG emissions. According to the plan, buildings are the largest consumers of electricity, and as a result are the largest source of GHG emissions. It also notes that most buildings in Los Angeles were built before state energy conservation codes, and thus use more energy than those built today. Therefore, cost-effective retrofits to existing buildings will contribute to meeting the city's goals of reducing energy use thirty percent below the 2013 baseline by 2035. Strategies for meeting this goal include building energy efficiency education and financial programming, building energy consumption benchmarking, carbon net-zero energy code piloting, and leading-by-example with municipal buildings (City of Los Angeles 2014).

Also a part of the city's sustainability plan is the reduction of GHG emissions through increasing local renewable energy production. The goals outlined in pLAn seek to reduce GHG emissions by fifty percent from the 1990 levels by 2050. In order to attain this, the city is seeking to derive fifty percent of its energy from renewable energy sources by 2030, and the city is currently on track to eliminate ownership stakes in coal-fired electricity plants by 2025. In addition to the energy production strategies of increasing solar, hydro, wind, and geothermal sources, the city plans on increasing awareness of energy consumption and water usage of individuals in the city (City of Los Angeles 2014).

In June 2017, Mayor Eric Garcetti committed Los Angeles to meeting the 2-degree global warmth cap in direct response to the federal level decision to back out of the Paris Climate Agreement (Chandler 2017). Progress continued for pLAn in meeting its 2017 goals. Building energy efficiency benchmarking was in 2017 expanded to include 60 million more square feet (Mayor’s Office of Sustainability 2017). Privately owned buildings that are 20,000 square feet or more and city buildings over 7,500 square feet are required to be benchmarked, with owners disclosing annual energy and water consumption. Beginning in 2019, buildings must demonstrate energy and water efficiency based off their past data in addition to disclosing energy and water usage data, or they risk facing penalties from the city (City of Los Angeles 2018). The city is currently on track to completing energy efficiency financing, incentives, and education programs for their next major outcome deadline for 2025 (Mayor's Office of Sustainability 2017).

4.4 - Findings

Professionals in Los Angeles face numerous barriers that inhibit the full promotion of operating energy efficiency improvements in historic buildings, however there are opportunities to further efforts to expand project level decision-making and increase to GHG emissions reductions. The professionals involved in preservation and sustainability have integrated energy efficiency methods into past and present projects; however, inconsistent regulatory conditions inhibit buildings from reaching their full energy efficiency potential. The collaboration between architects, engineers, and historic preservation consultants is highly stressed in order to execute successful projects that ensure high levels of operating energy efficiency and preservation regulation approvals. These collaborations exhibit a high level of awareness of the relationship between climate change and historic building reuse, especially with Los Angeles' favorable climate; however, without specific energy-related mandates, projects can still fall short of reaching high levels of operating energy efficiency.

4.4.1 - SOI Standards Compliance Detracts from Full Building Operating Efficiency Potential

The review processes involved in historic building projects rely heavily on the SOI standards for preservation and rehabilitation, which do not take a straightforward approach to improving energy efficiency. The SOI standards highlight energy conserved through material conservation, building siting, and inherently sustainable design features, but these are not shared qualities of all historic buildings. These standards are applied to both HCMs and contributing buildings of HPOZs, in addition to projects seeking federal historic tax credits. In addition, projects on properties that are not officially designated but are identified on historic resource surveys are more likely to choose a construction plan that follows the SOI standards in order to exempt from CEQA review. This is due to CEQA's class 31 categorical exemption, which can occur when a project involving a historic resource provides proof of compliance with the SOI standards. This does not exempt the project completely from CEQA, but rather from additional review. Projects will still have to perform an initial study to assess the project's effects on light, air, traffic, noise, etc.

One example of this type of project is the Sunkist Headquarters building in Los Angeles' Sherman Oaks neighborhood, which is a building that is not officially designated. However, it is treated as a historic resource because it was identified in SurveyLA as such. Built in 1970, the complex is undergoing a reuse project, however in order to gain exemption from CEQA, a preservation plan proving compliance with SOI standards needs to exist. Chattel, Inc., an historic preservation consulting firm, is working with the advocacy group LA Conservancy and the developers of the project to come up with a plan involving the SOI standards. The developers are more likely to pursue this option, as there are benefits of not having to go through further strenuous CEQA review (Chattel 2018). In terms of widespread effect of this policy, there is enormous potential for non-designated buildings to pursue this strategy as SurveyLA identified approximately 60,000 properties as non-designated historic resources (Chattel 2018). With 60,000 properties given the option of CEQA review exemption, more properties are incentivized to comply with the SOI standards, which could have inhibitory impacts on Los Angeles climate change action goals if not handled carefully.

SOI standards compliance allows for creative energy efficiency strategies, but further work is required on behalf of the project team to convince regulatory bodies of the appropriateness of the physical interventions. Los Angeles' warm, sunny climate can have negative connotations in terms of energy efficiency, especially with solar heat gain through large windows of certain typologies of historic buildings increasing the load for air conditioning of interior spaces. The use of window films can reduce solar heat gain and are a more cost-efficient method of increasing the building's energy efficiency.

The typology of a large portion of downtown Los Angeles' historic building stock are daylight factories with large windows. The more prominent reuse of these buildings almost requires window changes in order to maintain a level of client comfort through reuse as housing, office, or commercial space. The SOI standards as regulated by the NPS do not favor window films due to the potential non-historic color tint that can occur after installation, however they have been accepted in the past. There are additional requirements for using films in a building, including making sure the appearance of the window does not change during both the day and the night. The Hamburger's Department Store, a 1.1 million square foot project in Downtown Los Angeles that includes 1000 wood sash windows, is using window film. The building is an HCM and listed on the National Register of Historic Places. Because the project is using federal historic tax credits, extra caution must be taken to ensure the NPS is aware that this technology is being used in the building, before it is installed (Chattel 2018). The NPS is strict in its interpretation of the SOI standards and ensuring compliance is one of the highest priorities of the project due to the financial risk at stake. Although window films are a more creative way of addressing the specific building type, the discrete sunny and hot climate challenges of almost necessitates this type of intervention for the building's reuse. Nevertheless, there is still caution associated with the CA OHP and NPS review.

Image [4] Hamburger's Department Store in Downtown Los Angeles.


Image [5] Window films that have a slightly blue tint to them were not accepted by the NPS.


Image [6] Installation of a different kind of window film that did not have the same color effect, and were approved by the NPS.

4.4.2 - Numerous Historic Preservation Regulation Processes De-Emphasize Energy Efficiency in Project Planning

Depending on the level of designation for the historic building, there can be up to four regulatory bodies that require numerous applications and reviews. These reviews focus on the building's architectural character, material, and environmental impact. The multiple review process detracts from the attention paid to increasing operating energy efficiency due to the additional procedural and SOI standards requirements. In addition, projects entering into a Mills Act contract must comply with the requirements and application, which is separate from the HCM alteration application. If the project is utilizing federal historic tax credits, extra levels of review occur at the state and national level. The numerous layers of project review de-emphasize the focus energy efficiency during the project planning process because of the comprehensive preservation-focused preparation work, making it more difficult to spend time and resources on energy efficiency improvements.

One example of layering multiple levels of review is the Sears Department Store reuse project, which is currently underway in downtown Los Angeles. Listed on the National Register and as a Historic-Cultural Monument, the store is utilizing the Mills Act program and federal historic tax credits. In addition to working with the OHR and CHC for ultimate permit approval, the project's Mills Act contract with Los Angeles requires a detailed scope of work for the project. Simultaneously, the project must go through SOI standards for rehabilitation review with the CA OHP Architectural Review Unit and the NPS in order to receive historic tax credits (Chattel 2018). The project preservation consultants identified these regulatory procedures as a challenge to promoting operating energy efficiency due to the numerous, extensive, and cross-purpose reviews. Although there are crossovers in the processes requiring SOI standard compliance, the existence of CHC approval, Mills Contracts, CEQA, and CA OHP architectural review processes adds enormous workloads for the project teams. Nevertheless, these taxing processes still require SOI standards compliance, which, as noted in 4.4.1, can detract from reaching full operating energy efficiency potential. The efforts focused on addressing multiple and overlaid regulatory environments leaves little project team energy devoted to focusing on ensuring the building is highly energy efficient.

4.4.3 - Project Team Collaboration Ensures Project Success

Despite the numerous potential review processes, a "good" project team is necessary to balance the treatment of operating energy efficiency within the complex regulatory field of historic preservation. This ties into the education expertise of building professionals specifically when it comes to historic preservation. The collaboration of architects, historic preservationists, and engineers can bridge education gaps in policy, building systems, and design. For example, the Title & Trust Insurance Company Building in Downtown Los Angeles is currently undergoing a reuse project for office space. The locally, state, and federally listed building must comply with the SOI standards in order to pass through local review at the CHC. At the same time, the new office space is interested in attracting clients with low utility costs through the marketing bonus of an energy efficiency building with LEED certification. The team consists of developers, historic preservation architects, and energy consultants who all are working together under the same ethic of preservation and sufficient modern updates to ensure the building is energy efficient (Leong 2018). Lambert Giessinger, an Historic Preservation Architect at the OHR, has worked closely with the Title & Trust Insurance Company Building throughout the project's development. He notes this relationship between historic building reuse projects and the OHR is strong, as developers want a predictable outcome for permit approval. The expertise of historic preservationists combined with architects, engineers, and energy consultants can result in a project that meets SOI standards, client design needs, and adequate energy efficiency (Giessinger 2018).

John Lesak, a Principal at Page & Turnbull, echoes Lambert's thoughts on project collaboration, and takes it further to suggest that "good" teams involve consultants that make the effort to convince clients to make better operating energy efficiency a higher priority. In his own career, he frequently consults architecture advisors to the State Historic Building Commission about conflicts for energy efficiency upgrades, and is on the CHC. In general, windows are always the most controversial during review, while insulation and mechanical system upgrades have not been an issue. Forward-thinking project teams that know historic buildings really well propose insulating in strategic places—the attic, for example—and upgrading systems with efficient equipment so that system loads are reduced. Coupled with occupant control measures, this can significantly reduce operating energy consumption. Therefore, project teams that are in tune with historic buildings can provide solutions that can meet regulatory approvals and still improve energy efficiency; however, with few energy code requirements for this type of work, the implementation of these measures relies upon the project team's influence on the client (Lesak 2018).

4.4.4 - Strong Preservation and Sustainability Ethics Exist Among Building Professionals

The pairing of historic preservation and energy sustainability ethics are highly visible in historic building projects. Architects and consultants are interested in integrating creative design solutions that mold buildings' architectural and cultural significance with energy saving features that capitalize on Los Angeles' favorable climate. Drisko Studio Architects are an example of a firm that believes strongly in making a building usable and functional. One of their projects they completed for a church organization is called the Briggs Residence, a 1910-constructed house they renovated for full-time occupants. The house is located in the Adams-Normandie HPOZ. In working with a mechanical consultant, they found that air movement through the house could be a substitute for air conditioning, and Los Angeles' climate allowed this passive technique to be used more effectively. They rehabilitated the house's double-hung windows for functional use, introduced ceiling fans, and utilized the double-height stair hall for hot air release through the roof. They found that with user modifications, the occupants would not trigger the air conditioning until it was very hot, and overall these modifications lowered the operating energy consumption of the whole house (Drisko and Knight 2018).

This project was successful in using historic building’s inherent features in combination with Los Angeles’ climate. However, this is a specific typology of historic building, and these design features are not shared on a broad spectrum. Instead of focusing on the design aspects of the building, the effort made by historic preservationists to carefully consider the building’s features and work together with consultants to find solutions that best fit sustainability practices are an asset to aligning historic preservation with climate change action principles.

4.5 - Conclusion

Los Angeles boasts leading efforts in climate change mitigation strategies through their sustainability plan focusing on increasing the energy efficiency of the city's buildings, the reduction of GHG emissions, and the dramatic increase of renewable energy sources in combination with eliminating coal power electricity production. Simultaneously, preservation efforts are escalating and becoming an integral aspect of the city's planning department. Los Angeles' large geographic area also encompasses a significant footprint of historic buildings. The city's current 22,000 designated properties could potentially increase to 80,000 through the help of more robust historic preservation planning tools like SurveyLA and HistoricPlacesLA.

There are a number of opportunities for climate change mitigation and historic preservation to be more aligned. These parallel initiatives provide an immense number of opportunities for collaboration. Los Angeles’ climate compatibility with reducing energy consumption has been greatly explored with strategies to allow occupants more control over interior temperature. Window films and up-to-date mechanical systems are becoming integrated at high rates into projects, however the review processes at the state and federal level can potentially inhibit projects’ timelines. Nevertheless, the strong ethic for preservationists engaging with questions of climate change and sustainability is promising for the future of preservation in addressing Los Angeles’ climate change goals.

Image [7]
Downtown Minneapolis at night,
looking north on Interstate 35-W

5. Minneapolis, MN

5.1 - Introduction

The current regulatory conditions in Minneapolis do not favor the promotion of operating energy efficiency in historic buildings, especially as improved efficiency relates to reducing greenhouse gas emissions. The city recognizes the environmentally sustainable aspects of preservation, but focuses largely on the benefits of recycling old buildings, namely dealing with embodied energy and minimizing demolition waste. Nevertheless, Minneapolis has a strong preservation ethic, which has flourished as a development method. The city's historic built environment is given new context and new meaning as the city encourages the development of more housing, commercial, and institutional spaces in historic buildings, making use of federal monetary incentives that shift the regulatory pressure from the city's historic preservation officials to the state office of historic preservation. Meanwhile, the education of regulatory officials, clients, as well as some architects and engineers does not emphasize operating energy efficiency in historic buildings. Engineers with adequate expertise to deal with operating energy efficiency in historic buildings are isolated from the preservation field, and current regulatory conditions do not require them to work together. Thus, operating energy efficiency improvements in historic buildings depend upon choices made by the client, architect, and project teams. This poses a challenge as the architect usually bears the responsibility to promote certain strategies, even when they are not mandated. This all happens within a city that has placed high priority on limiting greenhouse gas emissions through increased existing building energy efficiency. In addition, the relationship between the city and state, where state regulations interfere or supersede city regulations, has depended on the ability for historic buildings to actively play a role in local climate change mitigation goals.

Historically, the site of Minneapolis was chosen for human settlement due to the feature of the only natural waterfall on the Mississippi, which played a major role in the industrial development of the city as the river was used to expand the logging and milling industries in the 19th century. By 1870, Minneapolis produced more flour than any other place in the country. Throughout the course of the 19th and 20th centuries many changes occurred to the built environment and population. The city peaked in population in 1951 with 521,718 as suburbanization of the region began spreading outwards from the urban core (The Editors of Encyclopaedia Brittanica 2018). Today, Minneapolis is Minnesota's largest city, boasting a population of over 400,000 within the 3.8 million people located in the Twin Cities metropolitan area (City-Data.com 2018). Located adjacent to St. Paul, with a series of suburban communities, the city sits at the center of a major network of interstates and highways, acting as a commercial, transportation, distribution, health care, financial, industrial and governmental center for the surrounding region (The Editors of Encyclopaedia Brittanica 2018).

Minneapolis is located in Hennepin County, which is labeled by the IECC as Climate Zone 6 (or Building

America's "Cold") and Moisture Regime A ("Moist"). Climate Zone 6 is defined as a region that has between 5,400 and 9,000 heating degree days a year at a 65º-Fahrenheit basis. Heating degree days are measured by the number of degree difference between the mean 24-hour outdoor temperature and a building's base indoor temperature (65º F). Therefore, the Climate Zone 6 has on average more degrees Fahrenheit to account for in building interior warming throughout the year than other climate zones (Baechler et al. 2015). Minneapolis has an average temperature of 46.15º F, with annual average high temperatures at 55.1ºF and annual average low temperatures at 37.2º F. Temperatures can vary drastically throughout the year, with average lows in January at 8º F and average highs in July at 83º F (U.S. Climate Data 2018b). These climate variations have outstanding effects on the adaptive reuse of historic buildings.

5.2 - Historic Preservation

In October of 2009, the City Council adopted the most updated comprehensive plan for Minneapolis. The plan, entitled "The Minneapolis Plan for Sustainable Growth" is a way to outline areas of implementation steps for land use, transportation, housing, economic development, public services and facilities, the environment, open space and parks, heritage preservation, arts and culture, and urban design. Each outline contains goals, context, objectives, policies, and implementation guidelines. As a chapter in the comprehensive plan, Heritage Preservation receives its own special role in the development of the city. The plan's vision for Minneapolis in 2030 involves a sustainable urban environment, where "the City implements and promotes preservation of its historical and cultural resources, and recognizes that adaptive reuse is more fiscally responsible than green field development" (City of Minneapolis 2009a, p. 14).

The Heritage Preservation chapter of The Minneapolis Plan for Sustainable Growth demonstrates the significance that the built, social, and environmental qualities of places with historic and cultural value can play in enhancing the city's growth. In discussion with future preservation goals, the plan emphasizes "reduce, reuse, and recycle" as a method for environmental sustainability and preservation to overlap. The chapter argues that reusing buildings is preferable to tearing them down because they "keep the city's building stock intact and conserve the energy and resources required to build a new structure" (City of Minneapolis 2009b, p. 11). Policies directed towards preservation and sustainable growth includes creating a regulatory framework to protect buildings (including non-designated historic resources) from demolition, and implementing incentives to support the ideals of reducing, reusing, and recycling old buildings (City of Minneapolis 2009b).

5.2.1 - Local Regulation

Local regulation in Minneapolis is defined by the Minneapolis Heritage Preservation ordinance, which was enacted in order “to promote the recognition, preservation, protection, and reuse of landmarks, historic districts, conservation districts, and historic resources; to promote the economic growth and general welfare of the city; and to further educational and cultural enrichment."[1] In addition, the ordinance outlines designation processes and the enforcement powers and duties of officials and bodies.

As outlined by the ordinance, the Heritage Preservation Commission (HPC) acts as the main decision-making regulatory body for projects making alterations to landmarks and properties within historic districts. The ordinance states that the HPC must consist of ten members that are all residents of Minneapolis and have "demonstrated interest, knowledge, ability or expertise in historic preservation, neighborhood revitalization, archaeology, urban planning, history or architecture." Among the ten members, at least one is an appointed representative of the mayor, at least two (if available) are registered architects, at least one is a licensed real estate agent or appraiser, at least one resides in or owns a landmarked property (either individually or in a district), and at least one is a member of the Hennepin History Museum. The appointment process is transparent to the public, and members serve three-year terms.[2] Public hearings are held at least once per month about decisions for alterations to designated properties.[3]

The HPC works closely with the Department of Community Planning and Economic Development (CPED) and City Council. Together, they represent a series of elected and appointed officials responsible for designation, building project application processing, certificates of appropriateness, and appeals. The HPC is the main decision-making body, with the Planning Director serving as the HPC's staff within CPED. CPED staff review applications and make recommendations for HPC decisions. They also have authority to approve conservation district certificates, however at this time there are no conservation districts designated in Minneapolis.

Historic building projects face various regulatory processes depending on level of designation and extent of the alteration. Locally designated properties, both individual and within districts, ultimately require Certificates of Appropriateness or Certificates of No Change administered through the HPC and the CPED to receive building permits. The Certificate of Appropriateness is required for major alterations, including new construction, additions, large-scale rehabilitation projects, use of materials that do not meet the applicable design guidelines, and signs that do not meet guidelines. This review requires a public hearing with the HPC and is only concerned with exterior work. On the other hand, minor alterations require Certificates of No Change, and are reviewed without a public hearing by the administrative staff at the CPED. Minor alterations include general maintenance, shingle roof replacement, tuck pointing, limited masonry and siding repair, changes that reproduce existing design, and signs that meet the sign guidelines (City of Minneapolis, n.d.).

5.2.2 - Minnesota State Historic Preservation Office

The 1966 National Historic Preservation Act laid the framework for State Offices of Historic Preservation to take leadership of historic preservation activity in each state. Minnesota's State Office of Historic Preservation (MN SHPO) was established by state statute in 1969 to provide this leadership to

1 Minneapolis Code of Ordinances, tit. 23, Chp. 599 § 599.30 (2014)
2 Minneapolis Code of Ordinances, tit. 23, chp. 599 § 599.120(c) (2014)
3 Minneapolis Code of Ordinances, tit. 23, chp. 599 § 599.120(d) (2014)

Minnesota. The MN SHPO is required by the NHPA's Section 106 to be consulted if any potential projects could have an adverse effect on a historic resource (Minnesota State Office of Historic Preservation, n.d.).

Aside from Section 106 reviews, there is no direct regulatory action taken to alteration projects on historic resources that involve the MN SHPO unless the project is planning on taking advantage of both federal and state tax incentives. The MN SHPO reviews applications for both federal and state tax credit applications and coordinates with projects to ensure the various requirements are met. The Federal Historic Tax Credit offers a twenty percent investment tax credit to projects on certified historic buildings that are income-producing, follow the SOI Standards for rehabilitation, and receive preliminary and final approval from the NPS (Minnesota State Office of Historic Preservation, n.d.). Minnesota's Historic Structure Rehabilitation Tax Credit also offers twenty percent for qualified historic rehabilitations on National Registered buildings or contributing buildings to National Registered districts. The buildings also have to be income-producing, meet SOI standards, and have plans and completed work approved by the NPS (Minnesota State Office of Historic Preservation n.d.).

If the project is receiving federal and state historic tax incentives, the process involves tax credit applications to the MN SHPO for review in accordance with the SOI standards for rehabilitation. The processes are fairly similar for both federal and state historic tax credits, with the NPS as final approver for both. In order for the project to receive the federal tax incentive, the building has to be a certified historic structure, which means it is either listed on the National Register of Historic Places, or a contributing member of an historic district or eligible historic district on the National Register of Historic Places, or a part of a Secretary of the Interior certified local historic district (Tess 2015). The historic tax credit application process involves three parts: the evaluation of significance, the description of the rehabilitation, and the request for certification of completed work. Throughout the process, the MN SHPO and NPS are involved to approve the various parts of the application to ensure that the project meets the SOI standards for rehabilitation (National Park Service 2014).

5.3 - Minneapolis and Minnesota Climate Change Action

Minneapolis' current climate change mitigation plan was adopted in June 2013 as a roadmap to reduce citywide GHG emissions fifteen percent by 2015 and thirty percent by 2025 from 2006 baseline levels. Beginning in 1993, the city has continually led initiatives to reduce GHG emissions through increased building energy efficiency (Carter and Center for Energy and Environment 1993). Over the course of twenty years, the strategies have evolved based on climate research. The strategies call for sixty-six percent of the emissions reductions to come from improved building energy efficiency, with forty-seven percent of that from commercial buildings, sixteen percent from residential buildings, seven percent from the University of Minnesota, and two percent from city operations. The plan elaborates on implementation strategies for building energy efficiency improvement that focus on cross cutting multiple sectors to promote better operating energy efficiency, as well as specifically on residential and industrial buildings, and renewable energy sources (City of Minneapolis 2013).

Minnesota enacted its first legislation for building energy benchmarking in 2001 specific to public buildings in order to ensure performance as expected, and to provide input for how best to improve buildings for the greatest return. The program called "Building, Benchmarking, and Beyond" or "B3" for short, currently has over 9,000 public buildings in its database consisting of over 300 million square feet. The program has been successful in identifying over $23 million in potential energy savings in about 1,500 buildings (or around 30 million square feet) (The Weidt Group 2018).

On a related note, in 2007 Minnesota endeavored on one of the country's most aggressive climate change mitigation acts with the passing of the Next Generation Energy Act which required Minnesota to produce twenty-five percent of its electricity from renewable energy sources by 2025 and to reduce fossil fuel consumption fifteen percent by 2015.[4] As of early 2016, Minnesota reached the reduction in fossil fuel consumption, and is on track to achieving the renewable energy source goals set for 2025. Coal usage was down to forty-four percent from sixty-six percent, and renewable energy sources were up to twenty-one percent, with seventeen percent of that coming from wind power. Solar energy is expected to experience dramatic growth, and will add to the expected 25% of renewable energy sources by 2025 (MPR News Staff 2016). In addition, both Minnesota Governor Mark Dayton and Minneapolis Mayor Betsy Hodges agreed to comply with the 2015 Paris Climate Agreement after President Donald Trump rescinded the U.S. from the agreement (Marcotty 2017).

5.4 - Findings

Minneapolis has a number of different challenges associated with making historic buildings more energy efficient. Because historic preservation activity in Minneapolis is largely oriented in concert with economic development, the majority of historic preservation projects utilize historic tax credits for income-producing rehabilitation projects. The historic tax credit involves approval by the NPS that the project meets the SOI standards for rehabilitation and throughout the project the MN SHPO plays the major role in project review, causing conflicts with potential energy efficiency improvements due to their more stringent review of both interior and exterior work. In addition, education of building professionals of the multiple aspects of the building project is lacking, regarding regulatory processes and how to handle physical interventions. This lack of education is heightened by the separation of expertise between architects, historic preservationists, public reviewers, and contractors. The cost of energy efficient interventions also poses a challenge as the high costs compete with other project expenses demanded by working with historic buildings. Moreover, Minneapolis' climate action plan has had little impact on historic building energy efficiency gains, as concerns are oriented towards operating cost-reduction and not GHG emission reduction.

4 Next Generation Act of 2007, S.F. No. 145, Chp. 136, Art. 1 § 216C.05 (2007).

5.4.1 - SOI Standards Cause Project Roadblocks for Improved Energy Efficiency

Minnesota's extreme climate plays a large role in how the SOI standards are applied to projects. The Minnesota SHPO can be very strict when it comes to reviewing tax credit project compliance with SOI standards in both commercial and residential sectors, and has become stricter in its interpretation of the standards since the creation of the Minnesota state historic tax credit in 2011. The increase in number of income producing historic preservation projects pursuing state and federal historic tax credits has caused challenges for projects balancing SOI standards compliance and Minnesota's cold climate.

Commercial hotels in downtown Minneapolis pursuing tax credits have both had issues with SOI standards compliance and historic windows. In 2009, the historic Foshay Tower was converted into a luxury W hotel. The project occurred before the state tax credit was created and was allowed to replace most of the building's unique butterfly windows with replica windows because the original windows would have been too expensive to rehabilitate throughout the whole tower. The purpose of this window replacement was to improve the interior environment, as the luxury hotel needed to provide comfortable spaces for its guests. Minnesota's extreme cold temperatures necessistated this improvement. On the other hand, the Plymouth Building hotel project was more recent in 2013, and utilized both the state and the federal historic tax credit. The historic building opened up as an Embassy Suites in 2016. In this example, the SHPO was stricter with their requirements, and all windows were required to be rehabilitated. Jeff Hultgren and Pete Lochner of

Image [8] The Foshay Tower, now the W Hotel, in downtown Minneapolis. The windows on the facade were mostly replaced.

Image [9] The Plymouth Building, now the Embassy Suites, in downtown Minneapolis.

Ryan Companies, the construction managers of the Plymouth Building project, recognized the distinctive material heritage value that Plymouth Building's historic windows offered. However, they were not convinced that rehabilitating the windows effectively preserved this value because, in their experience, rehabilitating windows often utilizes more new material than old. They believed that replacement windows would work more efficiently with a new HVAC system, and saw the strict interpretation of the SOI standards as inhibitory to improved energy efficiency (Hultgren and Lochner 2018).

Given the conflicts with SOI standards and window replacements, there are tactics afoot for how to avoid window rehabilitation in order to increase efficiency and improve interior comfort. This is exemplified in the Parlin and Orendorff Plow Company Warehouse, now the Copham Apartments, a building reuse tax credit housing project on a building that originally had galvanized metal windows. Because the project was a tax credit project, SHPO required the factory to retain the historic windows. However, this caused the tenants to be miserable during the winter when ice would form on the interiors of the windows. In order

Image [10] The Parlin and Orendorff Plow Company Warehouse, now the Copham Apartments.

to circumvent SOI standards compliance, the project waited five years for the tax credit recapture period to expire (so that the building no longer needed to comply), and the windows were replaced with more efficient windows catered towards tenant comfort (Roise 2018). By replacing the windows after the SOI standards compliance date, they were able to avoid SHPO and NPS review, while altering the building to adjust for new use and cold climate conditions. This illustrates the need for regulatory reform to more accurately assess the need for window replacements on a project-by-project level.

There are ways in which to appeal regulatory action with the NPS for tax credit projects, in order to allow historic preservation projects to become more energy efficient, but they are time consuming and often pose a barrier to finishing the project. An example of this is the controversy surrounding the installation of a tenant controlled energy efficient heating and cooling system in the floor of new office space at the Ford

Center. The Ford Center has enormous floor to ceiling windows, allowing for little space between the floor and window for a new system, and the installation threatened the SOI standards because it would create a non-original relationship between the floor and window. The NPS denied the new system as a part of the tax credit application, and the historic preservation consulting firm Hess Roise and Company fought the ruling in D.C. to allow the system to be installed (Roise 2018). The NPS denial and appeal process required significant project time and energy fighting regulatory decisions, thus inhibiting the way in which historic buildings can be brought to higher levels of energy efficiency. As projects in Minneapolis are oriented towards development, the adaptive reuse of historic buildings prioritizes income-producing housing and commercial buildings. The shifting of regulatory power from the city to the state has made it harder for projects to easily make energy efficiency improvements, while simultaneously enabling more development financing for historic building projects.

Image [11] The Ford Center in downtown Minneapolis.

5.4.2 - Lack of Energy Efficiency Intervention Education

Education in the treatment of energy efficiency in historic buildings is lacking for architects, historic preservation consultants, engineering consultants, and clients in Minneapolis. Because of the energy code exemption, there are no real mandates to include operating energy efficiency in projects involving historic buildings; however, the cost associated with building operations and energy consumption provide an incentive for the client to prefer more money saving features. This mindset can prove difficult when dealing with historic buildings, as there is no set formula to improve energy efficiency. Assumptions regarding what appropriate energy efficiency methods for new construction contrast with what is appropriate for older methods of construction, in terms of building science and material conservation.

Regulatory bodies, clients and engineering consultants often do not understand the intricacies of energy efficiency interventions and the physicality of the historic building. Varying definitions of what consists of "modern" energy efficiency standards by regulators, engineers, and clients creates a mixed set of expectations for the project, whereas the nuanced differences between more traditionally constructed historic buildings and more recently constructed historic buildings built with modern HVAC and lighting systems are not understood. Further, there are different expectations for how energy efficient equipment is integrated into the building, whereas easily updated "hidden in plain sight" technology interventions for things like cameras, internet antennae, and TV monitors, are not identified for favor of built-in features that are harder to change over time. There is also reluctance on behalf of architects and engineers to persuade clients to use more standard products available in the market that are more permanent interventions in the building as a result of the energy code exemption, cost of other aspects of the project, and potential conflict with regulatory action (Bjornberg 2018). Again, the absence of requirements mandated by energy code allows for more freedom when it comes to energy efficiency, however the decreased emphasis on energy efficiency and the lack of education of architects, historic preservation consultants, engineers, and clients creates a confusing decision-making environment that ultimately is put in the hands of private clients waging project budget limitations against future building operating energy consumption costs.

5.4.3 - Professional Experience Silos Exist

Similar to the fact that there is a limited scope of education surrounding operating energy efficiency in historic buildings, professional experience is siloed, limiting the expertise of proper intervention strategies to a few engineers versed in the context of historic buildings. On occasion, architects in Minneapolis working with clients on historic buildings will consult one of the few specialty consultants and mechanical, electrical, and plumbing (MEP) engineers, in addition to historic preservation consultants. Specialists in historic envelopes are consulted on an "as needed" basis (Thompson 2018). Meanwhile, MEP engineers are more typical on any building project, however their education level in terms of historic buildings varies, with trends towards less experience with new system integration into historic buildings (Bjornberg 2018). On the less technical side, architects and historic preservationists working on historic building reuse projects are limited in their scope, especially when dealing with the overarching big picture with clients, regarding change of use and tax credit application aid. These series of professional silos limit the abilities of project teams to adequately take into account the best possible energy efficiency standard for historic building projects.

5.4.4 - Energy Efficiency Upgrade Costs Deter Clients when not Mandated

Any building project is highly focused on balancing budgets to accommodate specific goals for the project. For historic building projects, a number of different costs deter building owners from including all possible energy efficiency upgrades, as the energy codes do not require compliance. Therefore, long-term operating cost becomes a major issue in whether or not clients will make decisions that improve energy efficiency. In addition, clients do not always accurately take into account the additional costs associated with energy efficiency expert consultants and their recommendations. Thus, the relationship between the client and the project team in terms of energy efficiency is centered on the team convincing the client to make certain decisions. Depending on the different clients and project teams, energy efficiency is not the focus, as it is an extra non-mandatory cost.

One strategy used by the city of Minneapolis is to involve the Weidt Group, a third party consultant that is paid for by the energy companies Xcel and CenterPoint. The Weidt Group meets with builders, developers, and designers for new and renovated commercial buildings throughout the region to suggest energy efficiency upgrades for building projects early in the project process. They offer rebates for certain energy efficiency upgrades integrated into projects that can save thousands of dollars. Local companies involved in historic preservation projects have utilized the group and their rebates consistently on their projects (Hultgren and Lochner 2018).

5.4.5 - Historic Buildings Disconnected from Climate Change Mitigation Efforts

Throughout discussion of improved energy efficiency in historic buildings, the conversation in Minneapolis does not highlight historic buildings as an important part of mitigating the effects of climate change. Of the interviewees responses, there were no clear perceptions of the overlaps between their work with historic buildings and Minneapolis' climate change mitigation plans involving existing building energy performance improvements, except in instances where the work is mandated by legislation either because they are government or municipally owned buildings. Interviewees also mentioned the introduction of newer mechanical and electrical systems as an overlap, especially as the systems improve the energy efficiency of the building, but because of the energy code exemption, there are no standardized mandates for energy efficiency technology in historic buildings

5.4.6 - Future Opportunities Exist in Case Study Projects and Technological Upgrades

Although there are a number of findings associated with inhibiting the promotion of operating energy efficiency in historic buildings, there are also a number of future opportunities for improvement in the present processes. First, historic building owners themselves are beginning to demonstrate forward-thinking approaches to improving energy efficiency in their buildings. Dominium, a developer client of the Historic Preservation Consulting firm Hess Roise and Company, is one of these forward-thinking clients. Their project at the A-Mill artist lofts repurposed a former Pillsbury mill for affordable artist housing. Located along the Mississippi within the St. Anthony Falls Historic District, Minneapolis' first historic district, eighty percent of the operating energy is sourced from the old hydro mill power system (Roise 2018). The A-Mill lofts provide a successful and unique example of how historic buildings can remain sustainable, especially as it was a historic tax credit project that abided by the SOI standards and went through regulatory review at the HPC, SHPO and NPS levels. Although it is a singular building type with historic hydropower built-in, it provides a case study for how creative historic building projects can make successful energy efficiency improvements.

Tying together regulatory and technical level interventions, there are plenty of opportunities to improve energy efficiency through robust minimal interventions, such as installing LED lighting, occupancy censors, energy efficient mechanical systems, and roof insulation, in addition to allowing higher efficiency windows. This may seem obvious, however adjustments to regulation that either ease strict regulation or mandate specific requirements carry enormous weight in building projects. For example, the SOI standards' relationship with window rehabilitation versus replacement has intervened in tax credit projects in Minneapolis, where laxer regulation regarding windows would have enabled a smoother project schedule and more targeted budget towards improving other aspects of energy efficiency within the building, including lighting and mechanical systems.

5.5 - Conclusion

Minneapolis exhibits forward-thinking climate change mitigation efforts that include environmental sustainability in multiple aspects of city planning and building energy efficiency improvements. However, historic preservation is only involved in this conversation in the context of anti-demolition and waste reduction. Historic buildings' exemption from the state energy code creates a missed opportunity to improve the energy efficiency of historic buildings, in furtherance of the city's climate change action agenda. Minnesota's efforts for increasing renewable energy sources and improving building efficiency through public building benchmarking data, in concert with Minneapolis' benchmarking mandates, all demonstrate the drive towards reducing greenhouse gas emissions through the built environment.

The emphasis on economic development as a means for historic preservation through large-scale income-producing tax credit projects definitely has wide scale benefits the local economy and maintaining integral attributes of Minneapolis built heritage. However, by limiting the scope of work to be compliant with the SOI standards there are issues with reaching the best possible building energy efficiency. Minnesota's extreme climate that alters between high levels of heat and low freezing temperatures create issues of internal comfort in adaptive reuse projects. This in turn, creates issues with window replacements and the SOI standards. In addition, newer technologies that might conflict with current SOI standards inhibit the ability for historic buildings to be able to be reused to fit modern standards, thus jeopardizing their longevity of use.

Image [12]
New York City skyline looking south
from Midtown

6. New York, NY

6.1 – Introduction

New York City's historic built environment encompasses a significant portion of the city's building footprint. Characterized by landmarks and historic districts both locally designated and layered with state and national level designations, the complicated fabric of the city is evolving with increased development pressure, economic influences, and social-spatial importance. The regulatory framework is well established with city agencies overseeing the processes of alterations to historic buildings, while including the preservation aspect of sustainability into the city's wider goals for climate change mitigation. The Mayor's Office for Sustainability and Mayor Bill de Blasio's 80x50 plan to reduce GHG emissions eighty percent by 2050 is well underway, with policy mandates and education programs that emphasize the need for existing building energy retrofits and upgraded technology that reduces the building's overall carbon footprint. The city's progressive efforts to create a preservation-friendly environment that is in line with sustainability goals shows promise; however, educational barriers regarding regulatory confusion and public interest do not yet correlate to provide a streamlined process that promotes higher operating energy efficiency in historic buildings.

As one of the earliest colonial settlements in North America, New York City has had a long history of development beginning in the early seventeenth century with the arrival of Dutch colonists. Throughout time, its deep, protected natural harbor and access to the Hudson River made it an important commercial center, as the English took over in 1661. The diverse combination of commercial and residential building representing centuries of architectural styles creates a unique environment ripe for preservation activity. The importance of historic buildings in New York should not be understated, as more than 36,000 buildings are locally landmarked or contributing members of local historic districts, or around 11% of the total building square footage of the city (City of New York 2018b; Halfknight 2018).

New York City's five boroughs are located in five counties (Bronx, Kings, Richmond, Queens, and New York). These counties are all listed under the IECC Climate Zone 4 and Moisture Regime A, making it a part of the band of the U.S. known as having a "Mixed-humid" climate. The mixed-humid climate is characterized by having approximately 5,400 heating degree days and twenty inches of precipitation, as well as having an average monthly outdoor temperature that drops below forty-five degrees Fahrenheit during the winter months (Baechler et al. 2015). Although not as cold as Minneapolis, New York still experiences a significant amount of extreme climate conditions, creating similar issues to Minneapolis in terms of envelope interventions.

6.2 - Historic Preservation

The New York City Landmarks Law is an important part of preserving the city's built heritage. In 1965, after decades of urban destruction and construction, City Council signed the Landmarks Law into effect, in order to "effect and accomplish the protection and enhancement and perpetuation of such improvements and landscape features and of districts which represent or reflect elements of the city's cultural, social, economic, political, and architectural history" (The Historic City Committee 1989, qtd. 6) The Law was passed through years of efforts coordinated through official committees as well as input from citizen groups, including labor unions, real estate investors, and neighborhood groups (in Greenwich Village and Brooklyn Heights) (The Historic City Committee 1989). Established by the New York Landmarks Law, the Landmarks Preservation Commission (LPC) became a charter-mandated New York City commission consisting of eleven mayoral-appointed commissioners. They are provided the responsibility of designating and regulating local landmarks and districts in New York City.

Another important milestone in New York City preservation history is the 1978 Supreme Court decision in Penn Central Transportation Co. v. New York City. This case involved Penn Central and their plan to construct an office building by Marcel Breuer on top of Grand Central Terminal. Grand Central Terminal's status as a local landmark allowed the LPC to prevent its demolition. This prompted a lawsuit by Penn Central against New York City due to the taking of their development rights. The case made its way to the U.S. Supreme Court, where they ruled in favor of the LPC. The court's ruling stated that the preservation of Grand Central promotes an "enhance[d] quality of life for all" (Goldberger 1990). This ruling set the precedent that historic buildings offer a public good to the residents and visitors of New York City.

6.2.1 - Local Regulation

Local regulation of historic buildings occurs through the LPC. A staff of approximately eighty preservationists, researchers, architects, historians, attorneys, archaeologists, and administrative employees supports the eleven commissioners. The Commission's membership has specific requirements, set forth through the Landmarks Law, that say there must be at least three architects, one historian, one city planner or landscape architect, and one realtor. In addition to these professions, one representative from each of the five boroughs must be included (The Historic City Committee 1989). The combination of commissioner and staff efforts help to regulate the existing 36,000 buildings, with 141 local historic districts and extensions, 1,405 individual landmarks, 120 interior landmarks, and 10 scenic landmarks (City of New York 2018b). As of 2016, these landmarked properties comprised 3.4% of city lots covering only 4% of New York City's total lot area (PlaceEconomics 2016).

Work on historic buildings that are locally landmarked or within a locally landmarked historic district in New York City usually requires Landmarks Preservation Commission approval; however different projects can pursue different avenues of approval, and depending on the type of work there may not need to be a permit. Alterations to historic buildings require permits, while general maintenance does not necessarily need a permit. The majority of the landmarks are regulated for exterior work; however, interior landmarks account for a small portion of the LPC's alteration approvals.

Expedited reviews take the form of either FasTrack Service or an Expedited Certificate of No Effect. FasTrack Service is meant for interior alterations, window replacements on non-visible facades, and HVAC installation on non-visible facades, and typically takes around ten days for approval. The Expedited Certificate of No Effect covers interior work and ensures that the work does not adversely affect the significant features of the landmark property, and usually takes around three days for approval. Expedited Certificates of No Effect can be issued for projects that do not alter the building's exterior assuming it is not an interior landmark (Landmarks Preservation Commission 2018c).

Different from Expedited Certificates of No Effect, are Certificates of No Effect (CNE), which account for the majority of LPC permits. CNEs cover exterior and interior renovations that require Department of Buildings permits – for example, installation of plumbing and heating equipment and exhaust fan vents. This work is all vetted to ensure the there is no effect on the building's significant architectural features, and it typically takes ten days from application completion to receive a permit (Landmarks Preservation Commission 2018b). For exterior work, a Permit for Minor Work (PMWs) are typically required. PMWs are issued for window or door replacement, masonry cleaning or repair, and restoration of architectural details. Similar to the CNE, the approval depends on the application's appropriateness to the building and or historic district, and takes about ten days from application completion to permit issuance (Landmarks Preservation Commission 2018e).

When applications have proposed work that significantly affects the protected architectural features or does not comply with the Rules, a project representative must present at an LPC public hearing in order to acquire a Certificate of Appropriateness (CoA). This type of work focuses mostly on exterior work and includes additions, demolitions, new construction, and removal of stoops, cornices, and other significant architectural features. The commission approval process depends on each project, and the permit is only issued after LPC staff has reviewed the final draft of construction documents that are submitted after the commission approval at the hearing. The public is also allowed to comment on this part of the process through Community Board review and testimonies at the LPC public hearing, and the commission takes into account public opinion. The whole process can take at least three months (Landmarks Preservation Commission 2018a).

In 2018, LPC released proposed Rules Amendments that refine the administrative duties of the staff and commission to streamline the project application approval process, making it more transparent and predictable (Landmarks Preservation Commission 2018d). The overarching changes shift the ability of the staff to approve select applications without having to appear in front of the Commission in a public hearing, which can be time consuming and costly. The types of applications that shift to the staff's responsibility were chosen based on past unanimous Commission decisions that are regularly approved with a consensus of support. For example, barrier-free access ramps typically receive approval from the Commission, therefore the new Rules allow for staff level approval, creating a predictable route for project completion (Bindelglass 2018).

The Rules Amendments have received mix reviews throughout building professionals, property owners, and preservationists in New York City. The streamlined and more efficient process is attractive to project applicants who have more information and predictability working within landmarked buildings and districts. However, preservationists are concerned over the decreased ability for the public to voice opinions on projects if they never reach LPC hearings. In addition to the public input issue, there are concerns over the rules allowing substitute materials in restoration work. There is a fear that the creation of a more predictable marketplace will lower the cost of these types of products, leading to an increase in the replacement of historic material (Bindelglass 2018).

6.3 – New York City and State Climate Action

New York City has been a leader for climate change action due to its unique built environment, and incentives to create higher quality living situations for all residents. Included in the city's long list of climate change mitigation strategies are the notable GHG emission reductions associated with the increased energy efficiency of existing buildings. Since 2009, the city has endeavored on major initiatives to understand building energy consumption, regulate new and existing building energy consumption, set goals for municipally owned building renovations, and build capacity through incentives and disincentives for privately owned buildings to do the same.

Local Laws 84 and 87 of 2009 lay the groundwork for the narrative of New York City's building energy consumption initiatives. Local Law 84 began the city's building benchmarking program that requires certain buildings to disclose energy data (Mayor's Office of Sustainability 2016). Benchmarking requires the disclosure of the total use of energy and water, and requires the use of a benchmarking internet-based tool developed by the U.S. EPA. The original 2009 law required buildings to report their energy and water use for the previous calendar year. The buildings that were required to do this were city buildings over 10,000 square feet, and any building that exceeds 50,000 square feet, and two or more buildings on the same lot that exceed 100,000 square feet, with a few exceptions.[1] In addition to energy benchmarking, Local Law 87 established the requirement that benchmarked buildings go through an energy audit every ten years, beginning in 2013, as well as retro-commissioning, which strives to ensure building systems operate as efficiently as possible.(City of New York 2015) As of 2016, Local Law 133 updates the required benchmarked buildings to include any buildings that exceed 25,000 square feet (rather than 50,000 from 2009), which includes more buildings than originally prescribed.[2]

In 2014, Local Law 66 established specific goals for GHG reductions, establishing the "80x50" goal of

1 New York City Administrative Code, tit. 28, sec. 1, chp. 3, art. 309 § 28-309.2 (2009).

2 New York City Administrative Code, tit. 28, sec. 1, chp. 3, art 309 § 28-309.2 (Amendments to Footnote 9) (2016).

reducing eighty percent of GHG emissions by 2050. The "One City: Built to Last" plan, released shortly after the law passed, lays out the city's plan for reducing GHG emissions, most notably through existing building energy retrofits. The report says,

> To reach 80 by 50, further GHG reductions will need to come from additional cleaner power generation, more sustainable modes of transportation, and better management of our solid waste. But the biggest untapped opportunity is to improve the energy efficiency of the city's one million buildings (City of New York 2014, p. 7)

The plan goes on to expand on five guiding strategies for how to reduce GHG emissions through the built environment. These include the city leading by example, creating financial incentives and easier policies for retrofitting buildings on the private level, raising energy efficiency standards, ensuring an equitable effect throughout all New York City neighborhoods, and using benchmarking data, analysis and stakeholder feedback to inform more specific paths forward (City of New York 2014). In 2015, "One New York: The Plan for a Strong and Just City" was released which unifies the environmental policies associated with the built environment and climate change in combination with social and economic goals (City of New York 2015). The plan, otherwise known as "OneNYC", as well as the 80x50 mindset, mainly guide implementation for the Mayor's Office of Sustainability. The Mayor's Office of Sustainability contains architects, data scientists, engineers, policy advisors, and city planners all working together to tackle challenges posed by climate change throughout the city (City of New York 2018a).

On June 2, 2017 Mayor Bill de Blasio signed Executive Order 26, which officially committed the city to alignment with the 2015 Paris Climate agreement and the 1.5 degrees’ Celsius limit in global average temperature warmth. This Executive Order was in direct response to President Trump's decision to pull the United States out of the Paris Climate Agreement. The Mayor argues,

> In New York City, we have known for some time that we have to address the existential crisis of climate change. Superstorm Sandy showed us the terrible cost of our warming planet. We had hoped we could depend on the federal government for leadership. Now we know we cannot. President Trump's decision to pull the United States out of the Paris Climate Agreement has set us on a dangerous path of denial. When our national government falls down, local governments have to step up. I am proud that New York City will play its part and that we are joining in common cause with hundreds of local governments around the nation and the world. Together, we will show that the people will solve this problem at the grassroots (City of New York 2017, p. 2).

The urgency of this new climate action alignment changed the strategies for the 80x50 movement by front loading GHG reductions by 2020 in order to meet this new goal. This requires creating more stringent mandates for building energy consumption, and the type of energy source that buildings use. Fossil fuels burning in buildings for heat and hot water account for 39% of the city's GHG emissions, and in order to meet the new 1.5-degree goal, the city will pursue legislation that will limit fossil fuel use below intensity targets by 2030 and 2035. In addition to this legislation, the city committed to achieving an additional twenty percent energy consumption reduction across their portfolios by 2025, as well as targeting 2019 and 2022 as years for energy code adaptations that could realize twenty to forty percent energy intensity reduction for new and substantially renovated buildings (City of New York 2017a).

In September 2017, the Mayor announced new mandates that will force existing building owners to make drastic reductions in GHG emissions, making New York City the first city to do so. The mandates will create fossil fuel caps for buildings over 25,000 square feet, and will trigger replacement of fossil fuel equipment and efficiency upgrades for the worst performing 14,500 buildings in this category. Together, this will produce a twenty-four percent decrease in total GHG emissions. A combination of incentives and penalties will motivate this mandate. The Property Assessed Clean Energy (PACE) program will provide low-interest financing to allow property owners to pay for energy efficiency upgrades through their property tax bill, while monetary penalties scaled to building size will come into effect in 2030 for buildings not in compliance (City of New York 2017b).

The recent Rules Amendments at the LPC relate to the 2017 changes in the 80x50 strategy. The Rules Amendments account for changes that will make higher levels of energy efficiency in buildings under the LPC's purview easier to achieve, helping to meet some of the more urgent energy efficiency goals set forth by the alignment with the 2015 Paris Climate Agreement. The report includes sections about how city agencies are assessing their own processes to best align with these overarching goals. The report notes,

> LPC is simplifying the process for gaining approval for interior alterations and energy efficiency measures, such as high performance windows and HVAC equipment, and renewable energy measures, such as solar panels (City of New York 2017a, p. 35).

To further this, the LPC Rules Amendments document lists one of the goals as updating the Commission's rules for approvals with concern to "barrier-free access, energy codes, and resiliency mandates" (Landmarks Preservation Commission 2018d, p. 2).

The local green building advocacy group Urban Green Council has been heavily involved in developing the city's climate action plans and analyzing benchmarking data to understand how New York's buildings are contributing to climate change. Urban Green Council is an affiliate of the U.S. Green Building Council. Established in 2002, they have combined expert and volunteer initiatives that focus on mitigating the causes of climate change in the built environment (Urban Green Council 2016).

In 2015, New York State released a comprehensive energy plan in an effort to "build a clean, resilient, and affordable system for all New Yorkers." This plan acts as a roadmap for achieving three overarching goals set by Governor Andrew M. Cuomo in 2014 with his initiative "Reforming the Energy Vision" (REV). REV seeks to create a forty percent reduction in greenhouse gas emissions from 1990 levels, produce fifty percent of electricity from renewable energy sources, and increase the statewide energy efficiency by 600 trillion Btu (New York State Energy Research & Development Authority 2018c).

The New York State Energy Research & Development Authority (NYSERDA) is helping to implement this comprehensive plan through a multitude of programs. The Clean Energy Standard (CES) is part of the ambitious goal to increase renewable energy sources to fifty percent by 2030 (New York State Energy Research & Development Authority 2018b). On top of procuring the development of more renewable energy sources, NYSERDA promotes the use of technology in buildings that will increase efficiency, and allows for the capability to obtain power from renewable sources rather than fossil fuel burning sources. For example, the Air-Source Heat Pump (ASHP) Program works with HVAC installers in order to promote the more extensive use of this efficient heating and cooling system. Each qualified ASHP installer will receive $500 for each unit installed, assistance from NYSERDA in providing ASHP solutions, as well as promotion and visibility for New York customers on the NYSERDA website. Air-Source Heat Pumps offer more energy efficient heating and cooling as they transfer heat between the inside and outside air of a building while operating on the electrical grid, offering the opportunity for renewable energy sources to power efficient equipment that offers significant indoor air control (New York State Energy Research & Development Authority 2018a). Efforts are afoot in New York City to educate building professionals about NYSERDA programs in order to further promote climate change mitigation strategies.

These initiatives have an effect on New York City's projects, as project teams strategize for GHG emissions reductions. The State's efforts to increase renewable sources ton fifty percent by 2030 drive the increased electrification of existing buildings in New York City. The more reliance on an increasingly renewable energy grid, the fewer GHG emissions. This electrification comes in the form of new heating and cooling technology like Air-Source Heat Pumps and Ground Source Heat Pumps (Ordower, Rauch, and Schwane 2017).

6.4 – Findings

New York City's robust historic preservation regulation has positive and negative attributes that play to promote or inhibit increased operating energy efficiency in its historic buildings. The strong correlation between existing building energy retrofits, including historic buildings specifically, and the ambitious city climate change action goals are significant in creating a building professional mindset catered towards increasing energy efficiency. This includes the recent LPC Rules Amendments changes to allow a more predictable review process for energy efficiency improvements. Meanwhile, historic buildings under the purview of LPC are primarily regulated in terms of traditional preservation goals. The expertise of the LPC staff thus is focused more on historic appropriateness rather than energy saving design features, which are not prioritized. Outside of the regulatory procedures, education, financing, and building project strategies have become issues on more holistic levels. Property owner procedural education, in combination with varying affordability of improvements, create an uneven environment for making these types of improvements across all different levels of historic buildings. Moreover, the exemption from the New York City Energy Conservation Code by becoming listed on or eligible for the National Register of Historic Places provides a loophole from more stringent energy saving upgrades, a pathway towards less costly renovation projects.

6.4.1 - Historic Preservation Projects Directly Contribute to City Greenhouse Gas Emission Reduction Goals

Differing from Minneapolis and Los Angeles, there is a strong correlation between increasing historic building energy efficiency in New York City and the broader climate change mitigation goals set forth by the city's recent alignment with the Paris Climate Agreement. This comes in the form of LPC Rules Amendments and the open conversation between LPC, the Mayor's Office of Sustainability, Urban Green Council and a larger group of stakeholders in figuring out how to make historic buildings more energy efficient. The LPC believes that historic buildings do not need to be entirely exempt from the NYC ECC, and supports the measures set forth by the city to reduce GHG emissions. The LPC Rules Amendments address these decisions by making it easier for projects to gain approval in a more predictable way. LPC won't regulate interior work unless it affects the exterior of the building, which can provide an opportunity for mechanical systems to be installed in place of outdated fossil fuel burning systems, depending on the extent of the project (Halfknight 2018).

Specifically regarding physical alterations to historic buildings, the LPC has been open to dealing with new approaches to energy efficiency, namely through passive house standards; however, this process is relatively new and requires extra review and convincing of the Commission. The current issue with this approach is the fact that there are building science challenges in these projects. Passive house standards for new construction ensure that the envelope of the building is sealed tight, to create the most efficient environment for heating and cooling the interior (City of New York 2014). This type of intervention on a historic building worries some Commissioners regarding building science and material preservation, causing long and complicated review process on behalf of the project applicant in order to prove how the alterations will not harm significant features. However, the LPC staff has good relationships with architects experimenting with passive house projects on historic buildings, and they often work together to ensure a smooth review process (Herrala 2018). Although passive house energy standards are an extreme example of energy efficiency improvements, they represent the direct changes happening at the LPC to allow existing buildings to reduce their carbon footprint.

Examples of sustainability-focused programs and historic preservation projects in New York City already exist. Cory Herrala, Deputy Director of the Preservation Department at the LPC, provided an example of a homeowner in a Brooklyn Historic District interested in achieving the highest level of energy efficiency. On her own, she explored grants for high performance mechanical equipment from ConEdison and NYSERDA and was able to install a split air-source heat pump system in her row house. She collaborated with LPC to ensure her ability to do this type of work in her home, and was successful in implementing these features, which included triple-glazed simulated double-hung windows at a public hearing (Herrala 2018).

This type of work is a successful example of the type of engagement with the sustainability community that the LPC has been involved with in attempting to improve energy efficiency of New York's historic buildings. However, education about New York's regulatory procedures continues to be a challenge for building professionals. Although there is evidence that select building professionals understand LPC's rules, there is still a murky understanding throughout the city about what can or can't be done with a historic building. Increased awareness and education of LPC's procedures involving energy efficiency improvements could lend itself well to more robust promotion of operating energy efficiency in historic buildings. Simplifying rules, engaging more with project applicants, and providing easily accessed online procedures and briefs of new technologies are all efforts afoot in New York.

Awareness outside of the preservation field in existing building reuse is already common practice. Informational sessions on how to electrify buildings to rely on an increasingly renewable energy grid are being held around the city, educating building professionals about technologies that work within New York City's variable climate. Ground-Source and Air-Source Heat Pumps are being pushed as ways of more efficiently heating and cooling existing buildings, and due to New York City's climate, they can easily be installed (Ordower, Rauch, and Schwane 2017).

6.4.2 - Public Benefit of Climate Change Mitigation Versus Historic Preservation Debated

Within the discussion surrounding LPC's recent Rules Amendments is the issue of where energy efficiency improvements fit into larger definitions of "public benefit". The major outcry over the Rules Amendments came from concerned preservation advocates in New York City that are afraid about the loss of public input for certain projects that they argue could negatively impact the public benefit preservation offers.

New York's preservation regulation jurisdiction over publicly inaccessible parts of historic buildings is very far reaching in comparison to other parts of the United States. Most notably in this public preservation debate regarding energy efficiency is the broad interpretation of public benefit extending to row house rear facade work, including rear facade insulation that changes the exterior character of the building. LPC is facing pressure from both property owners and the city with measures that increase energy efficiency. Therefore, there's a challenging balance between preservation aims, economic aims, ensuring properties are preserved for public benefit, and private property rights (including increased energy efficiency) at play (Halfknight 2018).

Preservationists' worries over the Rules Amendments specifically call out public input into the process, arguing that New York's preservation policy is hindered upon public input, and that the increase in staff level applications removes the public from decisions that could possibly affect their preservation interests and advocacy. Emphasis on built fabric conflicts with energy efficiency upgrades usually in regards to window material replacements. The Historic Districts Council is concerned with the fact that substitute materials should always require a commission review, and requiring in-kind replacements creates the opportunity for the marketplace to capitalize on this, driving down costs and creating more opportunity for material replacement (Bindelglass 2018). This issue of public benefit is something the LPC is wrestling with, especially as the preservation of buildings for future use combines with the city's extensive goals for carbon reduction. The balance between preservation advocacy groups' goals and the new Rules Amendments directly confronts this issue, especially as LPC has engaged preservation advocacy groups and sustainability groups as stakeholders in the development of the amendments. This ties back to arguments that support changing the SOI standards, which emphasize repairing historic material over replacing, and the fact that this does not always ensure long-term preservation.

6.4.3 - Mandates Work as a Method for Widespread Building Compliance

Voluntary action on behalf of property owners in increasing energy efficiency does not work well in New York City, and mandates regarding building regulation have demonstrated results. As an example, Local Law 88 of 2009 set commercial building standards for lighting to improve energy efficiency, however recently the law includes residential buildings over 25,000 square feet to update common area lighting. The compliance date is 2025, however buildings are already ensuring their compliance with this Local Law for fear of penalties associated with non-compliance (Halfknight 2018). Architects are thinking about these types of mandates and code requirements when working with clients. When retrofitting buildings, the only way to get people to make certain energy efficiency upgrades will be to require them. The cost-motivated decision-making does not favor a voluntary method. Clients will ask, "do you have to?" with regards to energy efficiency upgrades, and if the answer is no, then there is a far lower chance of them paying for these types of upgrades. Although this isn't true for all property owners, it's safe to assume given the competitive real estate marketplace of New York City that their interest mainly resides in return on investment and balancing overall maintenance and construction costs in the New York City market rather than saving the planet. Therefore, mandates play an important role in shifting the budget priorities of projects, especially in historic buildings (Azaroff 2018). The September 2017 mandates requiring existing buildings to replace their fossil fuel burning energy sources carry a heavy influence on the treatment of historic buildings.

6.4.4 - Energy Retrofit Strategies Need Rethinking

There are a number of different approaches to rethinking energy retrofits of historic buildings. However, improvements to the scope of energy upgrades and financing options, and attention to possible loopholes in regulation that provide exemption offer opportunities to effectively make meaningful energy changes in historic buildings. These approaches are all associated heavily with cost, whether or not projects can afford the energy upgrades, and whether or not they are mandated.

The City of New York has been the leader of energy retrofits in existing buildings, as set forth by their OneNYC plan to lead by example. The strategy focuses on the quantity of conventional energy retrofits rather than deep retrofits. Because energy improvements are seventy-five percent more effective when done during a large-scale capital improvement, this potentially inhibits the energy consumption impact of deep energy retrofits. Currently, the city is exploring recommendations made from benchmarking data analysis involving mechanical, electrical, and plumbing that usually have five to seven-year payback periods; however, there is a huge startup cost for doing multiple projects on different buildings. If instead there was a focus on a smaller number of buildings with whole scale retrofits for energy efficiency, there could be greater benefits in the long term (Rouillard 2018).

Historically designated buildings that require LPC staff level approval are included in these conventional energy retrofits. Therefore, upgrades to mechanical, electrical, and plumbing systems are required to be photographed or mocked up for review by the LPC. There are opportunities for improvement in time efficiency for these projects, where this review process could be folded into a larger project to be more time effective, in addition to being more energy efficient in the long run for the building (Rouillard 2018).

Developers and property owners play a large role in the energy efficiency improvements in buildings, and depending on the type of owner there are different options. Not specific to historic buildings, but in general building owners have varying levels of capital available for improvements. In office buildings, there are Class A and Class B offices. The differences between these offices refer to the owners of buildings, where Class A owners have immense ability to raise capital for work, including paying sophisticated energy consultants. While Class B owners do not necessarily have this ability, and are more diverse in terms of their ability to change energy efficiency of their buildings. This focus is highly cost-oriented, and with 11% of the square footage of the city covered by some sort of historic designation, it is invaluable to ensure that historic buildings and energy efficiency are cost-effective (Halfknight 2018).

Meanwhile, energy code loopholes play a large role in strategies for retrofits. The main loophole for energy code compliance for historic buildings is the compliance exemption triggered by listing on or eligibility for listing on the National Register of Historic Places. This is identified as a challenge in promoting operating energy efficiency in historic buildings due to the project pathway option to pursue cheaper energy interventions. Although this is not the case for all nationally designated buildings, this pathway places the burden on architects to convince clients to make certain energy efficiency improvements, even if they are not required (Rouillard 2018). Despite the national designation route, there are opportunities to not comply with the NYC ECC. Specifically, if a project spends fifty-one percent of the building's value in upgrades, it triggers compliance with the current NYC ECC, while fifty percent of the cost does not (Azaroff 2018).

6.5 – Conclusion

New York City exemplifies a unique situation of a dense historic built environment combined with forward-thinking policies to address the urgency of climate change. As the most populous city in the United States, there are great opportunities to mitigate the causes of climate change through GHG reductions, and the enormous group of existing buildings (including historic buildings) is pertinent in meeting the city's goals. That being said, there are a few takeaways and lessons learned from New York's historic building regulations that are key to helping promote better operating energy efficiency in historic buildings, as well as are similar to other parts of the country. The involvement of the Landmarks Preservation Commission with the sustainability community is a key advantage to the city concerning reducing GHG emissions in buildings. The City's realignment with the 2015 Paris Climate Agreement and the major changes set forth by the Mayor's Office of Sustainability to the city's plan in 2017 had an influence on revising the LPC Rules Amendments, streamlining some energy efficiency processes for LPC approval. In addition, New York City's climate allows for efficient technology that can reduce GHG emissions. Meanwhile, the same loophole exists for energy code compliance, forcing the option of energy efficiency upgrades to the architecture-client relationship, and thus oriented towards cost. These issues are spread throughout the other two case study cities, however the importance of New York City's attention paid to GHG reductions in relation to historic preservation projects should not be understated, and this strategy's use across other municipalities offers major opportunities for meeting climate change mitigation goals.

7. Recommendations

7.1 - Local Level Commonalities

The three municipal case studies exhibit a complex system of varied policy framework and professional practice expertise associated with historic building projects and their ability to achieve higher levels of efficiency. This thesis assesses the major commonalities between three local level regulatory environments in discrete climates in order to provide opportunities for how these multiple processes and procedures, on a broad scale, can be improved. The commonalities include:

1. SOI standards inhibit the potential for maximum operating energy efficiency.
2. Historic building energy code exemption releases buildings from mandated compliance, and causes voluntary, cost-driven, project-level energy efficiency decisions that do not promote higher operating energy efficiency.
3. Building industry practitioners need more holistic education for approval processes, historic building reuse projects, and strategies for reducing building GHG emissions.
4. Historic preservationists interact with the sustainability community inconsistently and the siloing of these fields inhibits essential communication.

These commonalities do not cover the extent of the findings from each municipal case study, but rather serve the purpose to expand the findings to nationwide patterns and narratives involving historic buildings and energy sustainability. They are separated into building regulation challenges and practitioner understanding and engagement with the regulations, which will be addressed through policy and programmatic recommendations. In terms of building regulation challenges, the widespread influence of SOI standards in project approval processes for building permits and financial incentives supports physical improvement inhibitory factors that were observed in Los Angeles and Minneapolis. This relates mostly to construction that improves the overall energy performance of a building, most notably involving window compatibility with indoor climate control. Climate variations for each municipality also determined the technology that was enabled in historic buildings projects. Meanwhile, the widespread energy code exemption does not push property owners to upgrade their historic buildings.

In terms of practitioner understanding and engagement, there is an inconsistent pattern of education about historic building reuse, regulation, and improvement of energy efficiency among the actors involved on the project team. Approval processes through historic building regulatory bodies are often perceived as lengthy and costly; however, improvements and refinement of the processes are not always propagated to widespread groups of building professionals and property owners. Physical improvements to the building, including windows and insulation, have varying regulation requirements depending on location, and assumptions regarding what can or cannot be done to the building play a major role in project decision-making. These assumptions may or may not be true depending on the local requirements amended by regulatory bodies. At the same time, connections with climate action policy are not strong across the country, with varying levels of engagement with the sustainability community, who are leading the efforts to mitigate the causes of global climate change on a local level.

7.2 - Policy Recommendations

Recommendations regarding policy refinement involve the ability to modify the codes, regulations, and standards to address municipal case study commonalities. They do not take the form of specific policy language refinement, but rather are suggested guidelines for implementing policy that addresses the weaknesses and challenges identified in this thesis.

7.2.1 - Promote Reasonable and Flexible Interpretation of the SOI Standards

The SOI standards play an enormous role in local, state, and national regulation of historic buildings, most notably in Federal Historic Rehabilitation Tax Credit projects. However, the inconsistent interpretation of the SOI standards across projects has had negative impacts on projects seeking higher energy efficiency. For these projects, the SOI standards apply to both interior and exterior, making it harder to implement certain physical and technological interventions into the historic fabric. In addition, historic buildings are not the same in their construction, cultural significance, climate, and reuse, making it difficult for the SOI standards to be applied evenly within these conditions. Although originally intended to be a flexible guideline for historic building reuse, the SOI standards have created a regulatory environment centered on predictable approval, demonizing replacement material and non-historic alteration.

In order to address these issues, SHPOs and the NPS should establish a clear energy efficiency goal. This goal would encourage and empower SHPOs and local level regulatory bodies to make building operating energy efficiency a priority during the review process for projects seeking tax credits, and discuss material replacement decisions through an energy sustainability lens. Due to the current structure of historic preservation policy in the U.S., this top-down approach would open the sustainability dialogue with SHPOs. Although the NPS published "The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings," and updated their Preservation Brief 3 on sustainability, there is no overarching goal for how historic buildings' operating energy efficiency should be improved. The identification of a clear energy goal from the national level should include climate predictions of fifty to one hundred years into the future, which would change the nature of the SOI standards interpretation as different conditions would emerge that might justify the replace material or alterations that threaten the buildings' historic architectural character. By creating a clear goal from the federal level, the flexible nature of the SOI standards would shift to favor more case-by-case decisions regarding the approval of energy efficiency measures, and address the issues faced by historic building projects attempting to achieve high levels of energy efficiency and receive federal and state financial incentives.

7.2.2 - Expand and Re-orient Energy Code Compliance for Historic Buildings

Energy conservation code exemptions throughout the country have provided an incentive for historic building reuse, easing additional regulations on the building that could threaten the buildings' architectural and material character. On the other hand, exemptions eliminate mandates that would make historic buildings achieve high levels of energy efficiency. By eliminating the standard blanket exemption for historic buildings, energy codes should be expanded to be more mindful of the ability of historic buildings to be energy efficient, including both prescriptive and performance based options for historic buildings. Prescriptive options include lighting wattage requirements for non-historic elements, similar to California's energy code, as well as non-GHG emitting equipment requirements, similar to New York City's efforts to reduce GHG emissions in existing buildings by mandating they update their equipment. Due to the diverse group of historic buildings, energy performance options would offer an alternative to prescriptive options. By expanding the requirements to ask more of historic buildings, project teams would no longer bear the responsibility to convince their clients to "do the right thing," and energy efficiency measures would be accurately incorporated into project budget planning, removing the unanticipated expense associated with the predictable code mandates. The elimination of the exemption and the replacement with case-by-case oversight would address the concern that energy code compliance would lead to fewer historic building retrofits and in turn, the loss of historic fabric.

Nevertheless, the option for exemption should not be discarded. Energy conservation code exemptions throughout the country should be re-oriented to make historic buildings exempt only if certain code requirements negatively affect significance of the historic building. The 2015 IECC code leads the effort to making this change with the inclusion of language specifically stating that there needs to be proof signed off by the owner, design professional, or representative of the SHPO that exempts the building from provisions that would "threaten, degrade, or destroy the historic form, fabric or function of the building" (Carroon 2012). Although the IECC has made this change in their model code, there is no obligation for states and local jurisdictions to adopt this language.

In order to implement these changes, local and state regulatory bodies should work with administrative code officials to modify energy code to be more mindful of historic buildings. Local code could be customized to the specific needs of each jurisdiction based on varying climates and the differences in historic preservation needs. For example, New York City's significant historic footprint differs from Minneapolis' smaller historic footprint. This changes the nature of the relationship between sustainability goals and historic preservation, which would affect the amount of attention given to historic building operating energy in code form. Thresholds could be established, similar to New York City, where if fifty-one percent of the building's value is spent on energy efficiency upgrades, full compliance is required. This would tease out the differences between deep and conventional energy retrofit projects. The re-orientation of energy code exemptions would require more capacity of the local review boards to accommodate the requirement of signed proof proving the detrimental effect on the building. Local historic preservation regulatory bodies should build this capacity by creating a specific position for this type of review. Alternatively, this responsibility could be folded in to an existing position, depending if the person responsible has qualifications to oversee energy interventions.

7.2.3 - Increase Financing Opportunities Specific to Energy Efficiency Improvements in Historic Buildings

It is crucial for financing opportunities specific to energy efficiency improvements be implemented in order to compliment mandates stipulated by changes in energy conservation codes. Financial support from public-private partnerships, private energy groups, municipalities, and states should be proliferated to make energy efficiency technology more accessible to projects. Funding programs can take the shape of public-private partnerships that provide grants through state organizations and energy efficiency technology companies, similar to NYSERDA in New York. While private companies could perform project assessments to determine what technology would best be incorporated, and offer rebates to offset the added costs, similar to the Weidt Group in Minnesota. Potential actors for implementing this funding will depend on varying locations, however they should include state organizations, private energy, and local historic preservation regulatory bodies. The collaboration of private, public, local and state energy efficiency interests with local historic preservation regulation bodies will ensure that the heritage professional voice is heard in this process. Research supported by local sustainability offices about long-term operating energy savings will round out the funding to inform the decisions of property owners for what types of improvements will be most beneficial in terms of cost in the long-term.

7.3 - Programmatic Recommendations

Although policy refinement is an important aspect in facilitating the regulatory processes through the lens of historic building energy efficiency, public historic preservation regulatory body programmatic changes offer more holistic solutions. Specifically, changes in agency communication with building professionals and the sustainability community that takes the form of processes education and sustainability programs. These programmatic changes can occur from the local regulatory standpoint, especially through increased public awareness and transparency to align building regulation with climate change action initiatives.

7.3.1 - Expand Outreach to Building Professional Community

Local historic preservation agencies should implement marketing related to their specific regulatory procedures related to historic buildings. Informational sessions, publicly accessible material, and easily comprehendible processes need to effectively communicate the requirements, procedures, and instructions for historic building permit acquisition. Historic preservation regulatory bodies should lead this effort to increase awareness of what construction is allowed at an historic building, and what kind of process is required for specific types of work. An example of this from Minneapolis takes the form of a brochure that includes the various processes and timelines for historic building project permit acquisition through an organized flow chart. New York City offers information about their various permits on the LPC website, however the instructions lack images and an easily understood flow chart. Links to energy efficiency incentives from public and private sustainability organizations would also be provided to establish strong correlation between historic buildings and energy sustainability. Informational sessions and published successful project examples would bolster this effort to ease the regulatory process for property owners and project teams, and should focus on sustainability concerns in order to myth bust common perceptions about the difficulty gain approval for energy efficiency improvements.

7.3.2 - Engage with Local Sustainability Groups

Increased collaboration between local historic preservation agencies and the sustainability community is integral to unifying the efforts to preserve and develop sustainable cities. A task force could be created by the city, initiated by the historic preservation agency, to assess how certain sustainability goals can be implemented into the historic building regulatory process, specifically with energy codes, and informational programs that educate building professionals about energy in historic buildings. The task force could organize lectures, meetings, research, and report development that examines the opportunities that historic preservation can provide in addressing overarching city sustainability goals. City sustainability goals already incorporate increased energy efficiency of existing buildings, and this task force would open the possibility for historic buildings to be more effectively incorporated into this goal. Members of the task force would be local preservation agency representatives, public and private climate change advocates, building professionals, and historic preservationists. This effort would prompt compromising solutions to policy decision-making that reconcile preservation values with the need for climate change mitigation.

7.4 - Further Research

Further research is needed to supplement this thesis with more detail. At a municipal level, focus on historic building performance metrics would more accurately account for climate variations and the need for historic buildings' contribution to climate change mitigation. Due to the diverse group of designated buildings, studies could be funneled through building typologies, locations, use, and material. Analyzing the number of designated buildings on a municipal level, along with their size, performance, and percentage of the city’s built footprint would more clearly identify historic buildings’ potential to contribute to a city's climate change goals. Additionally, an evaluation of educational programs for architects, engineers, and historic preservationists on energy efficiency and sustainability concerns would be useful to understand how building professionals are educated and capable of responding to the requirements of historic preservation regulation and the needs of climate change action.

8. Conclusion

Climate change is occurring and the decisions we make today carry immense weight to address its potential global disastrous effects. As preservationists, we must closely examine our contribution to global efforts to reduce GHG emissions. By examining historic preservation regulation through an energy efficiency lens, this thesis outlines why historic buildings may not be contributing to their fullest extent to mitigate the primary cause of climate change.

The solidified narrative of preservation's inherent sustainability needs to be re-evaluated and questioned as the preservation field evolves to include places that are not built with features that automatically conserve energy. Buildings that are preserved do not merely include architectural masterpieces, but consist of important places to many communities. This is a crucial aspect of preservation and is included in community planning through existing preservation policy throughout the country. However, historic building designations provide a loophole for compliance relative to energy conservation codes. The diverse array of historic buildings includes buildings capable of meeting higher standards of energy, making their blanket exemption inhibitory to mitigating climate change.

Meanwhile, historic building reuse projects throughout the country must comply with regulations that further inhibit attaining higher operating efficiency. SOI standards and aesthetic review become the focus of these projects due to the lack of regulation on behalf of energy efficiency. In most cases, the requirements involved in historic preservation review do not favor the deep energy retrofits to make buildings more efficient.

The issues summarized in this thesis contribute to the rich tapestry of policy influences and economic conditions that guide project-level decision-making in historic building projects. The urgency of climate change action in 2018 cannot be understated, and the field of historic preservation has an enormous responsibility to rethink how historic buildings will contribute to mitigating greenhouse gas emissions. Although there are numerous ways of addressing this issue across the historic preservation discipline, the ability to achieve high levels of operating energy efficiency that will in fact preserve buildings through upgraded use for the foreseeable future. Enabling historic buildings the opportunity to adapt and change to meet the problems of today is in itself an act of preservation.

Bibliography

Alliance Commision on National Energy Efficiency Policy. 2013. *The History of Energy Efficiency*. https://www.ase.org/sites/ase.org/files/resources/Media browser/ee_commission_history_report_2-1-13.pdf.

Anwar, Mumtaz. 2018. Interview with author. January 5, 2018. Personal conversation.

Architecture 2030. 2017. “Why the Building Sector?” 2017. Accessed May 3, 2018. architecture2030.org/buildings_problem_why.

Avrami, Erica. 2016. “Making Historic Preservation Sustainable.” *Journal of the American Planning Association* 82 (2): 104–12. https://doi.org/10.1080/01944363.2015.1126196.

———. 2017. “Re-Aligning Heritage Policy Toward Mitigation: Barriers to Change.” *Association for Preservation Technology International - National Trust for Canada Joint Conference.*

Azaroff, Illya. 2018. Interview with author. January 25, 2018. Tape recorded.

Baechler, Michael C., Theresa L. Gilbride, Pam C. Cole, Marye G. Hefty, and Kathi Ruiz. 2015. “High-Performance Home Technologies: Guide to Determining Climate Regions by County.” *Pacific Northwest National Laboratory & Oak Ridge National Laboratory.* Vol. 7. https://www.energy.gov/sites/prod/files/2015/10/f27/ba_climate_region_guide_7.3.pdf.

Bindelglass, Evan. 2018. “The Landmarks Preservation Commission’s Proposed Rule Changes, Explained.” Curbed New York. 2018.

Bjornberg, Michael. 2018. Interview with author. January 9, 2018. Phone conversation.

California Energy Commission. 2016a. *Abstract*. United States. http://www.jstor.org/stable/27650524.

———. 2016b. Table of Contents. http://www.jstor.org/stable/27650524.

California Natural Resources Agency. 2014. “Frequently Asked Questions About CEQA.” 2014. Accessed March 24, 2018. http://resources.ca.gov/ceqa/more/faq.html.

California Office of Historic Preservation. 2018a. “Mission and Responsibility.” California State Parks. 2018. Accessed March 26, 2018. http://ohp.parks.ca.gov/?page_id=1066.

———. 2018b. “OHP Organizational Chart.” Sacramento, CA. http://ohp.parks.ca.gov/pages/1054/files/OHP_OrgChart_Web.pdf.

California State Parks. 2018. “About the Office of Historic Preservation.” 2018. Accessed March 26, 2018. http://ohp.parks.ca.gov/?page_id=27961.

Carroon, Jean. 2012. “High-Performance Reconstruction and Historic Preservation: Conflict and Opportunity.” Building Design + Construction, no. May: 48–54.

Carter, Sheryl, and Center for Energy and Environment. 1993. “Minneapolis - Saint Paul Urban CO2 Project

Plan." http://www.ci.minneapolis.mn.us/www/groups/public/@citycoordinator/documents/webcontent/convert_284899.pdf.

Chandler, Jenna. 2017. "Mayor Eric Garcetti Says LA Will Adhere to Paris Agreement after Trump Withdraws." Curbed Los Angeles. 2017. https://la.curbed.com/2017/6/1/15726722/paris-climate-agreement-los-angeles-garcetti.

Chattel, Robert. 2018. Interview with author. January 8, 2018. Tape recorded.

City-Data.com. 2018. "Minneapolis, Minnesota." 2018. Accessed March 9, 2018. http://www.city-data.com/city/Minneapolis-Minnesota.html

City of Los Angeles. 2018a. "About the OHR." Office of Historic Resources. Accessed March 25, 2018a. https://preservation.lacity.org/about.

———. 2018b. "Adaptive Reuse Ordinance." Office of Historic Resources. Accessed March 25, 2018b. https://preservation.lacity.org/incentives/adaptive-reuse-ordinance.

———. 2018c. "History of the Cultural Heritage Commission." Office of Historic Resources. Accessed March 25, 2018c. https://preservation.lacity.org/commission/history-cultural-heritage-commission.

———. 2018d. "Mills Act Historical Property Contract Program." Office of Historic Resources. Accessed March 25, 2018d. https://preservation.lacity.org/incentives/mills-act-historical-property-contract-program.

———. 2018e. "Mission." Office of Historic Resources. Accessed March 25, 2018e. https://preservation.lacity.org/about/mission.

———. 2018f. "Project Description." Office of Historic Resources. Accessed March 25, 2018f. https://preservation.lacity.org/survey/description.

———. 2018g. "The HPOZ Review Process." Office of Historic Resources. Accessed March 26, 2018g. https://preservation.lacity.org/hpoz/hpoz-review-process.

———. 2014. "Los Angeles Sustainable City Plan." http://plan.lamayor.org/wp-content/uploads/2017/03/the-plan.pdf.

———. 2015. "Visit HistoricPlacesLA!" Office of Historic Resources. 2015. Accessed March 25, 2018. https://preservation.lacity.org/news/visit-historicplacesla.

———. 2018. "City of Los Angeles Energy and Water Efficiency Ordinance." LA Energy & Water Efficiency Resource Center. 2018. Accessed March 26, 2018. https://www.betterbuildingsla.com/.

City of Minneapolis. n.d. "A Guide to Heritage Preservation in Minneapolis." http://www.ci.minneapolis.mn.us/www/groups/public/@cped/documents/webcontent/wcmsp-194035.pdf

———. 2009a. "Executive Summary." In *The Minneapolis Plan for Sustainable Growth*, 1–14. Minneapolis, MN.

———. 2009b. "Heritage Preservation." In *The Minneapolis Plan for Sustainable Growth*, 1-18. Minneapolis, MN.

———. 2013. “Minneapolis Climate Action Plan.” http://www.ci.minneapolis.mn.us/www/groups/public/@citycoordinator/documents/webcontent/wcms1p-107462.pdf.

City of New York. 2014. “One City: Built to Last.” New York, NY. http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf.

———. 2015. “One New York The Plan for a Strong and Just City,” 1–354. http://www.nyc.gov/html/onenyc/downloads/pdf/publications/OneNYC.pdf.

———. 2017a. “1.5oC: Aligning New York City with the Paris Climate Agreement.” New York, NY. http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFOR-WEB.pdf.

———. 2017b. “Mayor de Blasio: NYC Will Be First City to Mandate That Existing Buildings Dramatically Cut Greenhouse Gas Emissions.”

———. 2018a. “About.” NYC Sustainability. 2018. Accessed March 31, 2018. http://www1.nyc.gov/site/sustainability/about/about.page.

———. 2018b. “About LPC.” Landmarks Preservation Commission. 2018. Accessed March 29, 2018. http://www1.nyc.gov/site/lpc/about/about-lpc.page.

Drisko, Kaitlin and Bob Knight. 2018. Interview with author. January 9, 2018. Tape recorded.

Elefante, Carl, and Edward Mazria. 2017. “Historic Buildings and the Race to Net-Zero Carbon.” In *Association for Preservation Technology International - National Trust for Canada Joint Conference. Ottawa, Canada.*

Frey, Patrice. 2008. “Building Reuse: Finding a Place on American Climate Policy Agendas.” *National Trust for Historic Preservation.*

Frey, Patrice J. 2007. “Measuring Up : The Performance of Historic Buildings Under the Leed-NC Green Building Rating System NC Green Building Rating System.” University of Pennsylvania.

Giessinger, Lambert. 2018. Interview with author. January 10, 2018. Tape recorded.

Gimmer, Anne E, Jo Ellen Hensley, Liz Petrella, and Audrey T. Tepper. 2011. *The Secretary of the Interior’s Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.*

Goldberger, Paul. 1990. “Preservation’s Supreme Authority.” *The New York Times,* September 16, 1990. https://archive.nytimes.com/www.nytimes.com/books/97/07/06/reviews/brennan-architecture.html?scp=167&sq=land%2520use&st=Search.

Grad, Shelby. 2017. “Los Angeles Hits a Milestone: 4 Million People and Counting.” *Los Angeles Times*, May 2, 2017. http://www.latimes.com/local/lanow/la-me-historic-population-20170501-htmlstory.html.

Halfknight, Christopher. 2018. Interview with author. January 26, 2018. Tape recorded.

Hart, Reid. 2017. “What’s New in Commercial Energy Codes 90.1-2016 and 2018 IECC.” In U.S. DOE 2017 *National Energy Codes Conference*. Pittsburgh, PA. https://www.energycodes.gov/sites/default/files/documents/ECodes2017_03_Hart.pdf.

Hensley, Jo Ellen, and Antonio Aguilar. 2011. "Improving Energy Efficiency in Historic Buildings," 1–16. https://doi.org/isbn 978-0-16-089762-7.

Herrala, Cory. 2018. Interview with author. January 19, 2018. Tape recorded.

Hultgren, Jeff and Pete Lochner. 2018. Interview with author. January 4, 2018. Tape recorded.

International Code Council. 2015. "Chapter 5 [RE] Existing Buildings." 2015 International Energy Conservation Code. 2015. Accessed May 3, 2018. https://codes.iccsafe.org/public/document/IECC2015/chapter-5-re-existing-buildings.

Landmarks Preservation Commission. 2018a. "Certificate of Appropriateness." 2018. Accessed March 31, 2018. http://www1.nyc.gov/site/lpc/applications/certificate-of-appropriateness.page.

———. 2018b. "Certificate of No Effect." 2018. Accessed March 31, 2018. http://www1.nyc.gov/site/lpc/applications/certificate-of-no-effect.page.

———. 2018c. "Expedited Reviews." 2018. Accessed March 31, 2018. http://www1.nyc.gov/site/lpc/applications/expedited-reviews.page.

———. 2018d. "Notice of Public Hearing and Opportunity to Comment on Proposed Amendments to the Landmarks Preservation Commission Rules." http://www1.nyc.gov/assets/lpc/downloads/pdf/LPC Rules Amendments 2018.pdf.

———. 2018e. "Permit for Minor Work." 2018. Accessed March 31, 2018. http://www1.nyc.gov/site/lpc/applications/permit-for-minor-work.page.

Leong, Justine. 2018. Interview with author. January 10, 2018. Personal conversation.

Lesak, John. 2018. Interview with author. January 11, 2018. Tape recorded.

Marcotty, Josephine. 2017. "Minnesota Signs on to States' Version of Paris Accord." *Star Tribune*, June 6, 2017. http://www.startribune.com/minnesota-signs-on-to-states-version-of-paris-accord/426598641/.

Martin, Shawn. 2010. "Trends in Energy Codes." In *HVACR and Plumbing Workshop*.

Mason, Randall, Patrice Frey, Jeana Wiser, Kevin McMahon, and Lindsey Gael. 2013. "Federal Historic Preservation and Energy Efficiency Policies: Exploring Alignments and Conflicts."

Mayor's Office of Sustainability. 2016. "New York City's Energy and Water Use 2013 Report." http://www.nyc.gov/html/gbee/downloads/pdf/nyc_energy_water_use_2013_report_final.pdf.

———. 2017. "Energy Efficient Buildings." pLAn. 2017. Accessed December 15, 2017. http://plan.lamayor.org/portfolio/energy-efficient-buildings/.

Meeks, Stephanie, and Kevin C. Murphy. 2016. "The Greenest Buildings: Preservation, Climate Change, and the Environment." In The Past and Future City, 235–56. Washington, DC: Island Press.

Mendelson, Lindsey. 2017. "In Step on Climate." Environment America Blog. 2017. https://environmentamerica.org/blogs/environment-america-blog/ame/step-climate.

Minnesota Department of Labor & Industry. 2017. “Minnesota Guide to the State Building Code.” http://www.dli.mn.gov/ccld/PDF/guide_to_code.pdf.

Minnesota State Office of Historic Preservation. n.d. “Federal Investment Tax Credits.” Accessed March 19, 2018. https://mn.gov/admin/shpo/incentives/federal/

———. n.d. “Minnesota Historic Structure Rehabilitation Tax Credit.” Accessed March 19, 2018. https://mn.gov/admin/shpo/incentives/state/.

———. n.d. “Project Review Process.” Accessed March 19, 2018. https://mn.gov/admin/shpo/protection/review/process/

Morgan, Michael D., and Michael Matts. 2009. “Over-the-Rhine Green-Historic Study: Exploring the Intersection between Environmental Sustainability and Historic Preservation.” Cincinnati, OH.

MPR News Staff. 2016. “Report: Renewable Energy Fuels 21 Percent of Minnesota’s Electricity.” *Minnesota Public Radio News,* March 3, 2016. https://www.mprnews.org/story/2016/03/03/renewable-energy-fuels-21-percent-minnesota-electricity.

National Park Service. 2014. “Historic Preservation Certification Application Instructions.” https://www.nps.gov/tps/tax-incentives/taxdocs/hpca-instructions.pdf.

New Building Institute. 2013. “Existing Buildings Get New Emphasis And Clarity in IECC and Other I-Codes.” 2013.

New York State Energy Research & Development Authority. 2018a. “Air-Source Heat Pump Program.” 2018. https://www.nyserda.ny.gov/All-Programs/Programs/Air-Source-Heat-Pump-Program.

———. 2018b. “Clean Energy Standard.” 2018. https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard.

———. 2018c. “New York State Energy Plan.” 2018. https://www.nyserda.ny.gov/Researchers-and-Policymakers/New-York-State-Energy-Plan.

Ordower, Aaron, Mark Rauch, and Jeff Schwane. 2017. “Building Electrification: A Not So Shocking Solution to Climate Change.” In *AIA Center for Architecture*. New York, NY.

Phoenix, Thomas. 2015. “Lessons Learned: ASHRAE’s Approach in the Refurbishment of Historic and Existing Buildings.” *Energy and Buildings* 95. Elsevier B.V.: 13–14. https://doi.org/10.1016/j.enbuild.2015.02.034.

PlaceEconomics. 2016. “Historic Preservation: At the Core of a Dynamic New York City.” New York, NY. http://www.placeeconomics.com/wp-content/uploads/2016/08/final_report_040816_pagessmall.pdf.

Preservation Green Lab. 2011. “The Greenest Building : Quantifying the Environmental Value of Building Reuse,” 1–94.

———. 2013. “Realizing the Energy Efficiency Potential of Small Buildings.” http://www.preservationnation.org/information-center/sustainable-communities/green-lab/small-buildings/130604_NTHP_report_sm.pdf.

———. 2017. “Los Angeles, CA: Atlas of Reurbanism Factsheet.” https://forum.savingplaces.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=393152be-954d-f9f7-6f78-b0ab160acde0&forceDialog=0.

Ramirez, Constance, and Donald R Horn. 1999. “The Economics of Preserving Historic Federal Buildings.” *Forum News*, 1999.

Rocky Mountain Institute, and General Services Administration. 2015. “The Path to A Deep Energy Retrofit: Using an Energy Savings Performance Contract.” https://d231jw5ce53gcq.cloudfront.net/wp-content/uploads/2017/04/2015-02_Path_to_DR_using_ESPC.pdf.

Rouillard, Cory. 2018. Interview with author. January 30, 2018. Tape recorded.

Smith, Baird M., and Carl Elefante. 2009. “Sustainable Design in Historic Buildings: Foundations and the Future.” APT Bulletin 40 (3/4): 19–26. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Sustainable+Design+in+Historic+Buildings:+Foundations+and+the+Future#0%5Cnhttp://www.jstor.org/stable/40284500?origin=JSTOR-pdf%5Cnhttp://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:

Strain, Larry. 2016. “Building Materials and the Time Value of Carbon.” BuildingGreen. 2016. https://www.buildinggreen.com/op-ed/building-materials-and-time-value-carbon.

Tess, John M. 2015. “Historic Designation: What, When and Why.” *Novogradac Journal of Tax Credits*.

The Advisory Council On Historic Preservation. 1979. “Preservation and Energy Conservation.” Washington, DC.

The City of New York. 2016. “New York City Energy Conservation Code Preface.” https://www1.nyc.gov/assets/buildings/apps/pdf_viewer/viewer.html?file=2016_PREFACE_ENERGY.pdf&section=energy_code_2016.

The Editors of Encyclopaedia Brittanica. 2018. “Minneapolis, Minnesota, United States.” Encyclopaedia Brittanica. 2018. https://www.britannica.com/place/Minneapolis.

The Historic City Committee. 1989. “New York The Historic City.” New York, NY.

The Weidt Group. 2018. “Building Energy Data in Your Hands.” B3 Benchmarking. 2018. Accessed March 9, 2018. https://mn.b3benchmarking.com/What-Is-B3.

U.S. Climate Data. 2018a. “Climate Los Angeles - California.” 2018.
———. 2018b. “Climate Minneapolis - Minnesota.” 2018. Accessed March 20, 2018. https://www.usclimatedata.com/climate/minneapolis/minnesota/united-states/usmn0503.

U.S. Department of Energy. 2013. “Adoption.” 2013. Accessed May 3, 2018. https://www.energycodes.gov/adoption

———. 2014. “Regulations & Rulemaking.” 2014. Accessed May 3, 2018. https://www.energycodes.gov/regulations

U.S. Department of the Interior. 1977. “District of Columbia Historic Preservation Guidelines: Energy Conservation for Historic Buildings.” *District of Columbia Historic Preservation Guidelines*. http://planning.dc.gov/DC/Planning/Historic+Preservation/Maps+and+Information/Policies+and+Procedures/Design+Guidelines/

Energy+Conservation+for+Historic+Buildings.

U.S. Energy Information Administration. 2003. “Consumption of Gross Energy Intensity for Sum of Major Fuels for Non Mall Buildings.” http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003set9/2003pdf/c3.pdf.

U.S. Green Building Council. 2013. “LEED for Neighborhood Development and Historic Preservation.” https://doi.org/10.1007/978-3-319-04975-5.

Urban Green Council. 2016. “About Us.” 2016. https://urbangreencouncil.org/aboutus.

Webb, Amanda L. 2017. “Evaluating the Energy Performance of Historic and Traditionally Constructed Buildings.” The Pennsylvania State University.

World Weather & Climate Information. 2018. “Climate: Average Monthly Weather in Los Angeles, United States of America.” 2018.

List of Images

List of Figures

Appendix A - Interview Questions

- Do I have your permission to quote you by name in my thesis writing?
- In what way do you deal with historically designated/landmarked buildings (both individual/in a district)?
    - o Do you work more with residential or commercial? Urban context or suburban context?
- What level(s) of designation do the buildings usually have?
- What challenges have you encountered, or weaknesses do you notice, with regards to energy efficiency interventions and historically designated/landmarked buildings?
    - o What strengths in the present process have you noticed?
    - o What opportunities do you see for there to be improvement?
- Where do you see your work with historic preservation overlaps with your city's building energy performance goals?
- What other groups do you work with for projects involving historically designated/landmarked buildings, if at all?
- What guidelines (if at all) do you use to inform energy-related interventions in historic buildings?
- What energy efficiency approaches do you see becoming more consistently integrated into historic/landmarked buildings?
- Have you noticed different energy efficiency upgrades are more typical in residential versus commercial buildings?
- Are there certain kinds of property owners leaning towards energy efficiency versus not, and why is that the case?
- In your experience, why are building owners motivated to make energy efficiency upgrades in their historic/landmarked building, if at all?
- What kind of tools are you using to evaluate or predict energy consumption?

Appendix B - Interviewees

Los Angeles, CA

Robert Chattel, Chattel, Inc.
Kaitlin Drisko and Bob Knight, Drisko Studio Architects
Lambert Geissinger, Office of Historic Resources
John Lesak, Page & Turnbull
Justine Leong, Architectural Resources Group

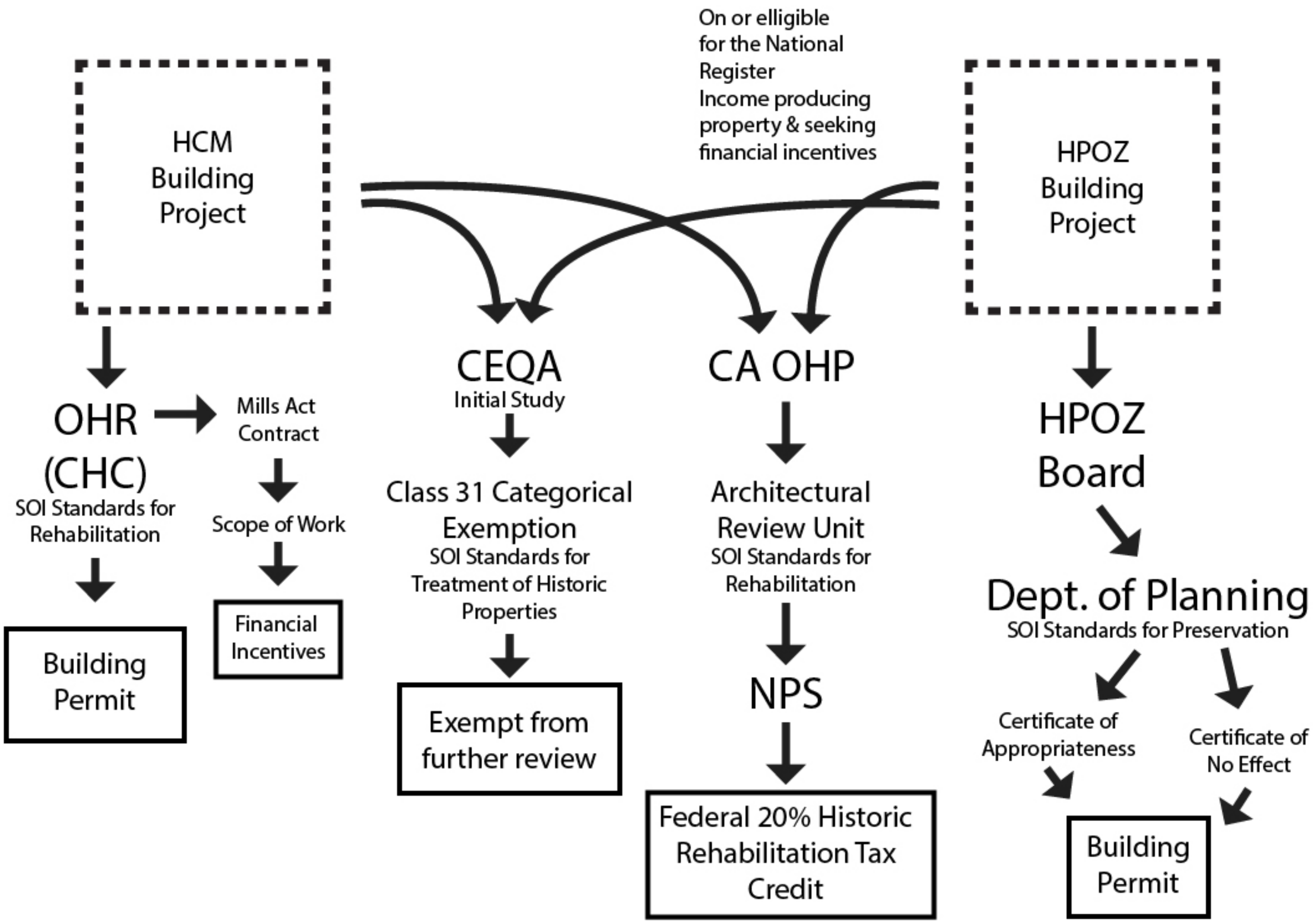
Minneapolis, MN

Mumtaz Anwar, City of Minneapolis, CPED
Michael Bjornberg, Preservation Design Works
Jeff Hultgren and Pete Lochner, Ryan Companies
Charlene Roise, Hess Roise & Company
Martin Thompson, Kodet Architectural Group, Ltd.

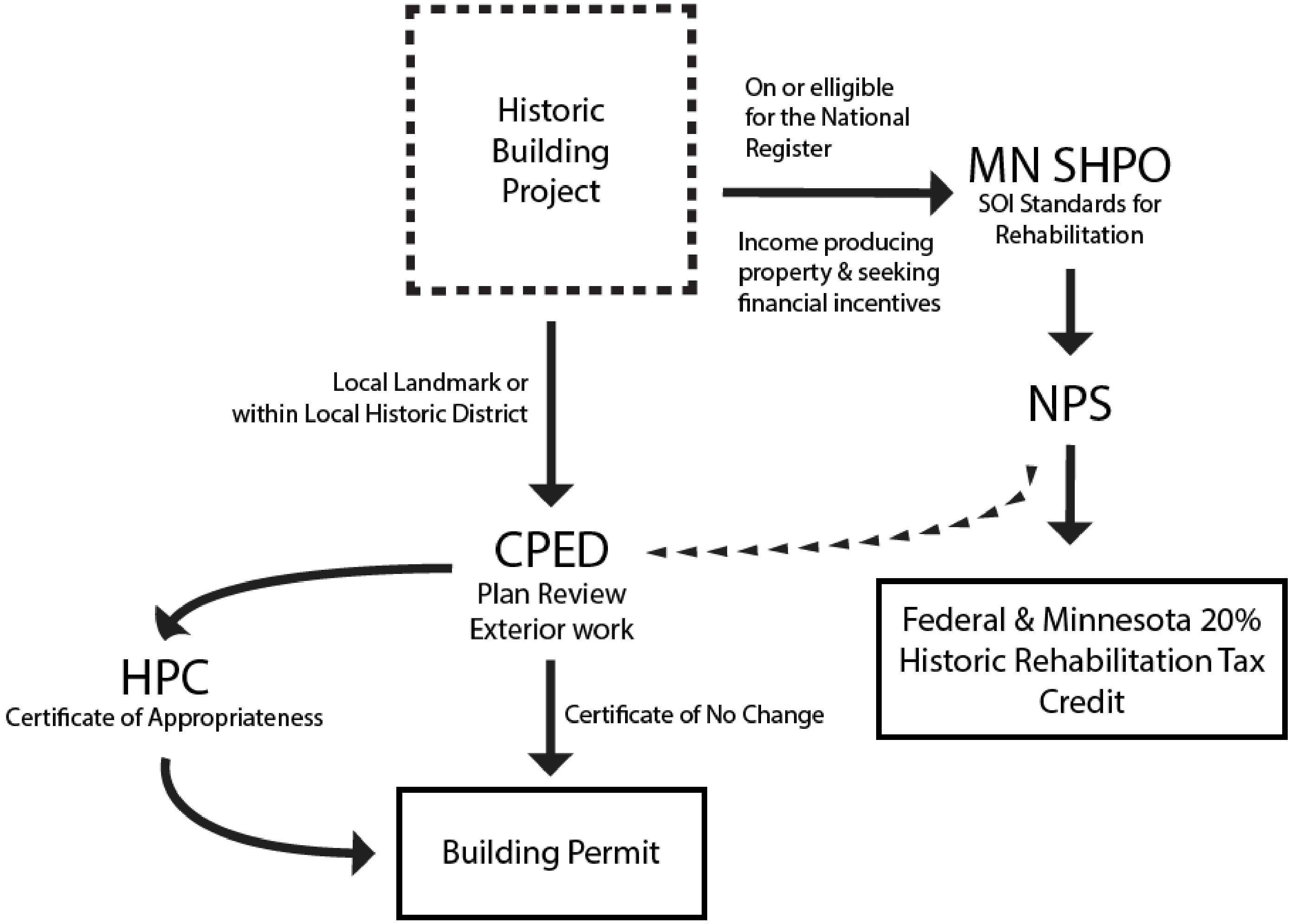
New York, NY

Illya Azaroff, +LAB Architecture
Christopher Halfknight, Urban Green Council
Cory Herrala, Landmarks Preservation Commission
Cory Rouillard, Jan Hird Pokorny

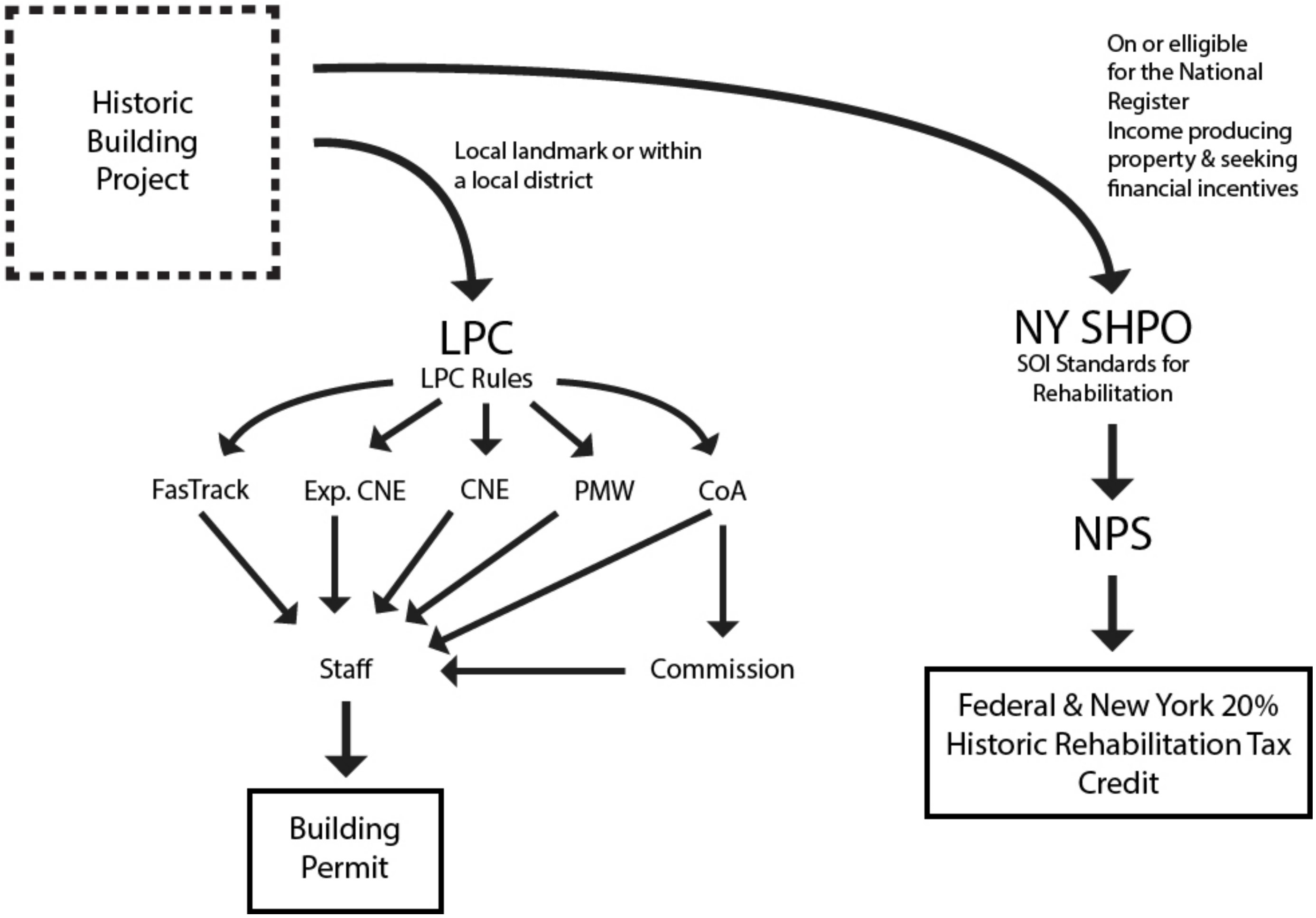
Appendix C - Regulatory Maps



Los Angeles, CA - Locally designated buildings, either HCMs or contributing members to HPOZs, must both comply with CEQA initial studies. If they meet the SOI standards, they become exempt from additional review. HCMs work with the OHR (CHC) to comply with the SOI standards to receive a building permit. A public hearing with the CHC may be required depending on the potential impact of the project. If the HCM has a Mills Act Contract, the project works with the OHR to establish the scope of work in order to receive financial incentives. HPOZ projects first go through the HPOZ board, which makes recommendations to the Department of Planning. Projects use the SOI standards for preservation to either acquire a Certificate of Appropriateness or Certificate of No Effect, which results in a building permit. If the property is seeking federal historic tax credits, it has to be on or elligible for the National Register of Historic Places (including contributing buildings to districts). The project works with the CA OHP Architectural Review Unit using the SOI standards to receive tax credits.



Minneapolis, MN - Historic buildings listed locally must go through the CPED for plan review of the exterior work. The HPC makes the decisions for projects requiring Certificates of Appropriateness, however Certificates of No Change (for minimal work) can be issued straight from the CPED. If the building is on or elligible for the National Register of Historic Places, the project works with the MN SHPO using the SOI standards to ultimately go through the NPS for both federal and state historic tax credits. Often times, the tax credit projects will use the review from the SHPO as the last step in the permit approval process in the CPED.



New York, NY - Locally landmarked buildings and buildings within locally landmarked districts must work with the LPC. The LPC has rules established to determine what level of review is required for different types of work. There can be FasTrack, Expedited Certificate of No Effect, Certificate of No Effect, Permit for Minor Work, and Certificate of Appropriateness. Most of these require staff level approval, however Certificate of Appropriatenesses must be approved by the Commission in order for the project to receive a building permit. If the building is on or elligible for the National Register of Historic Places (including contributing buildings to districts), the project must work with the NY SHPO to abide by the SOI standards for federal and state historic tax credits, with ultimate approval made by the NPS.