EF 1:
SIMPLIFY COMMERCIAL ENERGY CODE TO CURRENT ASHRAE 90.1

Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:
The Energy Code provides commercial buildings two major compliance paths with over a dozen sub-paths. This results in an excessively complex code structure, which creates loopholes and makes enforcement difficult.

Recommendation:
To simplify compliance and enforcement, require that all commercial buildings follow ASHRAE 90.1.

Proposed Legislation, Rule or Study

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Delete Chapter 8 and replace with a new Chapter 8 as follows:

<u>CHAPTER 8</u>

<u>BUILDING DESIGN FOR COMMERCIAL BUILDINGS</u>

<u>SECTION 801</u>

<u>ADOPTION OF ANSI/ASHRAE/IESNA Standard 90.1 (2007)</u>

<u>801.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. Buildings constructed in accordance with this chapter are deemed to comply with this code. These commercial buildings shall meet the requirements of ANSI/ASHREA/IESNA Standard 90.1 (2007), Energy Standard for Buildings Except for Low-Rise Residential Buildings.</u>

Supporting Information

Issue – Expanded
The Energy Conservation Code of New York State for commercial buildings essentially consists of two separate but comprehensive codes, allowing users to choose their compliance option: ASHRAE Standard 90.1 and Chapter 8 of the International Energy Conservation Code. Anecdotal evidence suggests that the origin of this arrangement was a compromise between two competing Code bodies (ASHRAE and the Uniform Building Code, now the International Code Council); instead of integrating the best aspects of each code, both codes were included as options.

Having two codes in New York State has proven untenable for many reasons. Each code is more than 100 pages long and is intricate and complex; together they provide at least one dozen potential sub-paths. Thus, it is very difficult for a practitioner or code enforcement official to be highly knowledgeable about both codes. This is especially challenging because both the two codes share many similarities in structure and organization, but are very different in detail—thus causing even more confusion when attempting to commit requirements to memory.

In addition, the energy codes in the U.S. are being upgraded on a regular basis and there is no systematic means to maintain uniformity of overall performance requirements between the two codes. Anecdotal evidence suggests that at one time this role was informally played by US Department of Energy staff, but that is not currently the case.

In recent years, ASHRAE Standard 90.1 has emerged as the dominant venue for debating and enacting energy performance policy within the US, both in government and the private sector. ASHRAE 90.1 is the standard referenced consistently within Federal energy legislation, including recent Energy Policy Acts as well as bills now pending in congress. ASHRAE 90.1 was developed and is maintained through a rigorous national consensus based development and upgrade process. ASHRAE 90.1 is also the primary energy standard utilized in the LEED Rating System by the US Green Building Council. Moreover, ASHRAE 90.1 is most often utilized by the industry in New York City for energy code performance.

For all these reasons, this proposal would simplify the Energy Code to require compliance with ASHRAE 90.1, and no longer include Chapter 8 of the International Code Council as an alternative path.

Environmental & Health Benefits
A simplified energy Code structure for commercial buildings will enable greater understanding of the Code requirements by practitioners, greater ability to enforce the requirements of the Code by City officials, and thus greater energy performance of New York City's commercial buildings.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a positive, indirect health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. It was thus categorized as not incurring a capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Indirectly, a simplified energy Code structure would result in reduced cost to practitioners to obtain and maintain proficiency with the Code, and reduced cost to New York City government to interpret and enforce the Code.

Precedents
There are no known precedents for this proposal.

LEED
Current LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections require that the scope of work complies with ANSI/ASHRAE/IESNA standard 90.1-2007, or the local energy code, whichever is more stringent. In New York City, this means that all projects that participate in LEED must comply with ASHRAE 90.1, thus the proposed Code simplification is consistent with LEED.

Implementation & Market Availability
There are no significant barriers to implementation of this proposal.

More engineers and architects are familiar with ASHRAE 90.1 than with Chapter 8 of the International Code Council. Some design professionals may require training on ASHRAE 90.1.

EF 2:
BUILD NEW HOMES TO ENERGY STAR® STANDARD

New York City Building Code
Proposal developed by the Homes Committee

Summary

Issue:
New homes are not designed to take advantage of cost-effective energy-saving measures. ENERGY STAR is a widely accepted national standard for energy-efficient housing design.

Recommendation:
Require all new residential buildings of three stories or less to be constructed to ENERGY STAR standards.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Chapter 13 to include a new section 1302 as follows:

1302 Energy star homes.

1302.1 Definitions. For the purposes of this Section 1302 only, the definitions found in chapter 4 of the Energy Conservation Construction Code of New York State shall apply. In addition, for the purposes of this Section 1302, the following terms shall have the following meaning:

ENERGY STAR HOMES STANDARDS. Energy efficiency standards for homes set forth by the New York State Energy Research and Development Authority in the New York ENERGY STAR Homes Technical Specifications.

CERTIFIED HERS RATER. A person with certification as a Certified Home Energy Rater by the Residential Energy Services Network.

1302.2 Energy Star requirements. In addition to the requirements of Section 1301.1.1, any residential building classified in occupancy group R-2 and 3 stories or less or classified in occupancy group R-3 shall be designed and constructed in accordance with the Energy Star homes standards. Any application for a permit for such construction shall include a statement from a registered design professional or certified HERS rater that the construction documents comply with such standards. Prior to sign-off, such building shall schedule a final Energy Star inspection by a certified HERS rater and submit documentation to the department demonstrating that such inspection has been scheduled.

Supporting Information

Issue – Expanded
Residential buildings consume over 37% of the energy used in NYC.[1] Energy is used in homes either through direct burning of fossil fuels or in the use of electricity produced by burning fossil fuels at power plants. This energy use contributes to smog, acid rain, and global warming; the less energy we use in our homes, the less air pollution we generate.[2]

ENERGY STAR is a certification for homes that have met energy efficiency guidelines established by the U.S. Environmental Protection Agency (EPA). These homes must be at least 15% more energy efficient than required under the 2004 International Residential Code, and "include additional energy-saving features that typically make them 20–

30% more efficient than standard homes."[3]

Over 1 million homes have been certified under this program, which relies on tried and true energy-efficiency technologies.[4] The features of ENERGY STAR homes include effective insulation, high-performance windows, tight construction and ducts, efficient heating and cooling equipment, and efficient electrical products and appliances. The EPA uses independent Home Energy Rates to verify compliance with the standard.

Environmental & Health Benefits

ENERGY STAR certified homes use less energy than conventional homes, reducing climate change, improving air quality, and increasing energy independence.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have no significant positive health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents

Countless jurisdictions across the country have mandated ENERGY STAR for new homes. In Long Island, towns representing more than half of the new home starts in 2008 require compliance with ENERGY STAR.[5]

LEED

LEED for Homes requires that the building or space meets the performance requirements of ENERGY STAR for Homes (including third party inspections) as a prerequisite for the Energy & Atmosphere sections. LEED for Existing Buildings requires that a building or space meet a minimum ENERGY STAR rating as outlined by LEED, or for buildings types not addressed by ENERGY STAR demonstrate that the building has an equivalent rating as calculated by an alternative method described by LEED. Therefore, this proposal will assist in achieving LEED certification under these rating systems provided that these provisions are met.

Other rating systems utilize differing criteria for compliance with LEED.

Implementation & Market Availability

The expertise and materials to construct ENERGY STAR homes is widely available since over 1 million homes have been certified under the program and it is mandatory across much of Long Island.

As of July 2009, there were 87 Certified HERS Raters statewide (up from 65 in May[6]), a clear indication of how fast the market is adapting to the growing demand. There are 15 Energy Star builders in New York City at the moment, a number that is expected to rise at the same rate as the HERS raters.[7]

ENDNOTES:

[1] CITY OF NEW YORK, PLANYC: A GREENER GREATER NEW YORK, 107 (2007), http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf.

[2] U.S. EPA, Energy Star, New Homes: Benefits for Homeowners http://www.energystar.gov/index.cfm?c=new_homes.nh_benefits (last visited January 21, 2010).

[3] U.S. EPA, Energy Star, New Homes, http://www.energystar.gov/index.cfm?c=new_homes.hm_index (last visited January 21, 2010).

[4] U.S. EPA, Energy Star, New Homes: Celebrating 1 Million Energy Star Homes http://www.energystar.gov/index.cfm?fuseaction=mil_homes.showSplash (last visited January 21, 2010).

[5] RICHARD FAESY, RATCHETING RESIDENTIAL ENERGY CODES UP TO ENERGY STAR: THE LONG ISLAND MODEL AS AN EXAMPLE OF WHAT CAN BE ACHIEVED (March 2, 2007) http://www.hersindex.com/ratings/codes/faesy-white_paper.pdf.

[6] RESNET, Certified Rater Directory, http://www.natresnet.org/directory/raters.aspx (last visited January 21, 2010).

[7] New York State Energy Research and Development Authority, Resource Locator Map, http://www.getenergysmart.org/Resources/FindPartner.aspx?t=1 (last visited January 21, 2010).

EF 3:
LIMIT HEAT LOSS THROUGH EXTERIOR WALLS

ANSI/ASHRAE/IESNA 90.1 (2007) and the Energy Conservation Construction Code of New York State
Proposal developed by Energy & Ventilation Committee

Summary

Issue:
Building envelope design has a major impact on both heat loss in winter and solar gain in summer. Using the flexibility in current energy codes, designers can meet energy-efficiency requirements by trading off the efficiency of mechanical and lighting equipment against the thermal integrity of the envelope. Since the building envelope will be in use for a century or more, this trade-off is short-sighted.

Recommendation:
Establish fixed performance requirements for building envelopes with respect to heat loss, independent of mechanical and lighting equipment choices.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 5.4.4 as follows:

5.4.4 Maximum Exterior Building Envelope Heat Transfer.

5.4.4.1 *Exterior building envelopes* shall comply either with the prescriptive option of subsection 5.4.4.2 or the performance option of subsection 5.4.4.3 notwithstanding whether the overall building design complies with the requirements of the *Energy Cost Budget* Method of Section 11. In addition to the foregoing, if the *energy cost budget* trade off option as set forth in Section 11 is chosen as a compliance path and requires a lower average U-factor than .25 Btu/hr-sf-°F, then that lower value must be utilized in the *proposed design*.

Exception: Any building with a peak design rate of energy usage less than 3.4 Btu/hr-sf or 1.0 watt/sf of floor area for space conditioning purposes.

5.4.4.2 *Exterior building envelopes* excluding the *roof* but including *skylight* area in excess of 5% of roof area shall have a maximum average U-factor of 0.25 Btu/hr-sf-°F for *buildings* receiving permits before July 1, 2016, 0.20 Btu/hr-sf-°F for *buildings* receiving permits after July 1, 2016 but before July 1, 2022, or 0.16 Btu/hr-sf-°F for *buildings* receiving permits after July 1, 2022, notwithstanding whether the *exterior building envelope* has a sufficiently high *envelope performance factor* as set forth in Section 5.6, except as permitted in subsection 5.4.4.3 The maximum average U-factor shall be calculated by averaging the U-factor of each component of the *exterior building envelope* excluding *roof* but including *skylights* over the entire *above-ground wall* and *fenestration* areas that enclose *heated spaces* but excluding *semiheated spaces*. The average U-factor shall be calculated as follows:

$$\text{Average U-factor} = \text{UAref/Atotal} = (UA_1 + UA_2 + \ldots UA_n) / \text{Atotal}$$

where

UA = the U-factor for each individual *exterior building envelope* component excluding the *roof* but including *skylights* (except those over *semiheated spaces*) multiplied by the total area of such component incorporated in the *exterior building envelope*. The U-factor for each component shall be calculated by taking into account thermal bridging at metal studs and members, shelf angles, floor edges, projecting balconies, window frames, and other components passing through the thermal barrier. U-factors can be determined using test results as required by this standard, tabulations provided by this standard, Standard NFRC-100-2004 methods, or two-dimensional or three-dimensional heat flow modeling, provided that three-dimensional heat flow modeling shall not be used to determine the U-value for standard wall-types listed in the above referenced tables. For residential construction with exposed slab edges, the following table must be used for U-factors.

UAref = the sum of all of the UAs for the *exterior building envelope* components excluding *roof* but including *skylights* ; and

Atotal = the total area of the *exterior building envelope* excluding *roof* but including *skylights*

(RESIDENTIAL SLAB-EDGE TABLE TO BE PROVIDED HERE DURING IMPLEMENTATION).

5.4.4.3 A *building* may comply with this section by employing the *building envelope* trade-off option in Section 5.6 to demonstrate that the *proposed envelope performance factor* is 10% less than the *base envelope performance factor*, where the base building complies with subsection 5.4.4.2 and for which all fenestration has an *SHGC* of 0.40 or less. In no case shall the average U-factor of the proposed building exceed 0.28 Btu/hr-sf-°F for *buildings* receiving permits before July1, 2016, 0.23 Btu/hr-sf-°F for *buildings* receiving permits after July 1, 2016 but before July 1, 2022, or 0.18 Btu/hr-sf-°F for *buildings* receiving permits after July 1, 2022.

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 402.1.5 as follows:

402.1.5 Maximum Building Envelope Heat Transfer. Notwithstanding any provision of Section 402 to the contrary, building envelopes excluding *roof* but including *skylights* shall have a maximum average *U*-factor of 0.25 Btu/hr-sf-°F for buildings receiving permits before July1, 2016, 0.20 Btu/hr-sf-°F for buildings receiving permits after July 1, 2016 but before July 1, 2022, or 0.16 Btu/hr-sf-°F for buildings receiving permits after Jul 1, 2022.
The maximum average *U*-factor shall be calculated by averaging the *U*-factor of each component of the building envelope over the entire above-ground wall and fenestration areas that enclose heated spaces but excluding semiheated spaces. For the purposes of this Section 402.1.5, the definitions of “wall”, “fenestration” and “semiheated spaces” shall have the meanings set forth in ANSI/ASHRAE/IESNA Standard 90.1(2007).The average *U*-factor shall be calculated as follows:

$$\text{Average } U\text{-factor} = \text{UAref}/\text{Atotal} = (\text{UA}_1 + \text{UA}_2 + \ldots \text{UA}_n) / \text{Atotal}$$

where

UA = the *U*-factor for each individual building envelope component excluding *roof* but including *skylights* (except for those over semiheated spaces) multiplied by the total area of such component incorporated in the building envelope. The *U*-factor for each component shall be calculated by taking in account thermal bridging at metal studs and members, shelf angles, floor edges, projecting balconies, window frames, and other components passing through the thermal barrier. *U*-factors can be determined using test results as required by ANSI/ASHRAE/IESNA Standard 90.1(2007), ANSI/ASHRAE/IESNA Standard 90.1(2007) tabulations, Standard NFRC-100-2004 methods, or three-dimensional heat flow modeling;

UAref = the sum of all of the UAs for the *building envelope* components excluding *roof* but including *skylights* ; and

Atotal = the total area of the *building envelope* excluding *roof* but including *skylights* .

Supporting Information

Issue – Expanded
Many buildings being constructed today – particularly the large ones – have poorly performing exterior envelopes. This is because the energy code allows a “performance path”, wherein the thermal efficiency of the envelope can be diminished if other systems, such as lighting or the mechanical system, are made more efficient to compensate, as documented using an energy model. Many builders decide to utilize this trade-off because it is the least expensive way to meet the code and provide highly glazed facades or simply built brick high-rise buildings. But the price for this trade-off is a generation of buildings with poorly performing facades that will far outlast their efficient lighting and mechanical systems, which are changed out within 15 to 25 year cycles. Building envelopes will typically survive for the life of the building, which can easily exceed 100 years, so their impact on fuel and electric use and carbon emissions is substantial. This proposal aims to improve the long-term efficiency of the building stock by requiring that all building envelopes achieve a minimum thermal performance that is independent of the other trade-offs pursued.
How will this proposal impact the way the way buildings are built? There has been concern that this proposal will make it impossible to build all-glass buildings, which is not the case. Many trade-offs are available to the designer of a façade, including not just the amount of glazing, but the amount of glazing that is actually clear (i.e. the vision glazing), the amount of insulation used in the spandrel panels, the thermal properties of the glass, the properties of the mullions, and

the inclusion of shading devices, double walls, or glass with well-tuned solar heat gain factors. As the Cost / Savings section shows, some of these strategies will result in increased cost, but that is not inevitable, as there are no-cost ways to comply.

Nonetheless, the proposal will increase the cost of buildings that have clear floor-to-ceiling glass, at least in the near term. It should be noted such floor-to-ceiling glass is not a benefit from the point of view of day-lighting; there is no gain in daylighting advantages (reduction in lighting electric use) from more than 40% vision glazing, since when the sun is out the additional glare usually leads occupants to draw the blinds or erect shades. And there is a serious thermal penalty for such glass when built utilizing the current generation of mullions and double glazed panels, a fact that is well known in the industry.

Still, looking out of floor-to-ceiling glazing is unarguably a striking experience, and many developers find this effect to be sought by tenants. In such cases, many existing technologies can bring a highly glazed facade into compliance—see the Cost and Market Availability sections below.

It should be noted that this proposal only impacts the insulating value of the glass. Considerable time was spent trying to construct a meaningful overall limit on solar heat gain factor, but due to the complexity of the issue and fact that New York City buildings are either heating dominated or, if cooling dominated, driven largely by internal loads, this component was dropped from the measure. Improved solar heat gain performance can be incorporated by using the trade-off option, 5.4.4.3.

The result of adoption of this proposal will be a generation of buildings that out-perform many of today's buildings both immediately (for buildings that follow the prescriptive path) and over the long haul for all buildings, since their performance will be much less subject to compromise should a future owner decide to replace the original mechanical equipment with less efficient substitutes at the time of failure. If owners continue to use the best available equipment, savings will be even greater. The task force expects this measure to generate a new level of common practice, much as the NYS ECCC resulted in the adaptation of double-glazed windows, which became relatively low-cost items as industry adopted them as the standard.

EF04 and EF03 are intended to work together in order to ensure significant improvements in the energy efficiency of exterior walls in New York City and consequently lead to substantial energy savings over time. The two proposals will transform the industry by pushing it to adopt new technology and design exterior walls that will outperform comparable existing walls by a substantial margin. The phased approach to new maximum U-values makes the transition feasible and allows for flexibility as developers, building owners and designers will be able to follow either the performance or prescriptive path in many ways as long as they meet the prescribed criteria. The performance path in particular will give more flexibility to designers to use dynamic systems (shading, double walls, glass that responds to light conditions, etc.) and other new strategies to meet the requirements.

Section 5.6 of and Appendix C of ASHRAE 90.1 have been used as the basis of the trade-off option. An alternative, possibly superior, approach would be to use the building modeling constraints of EPAct 2005 – the system used for Federal tax credits. This would not affect the criteria presented here, only the details of how the modeling will be carried out, and can be incorporated into the legislation if appropriate.

Further development may be needed for the case of roofs with large areas of skylights. Also, since ASHRAE 90.1 does not provide adequate tables for effective R and U values for exposed slab edges, the Task Force will provide such tables. They have not yet been prepared, so a place-holder has been inserted in the code language above.

Environmental & Health Benefits

Adaptation of this measure will result in substantially lowered fuel and electric use in large buildings, with associated reductions in pollutants and CO2 emissions.

This proposal was fpund to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

Capital cost impact will vary widely with building type and alternative designs. For buildings with less than 40% vision glass, current good design practice can meet these criteria at no additional cost. Construction with more than 60% vision glass would be more expensive under this proposal, since triple or quadruple glazing and/or high performance mullions would be required. Between 40 and 60% vision glass there may or may not be an increase in cost depending on the particular design. The minimum U-factor of 0.25 Btu/sf-°F was chosen because it can be reached (at some additional expense) with a façade incorporating a high percentage of vision glass.
Typical construction utilizes double-glazing with moderately thermally broken aluminum mullions. Typical overall U-values for this vision glass are around 0.5 Btu/ft^2-°F, or R-2. Improvements are commonly made using low emissivity coatings, improved mullions, and argon or krypton fill. (There is ongoing uncertainty about the long-term integrity of

the gas fills.) The following table shows the whole window U-value required to meet the criterion of U_{Ave}=0.25 Btu/ft^2-°F if the non-vision glass parts are insulated to R-12, easily achieved with continuous insulation. (The table is exemplary and does not take many details of construction into account.)

Vision glass fraction:	40%	50%	60%	70%
Whole-window U-value (Btu/ft^2-°F):	0.50	0.42	0.36	0.32

However, it is possible to do considerably better even with materials readily available today. A prominent mid-town skyscraper currently under construction has achieved an overall U-value of 0.28 Btu/sf-°F with floor-to-ceiling vision glass on 60% of the envelope by selecting high quality materials based on double-glazing at costs well within the budget of a building of this class.[1] Utilization of higher quality mullions, low-e coatings, and finally triple glazing do lead to somewhat higher costs, but these will normally be repaid through fuel savings.

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For this proposal, costs were developed for many different combinations of building type and vision glass, and are summarized in Appendix A. For the large scale commercial building with a curtain wall, the type perhaps of most concern to New York City business, there was no increase in overall building construction cost at the 40% vision wall level, a 0.7% increase for 52.5% vision wall, and a more significant 1.3% increase for 65% vision wall. Fuel savings were estimated for this building type, and were sufficient to pay for the increased cost in twelve years for the 52.5% vision glass case, and slightly over twenty years in the case of 65% glazing.

For the other building types, the cost increases range from zero (for 40% vision glass) to values higher than for the large commercial building. Savings were not estimated for these buildings, but should be comparable, since the improvement in envelope is roughly the same. For masonry buildings, Bovis found cost increases in all cases, but the task force believes this stemmed from a misunderstanding about the base case, which should have been chosen to meet the new criterion without improvements in the case of 40% vision glass.

All these cost estimates were based on current pricing for widely used and standard materials. Newer multi-glazed window materials, based on internal polymer films rather than a third layer of vitreous glazing, are available at substantially lower cost. The primary obstacle to their use appears to be lack of familiarity and experience, but as they become better known, the capital cost increments will shrink, drawing the payback periods down with them.

Precedents
All energy codes seem to include limits on building thermal losses, often this stringent, but they also permit performance trade-offs so that better mechanical equipment can offset a poor façade. No codes were found with a similar absolute limit on thermal performance.

LEED
Current LEED prerequisites for Minimum Energy Performance under the Energy & Atmosphere sections of almost all of the rating systems require that the scope of work complies with *ANSI/ASHRAE/IESNA standard 90.1-2004*. This proposed code requires compliance with measures exceeding *ASHRAE 90.1-2007.* Since LEED 2009 prerequisites for Minimum Energy Performance also reference *ASHRAE 90.1-2007,* the measures outlined in this proposal will be correlated with the next generation of LEED.

However, LEED qualifies that a more stringent local code requirement becomes the LEED prerequisite requirement as well. Therefore, this proposal will change the baseline criteria that registered projects must meet for LEED certification.

Implementation & Market Availability
Given the significance of this proposal, members of the Steering Committee and real estate members of the Industry Advisory Committee held several meetings to discuss its content and implementation. These discussions provided valuable input and are reflected in revisions to the proposal content (shifting the first trigger date from 2013 to 2016) and in the discussion that follows.

All alternative façade options are mature. Thermally improved and broken mullions are widely available and currently in use in select buildings. Triple glazing is widely used in Europe and provides the envelope for a 15 story building in Calgary, Alberta[2]. Manufacturers[3] assured that although triple glazing has not been widely used in the US, it is readily available should demand arise. Although concerns were raised about the increased weight of vitreous triple glazing, other knowledgeable engineers asserted that the additional weight could be readily incorporated into standard design practice, and that steps taken to incorporate blast resistance into critical buildings already had a greater impact.

Concerns were raised that visual distortion, which can be a modest problem with large double glazed panels, would be exacerbated in triple-glazed products. Others thought the effect would be minimal or could be countered through quality control, and cited the availability of European technology that minimizes this effect.

Manufacturers of products with a central polymer layer[4] offer vision glass that will allow construction of buildings with high vision glass fractions that meet the proposed thermal criteria at substantially lower cost than standard triple glazing. Serious Materials, for example, offers multiply glazed panels for curtain walls up to twelve feet high and six feet wide. The polymer layer will not produce any distortion of transmitted light, even if it is not quite flat, due to its thinness. These newer products have not been used widely in New York City high-rise buildings, so dealers, architects, and contractors will have to develop confidence in the products and production may have to ramp up.

Notes

The section for the NYS ECCC is included to apply to additions and alterations of existing buildings, since new low rise construction is covered by our Energy Star requirement. An exemption is granted by NYS ECCC 101.5.2.1 for low energy buildings with design load of less than 3.4 Btu/hr-sf. The Task Force has used this criterion as an exception for the high rise/commercial case also.

ENDNOTES:

[1] For an excellent discussion of the technical side of this issue, see John Straube, *Can highly glazed building facades be green?* BUILDING SCIENCE INSIGHT May 22, 2009, http://www.buildingscience.com/documents/insights/bsi-006-can-fully-glazed-curtainwalls-be-green/?full_view=1.

[2] Brookfield Properties, Bankers Court (2010), http://www.brookfieldproperties.com/building/detail.cfm?BID=257 (last visited Jan. 30, 2010).

[3] Benson Industries, Home Page (2010), http://www.bensonglobal.com (last visited Jan. 30, 2010); Permasteelisa North America, Home Page (2010), http://www.permasteelisa.com (last visited Jan. 30, 2010); Saint Gobain, Home Page (2010), http://www.saint-gobain.com/en (last visited Jan. 30, 2010); Soto Glazing, Home Page (2010), http://www.sotawall.com (last visited Jan. 30, 2010); Viracon, Home Page (2010), http://www.viracon.com (last visited Jan. 30, 2010); and J.E.Berkowitz, Home Page (2010), http://www.jeberkowitz.com/default.aspx (last visited Jan. 30, 2010).

[4] Southwall Energy Technologies, Home Page, http://www.southwall.com/southwall/Home.html (last visited Jan. 30, 2010); and Vision Wall, Home Page (2010), http://www.visionwall.com (last visited Jan. 30, 2010).

EF 4:
PROMOTE SUPER-INSULATED EXTERIOR WALLS

Zoning Resolution of the City of New York
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:
The City's definition of "floor area," which determines how large a building can be, includes exterior wall thickness. This penalizes thick, energy-efficient walls, and rewards poorly insulated thin-wall construction.

Recommendation:
For super-insulated walls, exclude up to eight inches of the exterior wall thickness from the "floor area" calculation.

Proposed Legislation, Rule or Study

Amendments to Zoning Resolution of the City of New York

1. Amend Section 12-10 to add the following definition:

Exterior Building Envelope: the elements of a building that separate conditioned spaces from the exterior; Definition of Roof; the upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60^{o} from the horizontal; Definition of Skylight: a fenestration surface having a slope of less than 60^{o} from the horizontal plane. (All definitions from ASHRAEA 90.1, 2007)

2. Amend Section 12-10 as follows:

...However the "floor area" of a building shall not include: <Add the following to the list>

(12) Floor area used to add thermal insulation to the exterior of an existing building or to super-insulate a new building, subject to the following:

(i) In buildings constructed or permitted prior to July 1, 2011, the exempted floor area is the thickness of the insulated wall assembly added to the existing exterior side wall, rear wall, or rear wall equivalent, limited to a maximum of 8" added to any wall, and provided that the added insulated wall assembly achieves a minimum R-value of 3.5 times its thickness in inches, the windows achieve a minimum of R-3.5, and within the walls being insulated, the window area does not exceed 50% of the wall area.

(ii) In buildings or additions permitted after July 1, 2011, the exempted floor area is up to 8" of exterior wall thickness in excess of 8" thickness (i.e. for exterior wall thickness between 8" and 16"), measured at a point 30" above the finished floor, provided that the thermal performance of the building envelope meets the minimum prescriptive or performance requirements listed below, that the total exempted floor area does not exceed 5% of the allowable floor area, and that the building implement measurement and verification protocols to determine whether the envelope is performing as predicted with respect to thermal transmission.

- The minimum prescriptive requirement is that average U-value of the exterior building envelope excluding roof but including skylights is less than .75 the average U-value allowed by the New York City Energy Conservation Code.
- The minimum performance requirement is that on an annual basis the modeled envelope must perform better than or equal to an envelope where average U-value of the exterior building envelope excluding roof but including skylight area in excess of 5% of roof area is less than .70 the average U-value allowed by the New York City Energy Conservation Code and the vision glass has a SHGC of less than 0.4; but in no case can the average U-value of the exterior building envelope excluding roof but including skylight area in excess of 5% of roof area be greater than the average U-value allowed by the New York City Energy Conservation Code.

(iii) The calculation of R-values, the average U-value, and any modeling shall be as per the requirements of the New York City Energy Conservation Code and submitted to the Department of Buildings.

Supporting Information

Issue – Expanded
This proposal has two parts: one part that impacts existing buildings, and another for new construction. The part that impacts existing buildings would allow owners of currently existing buildings to add insulation to the side or rear of a building even if the building had already utilized all of the area available (its FAR). This is beneficial because it is much more effective to add insulation to the exterior of the building than the interior.

The more complex part of this proposal affects new construction, and is meant to compensate for a problematic side-effect of current zoning calculations for developers. Poorly insulated building envelopes (i.e., exterior walls) are an unintended consequence of New York's zoning laws. This is because the floor area a developer is allowed to build is measured to the outside of the building envelope, whereas the useable space is the area within the inside face. In order to maximize the useable area within the maximum allowed floor area, it behooves a developer to make the exterior walls as thin as possible. These thin walls often perform poorly from a thermal standpoint, but the developer can still meet the energy code by compensating with higher performing mechanical and lighting systems. This is very detrimental to the city because, although the lighting and mechanical systems will be changed out within 10 to 25 years, these poorly performing facades will be around for decades or more, increasing the city's energy costs and greenhouse gas emissions far into the future.

This proposal seeks to level the playing field by discounting the space used to create thicker and better performing walls. It allows flexibility in terms of how this can be achieved by allowing both a prescriptive and a performance path within the envelope design only. (The envelope will not be able to be traded off against other systems.) Doing so will provide designers with the flexibility to utilize dynamic systems (shading, double walls, glass that responds to light conditions, etc.) which may perform as well as highly insulated walls, but which cannot be described by a single insulating value. The performance requirement is slightly higher than the prescriptive one, in order to compensate for errors or gaming introduced by the modeling process.

EF 4, Limit Heat Loss Through Exterior Walls, and EF 3 are intended to work together as a carrot and stick to spur significant improvements to the energy efficiency of exterior walls in New York City. EF 3 sets a minimum level, while EF 4 offers an incentive for exemplary performance, and the threshold for both of them will increase over time. Thus, developers are incentivized to create better facades, utilizing either technologically based or design based solutions, or both, and over time the technologies and design strategies they have helped to create will become better known and more available and affordable. This in turn will allow the city to require better performing facades for all buildings.

The date presented in the draft code language (July 1, 2011) is exemplary. The actual transition date must be adjusted to coordinate with implementation of EF3, since that contains the U-values to which Sections 12-10 (12) ii & iii refer.

Environmental & Health Benefits
This proposal will lead to better insulated exterior walls, reducing energy use, air pollution, and greenhouse gas emissions.

This proposal was found to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

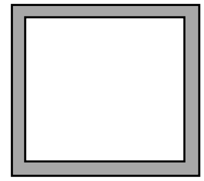
This proposal was found to have a positive, indirect health impact.

Cost & Savings
This will not add directly to development costs since this proposal is optional for buildings. Instead, it will make the development of better insulated projects more financially attractive for developers and help correct an unintended consequence of zoning area calculations, which encourages thin facades, and a misaligned incentive between the developer and future tenants. For new buildings, it will allow developers to create thicker, better insulated walls without being penalized by losing floor area. This is extremely valuable because developers pay for the cost of building, but are repaid in rents or sales that are proportional to the habitable floor area. If floor area is lost, the developer will lose potential income. On the other hand, future tenants serve to benefit from better insulated walls, since their energy bills will be lower, but they are not at the table when decisions about the building envelope are being made. For existing buildings that may have already reached the maximum size allowed by the zoning rules, this measure will simply allow the addition of exterior insulation, which is far more effective than adding insulation to the inside, as well as being technically simpler.

Impacts on various sizes and configurations of buildings with 8" walls. Calculations showing the percentage area to be excluded with 8'' walls.

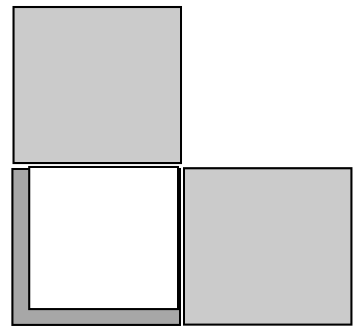
Calculations for Freestanding Buildings (8″walls)

floor plate size (ft)	floor plate with 8″ wall (ft)	% floor area gain (exempted floor area)	% area with 5% cap
200x200	201.34x201.34	1.34%	1.34%
100X100	101.34x101.34	2.70%	2.70%
50x50	51.34x51.34	5.43%	5.00%
25X25	26.34x26.34	11.01%	5.00%



Calculations for Corner Buildings (8″ walls)

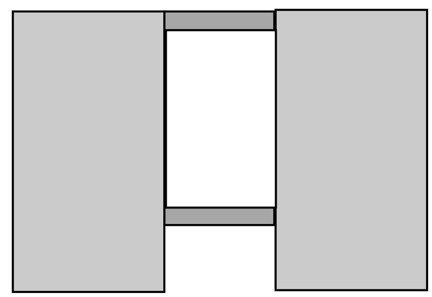
floor plate size (ft)	floor plate with 8″ wall (ft)	% floor area gain (exempted floor area)	% area with 5% cap
200x200	200.67x200.67	0.67%	0.67%
100X100	100.67x100.67	1.34%	1.34%
50x50	50.67x50.67	2.70%	2.70%
25X25	25.67x25.67	5.43%	5.00%



Calculations for Townhouses (8″ walls)*

floor plate size (ft)	floor plate with 8″ wall (ft)	% floor area gain (exempted floor area)	% area with 5% cap
25X50	25x51.34	2.68%	2.68%

* townhouses will be granted the zoning incentive only for the 25 feet wide wall; in the town houses case, only a corner situation (no freestanding) is expected



Precedents
Within CD-1 districts, Vancouver's new Zoning and Development By-law, dated Feb. 2009, excludes wall thickness greater than 152 mm (6"), up to a maximum excluded thickness, provided that such walls are highly insulated.[1] See Section 10: 10.34.

LEED
The measure outlined in this proposal will positively impact the feasibility of super-insulating existing walls, thereby increasing the potential of meeting LEED requirements.

In an existing building, this recommendation will assist in complying with:
- LEED EB-EA prerequisite 2, Minimum Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance.

For existing walls in a new construction project, this recommendation will assist in complying with:
- LEED NC-EA prerequisite 2, Minimum Energy Performance
- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA prerequisite 2, Minimum Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED CI-EA prerequisite 2, Minimum Energy Performance
- LEED CI-EA cr. 1.3, Optimize Energy Performance, HVAC

This recommendation will also assist in complying with:
- LEED for Homes EA cr.1, Optimize Energy Performance.

Since numerous points can be acquired under all of these rating systems, any code changes involving energy performance could have a significant influence.

Implementation & Market Availability

There are no known implementation issues for this proposal. Systems and techniques to utilize the newly available wall depth to provide superior insulation are readily available.

Notes
For (i) existing buildings. Most rigid insulation panels currently on the market achieve R-3.5 per inch. Moderately priced insulation panels tend to be in the range of R-5 per inch, so a building adding 8" of insulation can readily achieve an R-30, which is what is required to meet Passive House Standard in NYC's temperature zone. NOTE: this depends on building compactness. R20 is sufficient in many cases.

For (ii) new buildings and additions. EF 4, Limit Heat Loss Through Exterior Walls, proposes a minimum average U-value of 0.25 as a mandatory requirement, and it can be achieved fairly easily with traditional construction; for curtain walls, it can be achieved using triple glazing or double glazing with a central film. In order to receive the floor area exemption, new construction would need to considerably out-perform the minimum wall required by code; still, the first standard of avg. U < 0.15 is achievable in an affordable manner using current technology (for example a wall with 50% solid area and 50% fenestration, achieving R-20 for the solid portion and R-4 for the fenestration). Even the avg. U-value of 0.10 required by 2015 is achievable now (for example a wall with 63% solid area and 37% fenestration, achieving R-25 for the solid portion and R-5 for the fenestration), although these evolving standards will certainly push the industry to provide a range of affordable solutions with a high percentage of glazed area.

ENDNOTES:

[1] CITY OF VANCOUVER, CA., ZONING AND DEVELOPMENT BYLAWS § 10.34 (2009) available at http://vancouver.ca/COMMSVCS/Bylaws/zoning/sec10.pdf. Vancouver's new Zoning and Development By-law, excludes wall thickness greater than 152 mm (6"), up to a maximum excluded thickness, provided that such walls are highly insulated.

EF 5:
ALLOW EXTERNAL INSULATION BEYOND THE ZONING LIMITS

New York City Zoning Resolution: Various sections
Proposal developed by the Energy & Ventilation Committee.

Summary

Issue:
Insulating the exterior of a building is often the most effective way to reduce heat transfer and fuel consumption. But many buildings are built up to the zoning setbacks, making it impossible to add insulation to the exterior.

Recommendation:
Allow exterior insulation on existing buildings to extend into side and rear yard setbacks.

Proposed Legislation, Rule or Study

Amendment to the Zoning Resolution of the City of New York

1. Include the following as a permitted obstruction in the sections listed below:

<u>For #buildings# constructed prior to July 1, 2009, insulation added to an existing exterior side wall, rear wall, or rear wall equivalent, up to a maximum added wall assembly thickness of 6", provided that the added insulated wall assembly achieves a minimum R-value of 3.5 times its thickness in inches, and provided that such added wall assembly shall not encroach on the required width of any driveway up to a height of 8'- 0" above the driveway.</u>

<u>Section 23-12 (Permitted Obstructions in Open Space)</u>
<u>Section 23-44 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)</u>
<u>Section 23-62 (Permitted Obstructions)</u>
<u>Section 23-87 (Permitted Obstructions in Courts)</u>
<u>Section 24-33 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)</u>
<u>Section 24-51 (Permitted Obstructions)</u>
<u>Section 24-68 (Permitted Obstructions in Courts)</u>
<u>Section 33-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)</u>
<u>Section 33-42 (Permitted Obstructions)</u>
<u>Section 37-721 (Sidewalk Frontage)</u>
<u>Section 37-723 (Circulation Paths)</u>
<u>Section 37-726 (Permitted Obstructions)</u>
<u>Section 43-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)</u>
<u>Section 43-42 (Permitted Obstructions)</u>
<u>Section 62-626 (Permitted Obstructions)</u>
<u>Section 81-252 (Permitted Obstructions)</u>
<u>Section 84-135(e) (Limited Height of Buildings)</u>
<u>Section 84-333(b) (Limited Height of Buildings)</u>
<u>Section 104-322 (Permitted Obstructions)</u>

Supporting Information

Issue- Expanded

Applying insulation on the exterior of a building is a relatively easy and effective way to substantially improve the R-value of existing walls without interrupting occupancy or requiring expensive renovation. Creative techniques for application are currently being developed in Canada, Europe and the US. Some techniques, such as spray foam and EIFS (Exterior Insulation Finishing System) have the added value of creating an air barrier, a necessity for managing and lowering energy use in the building. In addition, insulation applied to masonry walls encloses the existing masonry, allowing the thermal mass of the masonry to buffer temperature swings that tax mechanical systems. Exterior application of insulation to existing buildings has become a common option in Europe and will become a necessity in the US as energy becomes less available. If enough insulation is added to a structure, some building types and uses may not need traditional heating and air conditioning systems.

The Zoning Resolution requires buildings to be setback from lot lines under many circumstances. Since many buildings are constructed right up to their zoning setbacks, this means they would be unable to add exterior insulation. This proposal would add external insulation as a "permitted obstruction" under the Zoning Resolution, enabling the insulation to extend over setbacks. The proposal includes minimum R-value requirements to ensure the insulation's effectiveness and sets a cap on the distance the insulation may extend over setback lines.

Environmental & Health Benefits

By directly reducing building loads, increased insulation will lower emissions associated with boilers, furnaces, and the power plants that supply electricity to air conditioners. By reducing thermal gradients and drafts within buildings, external insulation will contribute to greater occupant comfort and fewer colds. Because the cost effectiveness of external insulation varies widely between buildings, it is not possible to project implementation rates or overall impacts.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings

This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal. .

LEED

The measure outlined in this proposal will positively impact the feasibility of insulating existing walls, thereby increasing the potential of meeting LEED requirements.

In an existing building, this recommendation will assist in complying with:

- LEED EB-EA prerequisite 2, Minimum Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance.

For existing walls in a new construction project, this recommendation will assist in complying with:

- LEED NC-EA prerequisite 2, Minimum Energy Performance
- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA prerequisite 2, Minimum Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED CI-EA prerequisite 2, Minimum Energy Performance
- LEED CI-EA cr. 1.3, Optimize Energy Performance, HVAC

This recommendation will also assist in complying with:

- LEED for Homes EA cr.1, Optimize Energy Performance.

Since numerous points can be acquired under all of these rating systems, any code changes involving energy performance could have a significant influence.

Implementation & Market Availability

Technology is currently available to add insulation to the exterior of buildings. The Issue – Expanded section listed EIFS as one way to add insulation to the exterior of buildings, and it is. However, misuse of EIFS has resulted in rot and structural damage to buildings and must be avoided by good practice. In general, insulation must be added in ways that do not trap moisture in the interior of building walls, and competent professionals commonly do this.

EF 6:
INCREASE ALLOWABLE SIZE OF SOLAR SHADES

Zoning Resolution & New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue
Shading devices help combat heat gain and prevent glare, decreasing cooling energy requirements. The Building Code only permits these shading devices to extend 10 inches from the building, thus restricting their effectiveness. They are also not "permitted obstructions" under the Zoning Resolution.

Recommendation:
Treat shading devices the same as awnings and canopies, which are permitted to extend five feet from the building. Also add these devices to the list of "permitted obstructions" in the Zoning Resolution.

Proposed Legislation, Rule or Study

Text Amendments to the Zoning Resolution:

1. Include the following definition of "sun control device" in Section 12-10 (Definitions):

Sun control device

A "sun control device" is an architectural projection as defined in Section 202 of the *New York City Building Code*.

2. Include "sun control devices" as a permitted obstruction in the following sections:

Section 23-12 (Permitted Obstructions in Open Space)
Section 23-44 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 23-62 (Permitted Obstructions)
Section 23-87 (Permitted Obstructions in Courts)
Section 24-33 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 24-51 (Permitted Obstructions)
Section 24-68 (Permitted Obstructions in Courts)
Section 33-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 33-42 (Permitted Obstructions)
Section 37-721 (Sidewalk Frontage)
Section 37-723 (Circulation Paths)
Section 37-726 (Permitted Obstructions)
Section 43-23 (Permitted Obstructions in Required Yards or Rear Yard Equivalents)
Section 43-42 (Permitted Obstructions)
Section 62-626 (Permitted Obstructions)
Section 81-252 (Permitted Obstructions)
Section 84-135(e) (Limited Height of Buildings)
Section 84-333(b) (Limited Height of Buildings)
Section 104-322 (Permitted Obstructions)

Amendments to the New York City Building Code:

1. Include the following definition of "sun control device" in Section 202:

SUN CONTROL DEVICE. An architectural projection that provides protection against solar radiation entering a building through glazed areas and is supported by the building to which it is attached. A sun control device may be a fixed sun control device, a retractable sun control device, a rotating sun control device or other similar device. A fixed sun control device has no moving parts and is typically composed of horizontal overhangs or vertical fins. A retractable sun control device extends or retracts, and in the extended position casts a shadow on designated glazed portions of the building. A rotating sun control device may be of fixed or adjustable length and pivots at its base.

2. Amend Section 3101.1 as follows:

3101.1 Scope. The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, awnings [and], canopies[,] and sun control devices, marquees, signs, telecommunications towers and antennas, swimming pools and enclosures, sidewalk cafés, and fences.

3. Amend Section 3105 as follows:

SECTION BC 3105
AWNINGS, [AND] CANOPIES AND SUN CONTROL DEVICES

3105.1 General. Awnings, [and] canopies and sun control devices shall comply with the requirements of this section, the requirements of Chapter 32 for projections over public ways, and other applicable sections of this code.

4. Amend Section 3105.3 as follows:

3105.3 Design and construction. Awnings, [and] canopies and sun control devices shall be designed and constructed to withstand wind or other lateral loads and live loads as required by Chapter 16 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. Awnings shall have frames of noncombustible material, covered with flame-resistant fabric in accordance with NFPA 701, plastic in accordance with Section 2605, sheet metal, or other equivalent material, and shall be either fixed, retractable, folding or collapsible.

5. Amend Section 3202.2.3 as follows:

3202.2.3 Awnings and sun control devices. Awnings and sun control devices constructed in accordance with Section 3105 and supported entirely from the building may project beyond the street line as follows:

3202.2.3.1 Store front awnings. Store front awnings may project beyond the street line not more than 8 feet (2438 mm), provided no part of the awning is less than 8 feet (2438 mm) above the ground or sidewalk level, except for a flexible valance which may be not less than 7 feet (2134 mm) above the ground or sidewalk level, and provided that the awning box or cover does not project more than 12 inches (305 mm).

3202.2.3.2 Awnings and sun control devices over windows or doors. Awnings and sun control devices over windows or doors may project beyond the street line not more than 5 feet (1524 mm), provided that no part of the awning or sun control device is less than 8 feet (2438 mm) above the ground or sidewalk level.

6. Amend Section 3202.2.1.2 as follows:

3202.2.1.2 Architectural details. Details such as cornices, eaves, bases, sills, headers, band course, opening frames, [sun control devices,] rustications, applied ornament or sculpture, grilles, windows when fully open, air conditioning units, and other similar elements may be constructed:

Supporting Information

Issue – Expanded

Prior to the advent of mechanical cooling, standard building design included awnings and other solar shading techniques like inset windows. Early pictures of iconic buildings like the Flatiron Building, City Hall and just about any New York street show awnings over many windows. Although these techniques fell out of fashion, new exterior sun control devices have been developed which save energy, improve user comfort in summer and reduce glare. As the amount of glass in buildings has increased, exterior solar shading has become an increasingly important tool to combat solar heat gain, reduce glare and improve occupant comfort. Since solar shading is a passive design element, it reduces cooling loads on mechanical equipment.

Due to an anomaly in the Building Code and Zoning Resolution, modern solar shades are regulated differently than awnings and face more restrictions on their use. However, in shading and visual impact they are equivalent. This proposal seeks to apply the same standards to exterior solar shades as apply to awnings.

Environmental & Health Benefits
According to analysis by the Office of Long-Term Planning and Sustainability, 15 to 20% of the energy use in New York

City is related to cooling buildings. In the summer, energy consumption for cooling purposes increases dramatically and accounts for 40% of the energy use in the city. Solar shading is a passive design technique that presents a long-term solution to reducing cooling of buildings. Most importantly, sun shade devices can reduce peak energy loads and thus, conserve energy at times when it is most valuable, expensive, and polluting. When mounted on the outside, solar shades can decrease 30% to 60% of air-conditioning loads and substantially lower room temperatures in uncooled spaces. Unlike interior curtains or shades, exterior solar shading devices do not impede window view or disrupt airflow through open windows. As a result, they facilitate passive, natural ventilation.
This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings
This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents
There are no know precedents for this proposal.

LEED
The implementation of this proposal will encourage the use of sun control devices that would assist in LEED compliance across numerous rating systems (including pilot programs under development).

Used in conjunction with daylighting strategies, sun control devices will provide daylight redirection and/or glare control to ensure daylight effectiveness. Therefore, this proposal could facilitate achieving the following credits:

- LEED NC-EQ cr. 8.1 & 8.2, Daylight & Views
- LEED CI-EQ cr. 8.1 & 8.2, Daylighting & Views
- LEED for Schools EQ cr. 8.1 & 8.2, Daylight & Views
- LEED EB-EQ cr.8, Daylight & Views

This proposal could be advantageous for projects utilizing the Performance Rating Method for compliance with LEED Energy & Atmosphere credits. Shading projections in the proposed design, which reduce the solar gains on the glazing, can be modeled to demonstrate energy savings compared to the baseline model which will have fenestration flush to the exterior wall. This would facilitate achieving the following credits:

- LEED NC-EA cr.1, Optimize Energy Performance
- LEED for Schools EA cr.1, Optimize Energy Performance
- LEED EB-EA cr.1, Optimize Energy Performance
- LEED ND-GCT cr.2, Energy Efficiency in Buildings (pilot program)
- LEED for Homes EA cr.1, Optimize Energy Performance

Implementation & Market Availability
Sun control devices are fabricated from standard construction components. In addition to custom devices, many curtain wall and window manufacturers offer them as options in their systems.
One concern sometimes expressed about solar shades is ice and snow build-up. This is an issue for all projections such as cornices, eaves, lintels and sills, railings, ornamental work, sculpture, signage and signage supports, air conditioning units, and fire escapes. Snow and ice can be mitigated by providing:

- A canopy or awning at sidewalk level;
- Less solid horizontal surface areas for ice and snow to build up on, such as fin-shaped or vertical louvers, or perforated metal; or
- If horizontal surfaces are used, include projections, such as fins at the edge of a device that will catch snow and ice so that it melts gradually rather than blows off in large portions.

It should be emphasized again that snow and ice is a concern for all projections, and so solar shades should not be singled out on this issue. In addition, sun shade devices are typically arrayed one atop another – falling ice from one would tend to shatter on a device below before falling to the ground.

EF 7:
MINIMIZE AIR LEAKAGE THROUGH BUILDING EXTERIORS

ANSI/ASHRAE/IESNA 90.1 (2007) and Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code
This proposal was developed by the Energy & Ventilation Committee.

Summary

Issue:
Energy code requirements for air barriers are insufficient to prevent air leakage both in and out of buildings. An effective air barrier permits controlled levels of ventilation, prevents drafts, lowers heating loads and contributes to overall energy savings.

Recommendation:
Strengthen the energy code to include requirements for –more-effective air barriers.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Amend Section 5.4.3.1 as follows:

5.4.3.1 Building Envelope Sealing. [The following areas of the *building envelope* shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:

a. joints around *fenestration* and *door* frames
b. junctions between *walls* and foundations, between *walls* at building corners, between *walls* and structural *floors* or *roofs*, and between *walls* and *roof* or *wall* panels
c. openings and penetrations of utility services through *roofs*, *walls*, and *floors*
d. site-built *fenestration* and *doors*
e. building assemblies used as ducts or plenums
f. joints, seams, and penetrations of vapor retarders
g. all other openings in the *building envelope*]

Openings and penetrations in the *building envelope* shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

5.4.3.1.1 Continuous Air Barrier. Except in unheated structures and as permitted by this section, a continuous air barrier shall be installed and shall have all of the following characteristics:

a. continuous throughout the *building envelope* with all joints and seams sealed and with sealed connections between all transitions in planes and changes in materials and at all penetrations
b. joined and sealed in a flexible manner to the air barrier component of adjacent assemblies, allowing for the relative movement of these assemblies and components
c. installed in accordance with the manufacturer's instructions and in such a manner as to achieve the performance requirements as contained in Section 5.4.3.1.2
d. penetrations of the continuous air barrier shall be made in a way such that the integrity of the continuous air barrier is maintained

5.4.3.1.2 Requirements for Continuous Air Barrier. The continuous air barrier must meet one of the following three criteria;
a. Materials. Using individual materials whose air permeability shall not exceed 0.02 L/s·m2 under a pressure differential of 75 Pa (0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57 lb/ft2)) when tested in accordance with ASTM E2178.

b. Assemblies. Using assemblies of materials and components whose average air leakage shall not exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57 psf)) when tested in accordance with ASTM E2357 or ASTM E1677. In addition these assemblies must meet the requirement for joints per Section 502.4.3.
3. Building. Demonstrating through testing that the air leakage rate of the completed *building envelope* shall not exceed 2.0 L/s·m2 @ 75 Pa (0.40 cfm/ft2 at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent approved method.

5.4.3.1.3 Moisture Control. All framed *walls*, *floors* and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7x10^{-11} kg/Pa.s.m^2) or less, when measured in accordance with the desiccant method using Procedure A of ASTM E96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

a. Construction where moisture or its freezing will not damage the materials.
b. Where the department approves other means to avoid condensation in unventilated framed *walls*, *floors*, *roofs*, or ceiling cavities.

Amendments to the Energy Conservation Construction Code of New York State, as incorporated in Chapter 13 of the New York City Building Code:

1. Amend Section 402.4.1 as follows:

402.4.1 Building [thermal] envelope. [The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped, or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams, and penetrations

2. Site-built windows, doors, and skylights

3. Openings between window and door assemblies and their respective jambs and framing.

4. Utility penetrations

5. Dropped ceilings or chases adjacent to the thermal envelope.

6. Knee walls

7. Walls and ceiling separating a garage from a conditioned space.

8. Behind tubs and showers on exterior walls.

9. Common walls between dwelling units.

10. Other sources of infiltration.]

Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

402.4.1.1 Continuous Air Barrier. Except in unheated structures and as permitted by this section, a continuous air barrier shall be installed and shall have all of the following characteristics:

1. Continuous throughout the building envelope with all joints and seams sealed and with sealed connections between all transitions in planes and changes in materials and at all penetrations;

2. Joined and sealed in a flexible manner to the air barrier component of adjacent assemblies, allowing for the relative movement of these assemblies and components;

3. Installed in accordance with the manufacturer's instructions and in such a manner as to achieve the performance requirements as contained in Section 402.4.1.2; and

4. Penetrations of the continuous air barrier shall be made in a way such that the integrity of the continuous air barrier is maintained.

402.4.1.2 Requirements for Continuous Air Barrier. The continuous air barrier must meet one of the following three criteria:
1. Materials. Using individual materials whose air permeability shall not exceed 0.02 L/s·m2 under a pressure differential of 75 Pa (0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57 lb/ft2)) when tested in accordance with ASTM E2178;
2. Assemblies. Using assemblies of materials and components whose average air leakage shall not exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57 psf)) when tested in accordance with ASTM E2357 or ASTM E1677. In addition these assemblies must meet the requirement for joints per Section 502.4.3:
3. Building. Demonstrating through testing that the air leakage rate of the completed building envelope does not exceed 2.0 L/s·m2 @ 75 Pa (0.40 cfm/ft2 at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent approved method.

402.4.1.3 Moisture Control. All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7x10-11 kg/Pa.s.m2) or less, when measured in accordance with the desiccant method using Procedure A of ASTM E96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:
3. Construction where moisture or its freezing will not damage the materials
4. Where the department approves other means to avoid condensation in unventilated framed wall, floor, roof, ceiling cavities.

Supporting Information

Issue - Expanded
A well-sealed building plays an important role in energy savings. Preventing the flow of cold winter air and warm summer air into a building reduces the amount of energy needed to condition the space. When the leakage occurs around a window frame, the increase in heating and cooling is direct. When it occurs through an opaque wall, infiltration can also result in a reduction in the effective R-value of the insulation. A good air barrier can lessen these heat losses and lower fuel use.
However, traditional buildings relied on air leaks to ensure adequate ventilation. Increased building tightness can result in inadequate air exchange if pursued without regard for other building systems. A tight envelope must be combined with correct design and operation of mechanical ventilation to insure adequate indoor air quality

An air barrier is made of a material that is specifically permeable to water vapor, while preventing the flow of liquid water or air. A vapor barrier, conversely, is impermeable to the passage of any of these substances. Vapor barriers can consist of metal foil or solid polymer films (such as polyethylene), while air barriers are made from microscopically porous films engineered to permit the passage of water vapor (e.g., Tyvek). The theoretically optimal design for a building in the New York City climate zone will have an impermeable vapor barrier on the interior to prevent the flow of moist, heated air into the wall cavities in winter, and an air barrier under the exterior cladding to keep drafts and liquid water out of the wall cavities. If quantities are small, any moisture that does accumulate in the wall cavities can evaporate out through the air barrier when heated in summer.

However, when there is a large difference between inside and outside temperatures, any air infiltration into walls through leaks in the barriers from the interior in winter can result in moisture condensation. Likewise, contaminants from outside and from within the walls can also be brought into the interior via air infiltration. A correctly installed air barrier can prevent this flow and these effects, but errors in installation or subsequent damage can cause leakage, giving rise to problems.

For these reasons, and because there may be limitations in the skills available at the job site or other difficulties, it may not be practical to execute the requirements we propose exactly as written. This proposal includes a substantial exception, allowing the designer to propose an alternative method to control the migration of water vapor, as long as it is approved by the Department of Buildings

Environmental & Health Benefits
Reduced energy use will result in increased energy efficiency and reduced greenhouse gas emissions. Reduced drafts inside the building will increase comfort, and lower the risk of colds and long-term breathing ailments.
Research conducted at Oak Ridge National Laboratories, the Canadian Mortgage Housing Corporations, Sweden and Germany has found that controlled air flow reduces moisture problems such as corrosion, deterioration, and the growth

of mold, mildew and fungus. Air flow has the ability to transport substantially more moisture into and through the building enclosure system than occurs through vapor migration.[1]

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have a positive, indirect health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.10% to 1.5%, depending on building type. It was thus categorized as incurring a medium to higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years for some building types.

Precedents
There are several related sections already in place within New York City and New York State codes:

Relevant NYC BC Entries:
1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.3. The exterior wall envelope and its drainage system shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1404.2 and a means for draining water that enters the assembly to the exterior of the veneer, unless it is determined that penetration of water behind the veneer shall not be detrimental to the building performance. Protection against condensation in the exterior wall assembly shall be provided in accordance with the New York State Energy Conservation Construction Code.
1403.3 Vapor retarder. An approved vapor retarder shall be provided.

Relevant NYS ECCC item:
The following item from the NYS ECCC was incorporated into these modifications of ASHRAE 90.1 since 90.1 does not include a comparable section on moisture control.

802.1.2 Moisture Control. All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm ($5.7x10^{-11}$ kg/Pa.s.m^2) or less, when measured in accordance with the desiccant method using Procedure A of ASTM E96. The vapor retarder shall be installed on the warm-in-winter side of the insulation. (2 exceptions)

The NYS ECCC now contains the first paragraph of the addition proposed above:

"802.3.3 Sealing of the Building Envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials."

But the NYS ECCC lacks the succeeding three detail sections. 802.3.3 and those three detailed sections are currently scheduled to be included in the 2009 NYS ECCC, numbered as 502.4 due to reorganization. However, the future of the 2009 NYS ECC is currently uncertain.

MA Energy Code:
This proposal (except moisture control) is essentially the same as language that has been adopted and implemented in Massachusetts since 1995.

NIST Study
There are considerable energy, comfort and cost savings to be realized by providing air barriers in commercial buildings, as substantiated by the NIST study cited below. Further, there is a great deal of support from the ABAA and materials manufacturers, as well as several different types of air sealing materials and dozens of products to address the market.2

LEED
An air barrier could qualify as an energy-saving system under the EAc1 "Optimize Energy Efficiency."

Implementation and Market Availability
There are no known implementation issues for this proposal. Air barriers are readily available and in widespread use.

ENDNOTES:

[1] Air Barrier Association of America, Upcoming Events, http://www.airbarrier.org/events/index_e.php (last visited Jan. 28, 2010).

[2] S. EMMERICH, ET AL., NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, INVESTIGATION OF THE IMPACT OF COMMERCIAL BUILDING ENVELOPE AIRTIGHTNESS ON HVAC ENERGY USE (2005), http://fire.nist.gov/bfrlpubs/build05/PDF/b05007.pdf.

EF 8:
PROVIDE WINDOW SCREENS TO ENCOURAGE NATURAL VENTILATION

New York City Health Code
Proposal developed by the Climate Adaptation Committee

Summary

Issue:
Many people do not open their windows in the summer due to concern for insect bites, but this also prevents the use of natural, energy-free ventilation. This issue is likely to become more important in the future as climate change expands the habitat of tropical insects.

Recommendation:
Provide fitted window screens on all new windows at seven stories or lower. Beginning in 2016, provide expandable screens on request for all windows.

Proposed Legislation, Rule or Study

Amendments to the New York City Health Code:

1. Add a new section 131.16 as follows:

§131.16 Window screens. (a) The owner, lessee, agent or other person who manages or controls a building or portion of a building classified in occupancy group R shall install and maintain a window screen for:

i. any new openable window located on the seventh story or below of any portion of the building classified in occupancy group R; and

ii. beginning July 1, 2016, for any openable window in any portion of the building classified in occupancy group R upon written request from the tenant of a dwelling unit.

(b) For new windows, the window screen shall be integrated into the window frame assembly. For existing windows, the window screen shall either be integrated into the window frame assembly or shall be a removable screen with fixed height and expandable width.

(c) For the purposes of this section, an "openable window" is defined as an exterior window in a portion of a building classified in occupancy group R that may be opened without a key or specialized tool, but shall not include any windows for which a window screen would be considered an impermissible obstruction under the New York city building code, New York city fire code or other applicable law or regulation. An "openable window" shall not include pivot windows.

Supporting Information

Issue – Expanded
In the United States, insect bites are typically no more than a nuisance. In much of the world, however, insects are a major vector of disease, and may become so in the U.S. and New York due to climate change - West Nile virus is just one example of an insect-borne disease. Also, if biting insects come in through windows, residents will understandably close them, eliminating an energy-free source of ventilation.

Cooling is responsible for approximately 5% of energy use in multi-family residential buildings.[1] During warm months, residents can often achieve a comfortable indoor temperature through a combination of open windows and fans, which requires significantly less energy than air conditioning. This is part of a major movement in green building towards non-mechanical, "passive" design methods that do not require energy to function. People on low floors of buildings, however, will close windows and will not rely on natural ventilation if insects are prevalent.

In addition, according to the Centers for Disease Control and Prevention (CDC), climate change may expand the distribution of insect-borne diseases in the United States.[2] The CDC hypothesizes that not only could "formerly-prevalent diseases such as malaria and dengue fever" return, but climate change could "facilitate the introduction and spread of new disease agents, such as West Nile virus."[3] Mosquitoes, for example, feed more often as temperatures rise.[4] While research on the relationship between climate change and infectious disease is still being conducted and refined, some studies indicate a global increase in temperature of 2-3 degrees Celsius would increase the number of people at risk of contracting malaria by 3-5% (several hundred million).[5]

There have been over 254 human cases and 26 deaths from West Nile virus in New York State since 2000,[6] and 159 cases and 23 deaths in New York City from 1999-2007.[7] In 2007 alone,18 people in New York City were infected with West Nile virus.[8]

Environmental & Health Benefits
Around the world, screens or bed nets are the first line of protection against disease-carrying pests and the CDC recommends window screens as a "[k]ey" household West Nile virus prevention measure.[9] Since 2000, New York City has spent tens of millions of dollars on West Nile Virus prevention and education.[10] It is estimated that each case of West Nile virus in the United States costs $20,0000-$59,000.[11] In New York today, window screens reduce the incidence of West Nile virus and the inconvenience of itchy insect bites; in the future, screens may protect against much more serious disease.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given an health score of 1.

Cost / Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.06% to 0.26%, depending on building type. It was thus categorized as incurring a medium capital cost increment.

Precedents
The International Property Maintenance Code requires window screens for all doors, windows and other outside openings in residential units.[12] In addition, the Massachusetts State Sanitary Code requires window screens for the first four floors of dwelling units.[13]

LEED
There are no LEED credits affiliated with this proposal.

Implementation & Market Availability
Large manufacturers of windows (Marvin, Pella) have provisions for screens in most of their series, even if screens were not part of the original order. For windows where screens are not a standard option (such as custom made windows) retrofitting them into wood frames are relatively easy with grommets and a drill. It is more complicated with metal frames – drilling into them can be difficult and may void the window warranty.

It is recommended that screens be taken down for the winter – leaving them in place can prevent the circulation of air on the window causing frost to collect.

For windows in a landmarked building, or within an historic district, New York City Landmarks Preservation Commission requires a permit if screens are added on the exterior (which is the case for double-hung windows, inward opening hoppers, casements, etc).

Screens cannot be placed on pivot windows. The largest size screen areas are 5' x 5' (larger ones require a cross brace).

Notes
With the large numbers of multi-storied buildings in New York City, the vertical limit of mosquitoes' habitats is an important consideration for this proposal. It had been thought that mosquito species that bite humans generally do not fly above 25 feet.[14] Wind speeds and temperature changes were thought to be barriers that kept mosquitoes close to the ground.[15] Mosquitoes, however, have been found as high as 1000 feet[16] and the Asian Tiger Mosquito is known to breed in pools of water as high as 40 feet.[17]

Urban environments have the potential to vastly expand the height of a mosquito's habitat.[18] In the first study of vertical dispersion of mosquitoes, it was found that vertical distance "constitutes no barrier to movement" for mosquitoes.[19] In the study, researchers released mosquitoes on the 12th floor of a 21 story building in Singapore and then measured mosquito density on each floor.[20] Mosquitoes were found to have rapidly dispersed throughout the building.[21] Mosquitoes, particularly females, "move about extensively and the potential for virus dissemination in a building is great."[22] The researchers concluded that the study was of particular importance to Singapore because 85% of the population lives in high-rise apartment buildings;[23] a similar conclusion could be drawn for New York City.

Furthermore, as temperatures rise, the mosquitoes' environmental barriers could diminish.[24] This has already been seen in mountainous regions in Asia, Africa and Central and South America.[25] Historically, mountains have "limited the spread of diseases carried by insects," but as a result of rising temperatures, "mosquito-borne diseases such as malaria and dengue fever are being reported at increasing elevations."[26]

Due to the uncertainty regarding the vertical limit of mosquitoes, the committee was reluctant require window screens as a matter of course beyond lower stories where mosquitoes are certainly found. At the same time, the committee recommended that screens be provided upon demand for windows at any story.

ENDNOTES:

1 THE CITY OF NEW YORK, PLANYC: A GREENER GREATER NEW YORK 107 (April 22, 2007), available at www.nyc.gov/html/planyc2030/html/downloads/pdf/full_report.pdf.

2 Centers for Disease Control and Prevention, Vector-borne and Zoonotic Diseases, http://www.cdc.gov/ClimateChange/effects/vectorborne.htm (last visited Jan. 26, 2010).

3 Ibid.

4 Ibid.

5 WORLD HEALTH ORGANIZATION. CLIMATE CHANGE AND HUMAN HEALTH - RISK AND RESPONSES (2003), http://www.who.int/globalchange/publications/climchange.pdf.

6 NYS Dep't of Health, West Nile Virus Update - January 1, 2007 - December 31, 2007, http://www.health.state.ny.us/nysdoh/westnile/update/2007/wnv_summary.htm (last visited Jan. 26, 2010).

7 CITY OF NEW YORK DEP'T OF HEALTH AND MENTAL HYGIENE, COMPREHENSIVE MOSQUITO SURVEILLANCE AND CONTROL PLAN OF 2008 2 http://www.nyc.gov/html/doh/downloads/pdf/wnv/wnvplan2008.pdf.

8 Ibid. at 1.

9 CENTERS FOR DISEASE CONTROL AND PREVENTION, EPIDEMIC/EPIZOOTIC WEST NILE VIRUS IN THE UNITED STATES: GUIDELINES FOR SURVEILLANCE, PREVENTION, AND CONTROL, 36 (2003), available at http://www.cdc.gov/ncidod/dvbid/westnile/resources/wnv-guidelines-aug-2003.pdf.

10 Sarah Kershaw, City to Spray for West Nile In Central Park and Queens, N.Y. TIMES, August 23, 2001, available at http://www.nytimes.com/2001/08/23/nyregion/city-to-spray-for-west-nile-in-central-park-and-queens.html?pagewanted=1; and

CITY OF NEW YORK DEP'T OF MENTAL HEALTH AND HYGIENE, FISCAL 2009 PRELIMINARY 2009 BUDGET HEARINGS, COMMITTEE ON HEALTH, 3 (2008), http://council.nyc.gov/html/budget/briefings/FY09capital_preliminary_DOHMH.pdf.

11 Armineh Zohrabian, et al., Cost-effectiveness of West Nile Virus Vaccination, 12:3 EMERGING INFECTIOUS DISEASES (2006), available at http://www.medscape.com/viewarticle/525114.

12 INTERNATIONAL PROPERTY MAINTENANCE CODE, AMENDMENTS TO THE IPMC, § 304.14 (2006), http://www.northglenn.org/WEB-PDF/Amendments_Int'l_Property_Maintenance_Code2006.pdf; and Alliance for Healthy Homes, Housing and Building Codes, http://www.afhh.org/aa/aa_housing_codes_pest-free.htm (last visited Jan. 26, 2010).

13 105 MASS. CODE REGS. 410.000: Minimum Standards of Fitness for Human Habitation (Chapter II), available at http://www.mass.gov/Eeohhs2/docs/dph/regs/105cmr410.pdf.

14 The American Mosquito Control Association, Frequently Asked Questions: How High do Mosquitoes Fly?, http://www.mosquito.org/mosquito-information/faq.aspx#9 (last visited Jan. 26, 2010).

15 Sherry Seethaler, Questions Answered, S.D. UNION TRIBUNE, July 20, 2006, available at http://www.signonsandiego.com/uniontrib/20060720/news_1c20sciqa.html.

16 Ibid.

17 The American Mosquito Control Association, Frequently Asked Questions: How High do Mosquitoes Fly?, http://www.mosquito.org/mosquito-information/faq.aspx#9 (last visited Jan. 26, 2010); and Lee Dye, Ferocious Tiger Mosquito Invades the United States, ABC NEWS, July 26, 2001, available at http://abcnews.go.com/Technology/Story?id=98380&page=1. Asian Tiger mosquitoes were accidentally introduced in the United States in the 1980's and have spread rapidly throughout the Southeast and Mid-Atlantic.

18 Christina Liew and Chris Curtis, Horizontal and Vertical Dispersal of Dengue Vector Mosquitoes, Aedes Aaegypti and Aedes Albopictus, in Singapore, 18:4 MED. VETERINARY ENTOMOLOGY 51-360 (2005).

19 Ibid. at 358-9.

20 Ibid. at 355.

21 Ibid. at 358.

22 Ibid.

23 Ibid.

24 Sherry Seethaler, Questions Answered, S.D. UNION TRIBUNE, July 20, 2006, available at http://www.signonsandiego.com/uniontrib/20060720/news_1c20sciqa.html.

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[25] Ibid.
[26] Ibid.

EF 9:
ENSURE OPERABLE WINDOWS IN RESIDENTIAL BUILDINGS

New York City Building Code; New York City Health Code
Proposal developed by the Climate Adaptation Committee

Summary

Issue:
Operable windows permit cooling without power, which saves energy and allows buildings to remain habitable during power outages. Builders have misinterpreted Health Code regulations to limit window openings to 4.5 inches, which is inconsistent with the Building Code.

Recommendation:
DOB should require documentation showing that residential properties provide window openings as required by code, counting only the actual area that can be opened with window stops, if stops are provided.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1203.4.1 as follows:

1203.4 Natural ventilation. Natural ventilation of occupiable and habitable space shall be through openings to the outdoors. The openings shall be of a type permitted under Sections 1203.4.1.1, 1203.4.1.2, 1203.4.1.3 and 1203.4.1.4. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants. <u>Compliance of all permitted openings with this section shall be demonstrated in a form acceptable to the commissioner.</u>

Amendments to New York City Health Code:

1. Add a new paragraph (6) to subdivision G of Section 12-10 as follows:

<u>6. Notwithstanding the requirements of this section, stops shall not limit the openable area to less than the minimum required by Section 1203.4.1 of the New York City Building Code and Section 27-2058 of the New York City Housing Maintenance Code.</u>

2. Add a new paragraph (3) to subdivision B of Section 12-11 as follows:

<u>3. Notwithstanding the requirements of this section, stops shall not limit the openable area to less than the minimum required by Section 1203.4.1of the New York City Building Code and Section 27-2058 of the New York City Housing Maintenance Code.</u>

Supporting Information

Issue - Expanded
For many years the New York City Building Code has required naturally ventilated buildings to provide a minimum openable area to the outdoors that is equivalent to 5 percent of floor area.[i] Buildings that mechanically supply fresh air into habitable spaces must also provide openable windows (though the minimum operable area required is reduced to 2½ percent of the floor area if a minimum of 40 cubic feet per minute of fresh air is supplied). The advantage of natural ventilation is that it does not use energy or fail during blackouts.

In 1976, in response to children accidently falling out of apartment windows, the New York City Department of Health and Mental Hygiene enacted Window Guard Regulations to require landlords, building managers or owners (in condominium units) to install window guards and/or stops. They are required in all windows of apartments where children 10 years or younger reside, except at fire escapes, and must reject the passage of a solid 5 inch sphere.[ii] This is straightforward for some windows as guards on double hung windows are now common in the city. Depending on the configuration, some pivot windows present particular complications for using guards, in which case window stops must be installed to prevent the window opening beyond 5 inches.[iii]

Window stops are inexpensive, simple to install and not unsightly as are guards. For these reasons, many developers are installing all windows with stops in order to comply with the Department of Health, whether or not children reside in the apartment. Even manufacturers of double hung windows are incorporating them as an option in the window assembly.

Windows with stops, however, do not provide the amount of ventilation required under the Building Code. While tenants or owners of apartments without children 10 years or younger can remove windows stops, those with children 10 years or younger cannot. Moreover, the use of stops has grown more widespread as recent residential construction has incorporated large fixed expanses of glass with minimal openings, increasingly turning to pivot-style windows.

There is a lack of coordination between the window requirements in the Health and Building codes. Windows are being installed that open a maximum of 5", resulting in less available ventilation than the Building Code requires.

Environmental & Health Benefits
Before mechanical means, natural ventilation via windows and skylights was the only way to flush stale, hot or dirty air out of an interior space and New York City's ground-breaking Tenement House Act of 1901 ensured that all apartments would have access to fresh air and natural light. Operable windows are still the most efficient way to provide fresh air and the NYC Building Code still requires that residential spaces have operable windows.

Using natural ventilation can substantially reduce energy use, especially during spring and fall when the temperature and humidity match human comfort levels.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have a low positive health impact per building and to impact a small number of buildings. It was thus given an health score of 1.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents
This proposal clarifies existing regulations under New York City law.

LEED
All projects pursuing LEED certification must meet minimum indoor air quality performance (AE Prerequisite 1), in conformance with ASHRAE Standard 62.1-2004. Buildings that are not mechanically ventilated are required in Section 5.1 to have all naturally ventilated spaces permanently open to and within 25 feet of operable wall or roof openings and that the opening area be at least 4% of the net occupiable floor area.

Implementation & Market Availability
Marvin Windows manufactures all of its sashes with optional limiters that are installed in the field. They can be removed with normal tools.[iv] Pella Windows produces vent stops for their double hung windows only. The vent stops can be popped out and are not tamper proof. Their double hung windows require guards or stops as per the requirements of the Department of Health.[v]

ENDNOTES:

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[i] CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE §1203.4.1.2 (2009) available at http://www.nyc.gov/html/dob/downloads/pdf/cc_chapter12.pdf. (The minimum operable area to the outdoors shall be 5 percent of the floor area of the habitable space to be ventilated. Every opening providing required natural ventilation shall be at least 12 square feet, providing a minimum of six square feet of openable space. Exceptions: 1. Where fresh air is furnished in any habitable room or space by mechanical means supplying a minimum of 40 cubic feet per minute, the free openable area of the openings may be reduced to 2 ½ percent of the flow area but each such opening shall provide not less than 5 ½ square feet of openable area. 2. The minimum free openable area of a mullioned casement window shall be 5 ½ square feet provided that the minimum ratio of floor area to openable area is met); CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE § 27-2058(c) (2009) available at http://www.nyc.gov/html/dob/downloads/pdf/cc_chapter12.pdf. (1. The total area of all windows in the room shall be at least one-tenth the floor area of such room… 3. At least one-half of every required window shall open, except that for a mullioned casement window a minimum of five and one-half square feet is sufficient. In a room where a centralized mechanical ventilating system provides forty cubic feet of air per minute, twenty-five percent of the window area or five and one-half square feet of such area, whichever is greater, shall be openable).

[ii] CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE § 12, (2009). (Requires the installation of window guards "on all windows except fire escape access windows and secondary egress windows in first floor apartments, where the fire escapes are on the upper floors. Choice of unguarded window is optional in latter cases." Section 12-10 specifies that window guards must be at least 15 inches high and capable of rejecting "the passage of a solid five (5) inch sphere at every space and interval." That section also requires the installation of stops to prevent "the lower window from being raised more than 4 ½ inches above the lowest section of the top horizontal bar of the window guard.").

[iii] CITY OF NEW YORK, NY, HOUSING MAINTENANCE CODE § 12-11 (2009), available at http://www.nyc.gov/html/doh/html/win/wincha.shtml#12-11.

[iv] Telephone Interview with Doug Andersen, Technical Staff, Marvin Windows (June 10, 2009).

[v] Telephone Interview with Mr. Cricket, Technical Staff, Pella Windows (June 10, 2009).

EF 10:
REDUCE ARTIFICIAL LIGHTING IN SUNLIT SPACES

New York City Building Code
Proposal developed by the Lighting & Daylighting Committee

Summary

Issue:
Many of New York's buildings have been designed to maximize daylight in interior spaces. However, these buildings often waste energy by using artificial light when daylight could provide much of the required illumination.

Recommendation:
Require daylight responsive controls that reduce artificial light when sufficient daylight is present.

Proposed Legislation, Rule or Study

Amendments to ANSI/ASHRAE/IESNA 90.1 (2007), as incorporated in Chapter 13 of the New York City Building Code:

1. Add a new Section 9.4.1.5 as follows:

9.4.1.5 Daylight Responsive Controls. In spaces greater than 5000 square feet at the perimeter of a building where more than 25 percent of the area of the exterior wall consists of a glazed area, the lighting fixtures located within 15 feet of such exterior walls shall be controlled by an automatic control device or dimming controls capable of reducing lighting energy consumption by at least 50% whenever daylight provides a minimum of 20 horizontal footcandles, measured at an unobstructed point located 30 inches above the floor and 15 feet from the glazing.

Exceptions:

a. Spaces where the height above the floor of buildings or structures outside the glazing is greater than their distance away from the glazing.
b. Spaces where daylight will not provide a minimum of 20 horizontal footcandles, measured at an unobstructed point located 30 inches above the floor and 15 ft from the glazing, for at least 1000 hours per year.
c. Spaces with less than 90 watts of lighting installed within 15 ft of the glazing.
d. Saunas, steam rooms, and spaces containing swimming pools or spa pools.
e. Spaces where medical care is rendered.
f. Spaces within dwelling units.
g. Spaces within guest rooms and suites.
h. Retail spaces.
i. Spaces in which the lighting is dimmable and controlled by dimming controls that are located within the space and accessible to the space occupant.

Supporting Information

Issue – Expanded
Many historic and new green buildings were designed to maximize interior daylight. Using daylight rather than electronic illumination can save significant amounts of energy and improve the psychological wellbeing of building occupants.

Numerous studies have documented lighting energy savings greater than 30% when daylight-responsive lighting controls are used in commercial spaces. According to the Lawrence Berkeley National Laboratory, "35% energy savings from daylighting controls in daylit spaces is typical of documented energy savings from available, monitored case studies."[1] This finding is consistent with studies from many other organizations, some of which estimate even greater savings.[2] In addition to energy savings, daylight responsive controls significantly reduce peak electricity demand since peak demand usually occurs in the middle of a sunny summer afternoon, which coincides with peak daylight availability. An 80% reduction in electricity demand for lighting is typical at these times.

Daylight also promotes productivity and health benefits. People intuitively prefer daylight over artificial light, and studies have demonstrated that access to views and natural light can increase productivity in the workplace. According to the Lighting Research Center at Rensselaer Polytechnic Institute, daylight reduces eye strain and skin problems, alleviates sleep disorders and seasonal affective disorder (SAD), and provides vitamin D and stress relief.[3]

Energy savings from daylight can only be realized if electric lights are dimmed or turned off in daylit spaces to avoid over-lighting. While some people who work in spaces with windows will turn their lights off during the day to save energy, in commercial spaces this is relatively rare. The greater the financial savings from daylight, the more likely that daylight will also be incorporated into the design of new buildings and that people will receive the associated psychological and health benefits.

Environmental & Health Benefits
In typical office installations (1.1 watt/square foot of lighting operating 3,000 hours per year) this proposal will save 1 kWh of electricity per square foot per year, or 100 kWh per year for a typical private office There will also be a peak load reduction of 0.9 watts/square foot, or 90 watts for a typical private office.

Control systems that switch lamps off also extend lamp life, reducing lighting maintenance costs.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant positive health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal was estimated to increase first capital costs by 0.09% to 0.7%, depending on building type. It was thus categorized as incurring a medium to a higher capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years depending on the building type.

Precedents
The Seattle's Energy Code requires daylight zone controls, defining parameters for a space to be considered as a daylight zone and specifying what kinds of controls are required in these areas. That code specifically requires automatic controls as a means of reducing lighting power in areas that have sufficient daylight. The code also includes extensive requirements for the operation of the automatic controls depending on the numbers of lighting sources and levels of automatic control.[4]

California's 2008 Building Energy Efficiency Standards includes prescriptive requirements for Automatic Daylighting Control Devices used to control lights in daylit zones. These guidelines require that the control devices reduce power consumption in daylit areas but maintain sufficient levels of illumination, as well as guidelines for set-up, operation and maintenance of the system.[5]

ANSI/ASHRAE/IESNA 90.1 (2010) is expected to include daylight responsive controls as a mandatory provision. BSR/ASHRAE/USGBC/IESNA Standard 189.1 will also require daylight responsive controls using language that is very similar to this proposal.

LEED
This proposal may facilitate achieving the following LEED Energy and Atmosphere credits:

- LEED NC-EA cr.1 Optimize Energy Performance
- LEED EB-EA cr.1 Optimize Energy Performance
- LEED CI-EA cr.1.2 Optimize Energy Performance, Lighting Controls
- LEED ND-GCT cr.2 Energy Efficiency in Buildings
- LEED for Schools EA cr.1 Optimize Energy Performance
- Additional credits under LEED pilot programs.

Implementation & Market Availability
There are no known implementation issues for this proposal. Daylight-responsive controls have been in widespread use for over 10 years, and there are a number of prominent new installations in New York City, including the New York Times building and One Bryant Park.

ENDNOTES:

[1] Integrated Building Environmental Communications System, Research: Energy Savings, http://lighting.lbl.gov/IBECS/ir_savings.html (last visited Jan. 21, 2010).

[2] Joel Loveland, Daylighting Lessons 2002, LIGHTING DESIGN LAB NEWS, Winter/ Spring 2003, http://www.lightingdesignlab.com/ldlnews/daylighting_lessons_02_jl.pdf ("A well daylight illuminated building can be built for the capital budget allocations typical of common construction, and these buildings can save 40-60% on their overall electric lighting operations costs with daylighting controls."); The New Buildings Institute, Advanced Lighting Guidelines, Table 8-4 (2003 Edition), available at http://www.newbuildings.org/lighting.htm (estimating savings of 35-40%); R. Leslie, et al., The Potential of Simplified Concepts for Daylight Harvesting, 37:1 LIGHTING RESEARCH CENTER, Fig. 1, available at http://www.lrc.rpi.edu/programs/daylighting/pdf/simplifiedConcepts.pdf (estimating energy savings from daylight harvesting of 24%-38% for office spaces located in Albany, NY).

[3] Lighting Research Center, Daylight Dividends: Health, http://www.lrc.rpi.edu/programs/daylighting/dr_health.asp (last visited Jan. 21, 2010). (Other studies have also documented the health benefits of daylight. Sasha Brown, Building Technology Expert Describes studies of Daylight, MIT NEWS, Nov. 8 2006, available at http://web.mit.edu/newsoffice/2006/building-tech-1108.html.)

[4] CITY OF SEATTLE ENERGY CODE Ch. 15 § 1513.3.2 (2006), available at http://www.seattle.gov/DPD/Codes/Energy_Code/Nonresidential/Chapter_15/default.asp.

[5] California Energy Commission, 2008 Building Energy and Efficiency Standards for Residential and Non-residential Buildings, CAL. ENERGY COMM'N. (2008), available at http://www.documents.dgs.ca.gov/bsc/prpsd_chngs/2008StandardsDoc.pdf#search=building%20energy%20efficiency%20standards&view=FitH&pagemode=none.

EF 11:
REDUCE SUMMER HEAT WITH COOL ROOFS

New York City Building Code
Developed by the Site & Site Stormwater Committee

Summary

Issue:
Light-colored roofs reflect light and heat back into the atmosphere, thereby cooling buildings and cities. The building code mandates white roof coatings, but the standards are not aligned with LEED, which is used by many developers.

Recommendation:
Amend specifications for cool roof coatings to align them with LEED.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 1502 to include the following definitions:

EMITTANCE. A measure of the ability of a surface material to release absorbed heat, determined as per ASTM 408 or ASTM C 1371.

INITIAL SOLAR REFLECTANCE. The solar reflectance of a material, measured when that material is first installed.

SOLAR REFLECTANCE. The measure of the ability of a surface material to reflect sunlight, including visible, infrared, and ultraviolet light, determined as per ASTM E 903, ASTM E 1918, or ASTM C1549.

SOLAR REFLECTANCE INDEX. A measure of the ability of a surface to reject solar heat that incorporates both solar reflectance and emittance, as determined by ASTM E 1980.

2. Amend Section 1504.8 as follows:

1504.8 Reflectance. Roof coverings on roofs or setbacks with slope less than three units vertical in 12 units horizontal (25 percent) shall be white in color or ENERGYSTAR as highly reflective for at least 75 percent of the area of the roof or setback surface.] At least 75 percent of the area of roofs and setbacks shall have a covering with a minimum solar reflectance index in accordance with Table 1504.8.

Table 1504.8

Roof or Setback Type	Slope	Solar Reflectance Index
Low-sloped	<= 2:12	78
Steep-sloped	> 2:12	29

Exceptions:
1. Any steep-sloped roof composed of copper, lead or tile, wood or slate shingles.
2. Terraces on setbacks comprising less than 25 percent of the area of the largest floor plate in the building.
[2]3. Green roofs in compliance with Section 1507.16 shall be permitted to comprise part or all of the 75 percent required area coverage.
[3]4. Roofs used as [outdoor] passive or active recreation space by the occupants of the building shall be permitted to be either landscaped or covered with a walking surface or other protective surface with [an albedo] an initial solar reflectance [index] of 30 percent or greater.
5. Ballasted roofs, provided that the ballast has an initial solar reflectance of 30 percent or greater.
6. Any portion of a roof that is under a planter, mechanical equipment, photovoltaic or solar thermal equipment or any other structure or equipment exempted by the commissioner.

3. Amend Section 1510.1 as follows:

1510.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exception:

Re-roofing shall not be required to conform to Section 1504.8 if the re-roofing is less than 50 percent of the roof area and less than 500 square feet.

Supporting Information

Issue – Expanded

Cool roofs are an extremely cost-effective strategy to combat high peak demand for cooling and the urban heat island effect, which is the tendency of urban areas to be hotter than their suburban surroundings because of dark absorbent surfaces and a lack of vegetation. New York City began addressing these issues by incorporating a requirement for white roofs in its last code cycle. This proposal seeks to build on that requirement by better aligning with LEED. For instance, the Building Code allows "white" coatings and references "albedo", whereas LEED measures reflectivity using solar reflectance index, which also takes into account emittance. In addition, the Building Code only covers low-sloped roofs, while LEED covers both low- and steep-sloped roofs. Since roofs are replaced every 15 to 25 years, capturing re-roofing means that within 20 years, most of New York City's low-sloped roofs will be cool roofs. It is estimated that this would decrease the City's urban heat island effect by at least 1 degree F.

The proposal will have impacts on three levels. On an individual building level, installing cool roofs will lower the roof surface temperature and, consequently, the need for air-conditioning, especially during summer peaks. On a hot, sunny day, the temperature of a black roof can reach 90° above the ambient air temperature (i.e. 180° on a 90° day). This is because non-reflective roofs absorb and retain solar energy as heat, which contributes not only to a hotter roof, but also to uneven thermal expansion/contraction and aging of the roof. The top floors of the building underneath are heated up by the hot roof, causing discomfort for the building inhabitants as well as increased local cooling loads, particularly in older buildings, which tend to have less insulation.

On a citywide level, this proposal will help mitigate the "urban heat island effect". This is a major problem in New York City due to the preponderance of dark roofs (944 million square feet of roof surface) as well as dark surfaces on roads and parking areas -- together causing summer temperatures to be 5 to 8 degrees F hotter than surrounding areas.[1] Installing light roofs on a large percentage of the city's buildings will collectively reflect enough heat to cool down not only the individual buildings but the city.

On a global level, implementing the proposal will also help combat global warming. The heat from the infrared and near infrared components of solar radiation is readily absorbed by dark roofs and radiated back at night as infrared radiation, which is then trapped by the CO2 blanket in the atmosphere. By locking in heat, this CO_2 layer warms up the Earth and its atmosphere -- the phenomenon of global warming. Light colored roof surfaces reflect more sunlight in the form of visible light rather than infrared radiation. Visible light does not get trapped by the CO2 blanket but rather passes through it and thus does not contribute to the warming up of the atmosphere.

Environmental & Health Benefits

Implementing the proposal will have significant environmental and health benefits:[2]

- Cool roofs and cooler air temperatures mean a cooler city and buildings and/or less energy consumed for air-conditioning purposes and consequently, lower carbon footprint.
- Reduced energy consumption during summer peaks of energy use, related to increased air conditioning requirements, will increase peak capacity and thus, help prevent frequent blackouts.
- Cool roofs will reduce the heat island effect and minimize the impact on microclimate and human and wildlife habitat. Lowering urban heat will also mitigate air pollution caused by the increased emission of nitrous oxides, sulphur dioxide and carbon dioxide associated with the increased energy use for cooling purposes. These pollutants combine photochemically in the presence of sunlight and heat and produce ground level ozone (smog), which is a health hazard. Reducing the heat island effect by installing light roofs will slow down this process, which occurs much more readily at the higher temperature.
- Reducing urban heat will also prevent life loss during extreme heat. A 1995 heat-wave in Chicago is estimated to have killed over 700 people – over twice as many as perished in the infamous Chicago Fire of 1871. Many of those who died were low-income persons who did not have air-conditioning and were unable to protect themselves from the ambient temperatures. Even more shocking was the European heat wave of August 2003, which is estimated to have claimed the lives of 35,000 people, with over 14,000 dying in France alone.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

New York City placed cool roof requirements in the last iteration of the New York City Building Code.

City of Chicago's energy code requires that roof installations on most commercial low-sloped air-conditioned buildings meet SRI criteria.

State of Georgia "Georgia White Roof Amendment" requires the use of additional insulation for roofing systems whose surfaces do not have SRI test values of 0.75 or more.

California's Title 24 of the Energy Code requires the installation of cool roofs and California's Cool Savings Program provides rebates to building owners for installing roofing materials with high SRI values.

LEED

This measure is applicable to:

- LEED CI-SS cr.1 Option E: Heat Island Reduction, Roof (1/2 point);
- LEED NC-SS cr.7.2: Heat Island effect, Roof (1 point);
- LEED EB-SS cr. 6.2 Heat Island Reduction, Roof (1 point).

Each rating system provides various options for achieving LEED points. Compliance with the code requirements of this new proposal may assist in achieving these LEED credits, provided that certain additional provisions are met.

This proposal does not include steep sloped roofs. The NYC building code and LEED have differing criteria for defining low vs. steep roof slopes; therefore calculations for and compliance with solar reflectance will vary accordingly. Additionally, LEED does not differentiate roofs used as outdoor recreation spaces.

The proposal is consistent (for low sloped roofs) with LEED 2009 language currently under consideration.

ENERGYSTAR products do not automatically achieve credits under LEED.

Taking advantage of the exemptions to this proposed code revision may negatively impact the ability to achieve LEED credits.

Implementation & Market Availability

There are no known implementation issues associated for this proposal.

Green roofs or roofs with high Solar Reflectance Indexes reduce costs associated with cooling and HVAC equipment. Green roofs typically require an additional up-front investment, while cool roofs may or may not cost more than other roofs. However, any up front investment is likely to result in energy cost savings throughout the lifecycle of the project.

This proposal would not unduly limit the use of wood or other decking as only 75% of a roof surface must comply with the SRI requirements and the NYC Fire Code already restricts the use of wood decking to not more than 30% of the roof surface.

ENDNOTES:

[1] City of New York Dep't of Design and Construction, DDC Cool and Green Manual, (2007), *available at* http://www.nyc.gov/html/ddc/downloads/pdf/cool_green_roof_man.pdf.

[2] Ibid.

EF 12:
REDUCE SUMMER HEAT WITH COOL, SHADY BUILDING LOTS

New York City Building Code
Proposal developed by the Site & Site Stormwater Committee

Summary

Issue:
Unbuilt areas on private building lots make up approximately one third of New York City's space. Because these areas are often covered in dark, unshaded pavement, they contribute to the city's heat island.

Recommendation:
Require light-colored pavement, trees or plantings on 50% of the unbuilt areas of building lots.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code

1. Add a new Chapter 34 as follows:

CHAPTER 34
SITE AND LANDSCAPING

SECTION BC 3401
GENERAL

3401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of the site and landscaping.

SECTION BC 3402
DEFINITIONS

3402.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the following meanings.

HARDSCAPE. Non-built area that is impervious, such as roads, walks, courtyards and parking lots.

OPEN-GRID PAVEMENT. Pavement that is at least 50% pervious and contains vegetation in the open cells.

NON-BUILT AREA. The area of a site that does not include the building footprint or any area used exclusively for athletic activities, such as ballfields, tennis courts, basketball courts or swimming pools. This definition includes turf grass areas that may be used for multiple purposes, including athletic activities.

PERVIOUS. The surface area of a paving material that is open and allows moisture to pass through the material and soak into the earth below the paving system.

SHADE TREE. A tree with a spreading canopy that screens the sun, such as honey locust, sweetgum, elm, linden, maple and oak.

SOLAR REFLECTANCE INDEX. A measure of the ability of a material to reject solar heat as calculated using ASTM E1980.

SECTION BC 3403
PAVED AREAS

3403.1 Cooling and shading. Any site, except any site subject to Section 3403.2, shall provide any combination of the following for fifty percent (50%) of the site hardscape:

1. Paving material with a solar reflectance index of 29 or greater;
2. Shading from plants or other landscaped features such as trellises; or

3. Open-grid pavement.

The shade attributed to plants, including trees, hedges and shrubs, shall be based on an estimate of plant coverage after 5 years and the shade provided at 12:00 P.M. on June 21 of such year.

3403.2 R-3 Buildings. This section shall apply to any site on which more than fifty percent (50%) of the uses of a building, measured in square feet, are classified in occupancy group R-3. If at least fifty percent (50%) of the non-built area is hardscape, such site either comply with the provisions of Section 3403.1 or provide one shade tree per 1,000 square feet of non-built area.

3403.3 Exceptions. Sections 3403.1 and 3403.2 shall not apply to any site in which:

1. At least seventy-five percent (75%) of the non-built area is shaded at noon on June 21; or
2. The non-built area is less than 500 square feet.

Supporting Information

Issue – Expanded

The term "heat island" describes built up areas that are hotter than nearby rural areas. The annual mean air temperature of a city with one million people or more can be 1.8–5.4°F (1–3°C) warmer than its surroundings. In the evening, the difference can be as high as 22°F (12°C). Heat islands increase summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. The Lawrence Berkeley National Lab researchers estimate that about 10% of current U.S. air conditioning demand results from the urban heat island.

In addition, asphalt that is exposed to direct sunlight and high temperatures wears quicker. High temperatures lead to volatilization of asphalt binder and oxidation, which causes progressive hardening of the pavement and fatigue cracking. Cracking leads to water infiltration that can weaken the layers underneath. Higher surface temperatures also make asphalt pavement more prone to rutting. A study conducted in Modesto California showed that asphalt roads with shade required resurfacing every 12 years whereas unshaded roads required resurfacing every five years. This resulted in a savings of $.66/SF over a 30 year period compared to an unshaded street.

Environmental & Health Benefits

Reducing the heat island effect will reduce the need for air conditioning in the summer, thus reducing energy consumption, decreasing greenhouse gas emissions, and improving air quality.

Lower temperatures also reduce a series of negative health impacts - during periods of elevated temperatures, human health and comfort are compromised; respiratory disorders are exacerbated and vulnerable populations, such as children and the elderly, suffer disproportionately. Elevated air temperatures resulting from the heat island effect also increase the rate of ground level ozone formation.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

Several small jurisdictions in the United States require site shading or limit pervious surfaces. For example, Altamonte Springs, Florida requires 15% shade coverage within five years over private property.[1] The ordinance gives shade values and points for different tree species. Kinston, North Carolina requires 20% shade coverage for all parking spaces, drives, walks and loading areas within private property.[2] The State of North Carolina prohibits more than 80% of the surface area of a “vehicular surface area” from being an impervious material if the vehicular surface area exceeds one acre.[3]

LEED

The following LEED credits address mitigating the heat-island effect through the use of light-colored/high-albedo materials:

- LEED NC-SS cr. 7.1 Heat Island Effect, non-roof
- LEED CI-SS cr.1D Heat Island Effect, non-roof
- LEED EB-SS cr.6 Heat Island Reduction
- LEED for Schools SS cr.7.1 Heat Island Effect, non-roof

- LEED for Homes SS cr.4.1 Surface Water Management
- LEED ND-GCT cr.10 Heat Island Reduction (pilot program).

This measures outlined in this proposal will positively impact achieving these LEED credits across the various rating systems.

Implementation & Market Availability

There are no known implementation issues for this proposal.

Many high albedo pavement options, including cement concrete and whitetopping, light-colored unit pavers, and pervious concrete pavers, are widely available and are being implemented for a full array of applications. Others, such as high albedo asphalt, are not as widely used but are beginning to be used in NYC for bike and bus lanes.

Notes

The committee considered requirements for light-colored asphalt aggregate given that roads represent a large portion of the city's dark surfaces. This issue is currently is currently being investigated by the NYC Department of Transportation and it remains a challenge to source and transport such aggregate. For these reasons, the committee declined to recommend any course of action regarding light-colored aggregate.

ENDNOTES:

[1] City of Altamonte Springs, Land Dev. Code., art. VIII (1993)

[2] City of Kinston, Unified Dev. Ordinance, art. XIX (1992).

[3] Impervious Parking Legislation, S. Res. 845 S.L. 2008-198 (Nc. 2008).

EF 13
CLARIFY STANDARDS FOR ATTACHING ROOFTOP SOLAR PANELS

New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:
The Building Code does not specify acceptable criteria for the attachment of solar panels to rooftops, inhibiting the installation of solar energy systems.

Recommendation:
Require the Department of Buildings to develop detailed criteria for roof attachment of solar panels.

Proposed Legislation, Rule or Study
Amendments to the New York City Building Code

1. Amend Section 1502.1 as follows:

1502.1 General. The following terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ADDED COVERING. Covering added over a roof covering.

2. Add a new Section 1509.1.1 as follows:

1509.10 Anchorage. Installation of equipment on a roof or roof setback shall be in accordance with Chapter 16. Any system, equipment, added covering or other building-related load on roofs or roof setbacks shall be anchored to the building in a manner consistent with Section 1604.8.3. Ballast shall be prohibited on roofs one hundred (100) feet or higher above grade. For roofs less than one hundred (100) feet above grade, ballast shall be fully contained.

Supporting Information

Issue- Expanded
Ambiguity as to acceptable practice in the installation of solar collectors can inhibit their adaptation. This proposal clarifies the requirements so that designers will know the standards they must meet, removing one barrier to the implementation of solar energy.

Environmental & Health Benefits
Since solar collectors decrease the use of fossil fuels, the increased rate of implementation due to removing this barrier will result in decreased emissions of both global warming emissions and Clean Air Act pollutants.

This proposal was determined to have a low environmental impact per building and to impact a low number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have an indirect health impact.

Cost & Savings
This proposal is to clarify code requirements, and will therefore have no direct impact on construction costs.

Precedents
There are no know precedents for this proposal.

LEED

This proposal will make it more feasible for projects to utilize solar energy installations, which will facilitate achieving the following LEED credits (among other credits in pilot programs):

- LEED NC-EA cr.2, On-Site Renewable Energy
- LEED CI-SS cr.1 Option K, On-Site Renewable Energy
- LEED EB-EA cr.2, On-Site and Off-Site Renewable Energy
- LEED for Schools EA cr.2, On-Site Renewable Energy
- LEED for Homes EA cr. 1, Optimize Energy Performance
- LEED ND-GCT cr.13, On-Site Renewable Energy Sources

Implementation Market Availability
The technologies are well known, although market penetration in NYC is not high and experience somewhat limited.

EF 14
ALLOW LARGE SOLAR ROOFTOP INSTALLATIONS

New York City Building Code
Proposal developed by the Energy & Ventilation Committee

Summary

Issue:
Current regulations limit the area of roof that solar panels can cover without counting as another floor. This can increase the effective cost of solar panels, or prevent their installation.

Recommendation:
Exempt solar panels from limits on rooftop coverage.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Amend Section 504.3 as follows:

    504.3 Rooftop structures. Rooftop structures including but not limited to roof tanks and their supports, ventilating, air conditioning and similar building service equipment, bulkheads, penthouses, chimneys, and parapet walls 4 feet (1219 mm) or less in height shall not be included in the height of the building or considered an additional story unless the aggregate area of all such structures exceeds 33 and one-third percent of the area of the roof of the building upon which they are erected. Rooftop structures shall be constructed in accordance with Section 1509.

    Exception: Solar thermal and solar electric (photovoltaic) collectors and/or panels and their supporting equipment, but not including any accessory plumbing or electrical equipment, shall not be included as rooftop structures subject to the 33 and one-third percent limitation on roof coverage.

Supporting Information

Issue- Expanded
This proposal will eliminate a barrier to the deployment of solar collectors and make possible an increase in the rate at which they are implemented. As written the restriction is reasonable for the structures listed, which do not take up much area. Solar collectors, however, cover as much of the roof as is practical, but do not constitute rentable space or project up as far as another story would. Because of their obvious benefits, and the absence of any detriments, solar collector usage should be encouraged, not limited or inhibited.

Environmental & Health Benefits
Since solar collectors decrease the use of fossil fuels, the increased rate of implementation due to removing this barrier will result in decreased emissions of both global warming emissions and Clean Air Act pollutants.

This proposal was determined to have a low environmental impact per building and to impact a low number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have an indirect health impact.

Cost & Savings
This proposal is for a code allowance, which will have no direct impact on construction costs.

Precedents

There are no known precedents for this proposal.

LEED
This proposal will make it more feasible for projects to utilize solar, thermal and photovoltaic panels, which will facilitate achieving the following LEED credits (among other credits in pilot programs):

- LEED NC-EA cr.2, On-Site Renewable Energy
- LEED CI-SS cr.1 Option K, On-Site Renewable Energy
- LEED EB-EA cr.2, On-Site and Off-Site Renewable Energy
- LEED for Schools EA cr.2, On-Site Renewable Energy
- LEED for Homes EA cr. 1, Optimize Energy Performance
- LEED ND-GCT cr.13, On-Site Renewable Energy Sources

Implementation and Market Availability
There are no known implementation issues for this proposal.

EF 15:
REMOVE ZONING IMPEDIMENTS TO ALTERNATIVE ENERGY

New York City Zoning Resolution
Proposal developed by the Homes Committee

Summary

Issue:
The Zoning Resolution allows many categories of mechanical equipment on a roof to exceed the allowable building height. However, equipment used for alternative or distributed energy is not treated as such a "permitted obstruction."

Recommendation:
Treat alternative and distributed energy equipment, such as photovoltaic and solar thermal collectors, as "permitted obstructions."

Proposed Legislation, Rule or Study

Amendments to the New York City Zoning Resolution:

1. Amend Section 23-62 as follows:

23-62

Permitted Obstructions

* * *

(d) Elevators or stair bulkhead, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage

* * *

2. Amend Section 23-621 as follows:

23-621

Permitted obstructions in certain districts

R2A R3 R4 R4A R4-1 R5A

(a) In the districts indicated, permitted obstructions are limited to those listed in paragraphs (b), (d) (with respect to alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures) only), (e) and (g) of Section 23-62 (Permitted Obstructions).

R2X

(b) In the district indicated, permitted obstructions are limited to those listed in paragraphs (b), (d) (with respect to alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures) only), (e) and (g) of Section 23-62. Dormers may be considered permitted obstructions if:

* * *

R5D

(d) In R5D Districts, permitted obstructions shall be as set forth in Section 23-62, except that elevator or stair bulkheads, roof water tanks, cooling towers, other mechanical equipment~~,~~ or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures) may exceed a maximum height limit provided that the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to eight times the width, in feet, of the street wall of the building facing such frontage.

3. Amend Section 24-51 as follows:

24-51

Permitted Obstructions

* * *

(c) Elevators or stair bulkhead, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage;

* * *

4. Amend Section 33-42 as follows:

33-42

Permitted Obstructions

* * *

(c) Elevator or stair bulkheads, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage;

* * *

5. Amend Section 43-42 as follows:

43-42

Permitted Obstructions

* * *

(b) Elevator or stair bulkheads, roof water tanks, cooling towers or alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines (including enclosures), each having an aggregate width of street walls equal to not more than 30 feet. However, the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage, times their average height, in feet, shall not exceed a figure equal to four times the width, in feet, of the street wall of the building facing such frontage;

* * *

6. Amend Section 81-252 as follows:

81-252

Permitted obstructions

With the exception of unenclosed balconies conforming to the provisions of Section 23-13 (Balconies) and alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines, the structures which under the provisions of Sections 33-42 or 43-42 (Permitted Obstructions) or 34-11 or 35-11 (General Provisions), are permitted to penetrate a maximum height limit or a sky exposure plane shall not be permitted as exceptions to the height limitations, setback requirements or rules for the measurement of encroachments or compensating recesses set forth in Section 81-26 (Height and Setback Regulations), nor shall they be excluded in determining daylight blockage pursuant to the provisions of Section 81-27 (Alternate Height and Setback Regulations).

7. Amend Section 84-135 as follows:

84-135

Limited Height of Buildings

* * *

(e) Sections 23-62 (Permitted Obstructions) and 33-42 (Permitted Obstructions) are hereby made inapplicable. Any portion of a building or other structure that exceeds an established height limit shall be subject to the following provisions:

(1) The following shall not be considered obstructions and may thus penetrate a maximum height limit:

- Chimneys or flues, with a total width not exceeding 10 percent of the aggregate width of street walls of a building at any level
- Elevator or stair bulkheads, roof water tanks, cooling towers or other accessory mechanical equipment (including enclosure walls), provided that either the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage times their average height, in feet, shall not exceed a figure equal to eight times the width, in feet, of the street wall of the building facing such frontage at curb level, or the lot coverage of all such obstructions does not exceed 20 percent of the lot coverage of the building and the height of all such obstructions does not exceed 40 feet

- Flagpoles and aerials
- Heliostats, wind turbines, solar panels and other alternative or distributed energy equipment
- Parapet walls, not more than four feet high
- Wire, chain link or other transparent fences

* * *

8. Amend Section 84-333 as follows:

Section 84-333

Permitted Obstructions

* * *

(b) Sections 23-62 and 33-42 (Permitted Obstructions) are hereby made inapplicable. Any portion of a building or other structure that exceeds an established height limit shall be subject to the following provisions:

(1) The following shall not be considered obstructions and may this penetrate a maximum height limit:

- Chimneys or flues, with a total width not exceeding 10 percent of the aggregate width of street walls or a building at any level;
- Elevator or stair bulkheads, roof water tanks, cooling towers, alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines or other accessory mechanical equipment (including enclosure walls), provided that either the product, in square feet, of the aggregate width of street walls of such obstructions facing each street frontage times their average height, in feet, shall not exceed a figure equal to eight times the width, in feet, of the street wall of the buildings facing such frontage at curb level, or the lot coverage of all such obstructions, does not exceed 20 percent of the lot coverage of the building and the height of all such obstructions does not exceed 40 feet;
- Fences, wire, chain link or other transparent type;
- Flagpoles and aerials;
- Parapet walls, not more than four feet high;

* * *

9. Amend Section 104-322 as follows:

Section 104-322

Permitted Obstructions

The following shall not be considered obstructions and thus may penetrate the applicable maximum building height and the applicable maximum height for mechanical equipment set forth in Appendix B of this Chapter, and may also penetrate the sky exposure plane set forth in Section 104-321 (Mechanical equipment).

* * *

Alternative or distributed energy equipment such as solar panels, wind turbines, or micro-turbines;

Antennae and structural support thereto;

* * *

Supporting Information

Issue – Expanded
Alternative and distributed energy is considered an important part of the city and country's long-term plan to reduce greenhouse gas emissions.

Distributed (on site) generation, including cogeneration, solar photovoltaic and wind power, prevents transmission losses, offsets fossil fuel combustion, and increases grid reliability. Approximately 30% of the electricity created at power plants is lost during transmission to the point of use. Distributed generation prevents these losses, substantially reducing carbon emissions associated with electricity generation. Furthermore, distributed generation, especially solar photovoltaic, produces the most energy when the chances of a brown/black-out are highest – on hot days in the summer. Distributed generation will make the power grid more reliable and may ultimately reduce the need for grid upgrades. Similarly, solar thermal technology reduces the burning of fossil fuels. This technology uses the sun to heat water, replacing fossil fuels otherwise needed for heating and domestic hot water, improving local air quality and reducing carbon emissions.

The current Zoning Resolution, however, was enacted in 1961, a time when alternative energy sources and distributed generation were not incorporated into buildings. As a result, the Zoning Resolution did not make any provision for their use. These and other administrative barriers discourage the installation of distributed and alternative generation systems in New York City and drive up costs. Solar installations in New York City, for example, are approximately 1/3 more expensive than those in New Jersey and Long Island. Even with incentives from the state and federal government, New York City has only installed 1.1 MW of solar capacity.[1]

In comparison, mechanical equipment, such as cooling towers and water tanks, is treated as a "permitted obstruction" and exempted from certain limitations under the Zoning Resolution. Most importantly, rooftop mechanical equipment is not counted towards building height limitations.

This proposal would provide alternative and distributed energy equipment with the same exceptions under the Zoning Resolution now enjoyed by mechanical equipment.

Environmental & Health Benefits
This proposal would make it easier to receive approvals for cogeneration, wind power, solar photovoltaic and solar thermal systems, thus reducing greenhouse gas emissions and improving local air quality.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings
This proposal is an allowance and is not expected to have any impact on capital costs.

Precedents
In Berkeley, CA, solar projects do not require zoning permits or design review.[2] The Berkeley Planning Department offers free non-binding design review evaluation of solar equipment installations.[3]

LEED
This code revision may result in more projects implementing alternative energy solutions when it wasn't previously feasible due to height restrictions.

These solutions assist in achieving points for

- LEED NC-EA cr. 2 Onsite Renewable Energy;
- LEED CI-SS cr.1 Option K. Onsite Renewable Energy;
- LEED EB-EA cr. 2.1-2.4 On-site and Off-Site Renewable Energy;
- LEED for Schools-EA cr.2 On-Site Renewable Energy;
- LEED ND (pilot program)-GCT cr. 13 On-Site Renewable Energy Sources;
- LEED for Retail NC (pilot program) EA cr.2 On-Site Renewable Energy; and
- LEED for Retail CI (pilot program) SS cr. 1 Option K. Onsite Renewable Energy.

LEED for Homes addresses renewable electric systems in EA cr.10, and solar hot water heating systems under EA cr. 7.3. A project receiving points for LEED for Homes EA 1 is not eligible for these credits, and vice versa.

Implementation and Market Availability

There are no implementation or market barriers to this proposal.

ENDNOTES:

[1] plaNYC, Energy Initiatives: Foster the Market for Renewable Energy, http://www.nyc.gov/html/planyc2030/html/plan/energy_renewable.shtml (last visited Oct. 14, 2009).

[2] CAL. GOV'T CODE § 65850.5 (1978).

[3] City of Berkeley, CA, Office of Energy and Sustainable Development, Residential Solar Photovoltaic Permit Guide, http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=37848 (last visited Oct. 14, 2009).

EF 16:
REMOVE LANDMARKS IMPEDIMENTS TO ALTERNATIVE ENERGY

New York City Landmarks Preservation Commission Rules
Proposal Developed by the Homes Committee

Summary

Issue:
In historic districts, rooftop equipment – including solar panels, wind turbines and micro-turbines -- is not permitted if visible from the street without a lengthy review by the Landmarks Preservation Commission.

Recommendation:
Treat alternative and distributed energy equipment the same as other rooftop mechanical equipment, which is allowed to be visible from the street.

Proposed Rule, Legislation or Study

Amendments to the Rules of the City of New York:

1. Amend the definition of "Mechanical Equipment" in Subdivision (a) of Section 2-19 of Title 63 as follows:

Mechanical equipment. "Mechanical equipment" shall include, but not be limited to, heating, venting and air conditioning equipment, <u>alternative or distributed energy equipment, such as solar panels, wind turbines, or micro-turbines,</u> watertanks and their supporting structures, satellite dishes, stair and elevator bulkheads, screens, dunnages, baffles and other accessory installations but shall not include telecommunication equipment and conventional television antennas. For the purpose of this rule, mechanical equipment shall also include unenclosed decks, garden trellises, or associated railings.

Supporting Information

Issue – Expanded
Alternative and distributed energy is considered an important part of the city and country's long-term plan to reduce greenhouse gas emissions.

Distributed (on site) generation, including cogeneration, solar photovoltaic and wind power, prevents transmission losses, offsets fossil fuel combustion, and increases grid reliability. Approximately 30% of the electricity created at power plants is lost during transmission to the point of use. Distributed generation prevents these losses, substantially reducing carbon emissions associated with electricity generation. Furthermore, distributed generation, especially solar photovoltaic, produces the most energy when the chances of a brown/black-out are highest – on hot days in the summer. Distributed generation will make the power grid more reliable and may ultimately reduce the need for grid upgrades. Similarly, solar thermal technology reduces the burning of fossil fuels. This technology uses the sun to heat water, replacing fossil fuels otherwise needed for heating and domestic hot water, improving local air quality and reducing carbon emissions.

When the Landmarks Preservation Council created its rules, alternative energy sources and distributed generation were not incorporated into buildings. As a result, the Commission did not make any provision for their use. These and other administrative barriers discourage the installation of distributed and alternative generation systems in New York City and drive up costs. Solar installations in New York City, for example, are approximately 1/3 more expensive than those in New Jersey and Long Island. Even with incentives from the state and federal government, New York City has only installed 1.1 MW of solar capacity.[1]

In comparison, mechanical equipment, such as cooling towers and water tanks, are permitted by the rules of the Landmarks Preservation Commission to be visible within certain parameters. This proposal would treat alternative and distributed energy equipment the same as mechanical equipment for the purposes of historic preservation.

Environmental & Health Benefits
New York City's Landmarks Districts are filled with vast acreage of residential buildings. This proposal will make it easier to get approvals for cogeneration, wind power, solar photovoltaic and solar thermal systems.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings
This proposal is an allowance and is not expected to have any impact on capital costs.

Precedents
There are no known precedents for this proposal.

LEED
This code revision may result in more projects implementing alternative energy solutions because it was previously more difficult to do so, due to visibility restrictions.

These solutions assist in achieving points for:

- LEED NC-EA cr. 2 Onsite Renewable Energy;
- LEED CI-SS cr.1 Option K. Onsite Renewable Energy;
- LEED EB-EA cr. 2.1-2.4 On-site and Off-Site Renewable Energy;
- LEED for Schools-EA cr.2 On-Site Renewable Energy;
- LEED ND (pilot program)-GCT cr. 13 On-Site Renewable Energy Sources;
- LEED for Retail NC (pilot program) EA cr.2 On-Site Renewable Energy; and
- LEED for Retail CI (pilot program) SS cr. 1 Option K. Onsite Renewable Energy.

LEED for Homes addresses renewable electric systems in EA cr.10, and solar hot water heating systems under EA cr. 7.3. A project receiving points for LEED for Homes EA 1 is not eligible for these credits, and vice versa.

Implementation & Market Availability

There are no known implementation issues for this proposal.

ENDNOTES:

[1] plaNYC, Energy Initiatives: Foster the Market for Renewable Energy, http://www.nyc.gov/html/planyc2030/html/plan/energy_renewable.shtml (last visited Oct. 14, 2009).

EF 17:
ALLOW USE OF BIOFUELS

New York City Mechanical Code
Proposal developed by the Materials & VOCs Committee

Summary

Issue:
Biofuels can create energy from waste, while reducing resource consumption and air pollution. However, they are not permitted under the Mechanical Code.

Recommendation:
Revise the definition of fuel oil to allow the use of alternative fuels.

Proposed Legislation, Rule or Study

Amendments to the New York City Mechanical Code:

1. Amend the definition of "FUEL OIL" and add the definitions of "BIODIESEL", "NON ESTER RENEWABLE DIESEL" and "NONPETROLEUM RENEWABLE RESOURCE" in Section 202 as follows:

BIODIESEL. Fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100, that meets the requirements of ASTM D 6751.

FUEL OIL. Kerosene, any hydrocarbon oil having a flash point not less than 100°F (38°C) or fuel comprised of biodiesel or non ester renewable diesel blended with petroleum heating oil in accordance with ASTM D 396.

NON ESTER RENEWABLE DIESEL. Fuel or fuel additive that meets all of the following criteria:

1. The registration requirements for fuels and fuel additives established by the United States Environmental Protection Agency under section 7545 of title 42 of the United States Code (Section 211 of the Clean Air Act).

2. Is not a mono-alkyl ester.

3. Is intended for use in engines that are designed to run on conventional, petroleum-derived diesel fuel.

4. Is derived from nonpetroleum renewable resources.

NONPETROLEUM RENEWABLE RESOURCE. Nonpetroleum renewable resources including, but not limited to, the following:

1. Plant oils;

2. Animal fats and animal wastes, including poultry fats and poultry wastes, and other waste materials; and

3. Municipal solid waste and sludges and oils derived from wastewater and the treatment of wastewater.

Supporting Information

Issue - Expanded
According to New York City's analysis of National Emissions Inventory data from the U.S. Environmental Protection Agency, heating oil is responsible for approximately 14% of local emissions of fine particulate matter (PM 2.5) and is a significant source of NOx, a precursor to smog. The burning of heating oil emits large quantities of particulate matter because of its high sulfur content – heating oil contains 2000-3000 parts per million of sulfur compared with 15 parts per million for on-road diesel. Because of heating oil and other sources, New York City does not comply with federal Clean Air Act standards for PM 2.5.

Particulate matter is made up of many compounds, most of which are highly toxic, but some sources of particulate matter are worse than others. PM 2.5 from residual heating oil tends to have high levels of nickel, vanadium and elemental carbon. Particulate matter and ozone are linked to respiratory problems, such as: irritation of the airways, coughing, or difficulty breathing; decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; heart attacks; and premature death in people with heart or lung disease. New York City asthma rates are consistently higher than elsewhere; 300,000 children in the City have been diagnosed with asthma and hospitalizations cost over $10,000 per visit and over $240 million a year. In addition, cardiovascular disease is the number one cause of death, killing over 22,000 New Yorkers a year.

The effect of heating oil on local air quality is exacerbated by the fact that the oil is burned in the midst of densely populated areas, creating high levels of exposure. Unlike diesel trucks or power plants, there are no commercially viable emission control devices for small and medium residential and commercial boilers. Cleaner fuel is the only control method.

Biodiesel is a liquid fuel produced from renewable, biological resources. In the United States, biodiesel is usually made from soybean oil or recycled restaurant grease. A blend of pure biodiesel with petroleum-based home heating oil known as “bioheat” can be substituted for heating fuel in domestic and commercial boilers with few or no modifications to the boiler. Bioheat contains less sulfur than conventional heating oil, decreasing harmful emissions while also improving fuel efficiency since lower sulfur content improves burner efficiency.

The Building Codes currently defines fuel oil as a hydrocarbon-based fuel. Since this definition does not include fuels derived from renewable sources, biofuels are not permitted for use as a heating fuel in New York City.

Environmental & Health Benefits

The combustion of fuel oil produces a significant amount of PM, NOx, and other pollutants. Indeed, recent research has found that communities with higher PM 2.5 content of nickel, vanadium, and elemental carbon and related sources have higher risk of hospitalizations associated with short term-exposure to PM 2.5[1], and that high nickel content is associated with the use of residual oil in New York City.[2]

Alternative fuels such as bioheating fuel generate fewer combustion emissions and thus improve air quality. Biodiesel blends have been shown to reduce the sulfur, carbon monoxide, and nitrous oxides content, leading to lower emissions in sulfur oxides, carbon emissions and particulate matter.[3] [4]

Common blends include B20 (a mixture of 20% biodiesel with 80% heating oil), B10 (a mixture of 10% biodiesel with 90% heating oil) and B5 (a mixture of 5% biodiesel with 95% heating oil). Biodiesel is sulfur-free and will therefore dilute the overall sulfur content of any heating fuel by displacing a percentage of the petroleum-based diesel in the blend. Studies show that, when compared with regular No. 2 or No. 6 petroleum fuel oil, bioheating fuel with even a low percentage of biodiesel achieves a significant decrease in emissions of particulate matter and sulfur oxide.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant positive health impact.

Cost & Savings

This proposal is not expected to have any significant impact on capital costs.

Precedents

There are no known precedents for this proposal. David Gardiner & Associates, LLC prepared a report for the Northeast Regional Biomass Program titled “Bioheat Laws, Regulations and Policies: Impediments and Solutions in the Northeast United States.”[5] This report provided summary and general overview of relevant laws, regulations and policies in the Northeast that posed obstacles to the distribution, use or sale of bioheating fuel. Their review of the NYC building code yielded the impediment cited above and is the impetus for this proposal.

LEED

There are no LEED credits affiliated with this proposal.

Implementation & Market Availability

There are no known implementation issues for this proposal. Bioheating oil is widely available and its use is widespread in some areas of New York City.

Notes

Extensive research has shown that operational concerns related to bioheating fuel are largely eliminated with the use of blends of B20 or lower.[6] Laboratory and field tests have demonstrated that B2, B5, B10 and B20 bioheating fuel can be used in almost every home or building without any additions or modifications to existing heating systems.[7, 8] In fact, results have demonstrated identical, if not improved, combustion performance with bioheating blends up to B30.[9]

As bioheating fuel has become more widely used, boiler manufacturers are responding positively. Given the track record of B20 and lower bioheating blends in unmodified No. 2 boilers, boiler manufacturer Beckett Corporation has issued a statement in support of the use of biodiesel blends up to B5 in Beckett burners without retrofits.[10] Other major manufacturers of oil, gas, residential and commercial burners such as Carlin Combustion Technology, Power Flame Incorporated, Riello Corporation of America, and Industrial Combustion, among others, have informally declared that the use of B5 bioheating fuel does not affect their product warranties because their testing has shown no adverse effects to the equipment and combustion.

Key definitions used in this recommendation were taken from the following federal regulations:

- "NON ESTER RENEWABLE DIESEL" from 40 CFR Part 80
- "NONPETROLEUM RENEWABLE RESOURCE" from 40 CFR 80.1101

ENDNOTES:

[1] *Michelle L. Bell et al., Hospital Admissions and Chemical Composition of Fine Particle Air Pollution, 179 Am. J. of Resp. and Critical Care Med., 1115-20 (2009), available at http://ajrccm.atsjournals.org/cgi/content/short/179/12/1115.*

[2] *Morton Lippmann et al., Seasonal and Spatial Distributions of Nickel in New York City Ambient Air, 19.6 Epidemiology (2008) available at http://journals.lww.com/epidem/Fulltext/2008/11001/Seasonal_and_Spatial_Distributions_of_Nickel_in.878.aspx.*

[3] *James F. Gennaro, Why a Bioheat Mandate?, Gotham Gazette, Apr. 21, 2008, available at http://www.gothamgazette.com/article/fea/20080421/202/2497.*

[4] *Harvard Green Campus Initiative, Bioheat Fact Sheet, http://green.harvard.edu/sites/default/files/attachments/renewables/bioheat-fact-sheet.pdf (last visited Oct. 14, 2009)*

[5] *David Gardiner & Associates, Bioheat Laws, Regulations and Policies: Impediments and Solutions in the Northeast United States (2007), http://www.dgardiner.com/doc/CONEG%202007%20Bioheat_Laws_Regs_Policies.pdf.*

[6] *C.R. Krishna with R.J. Albrecht, Brookhaven Natl. Lab., Biodiesel for Heating of Buildings in the United States (2008), http://www.bnl.gov/est/erd/biofuel/files/pdf/AlbrechtKrishnaPaper.pdf.*

[7] *C.R. Krishna with R.J. Albrecht, Natl. Renewable Energy Lab., Biodiesel Blends in Space Heating Equipment (2004), http://www.nrel.gov/docs/fy04osti/33579.pdf.*

[8] *State of Vermont Department of Buildings and General Services, Vermont Biodiesel Pilot Project: Emissions Testing of Biodiesel Blends with No. 6 Fuel Oil at the Waterbury State Office Complex (2006), http://vsjf.org/biofuels/documents/BGS_EmissionsReportFinal.pdf.*

[9] *C.R. Krishna with R.J. Albrecht, Brookhaven Natl. Lab., Biodiesel for Heating of Buildings in the United States (2008), http://www.bnl.gov/est/erd/biofuel/files/pdf/AlbrechtKrishnaPaper.pdf.*

[10] *R.W. Beckett Corporation, Beckett Burners BioHeat® Ready!, www.beckettcorp.com/protect/techsuppt/.../BioHeat_Questions.pdf, (last visited Jan. 28, 2010).*