

Architectural Record

Designing for New York's Climate Change Legislation



eBook Brought
to you by



Ornamental Metal Institute of New York



New York City is continually leading the way in enacting progressive climate initiatives. In the following pages, *Architectural Record* has partnered with the Ornamental Metal Institute of New York to show how the city is making advances through the legislation of its built environment. Past and present initiatives are covered, and there's even an opportunity to attain continuing education credits while reading these informative articles.

Thank you for reading, and we hope the information that follows inspires you to also provoke positive change for our climate.

A handwritten signature in black ink, which appears to read "Alex Bachrach".

Alex Bachrach, Publisher
ARCHITECTURAL RECORD

TABLE OF CONTENTS

- 4 A Better Climate for Action
- 7 Conquering Carbon 
- 27 New York's Big Buildings May Soon Curb Carbon Emissions
- 30 Cities and Carbon Policy 
- 33 Think Global, Act Local: New York's Carbon Policy
- 36 A Decade of Energy Regulation in NYC Pays Off in Data and Carbon

Published by Architectural Record, Copyright © 2021, BNP Media. All Rights Reserved. No part of this book may be reproduced or used in any manner, except as permitted by the U.S. Copyright Act, without the express written permission of the publisher. Every effort has been made to ensure the accuracy of the information presented in this book. However, BNP Media does not guarantee its accuracy. Any error brought to the attention of the publisher will be corrected in a future edition. For more information, go to www.architecturalrecord.com.

FROM THE EDITOR

A Better Climate for Action



THE LIST of past winners of the AIA Gold Medal is a who's who of some of the world's greatest modern architects, from Le Corbusier and Alvar Aalto to Frank Gehry and Tadao Ando.

But can you name a single building designed by the [2021 Gold Medalist, Edward Mazria](#)? Probably not. That's because Mazria is being honored for contributions to the built environment that are more urgent and profound today than innovations in form or space-making: he is helping to save the planet.

In 2002, Mazria launched Architecture 2030, a pro bono arm of his New Mexico-based practice, which came to be a force for raising awareness and setting stringent targets for reducing carbon emissions from construction, the economic sector that accounts for nearly 40 percent of the greenhouse gasses released into the atmosphere. The architect's groundbreaking research and development is the foundation of the AIA's own initiatives to push for carbon

neutrality in the built environment. As [AIA CEO Robert Ivy tells RECORD in a wide-ranging interview](#), climate action is the top priority in the organization's current strategic plan..

Mazria is optimistic that architects' projects can reach the essential goal of zero carbon emissions by 2040. Overall building energy use in the U.S. has been reduced over recent years, despite the addition of billions of square feet of new construction, while the push to innovate, and new digital tools available for those efforts, are central to contemporary architectural culture.

Public support for addressing the climate crisis is unequivocal. Two-thirds of Americans, across political party lines, according to the Pew Research Center, believe the government needs to do more. Even wider majorities in the 2020 survey favored such measures as taxing corporations for carbon emissions and restricting pollution-spewing power plants.

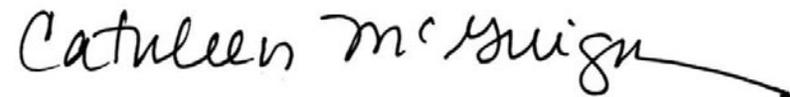
This month, the federal government will begin to tackle those challenges head-on. The first order of the incoming administration will be to rejoin the international Paris accord, which the AIA explicitly supports. What's striking about the new approach, according to The New York Times, is that measures to attack global warming will not only be a priority in such departments as the Environmental Protection Agency, but will be baked in to broader economic policies. Encouraging the ongoing development of fossil-fuel alternatives, for example, is likely to create a host of new jobs, while the cost of doing nothing is disastrously high. Economist Janet Yellen, the nominee for Secretary of the Treasury, has long warned about the consequences of inaction. In 2018, the government's own assessment, under the current administration, sounded the alarm that "natural disasters and other extreme weather events driven by a warming planet could cost the United States 10.5 percent of its domestic gross product by 2100," said the Times.

Architects have been in the advance guard in the fight against global warming for decades, thanks not only to leaders like Mazria but also the many practitioners who have educated themselves and their clients—and who keep bringing inventive ideas to design and construction, as the time frame to achieve zero carbon emissions narrows.

Now, a brief note from RECORD, as we start the new year: the last step in the refreshed redesign of the magazine and website, under art director Mike Powell, is the updated logo gracing our

cover. We invited architects and designers to submit their ideas. Out of 275 entries, we chose the simple elegance of the one from Allison Bryan, an architect and graphic designer who is Creative Director of CLB, based in the firm's Bozeman, Montana, office. Thank you, Allison.

And, lastly, RECORD is pleased to introduce a new podcast, [DESIGN:ED](#), hosted by Aaron Prinz. Prinz, who holds an M.Arch. from the University of Texas and practices in Austin, has interviewed more than 40 architects—hear from such voices as Thom Mayne, Glenn Murcutt, and Jenny Wu—and will produce new podcasts every month. Join us in welcoming Aaron to RECORD—and get ready to listen up.

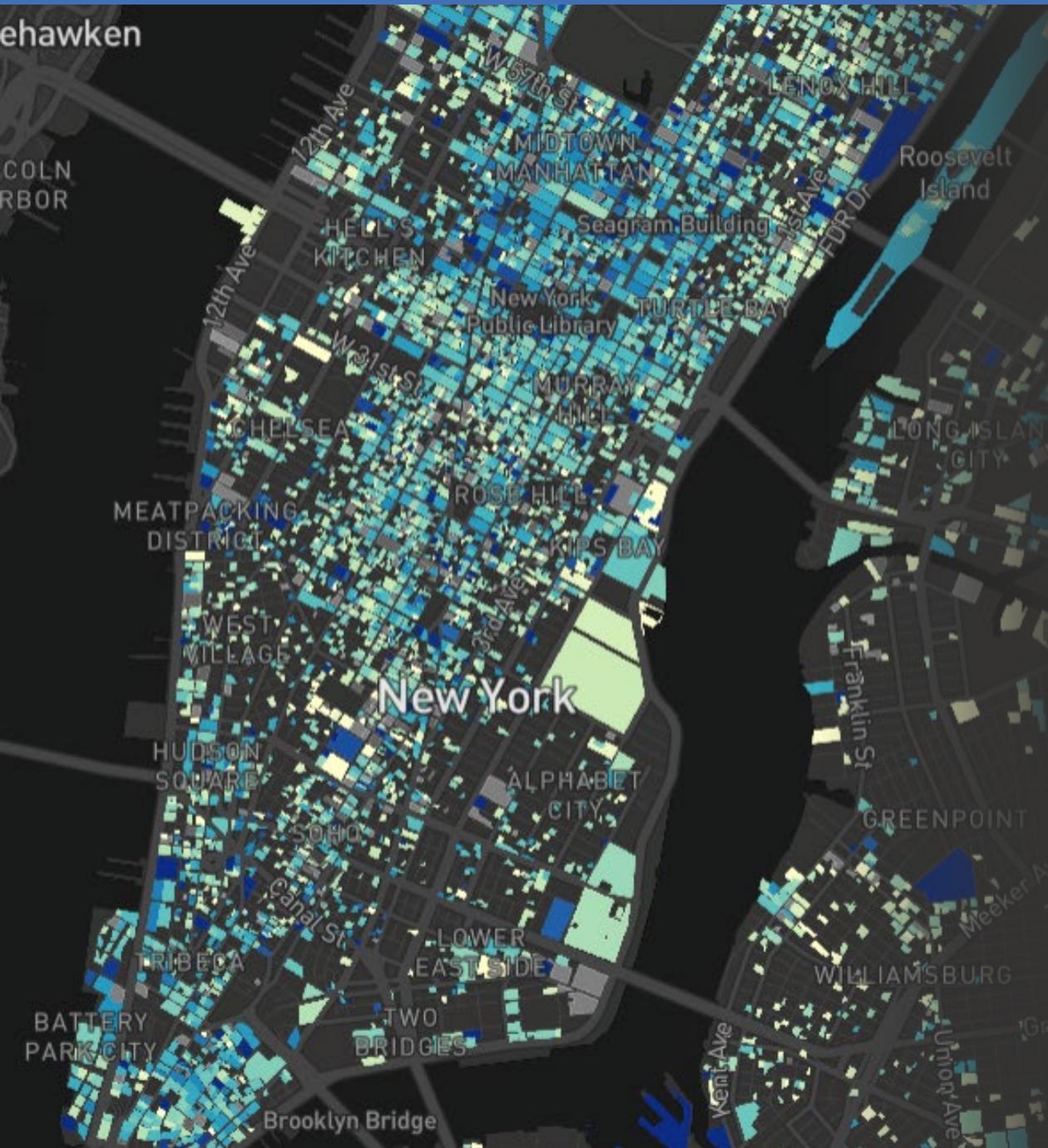


Cathleen McGuigan, Editor in Chief

**“With a high-performance building envelope,
it is possible to create glass skyscrapers without
compromising energy performance and still deliver
the quality of space in terms of expansive views
that developers want in order to market to tenants.”**

—Helen Sanders, Ph.D., Façade Tectonics Institute President

 **Ornamental Metal Institute of New York**



Conquering Carbon

Facade designs are key to meeting stringent New York City carbon reduction requirements

SPONSORED BY THE ORNAMENTAL METAL INSTITUTE OF NEW YORK
BY BARBARA HORWITZ-BENNETT

This map depicts large buildings in Lower Manhattan and west Brooklyn required to comply with Local Law 97 carbon emissions reductions.

IMAGE COURTESY OF NYU CENTER FOR URBAN SCIENCE AND PROGRESS

IN WHAT is being described as the most ambitious climate legislation for buildings enacted by any city in the world, New York City is requiring large buildings to progressively ratchet down their carbon emissions starting in 2024. By 2030, approximately 50,000 buildings, 25,000 square feet or larger, must reduce their emissions by an aggressive 40 percent, from a 2005 baseline, or face steep fines.

This map depicts large buildings in Lower Manhattan and west Brooklyn required to comply with Local Law 97 carbon emissions reductions.

“There are plenty of cities crafting impactful legislation around the built environment’s role in climate change, but no piece of legislation is as far-reaching as the emissions limits in Local Law 97,” reports Adam Roberts, director of policy, American Institute of Architects AIA New York.

While the road to 2030 compliance will be challenging and costly, the city will ultimately be looking at a savings of more than 5.3 million metric tons, the carbon equivalent of the entire City of San Francisco’s annual emissions.

“This is a very comprehensive approach. We do not know of any other city that has adopted that scale of carbon savings,” explains John Mandyck, chief executive, Urban Green Council, New York whose organization worked hand in hand with the city in drafting the new legislation.

Though Local Law 97 (LL97) from the Climate Mobilization Act impacts less than 4 percent of the city’s buildings, they represent

nearly 60 percent of the city’s building area and account for more than two thirds of greenhouse gas emissions.

“We have to take aggressive action and we have to focus on the buildings that are the largest polluters,” explains Gina Bocra, AIA, LEED Fellow, Department of Building’s Chief Sustainability Officer, New York.

The legislation is also unique in that it addresses carbon reduction, as opposed to energy efficiency. Whereas architects are used to measuring their sustainable designs by energy use, they will need to broaden their perspective to account for the source of this energy.

“Energy sources have varying carbon intensities depending on grid region and fuel source,” explains Michael Woods, senior project manager, Perkins and Will, New York. “Carbon, on the other hand, is a measure that casts a wider net over the thermodynamic processes at play and also speaks to the way cities everywhere will be measuring the impact of buildings within the broader context of climate action plans.”

Erik Olsen, managing partner, Transsolar KlimaEngineering, New York, further qualifies the significance of this climate legislation by the fact that it impacts the largest city in the United States, targets existing buildings, and is outcome-based.

Putting things in perspective, the legislation completely changes the cost-benefit analysis for envelope retrofits for existing buildings. Whereas previously, it was hard to justify costly envelope retrofits based on energy savings alone, now, with fines

factored in, it is much easier to make the case for investing in the building facade.

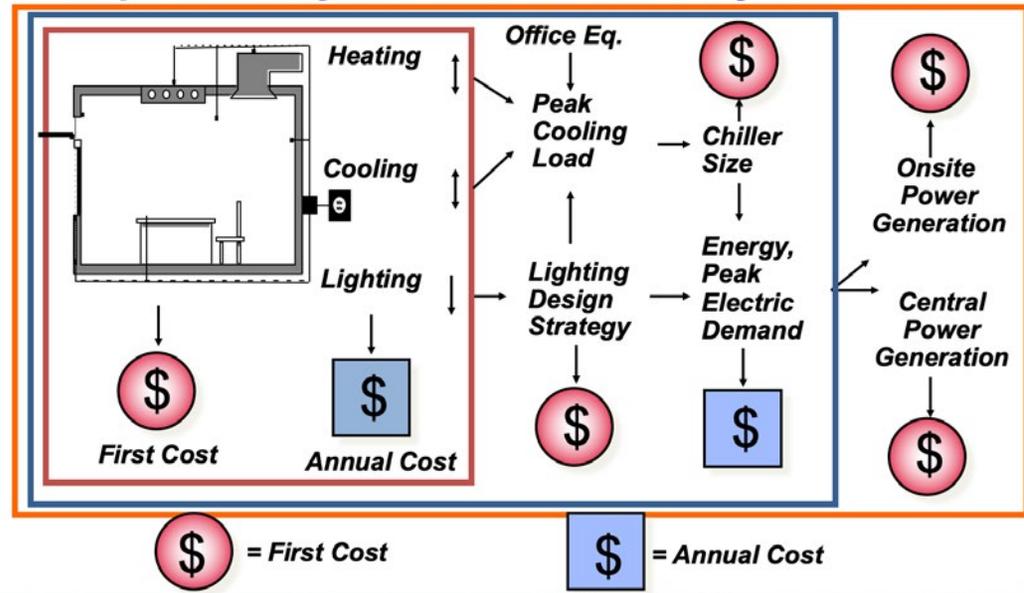
To better understand the difference between an outcome-based code and traditional codes that are linked to a simulated energy modeling comparison to a baseline building, Olsen explains that the former approach is not well correlated to actual building performance as a lot can happen between design simulation and actual operational performance. This can be caused by a number of factors, including:

- Not accounting for all energy losses in the building such as thermal bridging
- Inaccurate assumptions/inputs
- Simulation tools not calibrated to real building performance
- Value engineering
- Poor installation
- Building operation modeling does not take into account variables like human behavior and building operator training.

“So, with our typical simulation-based code compliance system (IECC/ASHRAE 90.1 etc.), we do not know, nor have to justify to a code official, that what we built performs how we expected it to perform,” he explains.

On the contrary, with LL97's ongoing regulation of carbon

Reliable System integration → First Cost tradeoffs Improved Façade = Lower HVAC System Cost



Improved building facade designs can enable savings via reduced lighting consumption and HVAC equipment and loads.

IMAGE COURTESY OF LAWRENCE BERKELEY NATIONAL LABORATORY

emissions, the design team's scope extends beyond the certificate of occupancy to building operation and training occupants.

“This means that design teams are forced to deal with issues like thermal bridging, which are not adequately addressed by conventional codes or performance evaluation standards, but

can cause significant energy gaps in real performance. It also means that commissioning of building envelopes will be widespread to ensure the quality of installation is achieved,” says Olsen.

TARGETING THE FACADE

While there are many measures that building owners can take to slim down their carbon profile such as switching to LED lighting or installing integrated control systems, many agree that facade improvements are key to achieving LL97 compliance, particularly with stricter requirements going into effect in 2030.

To put things into perspective, Bocra points out that 75 percent to 80 percent of New York’s large buildings should be able to meet 2024 carbon levels with relative ease, but before 2030, around 80 percent of these buildings will need significant retrofits and likely facade work.

“Facades are a key part of carbon deduction and energy efficiency reduction because they are, arguably, the most important part of a building’s energy efficiency strategy from a holistic standpoint,” explains Atilio Leveratto, vice president, CallisonRTKL, New York.

“Robust facades will lead to greater energy efficiency and less robust facades will lead to greater energy loss, all which have carbon implications,” agrees Mandyck.

In fact, air infiltration, heat loss, and solar gain through the facade account for up to 43 percent of a commercial building’s

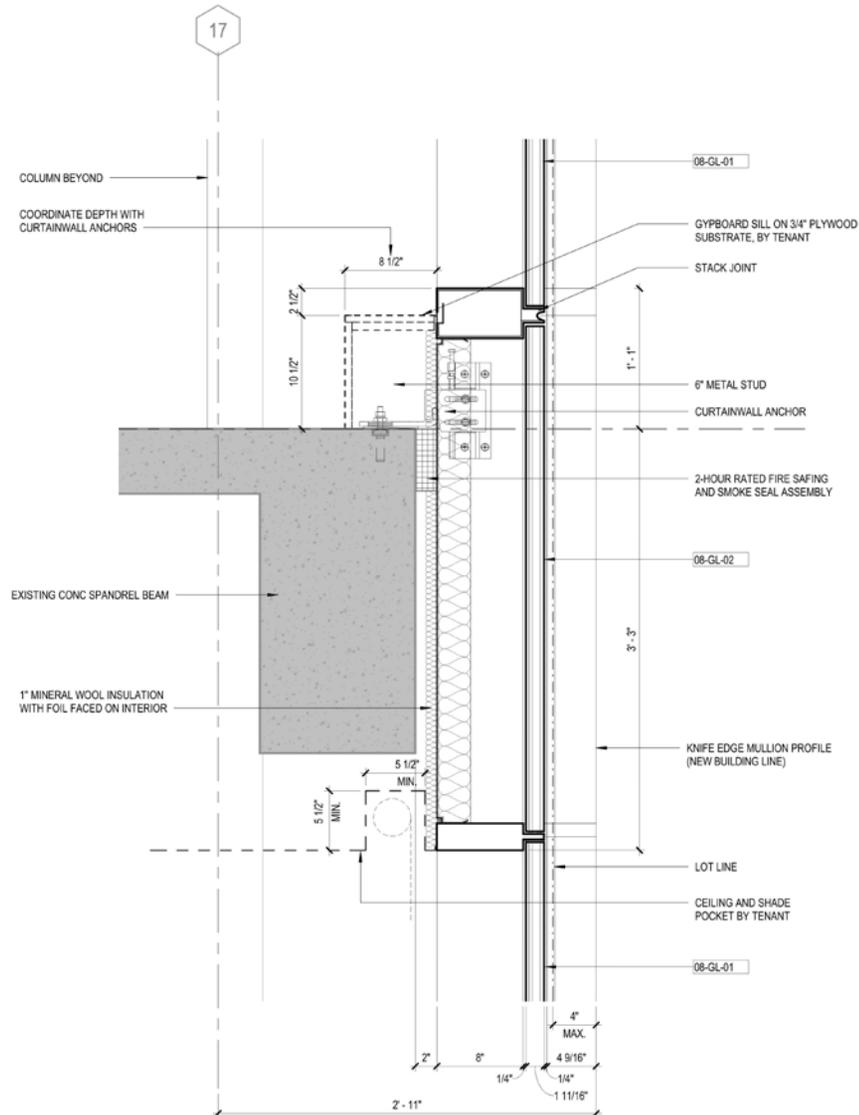
lighting, cooling, and heating loads.

“Improving facades is critical to compliance with LL97,” concurs Roberts. “Updating facade elements will keep buildings better insulated, making them more energy efficient. Technological upgrades to HVAC systems alone are not enough to ensure compliance, as those improvements must be supplemented by better-quality facades.”

Tied into daylighting/lighting and HVAC systems, the building’s level of air infiltration, heat loss and solar heat gain, will directly determine how much energy is required to heat, cool, ventilate, and light the interior. And this has significant ramifications on older New York buildings.

“The facades on most have been compromised in terms of maintaining a consistent thermal and air barrier. With the settling and structural movement that typically happens over time, exacerbated with extreme temperature fluctuations, as the permeability of a façade increases, air pathways are created,” explains Tommy Zakrzewski, PhD., director of integrative energy engineering, HKS Inc., Chicago.

“These air pathways, often cracks through building materials and individual construction components, increase undesirable infiltration. In many instances, infiltration can account for 30 percent to 50 percent of the heat lost or gained in structures that are not completely airtight.¹ Furthermore, excess air leakage through the facade can also de-rate the effective R-value of insulation by up to 60 percent.² Thus, the integrity of the facade



Utilizing Perkins and Will's Simulation Platform for Energy-Efficient Design (SPEED) program, the optimal combination of window-to-wall ratio and glazing type on the south facade of a New York City building is analyzed.

IMAGE COURTESY OF PERKINS AND WILL

plays a key role in meeting the aggressive emissions and carbon reductions in LL97," he states.

In fact, the U.S. Department of Energy estimates that 40 percent to 50 percent of a building's heating and cooling loads can be decreased by a high-performing enclosure. "Reducing these loads in turn has the compounding effect of downsizing mechanical equipment and lowers carbon emissions even further," adds Woods. "These kinds of synergistic opportunities between the architecture and building systems are essential for achieving ambitious carbon reduction goals."

Offering her perspective, Façade Tectonics Institute President Helen Sanders, Ph.D., expects that improving envelope performance in existing buildings—particularly those with old, single-glazed, non-thermally broken, leaky facades—will become an important strategy to achieving both the near-term 2024 targets and the longer-term 2030 targets.

In addition to improving efficiencies, a higher-performance building enclosure will boost occupant comfort, indoor environmental quality, and resiliency to better survive severe weather events.

Last year, New York City Mayor Bill de Blasio made a widely publicized statement that the city would introduce legislation to ban glass and steel skyscrapers in the fight against global warming, setting off a wave of backlash in the building community. In reality, LL97 does not seek to eliminate glass and steel facades. However, it does require them to meet a more

stringent energy standard.

“With a high-performance building envelope, it is possible to create glass skyscrapers without compromising energy performance and still deliver the quality of space in terms of expansive views that developers want in order to market to tenants, and with sufficient daylighting and thermal and visual comfort to support a productive, healthy indoor environment,” says Sanders. “A win–win–win for the planet, the building owner and the occupants.”

HOW DESIGNERS CAN PREPARE THEMSELVES

As owners begin working to get their buildings up to par, architects, engineers, facade designers, and contractors will have a significant role to play in helping buildings meet these LL97 carbon reduction standards.

In terms of preparation, Stephen Selkowitz, affiliate, building technology and urban systems, Lawrence Berkeley National Laboratory, Berkeley, California, advises designers to start by deepening their understanding of the role that the facade plays in both energy impacts and occupant comfort/satisfaction. Then they should better familiarize themselves with the technological options available, and not just glazing, but shading and daylighting controls/management as well. “Some of the best available options are sometimes difficult to ferret out,” he explains.

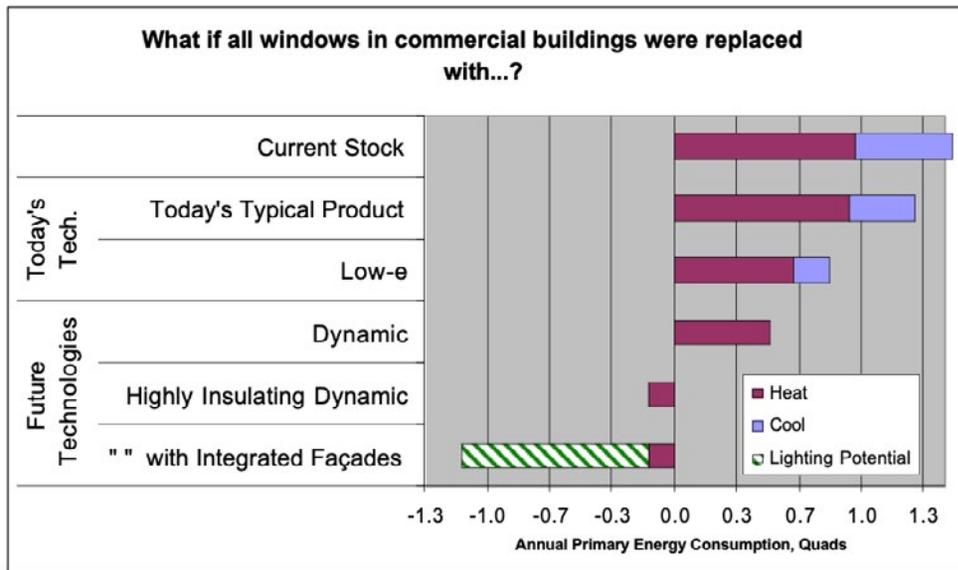
Further, Bocra points out that there are some limitations to the

U.S. Environmental Protection Agency portfolio manager’s tool which owners typically use to report to us in their annual energy benchmarking. Consequently, it is very helpful to engage with an architect or an engineer “to dig into the details of how they’re calculating their greenhouse gas emissions and fully understand where are the sources of the excess emissions in their buildings and then translate that into the opportunities that are going to help them move forward the fastest,” she says.

“To be in the best position to discover these ideal design solutions, this likely requires an integrated approach where a team of multi-disciplined professionals—with expertise in energy modeling, facade engineering, and thermal analysis—create a comprehensive delivery method that will see these projects through from start to finish,” adds Leveratto. “Having the ability to make decisions quickly about materials, thermal properties, modeling, and mockup will be key to finding the highest performing facade with the biggest impact to the building systems, while also taking into consideration the design aesthetic,” he explains.

Along these lines, Perkins and Will recently developed a new modeling tool called SPEED, Simulation Platform for Energy-Efficient Design. The tool was designed to significantly help reduce building energy use and carbon emissions at the earliest stages of design. While more suited for new construction, the tool will have relevance for many kinds of projects—once a new building receives its certificate of occupancy, it immediately falls

“Zero Net Energy” facades: National Impacts Converting a \$20B/yr cost to a \$15B/yr Net Surplus!



With advanced glazing and integrated facade technologies, U.S. commercial building window energy use can be converted from a \$20 billion/year cost to a \$15 billion/year surplus.

IMAGE COURTESY OF LAWRENCE BERKELEY NATIONAL LABORATORY

under Local Law 97 requirements, so all New York City projects moving forward must consider carbon.

“SPEED gives design teams the power to rapidly model hundreds, even thousands of building scenarios—taking into account variations in sizing, massing, stacking, and orientation—to identify the highest-performing configurations,” explains

Woods. “This includes configurations of the building envelope.”

Beyond carbon emissions and performance, Brandon Andow, PhD, RA, senior building performance analyst, EYP Architecture & Engineering, Denver, notes that the building facade is a “confluence of conflicting issues that span building physics and human comfort.” He further explains that heat transfer, water vapor transport, and advection are not easily intuited by designers and often defy rules-of-thumb.

For instance, designers may be looking to replace single-pane glass with double-pane insulated glazing, but if the non-thermally broken frames are left in place, the facade will still exhibit poor thermal performance and struggle with air infiltration.

“Architects and engineers will need to evolve their skill sets to effectively make decisions that increase the energy performance of facades and

improve occupant comfort, all while avoiding moisture problems, navigating cost pressures, and reimagining one of the most recognizable skylines in the world,” says Andow.

Along these lines, some educational resources include courses offered by AIA New York’s Committee on the Environment and New York Passive House. Other groups offer spaces for

professionals to exchange knowledge and ideas on facade retrofits and other elements of LL97 compliance. In particular, Max G. Wolf, AIA, P.E., CPHD, LEED AP, associate, SOM, recommends NYC's Retrofit Accelerator, and the Building Energy Exchange, which hosts classes in Passive House design and THERM.

Personally, Wolf decided to become a Certified Passive House Designer and has spent time honing his skills in THERM, an LBNL 2D heat transfer modeling, and WUFI dynamic hygrothermal analysis. While professional modelers inevitably need to be brought in to perform these complex calculations, Wolf is now in a better position to work more effectively and efficiently with these consultants.

Mandyck further advises architects and engineers to transition from an energy to a carbon mindset. While these two metrics are sometimes used synonymously, they are very different things. For the most part, buildings do not emit carbon, they use energy, primarily in the form of electricity. That electricity may come from a fossil fuel electrical plant hundreds of miles away where carbon is emitted, but the building owner is now being held responsible for that.

"Before now, the playbook was all about energy, but now it is carbon. This is a big transition that we are going to have to make," Mandyck explains.

He adds that as power plants become more renewable, this puts less pressure on the building design, so designers will need to pay more attention to the electrical grid.

GETTING STARTED

Fortunately, New York City building owners do have a strong starting point in considering where to make LL97-related upgrades. The city's Benchmarking Law has been requiring owners to calculate and submit their energy use levels on an annual basis for close to a decade. Consequently, they already have some useful data for analyzing energy use patterns.

"Benchmarking systems are the first step in outcome-based codes, and form the reporting infrastructure and provide the data which can create a basis for the adoption of carbon emission targets for existing buildings," says Sanders.

Wolf brings up another important point which is strategically analyzing the retrofitting of the building envelope so that the HVAC systems can be adjusted appropriately. "Without first properly upgrading an otherwise conventional envelope, nearly all changes to HVAC and possibly other building systems have a good chance of being grossly oversized, mis-coordinated, and wasteful of money, energy, emissions, and space.

Another diagnostic tool is utilizing drones for facade assessments, in particular, infrared imaging. "Before any energy efficiency measures are considered for a facade, an assessment must be made to determine the thermal integrity of all barrier systems," explains Zakrzewski. "This type of assessment will be invaluable with identifying areas of the building facade where insulation has degraded—and in some instances omitted during construction—and highlight any air infiltration/exfiltration."

Even without a drone assessment, a common issue with older buildings is likely leaky windows. Consequently, window replacement would be considered a low-hanging fruit for upgrades.

“Countless New Yorkers live in older buildings that have not had their windows replaced in years,” relates Roberts. “Installing new windows can often be done in an occupied unit, making it less inconvenient than more significant facade improvements.”

Owners may also consider newer window retrofit technologies such as a highly compact, lightweight glass/glazing retrofit system that mounts to the existing glass, creating a hermetically sealed insulating gap that performs like that of a factory-made insulating glass unit. Because there is no window removing/replacement involved, it can be done without disrupting building operations or occupants. Further, the technology is less expensive and faster than a conventional window retrofit, and provides a better return on investment.

Another cost-effective strategy is reducing the thermal conductivity of the exterior wall. One way to accomplish this is to reduce the glazing area with retrofit mullions and applied films, suggests Andow.

“We are looking at a better balance between transparent and opaque surfaces that meet Local Law 97 energy efficiency goals while maintaining the benefits of fully-transparent buildings,” adds Leveratto.

At the same time, Sanders points out that reducing the glazing

does not automatically mean that the enclosure will offer better thermal performance. “Thermal bridging—which is often not accounted for in building energy modeling—can degrade the walls’ thermal performance levels by more than 50 percent, and contributes to a gap between perceived performance and actual performance,” she explains.

“In fact, in some situations, facades with larger continuous windows can have a higher performance than those with smaller glazed areas because of thermal bridging issues. As a result, decisions related to window-to-wall ratio and actual delivered energy performance are not straightforward.”

Selkowitz agrees, pointing out that a well designed envelope can, in fact, support a larger percentage of glazing. Case in point, The New York Times Building incorporates floor-to-ceiling glass and fixed external shading, but also employs a state-of-the-art automated interior shading system for solar and glare control, and a dimmable, tunable electric lighting system responsive to daylight. A post occupancy study reported high levels of occupant satisfaction and energy consumption levels that were lower than the calculated use from a code-compliant, 40 percent glazed facade.

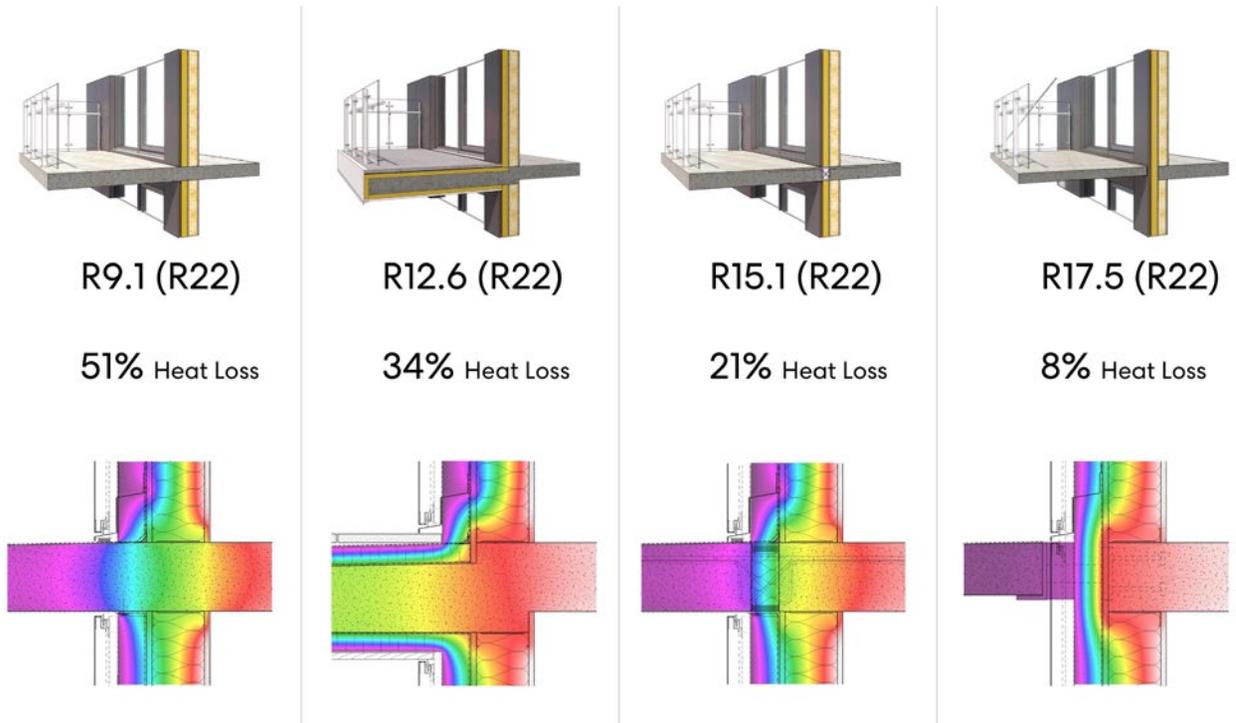
Another source of thermal loss is curtain wall spandrel panels, which have traditionally gotten by under the radar by qualifying as a prescriptive approach to code compliance. Backing this up with some numbers, Andow says the opaque areas of a curtain wall should meet a current energy code baseline thermal conductivity

of 0.064 Btu/hr.ft².F. However, the highly conductive aluminum framing means the thermal performance of spandrel areas bottom out at around 0.2 Btu/hr.ft².F. This translates to thermal performance levels that are three times less than that required by the building code.

DIGGING DEEPER

Getting back to Zakrzewski's suggested facade assessment approach, a next logical step might be to air seal the building envelope as this will improve comfort, air quality, and reduce energy consumption. "Depending on the age and quality of the insulation, it could also be replaced with higher performing material and in many cases, could serve as an air barrier improvement. However, detailed engineering analysis is recommended so that the enclosure performs as expected and a problem is not created, i.e. condensation," he adds.

Wolf recommends taking things a step further and pushing the envelope to get it as close to Passive House performance as possible. In New York City's 4A climate, this means ≤ 0.6 ACH



Exposed slab edges and balconies can reduce the effective thermal performance of a building envelope by up to 50 percent. Adding insulation and designing thermally broken details has the potential to improve the overall envelope thermal performance by 40 percent.

IMAGE COURTESY OF PERKINS AND WILL

airtightness at 50 Pa, between R-30 to R-40 for opaque walls and around R-8 or better for glazing.

In evaluating retrofit facade strategies, Woods points out that zoning and real estate pressures can make things more difficult as thicker or deeper facades mean less usable square footage per

floor, and if not married to reduced height restrictions, fewer rentable square feet. “In the case of existing buildings, lot lines and set-back, along with sky exposure plane requirements, challenge many effective solutions on the available space. Real estate is big business that lives at the edges of maximum allowances when it comes to floor area ratio and zoning square feet,” he says.

With this in mind, Woods recommends decreasing thermal bridging, adding exterior insulation, and providing exterior sun shading as viable retrofit strategies. Regarding the former, he explains that exposed slab edges are prevalent in modern New York City apartment buildings forcing heating systems to fight hard to overcome escaping heat in the winter. Consequently, he predicts that perimeter heating might soon become a thing of the past.

While adding insulation on the exterior can boost thermal performance, it can be complicated when buildings are built right up to the property lines. Recognizing this difficulty, the city is working on some allowances here.

“In this way, New York City’s new building regulations creates a ‘carrot’ to encourage facade improvement by allowing the owner to add height to their building,” says Schober.

REPLACING THE FACADE

While quite costly, in order to comply with Local Law 97 carbon levels by 2030, many buildings, particularly older ones, will

require a full facade upgrade.

“This facelift brings an updated architectural character as well as opening the door for thermally improved glazing systems, opaque rainscreen cladding with thermally improved brackets and a continuous insulation layer, and carefully designed details that mitigate thermal bridging,” says Schober.

Owners may also want to consider building-integrated photovoltaics as opaque cladding, as window shading devices, or incorporating into the glass itself. These solutions will require wiring, AC/DC conversion and perhaps energy storage.

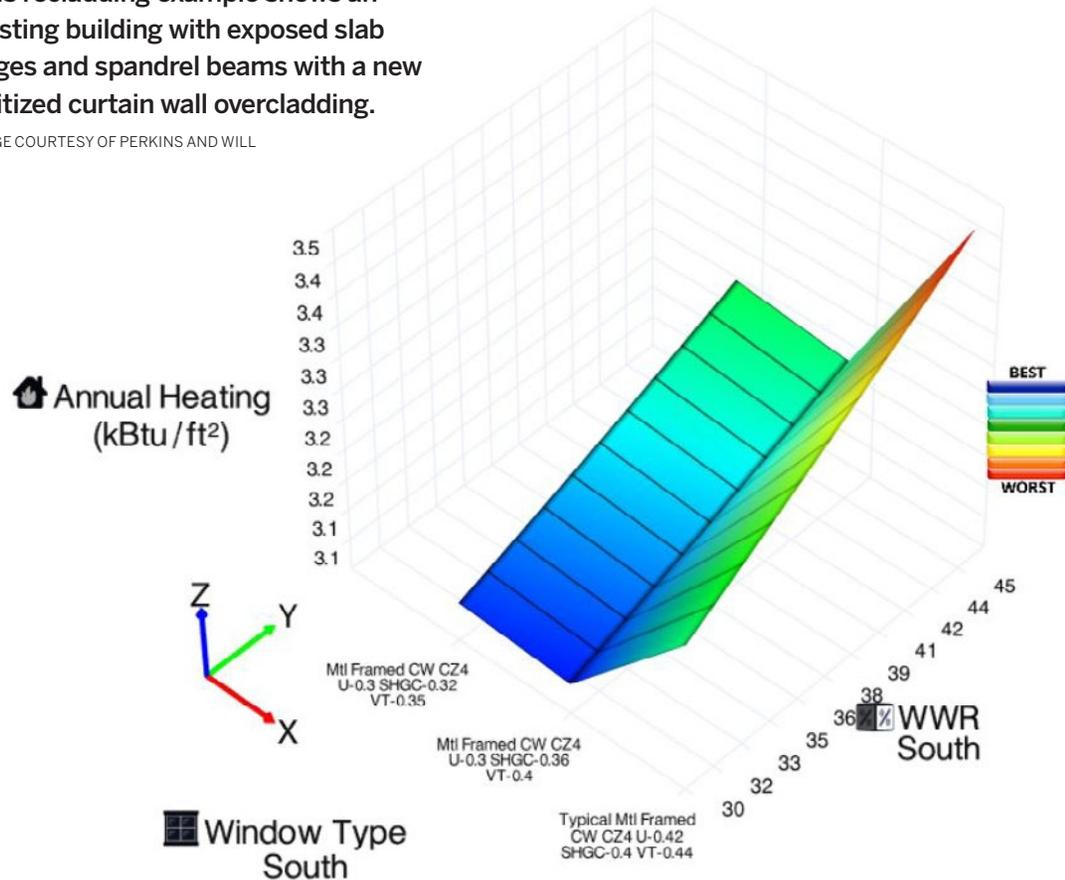
Offering some background on why aging New York City facades are in need of retrofits, Mic Patterson, PhD., LEED AP, ambassador of innovation & collaboration for the Facade Tectonics Institute, explains that the mid-20th century tall curtain wall buildings were largely experimental in nature and very little consideration was given to their extended durability as the buildings themselves were only expected to operate for 20 to 30 years.

“Now, 50 to 60 years later, these buildings are still in service and badly in need of facade retrofits,” he says. “Because their original design failed to recognize and accommodate the need for future retrofit, the renovation team is often left with very few options beyond stripping the entire facade system from the building and replacing it with a new one.”

When reglazing the facade, Vivian Loftness, professor and former school of head of architecture at Carnegie Mellon

This recladding example shows an existing building with exposed slab edges and spandrel beams with a new unitized curtain wall overcladding.

IMAGE COURTESY OF PERKINS AND WILL



University in Pittsburgh, recommends selecting the highest thermal resistance/R values with no thermal bridges—i.e., Passive House standards—and maximum airtightness, the highest visible transmission/VLT possible—greater than 60 percent—and the appropriate shading coefficient/SHGC by

climate and facade orientation without compromising visible transmission.

“While you might want to have low solar gain on the east and west facades, you may also want high solar gain on south facades for free solar heating in cooler climates, adding fixed or seasonal shading devices for summer,” she says.

Taking things a step further, building teams can overclad the entire building, a common best practice in Europe.

While a facade facelift or a full building overclad are highly effective carbon reduction strategies, cost and disruption to ongoing building operations are significant obstacles.

Further, if owners decide to invest in such aggressive strategies, it is important to future-proof the design. “This would include best-in-class thermally broken framing; triple pane, low-e coated, warm-edge glazing package; and perhaps a double skin, with effective

exterior solar shading,” instructs Sanders. “It would employ strategies to mitigate thermal bridging; include durable long-service life with easily serviceable components; and ideally, orientation specific design balancing energy performance, daylight admission, comfort, and resiliency.”

It would employ strategies to mitigate thermal bridging; include durable long-service life with easily serviceable components; and ideally, orientation specific design balancing energy performance, daylight admission, comfort, and resiliency.

Patterson agrees that new building facades and retrofits must be designed to accommodate future retrofit cycles. Consequently, designs should make it easy for these facade systems to adopt new higher performing glazing products and insulated panels as they become available in the future.

Ultimately, Patterson says, “Building lifecycle carbon performance and resilience will both depend on the capability of our buildings and their facade systems to adapt to these accelerating socio-technological and aesthetic changes, as well as to the uncertainties of climate change into the future.”

Working from the other end of the carbon equation, building owners should consider generating their own electricity through solar power, integrated photovoltaics, and thermal and electric power storage.

“In addition, net zero for the nation will require some level of carbon sequestration in our building materials,” adds Loftness. “We need to design with biological materials for structure, infill, rainscreens, and even insulation, e.g., wood that is sustainably harvested. We need to seek out alternatives and innovations in concrete, steel, aluminum, and synthetic insulation. Eliminating embodied carbon is the next frontier.”

FUNDING

While carbon reduction is clearly beneficial, there is no denying that these retrofits come with a hefty price tag. Further complicating matters is the general state of the economy amidst a pandemic.

To ease the burden, the city is introducing a new finance mechanism called the Commercial Property Assessed Clean Energy program, which offers owners low interest loans for energy improvements.

“The reason why they’re low interest is they’re collected on the building’s property tax bill, so they are a more highly securitized risk,” explains Mandyck. “The other benefit is the loan stays with the building, so if the building is sold, the loan goes to the new owner.”

In addition, New York State offers incentives through the New York State Energy Research Development Authority, NYSERDA, and some incentives are available from utilities like ConEdison.

Another long-standing option is energy service performance contracts with third-party energy service contract organizations,

ESCOs, who finance the upgrade and then share energy savings with the owner.

Selkowitz adds that high-performing, comfortable buildings ultimately make a significant contribution to employee well being and productivity, which is an important variable in an owner's return on investment. "Remember that productivity is worth 100 times the cost of energy, so a design enhancement that improves comfort and productivity can help justify a new investment in better performing solutions," he says.

Even so, Roberts says government funding will be needed to ensure that implementation is successful, both to fund proper regulation and provide additional incentives to owners.

But despite these mechanisms and programs, the fact remains that companies are struggling under today's economic conditions. However, the current situation does seem to have some positive aspects.

For starters, the required Local Law 97 upgrades are anticipated to stimulate economic activity in the construction industry. In fact, Urban Green estimates that if all buildings choose efficiency to meet the carbon caps, this presents a \$16.6 billion to \$24.3 billion energy retrofit market opportunity in the city by 2030. In comparison, New York building owners invested just \$235 million in building improvements to save energy in 2018. Consequently, LL97 could trigger a 13-fold increase in energy upgrades depending on how soon owners begin investing in their properties. In the short term, Urban Green predicts that

owners will invest \$2.2 billion to meet 2024 targets.

Woods also anticipates that implementing changes at the scale required of LL97 will create positive pressure on all kinds of industries to design and sell the best products and processes to achieve these goals. "This will certainly advance the technology available to architects and building owners to improve building performance," he asserts.

Bringing up a logistical issue, Wolf recommends staggering this construction as much as possible to spread out the unavoidable disruptions, particularly when entire neighborhoods require retrofits. In the absence of strategic planning, he cautions, "Crowding of job sites—possibly one next to the other for blocks—will slow retrofitting rates due to the local decrease in resources: material, spatial and temporal, and competition for workers skilled in constructing high-performance buildings."

For the moment, owners are investing in boosting the indoor air quality in their buildings. This includes better filtration systems, improved sterilization, and anti-microbial materials to battle COVID-19, all of which contribute to sustainability in buildings, explains Leveratto.

In a similar vein, Olsen states, "COVID-19 has greatly heightened the public's awareness of the impact of the indoor built environment on their daily life. This awareness can be leveraged to increase awareness of the need to act to meet the requirements."

Mandyck suggests that the pandemic has introduced a unique

CARBON TRADING

To help dense buildings comply with New York's Local Law 97, it is anticipated that buildings will be able to "trade carbon" by purchasing credits from buildings that have gone below the carbon cap.

While New York City's Local Law 97—requiring large buildings to reduce their carbon emissions by 2024, and again in 2030—is a promising climate change policy, it puts dense, high-energy building types at a major disadvantage.

"The way the law was passed presents a major challenge in that it penalizes density, which is counterintuitive to sustainable design because you want to put more people in a single building verses placing that same number of people in multiple buildings," explains John Mandyck, CEO, Urban Green Council, New York.

While these building types have the option of paying the fine, which is \$268 for each ton over the cap, this adds up to a few million dollars per building and unfortunately does nothing to help climate change.

"You could have a building that is super energy efficient and highly sustainable, but if it had 10,000 people working there, you can't get around the fact that it uses a lot of energy," says Mandyck.

UNDERSTANDING CARBON TRADING

What might building-level trading look like?

A Cap on Carbon

A cap sets a limit on carbon emissions from the energy used in buildings. Caps can be building-specific or for all buildings as a whole, and they grow more stringent over time.



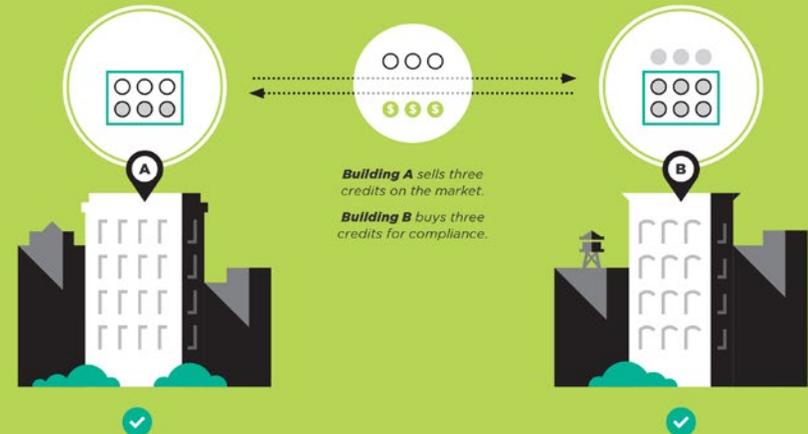
A New Commodity

Carbon savings become a quantifiable, tradable commodity. A building that reduces carbon below its cap receives a credit or allowance for those extra savings.

How It Works

Building A reduces emissions three units under its cap.

Building B's emissions are three units over its cap.



Building A now has revenue to invest in building upgrades.

Building B is now compliant and carbon goals are met.

URBAN GREEN COUNCIL

IMAGE COURTESY OF URBAN GREEN COUNCIL

“That is the concept of carbon trading that one building goes below their obligation and is able to trade and monetize those extra carbon savings with a building that is not able to meet their requirements,” Mandyck clarifies.

Urban Green has invested much in researching the concept and urging the city to incorporate carbon trading into Local Law 97. The council released a report this summer, “Trading: A New Climate Solution for Buildings,” which outlines 11 big questions that need to be answered for carbon trading to work in

any city and identifies 59 policy options under each of those questions for cities to evaluate.

At this time, the city is conducting a study on the details of carbon trading implementation. New York University is leading a team to run carbon modeling scenarios and Urban Green is heading up stakeholder engagement and consultation on the study.

“The study is meant to make a determination in January about whether carbon trading can work in New York City,” says Mandyck. “We are

hopeful that will lead to a positive determination.”

Urban Green views carbon trading as the “secret sauce” that will make Local Law 97 work, and something that can be exported to other cities to help reduce carbon emissions.

“It does not matter what climate you have, what political system you have, the age of your building stock, or whether you have hi-rise or low-rise buildings.” explain Mandyck. “This is a breakthrough policy tool for cities that are trying to tackle climate change.”

learning opportunity to better understand energy use patterns.

Take Rudin Management, for example. The property management company owns 16 commercial buildings totaling 10.2 million square feet in the city. While the company’s buildings have been at 10 percent capacity through the shutdown, they only saw a 30 percent drop in energy consumption. With computers, refrigerators, copiers, and the like still plugged in, there is a lot of phantom energy being wasted. Additionally, servers have continued operating to support people working from home.

“This is a learning moment. It is an opportunity for owners to

have discussions with their tenants. It is my hope that we can take this opportunity to learn about building energy use patterns to make improvements for the future,” says Mandyck.

Andow notes that ventilation rates and energy efficiency have always been at odds, but the COVID-19 pandemic has shifted priorities in favor of increased outside air to dilute potentially contaminated indoor air. “Satisfying new expectations for indoor air quality while reducing carbon emissions will instigate conflicts between near-term safety and long-term climate hazards,” he observes.

In the grand scheme of things, Bocra reiterates that the pandemic is a near-term crisis whereas climate change is a long-term crisis that cannot be ignored. The city remains steadfast and warns that the longer society waits to make these changes, the more it is going to cost.

Putting things into perspective, Mandyck points out that the city has 3 trillion dollars of insured coastal properties, which is twice the gross domestic product of the entire country of Canada. “That is what is at risk. Superstorm Sandy hit NYC as a tropical storm, it was not even a hurricane, and it left a \$20 billion bill. So I would argue that we are going to pay for climate change one way or another and if we do not make the investments today to lower our carbon emissions, we are in for it tenfold in climate catastrophes and events that we will not be able to overcome from a weather standpoint down the road.”

TAKING THE LEAD

Another question is whether New York City's efforts to fight climate change might impact other cities domestically and globally. The consensus seems to be that it will in fact make an impression.

“One of the primary aims of AIA New York and other groups who advocated for the passage of LL97 was to set an example for cities throughout the country. NYC is undeniably a leader of architecture and the ambition is that the law will be imitated subsequently by other cities,” says Roberts.

“As LL97's carbon emission caps become more rigorous over time, it will serve as an exemplary case study,” agrees Yasemin Kologlu, RIBA, LEED AP BD+C, design director, SOM, New York. “It will offer us the opportunity to monitor the actual change in carbon emissions over the years, and learn from this to enhance new ways to improve building performance and related carbon emissions. And it could—and should—set a precedent for all cities to follow in the future.”

For example, Mandyck suggests there is a lot to learn from the city's proactive policy solutions like carbon trading and commercial PACE funding, particularly in the absence of a federal solution. (For more, see sidebar, “Carbon Trading.”) He also observes that New York is serving as a strong example of cities playing a leading role in battling climate change, particularly in the absence of a federal solution.

“The passing and implementation of the law has and will continue to demonstrate the value of high-performance design,” agrees Woods. “It is also critically important to make building performance data accessible to the public and to other cities that stand to learn from and improve what New York City is doing.”

At this point, a number of cities have laid the groundwork for implementing a law like LL97. For instance, energy benchmarking is seen as a prerequisite to adopting carbon emission targets as it provides the key data and a reporting infrastructure. To date, 19 U.S. cities—including Chicago, Boston, Washington, D.C., Pittsburgh, Philadelphia, Atlanta, Los Angeles, San Francisco,

Seattle, Austin, and Denver—have established building energy benchmarking ordinances.

Further, Washington, D.C.'s +100 percent renewable energy portfolio program is projected to reduce even more carbon emissions, per capita, of LL97.

As for other cities, these energy benchmarking laws, will position them to move into implementing a law like Local Law 97, says Bocra. “We are very excited about paving the way and hopefully we have an implementation program that is as successful as it can be and we can share that with other cities.”

At the same time, she points out that efforts like LL97 are all a work in progress. Along these lines, there are a number of factors that still require standardization such as how to calculate on-site distributed energy storage and combined heat and power systems, and accounting for things like on-site solar energy panels. The city is consulting with an advisory board and working on a national level to better standardize how emissions are calculated in buildings.

TACKLING THE CHALLENGE

As the Big Apple embarks upon this historic carbon trimming effort, Mandyck points out that if other cities fail to follow suit, the New York Harbor is still going to flood. “So we have an obligation as the largest city in the United States to not only to reduce carbon emissions, but to do it in a way that can help other cities,” he says.

Raising the ethical side of the equation, Wolf points out that building teams would never imagine designing a building without safety factors, but when it comes to the ecosystems of our planet, that same sense of responsibility does not always carry through.

“We need to redouble our efforts to see that LL97 not only stays on schedule but attains some quantified margin of safety with detailed contingency plans,” he states. “It needs an experienced management team that is subject to open peer review and is answerable to the public at regular hearings.”

Further, carbon reduction needs to apply to new building designs. This means making the investment in well-thought-out, integrated sustainable designs at the onset.

“No one buys the cheapest car on the market, so why would you buy only the bare bones, code minimum facade?” asks Selkowitz. “With a bit of speculation, in a more competitive real estate post-COVID world, there may be a premium on workspace that has access to better views, fresh air from the facade, better thermal management and comfort, resilience, etc. A modest incremental investment in the facade may help future-proof your building marketability.”

Ultimately, architects are in a position to play a leading role in these crucial environmental efforts. Offering some encouragement, Kologlu states, “As designers, we are trying to spread our optimism to influence positive change. Everything we do today, whether we are setting new policies or designing a new

building, can still curb carbon emissions and prevent long-lasting, irreversible disruption to our planet.

When a building owner invests in healthy and low carbon materials, enhancing air quality and natural ventilation, maximizing daylighting and views, and implementing new smart technologies, they are investing in the health of the planet, the wellness and productivity of their tenants, and the longevity of their building,” she concludes.■

¹Hens, Hugo. “Heat, Air, and Moisture Transfer in Envelope Parts: The International Energy Agencies Annex 24 Common Exercises.” Department of Civil Engineering, Catholic University, Belgium. 1995. Web. 10 September 2020. <https://web.ornl.gov/sci/buildings/conf-archive/1995%20B6%20papers/037_Hens.pdf>.

²Montes-Amoros, Vicente. “LEED Through the Eyes of the Building Envelope,” Curtainwall Design Consulting. June 2013. Web. 10 September 2020. <<https://www.cdc-usa.com/blog/2013/06/leed-through-eyes-building-envelope>>.

Barbara Horwitz-Bennett is a veteran architectural journalist who has written hundreds of CEUs and articles for various AEC publications. www.bhbennett.com

CONTINUING EDUCATION

AIA
Continuing
Education
Provider

1 AIA LU/HSW

Learning Objectives

After reading this article, you should be able to:

1. Explain New York City Local Law 97 in large buildings and its framework of carbon reduction replacing energy efficiency as the key sustainability metric.
2. Identify key issues and shortcomings with older building facades, and review design tools and strategies for facade and building envelope retrofits.
3. Recognize how enhanced thermal performance and airtightness can significantly boost energy efficiencies in facades.
4. Describe the concept of carbon trading where densely populated buildings can purchase emission credits from buildings that are below the carbon cap.

To receive AIA credit, you are required to read the entire article and pass the test. Go to continuingeducation.bnpmmedia.com/courses/the-ornamental-metal-institute-of-new-york/conquering-carbon for complete text and to take the test for free.

AIA COURSE #K2011M

“Improving facades is critical to compliance with Local Law 97. Technological upgrades to HVAC systems alone are not enough to ensure compliance, as those improvements must be supplemented by better-quality facades.”

—Adam Roberts, director of policy,
American Institute of Architects AIA New York

 **Ornamental Metal Institute of New York**

New York's Big Buildings May Soon Curb Carbon Emissions

BY RONDA KAYSEN

ON APRIL 18, the New York City Council passed an ambitious package of climate change bills—legislation that imposes strict rules on the city's larger buildings, requiring them to drastically curb carbon emissions.

The centerpiece of the eight-bill [Climate Mobilization Act](#) is aimed at new and existing buildings larger than 25,000 square feet, requiring owners to cut emissions by 40 percent by 2030, and 80 percent by 2050. Fail to comply, and owners would face steep fines—\$1 million a year for the largest properties.

Mayor Bill de Blasio, who may run for president in 2020, is expected to sign the legislation in the coming weeks and has touted it as a Green New Deal for New York, one that could forge a path for other cities to follow.

"This is the first city in the world, that I know of, that has placed [significant carbon emission caps](#) on this many buildings," said John M. Mandycyk, the chief executive officer of the Urban Green Council, an advocacy group for sustainable buildings.

In 2016, the city pledged in its [Roadmap to 80x50 report](#) to



Mayor Bill de Blasio announced New York City's Green New Deal at Hunter's Point South Park in Queens on Earth Day, April 22, 2019.

PHOTO © MICHAEL APPLETON/MAYORAL PHOTOGRAPHY

meet the [Paris Climate Agreement](#) targets to reduce emissions by 80 percent by 2050. In New York, where the Urban Green Council estimates about 60 percent of the city's 1 million buildings are 25,000 square feet or larger, some 67 percent of carbon emissions come from the built environment. The Climate Mobilization Act builds on this and other existing rules, like the [city benchmarking law](#), which requires large buildings to measure and report energy and water consumption.

The new legislation makes specific, and expensive, demands on these larger buildings. Mark Chambers, the director of the Mayor's Office of Sustainability, estimates the work could cost property owners at least \$4 billion, as buildings replace or retrofit windows, roofs and heating and cooling systems.

"The new law is going to drive down carbon emissions and it does so through really tough requirements on buildings,"



Mayor Bill de Blasio speaking at Hunter's Point South Park in Queens on Earth Day, April 22, 2019

PHOTO © MICHAEL APPLETON/MAYORAL PHOTOGRAPHY

Mandyck of the Urban Green Council told *Architectural Record*.

But the bill does make some exceptions. Public housing, houses of worship, and apartment buildings with rent-regulated units would be exempt from the emissions caps, and instead have to meet softer targets, like insulating pipes. The Real Estate Board

of New York (REBNY) opposes the legislation for excluding so many buildings from the requirements and setting emission standards that it says could inhibit business growth.

The legislation “does not take a comprehensive, city-wide approach needed to solve this complex issue,” REBNY President John H. Banks said in a statement.

The Climate Mobilization Act includes an advisory board to recommend policy changes as the law rolls out. It also allows buildings to trade carbon credits and encourages building owners to buy renewable sources of energy in an effort to shift the city away from fossil fuels. Other new rules would require green roofs or solar panels on new construction and major retrofits. (Meanwhile, Los Angeles Mayor Eric Garcetti unveiled a version of a Green New Deal that would [phase out gas-fueled](#) cars in the city.)

In a [speech on Earth Day](#), Mayor de Blasio singled out glass skyscrapers as a major source of pollution. “We are going to introduce legislation to ban the glass and steel skyscrapers that have contributed so much to global warming,” he said, standing on the [Queens shoreline](#). “They have no place in our city or on our Earth anymore.” He doubled down on his statement a few days later on [MSNBC’s Morning Joe](#).

Chambers, however, back-pedaled de Blasio’s comments, telling *Architectural Record*, “No one is saying that no one is going to use glass material anymore. What we’re saying is we have to be as thoughtful as possible about our mass and glass ratios.”

REBNY’s Banks pushed back against criticism of glass towers in a May 1 op-ed in *Real Estate Weekly*, writing, “We must not forget that a building’s rate of energy use and efficiency is not dictated by the material found in its facade—far from it.”

The mayor may be able to implement design changes through the city’s revised energy code for new construction, expected by the end of the year, according to Mandyck. “We’re waiting to see any proposals,” he said in an email. “So we simply don’t know if it will be part of the code—and if, how—or separate legislation.”

Chambers also pointed to the energy code as a way to implement such changes, saying that the mayor “wants our energy code to be even stronger.” He added that he would like to see more buildings employ glazing technology to improve glass efficiency; use more photovoltaic glass; and consider alternate materials.

“There is one single archetype that has dominated, and that is solely floor to ceiling curtain wall,” Chamber said. “If we’re going to see glass, we’re going to see the highest performing glass, ushering in a new phase where we’re not designing buildings from the inside out.” ■

CONTINUING EDUCATION:

Cities and Carbon Policy

A goal without a plan is just a wish. That adage is especially true for the near-universally held goal of reducing human-caused carbon emissions. Cities—where a growing majority of the world's population lives, where about three quarters of global emissions are generated, and where the impacts of the **climate crisis** are increasingly felt—have a critical role to play in developing and implementing the requisite plan. Many plans, in fact, because cities are uniquely well positioned to tailor strategies to local circumstances for maximum effect.



New York skyline, as seen from the west.

PHOTO © VLAD GHIEA/ALAMY STOCK PHOTO

“Cities set the trends and take the lead,” says Paul Cartwright, program manager for new-building efficiency with C40 Cities, a global network of major municipalities committed to addressing the climate crisis. “Even where cities don’t have direct powers, they still find ways to take a leadership role.” Parallel with such initiatives as the 2030 Challenge, and the AIA’s 2030 Commitment, C40’s member cities have pledged to ensure that new buildings operate at net zero carbon by 2030, and all buildings by 2050.

It’s now 2020. In this section, RECORD checks in with five of these leading cities—[New York](#), [San Francisco](#), [Vancouver](#), [Stockholm](#), and [Tokyo](#)—asking whether their climate-action plans are on track to meet these commitments, and sharing snapshots of key initiatives and achievements to date.

Within cities, buildings are one of the largest consumers of energy, often accounting for more than half—and, in highly dense urban areas where mass transit reduces pollution from the transportation sector, more than 70 percent—of greenhouse-gas emissions, according to a 2016 analysis conducted by C40 in collaboration with Arup. A 2017 study by the McKinsey Center for Business and Environment suggests that optimizing energy use in buildings can reap between 20 and 55 percent of a city’s emissions-reduction potential. Heavy-hitting measures include stringent standards for new construction, building-envelope retrofits, HVAC and water heating, lighting upgrades, and installation of building automation and controls. Add in cuts from

decarbonizing the electricity grid, and these efforts can account for up to 60 percent of a city’s potential savings.

There are many tools available to catalyze these reductions. Cities have the power to set performance criteria and energy consumption limits, such as [Tokyo’s](#) cap-and-trade program, [New York’s](#) Local Law 97, and Vancouver’s Zero Emissions Building Plan. They can demonstrate best practices in the municipality’s own real-estate portfolio, as in [Stockholm’s](#) aggressive energy-consumption limits for buildings on city-owned land and [San Francisco’s](#) requirement that new municipal facilities depend only on electricity for power. Cities can use money—or money-equivalent mechanisms, such as density bonuses and preferential permit processing—to incentivize improvements. Vancouver’s 5 percent density allowance, for instance, ensures that developers building to Passive House standard aren’t penalized on square footage because of thicker walls. And cities have the ability, through information and communication, and through connections with higher levels of government, to influence other actors to implement additional education measures.

A critical obstacle cities often face in achieving emissions-reduction goals is a limited ability to access, manage, and analyze high-quality data. Data enable municipalities to understand the source and significance of their greenhouse-gas emissions, set appropriate mitigation targets, develop strong and cost-effective climate-action plans, and monitor progress. Leading cities have

developed successful reporting and disclosure policies to generate high-quality data on building energy performance, and the analytical tools to make sense of it. Tokyo, for example, introduced energy-reporting policies for private office buildings in 2005, and has since achieved energy savings in this sector of about 30 percent. American cities such as New York are seeing results from benchmarking and disclosure schemes. And Stockholm's showcase development, Royal Seaport, backs up its energy-consumption limit for new buildings with post-occupancy monitoring and reporting.

A 2019 survey conducted by the U.S. Conference of Mayors found that 96 percent of 182 responding cities from 39 states are feeling the impact of the climate crisis. In the last five years, nearly every one of them has experienced a climate-related incident, whether flooding, heat wave, drought, or forest fire. Over the last 12 months, 60 percent have launched or significantly expanded a climate initiative or policy, and 57 percent will launch or significantly expand a climate initiative or policy this year.

At this critical juncture in the growing climate emergency, the building-related actions highlighted in the following articles demonstrate what becomes practical and possible when cities commit to a carbon-free future. ■

CONTINUING EDUCATION

AIA
Continuing
Education
Provider

To earn one AIA learning unit (LU), including one hour of health, safety, and welfare (HSW) credit, read "Continuing Education: Cities' Carbon Policy", and the following articles.

- [New York's Carbon Policy](#)
- [San Francisco's Carbon Policy](#)
- [Vancouver's Carbon Policy](#)
- [Stockholm's Carbon Policy](#)
- [Tokyo's Carbon Policy](#)

Then, [complete the quiz](#). Upon passing the test, you will receive a certificate of completion, and your credit will be automatically reported to the AIA. Additional information regarding credit-reporting and continuing-education requirements can be found at continuingeducation.bnppmedia.com.

Learning Objectives

- Outline the leading-edge policies for reducing carbon emissions from both new and existing buildings for the five cities profiled.
- Describe ways to incentivize low-carbon building design, construction, and operations.
- Explain how a carbon cap-and-trade program for buildings works.
- Discuss the potential benefits of all-electric buildings.

AIA/CES Course #K2005A

Think Global, Act Local: New York's Carbon Policy

BY JOANN GONCHAR, FAIA

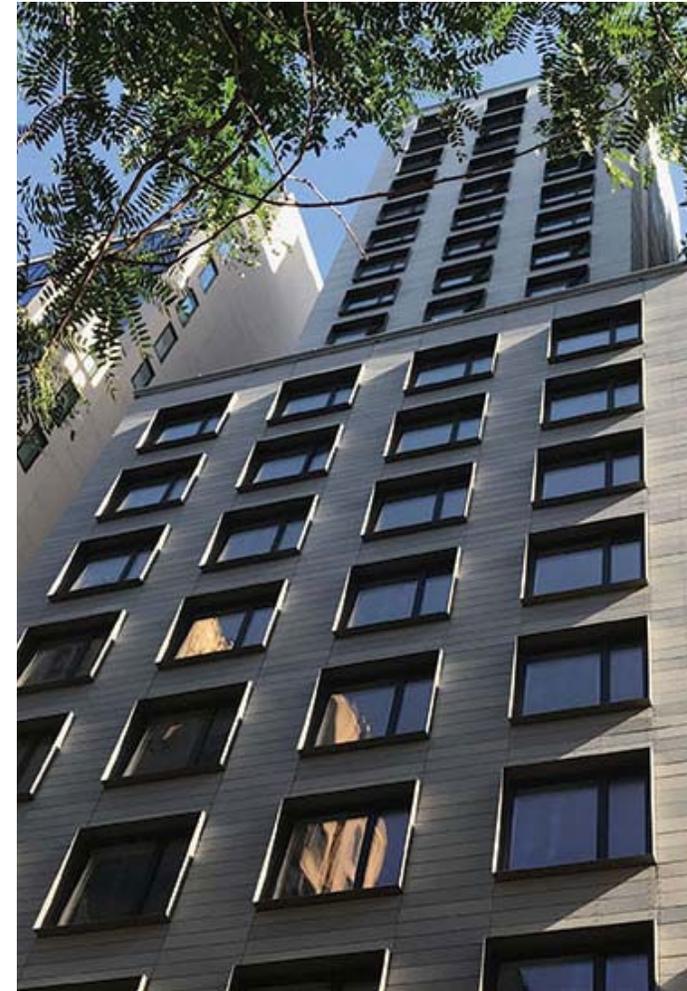


A five-story condo building in Brooklyn by ZH Architects.

PHOTO © EDWARD CARUSO

ADVOCATES OF New York's Local Law 97 refer to it as the most ambitious **climate** legislation for buildings enacted by any city in the world. The claim might sound like hyperbole, but John Mandyck, CEO of the Urban Green Council, a nonprofit that helped shape the regulation, points to its scope and scale. It applies to 50,000 existing buildings—any that are 25,000 square feet or larger. These structures amount to 60 percent of the city's floor area and are responsible for 40 percent of total greenhouse-gas emissions. By 2030, the law is expected to reduce emissions from large buildings by at least 40 percent compared to a 2005 baseline, which means cutting 5.3 million metric tons of carbon dioxide from current levels, the equivalent of San Francisco's citywide emissions.

The most consequential piece in a package of bills known as the **Climate Mobilization Act**, the law was passed by the City Council in April last year. It sets increasingly stringent limits for the



A five-story condo building in Brooklyn (1) and a 55-unit rental apartment tower in Manhattan (2), both recently completed and designed by ZH Architects, deploy such features as highly insulated and airtight facades, triple-glazed windows, and minimized thermal bridges. Both are expected to meet Local Law 97's anticipated emissions limits for 2050.

PHOTO (1) © EDWARD CARUSO. (2) COURTESY ZH ARCHITECTS [CLICK TO ENLARGE](#).

amount of CO2 facilities can emit based on building type. The first set of regulations go into effect in 2024, targeting the most carbon-intensive 20 percent of buildings, while the 2030 limits target the most carbon-intensive 75 percent. (Subsequent limits will be set by the Department of Buildings to achieve an 80 percent reduction in emissions citywide by 2050.) These thresholds are not aspirational but statutory, points out Mandyck: owners who fail to meet the limits face steep fines.

How can owners bring underperforming buildings into compliance? They can put new operating strategies in place, implement energy-saving retrofits, or buy green power. Work can be financed through a special low-interest loan program. Some building types—income-restricted housing or places of worship—can opt instead to complete a prescribed set of low-cost energy-saving measures, including insulating pipes, installing boiler sensors and controls, and fixing heating-system leaks.

Although the measure is aimed at upgrading existing structures, a year after a new building is completed, it is subject to the law's stringent reporting requirements and emissions limits. Some proponents maintain Local Law 97 isn't strict enough for new construction or projects that involve significant renovation or expansion. "New buildings should have different requirements," says Stas Zakrzewski, principal of ZH Architects, who sits on an advisory board helping guide the law's implementation. He points to two of his firm's recent projects: a five-story condo building in Brooklyn that incorporates a three-

story existing structure and an all-new 55-unit rental residential tower in Manhattan. The smaller building, at only 7,000 square feet, is not subject to Local Law 97. Nevertheless, it is expected to meet the anticipated 2050 emissions limits for residential construction—offering an example that other projects could emulate, with its highly insulated, airtight building envelope, triple-glazed windows, and minimized thermal bridges. Many of these strategies have been deployed on the tower, which has projected emissions far below the 2050 limits.

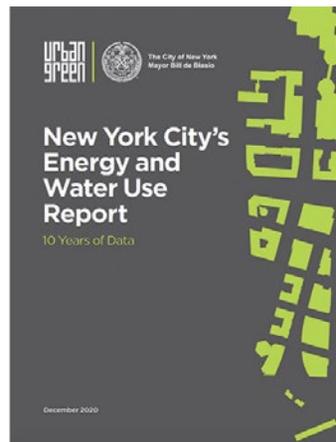
Some advocates of the law worry that it does not deal well with carbon-intensive uses, including those of trading floors and data centers. "This is a legitimate concern," says Mandyck. "The carbon metric is straightforward, but it is a blunt instrument." He suggests that a cap-and-trade scheme like [Tokyo's](#) could be a remedy; his organization is involved in developing the carbon-trading implementation plan that the law requires. It would allow a building with justified high-energy uses to buy credits from another building with emissions below its target.

It is too early to know how many out-of-compliance owners will perform retrofits, buy offsets, or simply pay the fine, notes Richard Yancey, executive director of the nonprofit Building Energy Exchange. But he is optimistic about the language of Local Law 97, which includes placeholders for programs like carbon trading and allows for other future adjustments in order to meet its reduction targets. It's "critically important" to get these modifications right, says Yancey: "Cities all over the world are looking to New York." ■

A Decade of Energy Regulation in NYC Pays Off in Data and Carbon

DECEMBER MARKED the 10th anniversary of [New York City's](#) Local Law 84 (LL84), which requires owners of large buildings to measure energy and water consumption to help the city achieve “80×50”: an 80 percent reduction in carbon emissions by 2050. To mark the occasion, the Urban Green Council (UGC) released a report quantifying the city’s progress. The data will influence responses to the climate emergency locally and, probably, nationwide.

The report is, in part, meant to help keep building owners in compliance. Caps on energy consumption take effect in 2024 and become tougher by stages through 2050, with stiff fines for owners who exceed the limits. Since buildings account for two-thirds of New York’s greenhouse-gas emissions, achieving this goal will dramatically shrink the city’s carbon footprint, along with improving air quality and residents’ health. “This report highlights the importance of data in determining energy policy,” says Rick Bell, of the Consortium for Sustainable Urbanization and Columbia University’s Center for Buildings, Infrastructure and Public Space. “Ten years of benchmarking allow policy-makers and



practitioners to analyze success stories and focus on where more can be done.”

The good news is that emissions from some 3,200 regularly benchmarked properties fell 22.6 percent over the decade, with particular gains in the commercial sector. Median emission intensities for the full benchmarked set followed a similar trend. The report cites five drivers: weather variation, cleaner electricity generation, improvements to the district steam system (which heats nearly a third of large office buildings), fuel switching, and more efficient energy use. When LL84 appeared in 2010, buildings over 50,000 gross square feet were required to report; with the addition of midsize properties (25,000–50,000 square feet) in 2017, the sample now totals about 25,000 buildings, comprising over 3 billion square feet in total.

The bad news is that progress is unevenly distributed, has slowed, and must accelerate to make 80×50 achievable. Uncertainties include whether residences and hotels can catch up with offices—the hotel sector actually lost ground, with 1 percent higher median

energy use intensity (EUI), in part reflecting a steady 8 percent rise in occupancy from 2010 to 2018.

Because an early inventory found that 5 percent of buildings contributed 36 percent of citywide greenhouse-gas emissions, benchmarking initially concentrated on the largest buildings. As a result of a decade of data collection, the knowledge base is more granular now, says Laurie Kerr, president of LK Policy Lab and a veteran of the city's Office of Long-Term Planning and Sustainability. "Ten years ago, when we passed these laws, we knew [buildings] were responsible for 75 percent of the city's carbon emissions," a proportion that electrical efficiency and other measures have reduced. "But we didn't know how individual buildings were performing, and, even worse, the building owners didn't know whether their buildings were efficient or not. So the benchmarking has been an eye-opener."

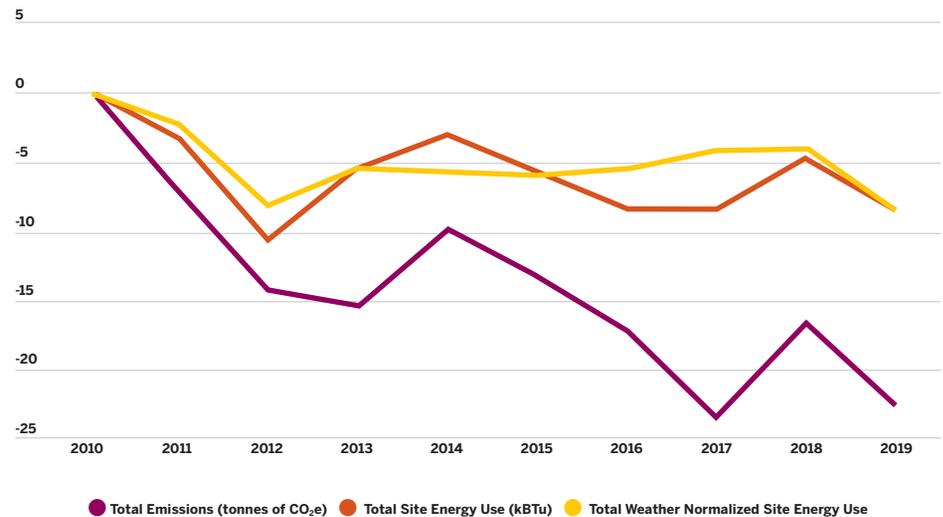
One of the revelations is that some 3,000 multifamily residential properties are over their caps and will face fines if they are not in compliance by 2024. Midsize residences with high occupant density are particularly big emitters: nearly 30 percent were noncompliant in 2019.

Some initial citywide gains represented low-hanging fruit. Phasing out heavy fuel oil by 2015, for example, accounted for about a quarter of the carbon cut. Energy-efficiency improvements account for about a third, and must continue. Achieving 80×50, Kerr emphasizes, is not blue-sky aspiration but can be achieved with common building-science strategies that include reducing on-site fossil-fuel burning,

Change in Emissions and Site Energy Use, 2010–19

Data: Local Law 84 2010–19 filtered for properties that regularly submitted data across 10 years

Percent change from 2010 levels



COURTESY URBAN GREEN COUNCIL

phasing out antiquated boilers, controlling thermal losses at windows, increasing lighting efficiency, implementing Passive House-type strategies such as heat recovery, and using electricity for heat and hot water. New York State has committed to a carbon-neutral electrical grid by 2040, she notes. With 40 percent of carbon emissions currently attributable to electricity use, and electric cars soon to add to demand, meeting the goal will be essential, as will be efficient electrical transmission and distribution.

"This 10-year data set not only guides NYC's climate approach," says Urban Green Council CEO John Mandyczk, "it can also inform decisions in other cities, so we can get to a low-carbon future faster." ■

“Facades are a key part of carbon deduction and energy efficiency reduction because they are, arguably, the most important part of a building’s energy efficiency strategy from a holistic standpoint.”

—Atilio Leveratto, Vice President, CallisonRTKL, New York





Among the more opportune aspects of Local Law 97's directive to curb carbon emissions is its enactment at a time when many of New York's aging curtain walls need replacement. Since HVAC accounts for 40 percent of all building emissions, it is often the initial focus of mitigation efforts. But without first upgrading the envelope, changes to mechanical systems can result in oversized equipment and wasted resources.

The high-performance facades featured in this eBook address these concerns by shrinking energy demand, a tribute not only to sophisticated architecture and engineering but also to the skilled performance of contractors involved in the highly interdisciplinary work of installing them. Building owners investing in this innovative technology can radically help curb carbon emissions. But it won't happen overnight, the time to plan is now.

A handwritten signature in black ink, appearing to read "Gary Higbee". The signature is fluid and cursive, with a small mark at the end.

Gary Higbee, AIA

Director of Industry Development

THE ORNAMENTAL METAL INSTITUTE OF NEW YORK