Green Renaissance

GUIDE TO HEALTHY, SUSTAINABLE URBAN DEVELOPMENT: A VIEW FROM HARLEM

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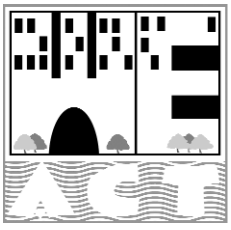

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WE ACT for Environmental Justice mission
WE ACT for Environmental Justice is a non-profit, community-based, environmental justice organization dedicated to building community power to fight environmental racism and improve environmental health, protection and policy in communities of color. WE ACT accomplishes its mission through community organizing, education and training, advocacy and research, and public policy development. Since 1988, WE ACT has informed, educated, trained and mobilized the predominately African-American and Latino residents of Northern Manhattan on issues that impact their quality of life—air, water and indoor pollution, toxins, land use and open space, waterfront development and usage, sanitation, transportation, historic preservation, regulatory enforcement, and citizen participation in public policy making.

Environmental Defense mission
Environmental Defense is dedicated to protecting the environmental rights of all people, including the right to clean air, clean water, healthy food and flourishing ecosystems. Guided by science, we work to create practical solutions that win lasting political, economic and social support because they are nonpartisan, cost-effective and fair.

Cover images: Left, the Apollo Theater on 125th Street in Harlem (Anhthu Hoang for WE ACT). Right, 1400 on Fifth in Harlem (Posro Media).

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The complete report is available online at www.environmentaldefense.org/greenbuildingharlem.

Executive summary

"Steps taken to green a site can yield valuable benefits for developers, from early and strong community support, to substantial savings on energy, water and waste disposal costs."

The way that buildings are built is often just as important as the fact that they have been built at all. How can entrepreneurs, community leaders and government policy leaders ensure not just that investment comes to urban neighborhoods but that it in fact contributes to a healthier and more sustainable environment?

In this report, WE ACT for Environmental Justice and Environmental Defense have come together to point the way toward true partnerships between developers and communities, so that urban redevelopment is healthy and sustainable. We do so through the lens of New York City and Harlem's 125th Street corridor, where new investment is spurring rapid change. This document presents a fresh vision for community development—one that brings investors and communities together in order to focus the best of local knowledge, environmental design, technologies, and ideas on creating a sustainable future.

Urban renewal policies often seek to spur investment in city neighborhoods, for example, with tax breaks, financial incentives, and business-friendly zoning changes. New York City, in particular, also offers economic incentives for projects that clean up brownfields, generate housing, or attract commercial investment. At the community level, development rarely arrives without controversy. Residents and community members often see new construction projects as a change to a neighborhood's unique ecology—in some ways the same and in some ways different from so-called "greenfield" development. Like any place, urban sites have essential connections with the natural world, from the use of water and energy to effects on clean air and natural features like rivers and wildlife migration patterns. But urban neighborhoods, especially one as historic as Harlem, are also rooted in the powerful concept of "human habitat." That is, a community's sense of place is interwoven with its rich history and culture, its transportation patterns, and its facilities for health and recreation.

How well buildings respond to their human context is tremendously important to health and ecology at many scales. It is also increasingly important to the bottom line. Steps taken to "green" a site can yield valuable benefits for developers, from early and strong community support, to substantial savings on energy,

Part 1 outlines environmental and health problems facing Harlem and describes the key challenges new developments pose for the neighborhood.

Part 2 is a short summary of recent precedents for successful developer-community partnerships through collaborative efforts (such as Community Benefits Agreements).

Part 3 outlines measures developers can take to address these challenges in Harlem and provides several real-world examples of how developers in New York City and elsewhere are raising the bar with projects that perform well for the environment and the bottom line.

Appendix A describes the current policy landscape for developers and provides details on federal, state and local incentives to build green in New York City.

Appendix B lists internet resources with additional information.

water and waste disposal costs. Around the country, developers are pioneering projects of all scales that are taking advantage of local knowledge and boosting environmental performance. These projects are forging a new path toward urban redevelopment that cuts diesel pollution, reduces the need for more power plants, reduces greenhouse gas emissions, saves drinking water, reduces run-off to rivers—and improves worker productivity and investment returns.

Successful efforts of developers working in win-win collaborations with communities should become the standard practice in urban economic development. For example, in Los Angeles, community leaders and project developers avoided clashing over a stadium expansion and a new airport expansion by coming together in open and frank negotiations that yielded significant project improvements and addressed local needs. Importantly, the dialogue began early on in the projects' planning stages so that community-specific mitigations could be integrated from the ground up, rather than as add-ons that could interfere with costs or design feasibility.

"Harlem residents and workers are largely still missing out on the green revolution that is taking place elsewhere."

In this report, we describe a number of different projects in and around New York City that have achieved positive environmental gains while yielding substantial economic benefits for their developers. The projects showcased in this report are relatively new residential and commercial buildings that have reduced energy use on average by 40 to 50% through efficiency improvements and cost-effective clean energy sources. Buildings have reduced water consumption up to 50%, and improved indoor air quality for occupants through high efficiency air filter systems that remove 85% of particulate matter. Some developments have achieved these environmental milestones while also generating millions of dollars per year in energy-related cost savings, and, in the case of Harlem's first "green" condo at 1400 on Fifth, achieving quality housing that is on par with other affordable housing projects in the city.

In Harlem, investment in real estate has been booming. Over one million square feet of space have either already been redeveloped or secured the required approvals for redevelopment. Thus far, however, residents and workers are largely still missing out on the green revolution that is taking place elsewhere. At the same time, Harlem continues to suffer from severe environmental challenges—traffic congestion chokes local streets, and trucks, buses and their associated facilities create diesel pollution "hot spots." Harlem has some of the nation's highest childhood asthma prevalence, hospitalization and morbidity rates. Obesity and diabetes rates are climbing because residents lack facilities that would promote exercise and healthy lifestyles such as open, green spaces and waterfront access. Rising heat levels from climate change can create disincentives for engaging in outdoor activities and threaten to bring more smog and thus additional health threats to people with respiratory illnesses. Finally, runoff from city streets burdens the neighborhood's sewers and waterways.

This document shows how urban investment can spark environmental improvement, in large part by responding thoughtfully and creatively to local, regional and even global environmental conditions. Rooted in Harlem's experience, it uses that community as a context for illustrating how development can be part of the solution for health and environmental stewardship. Drawing on specific real-world examples like

community benefit agreements, it demonstrates how partnership and dialogue between developers and community leaders can break the cycle of litigation that often mires projects in delay. Green building examples from around New York City and the country demonstrate how project designs that are sensitive to the local and environmental context deliver results for ecology and economy. The appendices give examples of incentives available to speed projects in this direction.

WE ACT and Environmental Defense offer this guide as a starting point for dialogue—an invitation to community leaders and developers to join in forging healthy, sustainable cities.

PART 1

Harlem's golden opportunity: Development as a catalyst for environmental stewardship

Until the mid-19th century, Harlem consisted primarily of sparsely settled farmland. The arrival of elevated subway trains in 1872 spurred a boom in residential development throughout northern Manhattan. In Harlem, the explosion in density helped lure private investment to the neighborhood's emerging commercial center. By the early parts of the 20th century, the convergence of Southern- and foreign-born (of African descent) black literary, musical and visual artists had created the Harlem Renaissance, the cultural movement that fundamentally changed modern African American, indeed American, life. Although Harlem has been populated by laborers of African descent since colonial times, the Great Migration (ca. 1890) touched off large waves of black immigration that has resulted in the African-Americans making up 48% of Harlem's population (according to the most recent data).[1] Then, as now, 125th Street served as the heart of entertainment and business activity in the community.

The Harlem Renaissance ended with the Great Depression, and the ensuing years were marked by rapid urban decline. Fewer visitors were attracted to the 125th Street area from the 1960s to 1980s because of the closing of the famed Apollo Theatre, Hotel Theresa, and many restaurants and department stores. Poverty, high crime rates, derelict buildings and drugs fundamentally reshaped the community. As recently as the mid-1980s, the city government owned 60% of the land in Harlem, and half of it was vacant.[2] Through the efforts of many public officials, such as Congressman Charles Rangel and other community advocates, government incentives and loans were set up to stimulate new investment and revitalize the area. Since 1996, the Upper Manhattan Empowerment Zone has financed or leveraged $829 million in loans to businesses in the zone.[3] Meanwhile, New York City's real estate market has grown hotter over the past decade, luring residential and commercial buyers

Seventh Avenue and 125th Street, circa 1948.

BROWN BROTHERS

to Harlem neighborhoods in search of better deals.

Today, Harlem is in the midst of another renaissance. Stimulated in part by government incentives, private capital is energizing the neighborhood's housing stock. Increasing numbers of tourists flock to the more than 700 historic landmarks that line Harlem's streets.[4] These forces create more demand for a central business district in the community, and there is strong grassroots support for revitalizing Harlem. Community-based groups and residents pushed the Department of City Planning to undertake the "River to River Study," which envisions 125th Street as a regional business district,[5] and the Bloomberg administration has made it a goal to redevelop the area as both a nighttime and daytime destination.[6]

Yet, despite all this positive change, Harlem is still menaced by severe environmental troubles, from traffic congestion that chokes the corridor's streets, to air pollution "hot spots" from diesel trucks, buses and polluting facilities that trigger asthma attacks in the neighborhood with some of the city's highest childhood asthma hospitalization rates. There is a lack of open green space and limited access to the waterfront. Runoff from city streets burdens the sewers and the grand waterways that flow past the area. Too few trees line the streets. Rising heat levels from global warming could increase smog and further threaten the health of people with respiratory illnesses.

The challenge Harlem faces is clear: Will all of this investment in the 125th Street corridor help solve the neighborhood's health and environmental problems, or will it exacerbate them? The answer depends on the degree to which new developments are planned to be environmentally friendly, from the design to the operating phase. Developments that are built to be green by reducing air emissions, providing open spaces and reducing water runoff and waste, among other things, can help make Harlem's environment a showcase for progress.

The North River Sewage Treatment Plant, on the Hudson River, is among Harlem's many environmental burdens. Its development included a state park on the roof which is now one of the most visited in the state park system.

Many of these measures are also good for a project's bottom line and yield additional benefits, such as enhanced worker productivity and community support.

The Harlem health story

Recent studies suggest significant links between the built environment and people's health.[8] Residents of densely developed urban neighborhoods like Harlem face a range of environmental risks both indoors and outdoors. Building characteristics, land-use patterns, transportation choices and urban-design decisions present opportunities and barriers to minimizing these risks. Air pollution, outdoor recreation, the heat island effect-all of these and more are influenced by what is built and how.

"Time with health-care providers is usually less than .05% of each person's 6,000 waking hours per year. The rest of the time, lives, health and behavior are in many ways shaped by the built environment—homes, commercial buildings, and neighborhoods."

Richard Jackson, M.D., Senior Advisor to the Director, Centers for Disease Control and Prevention[7]

CONGESTED CORRIDOR

Along the 125th Street corridor, Harlem residents must contend with heavy traffic congestion. Congestion here is among the city's worst: According to a recent Department of Transportation study, the corridor is congested for most of the day, and provides especially poor levels of service during peak times.[9] Out of the 38 Harlem intersections examined in the study, almost half have large delays and several are overcapacity.[10] Traffic flow is especially hampered by obstructions, truck deliveries and bus operations.[11] The transfer of goods from illegally parked delivery trucks impedes mobility and causes serious delays. Backups of buses at stops—due in part to traffic congestion—stifle flow and block lanes.

The 125th Street corridor can be a challenging place to walk, cross the street, or shop. Very little of the street space is devoted to pedestrians, and foot traffic overcrowds the small sidewalks. Construction scaffolding also competes with pedestrians for sidewalk space. Sidewalk congestion is not only a nuisance, it is also a safety hazard. The crowded sidewalks force pedestrians to spill into the street. Partly as a result of this, there were 14 pedestrian fatalities and 1,554 pedestrian injuries in Harlem from 1995–2001.[12] In fact, the mid-block section of 125th Street between Amsterdam Avenue and Old Broadway has the fourth-highest number of

NEW YORK CITY DEPARTMENT OF CITY PLANNING

Harlem regularly experiences heavy traffic congestion.

pedestrian injuries of any mid-block location in Manhattan.[13]

AIR POLLUTION

Harlem's extreme congestion means that the air is increasingly clogged with tailpipe pollutants. Diesel exhaust emitted by mobile sources (e.g., cars, trucks and buses) is of special concern to Harlem residents. Diesel particulate matter, for instance, is linked to premature mortality in people with pre-existing heart disease[14] (and heart disease is the leading cause of death in Harlem[15]). Air pollution from traffic is also linked to many other diseases, including asthma and cancer.

Particulate matter and other tailpipe pollutants are known asthma triggers. One study of Central Harlem has shown that as many as 25% of school-age children have been diagnosed with asthma, making them especially sensitive to air pollutants.[16] This is one of the highest asthma rates in the nation, and is well over the national average rate of 8.3%.[17] East Harlem leads the nation in asthma hospitalizations, with a rate three times higher than that for all of New York City.[18] (Figure 1 shows the concentration of asthma hospitalizations in Northern Manhattan.)

The people most affected by motor vehicle pollution are those living near congested roadways, where traffic can create highly concentrated pollution "hotspots." A critical mass of recent health studies have found increased health risks in a zone extending 500 to 1500 feet around heavily trafficked roads, depending on the health impact and pollutant.[19] For example, a study from the Keck School of Medicine at the University of Southern California found that children living near highways have a higher asthma risk, with an 89% increase in risk for every three-quarters of a mile closer to a highway children live.[20] Studies conducted by the U.S. EPA in Northern Manhattan in 1996 documented the presence of air pollution hotspots in Harlem, some of which exceeded EPA air quality standards by almost 200%.[21] Exposures to pollutants at hotspots can be much higher than those found using far-flung monitors and large-scale air quality models.[22]

Exposure to tailpipe pollutants also increases the risk of cancer. Mobile sources contribute 96% of the cancer

One of many construction sites in Harlem. Development means more construction and more construction equipment.

ANHTHU HOANG FOR WE ACT

risk from air pollution in Manhattan, with diesel emissions making the largest contribution.[23] A study of Erie and Niagara Counties in New York found a correlation between greater exposures to traffic emissions and the risk of breast cancer.[24] While the evidence is mixed, some studies identify a link between childhood leukemia and living near major roadways.[25] A Stockholm study found that the risk of lung cancer increased by 40% for people with the greatest exposure to nitrogen dioxide emitted from traffic.[26]

FIGURE 1

Asthma in Harlem: Polluting facilities and asthma hospitalization rates in Northern Manhattan

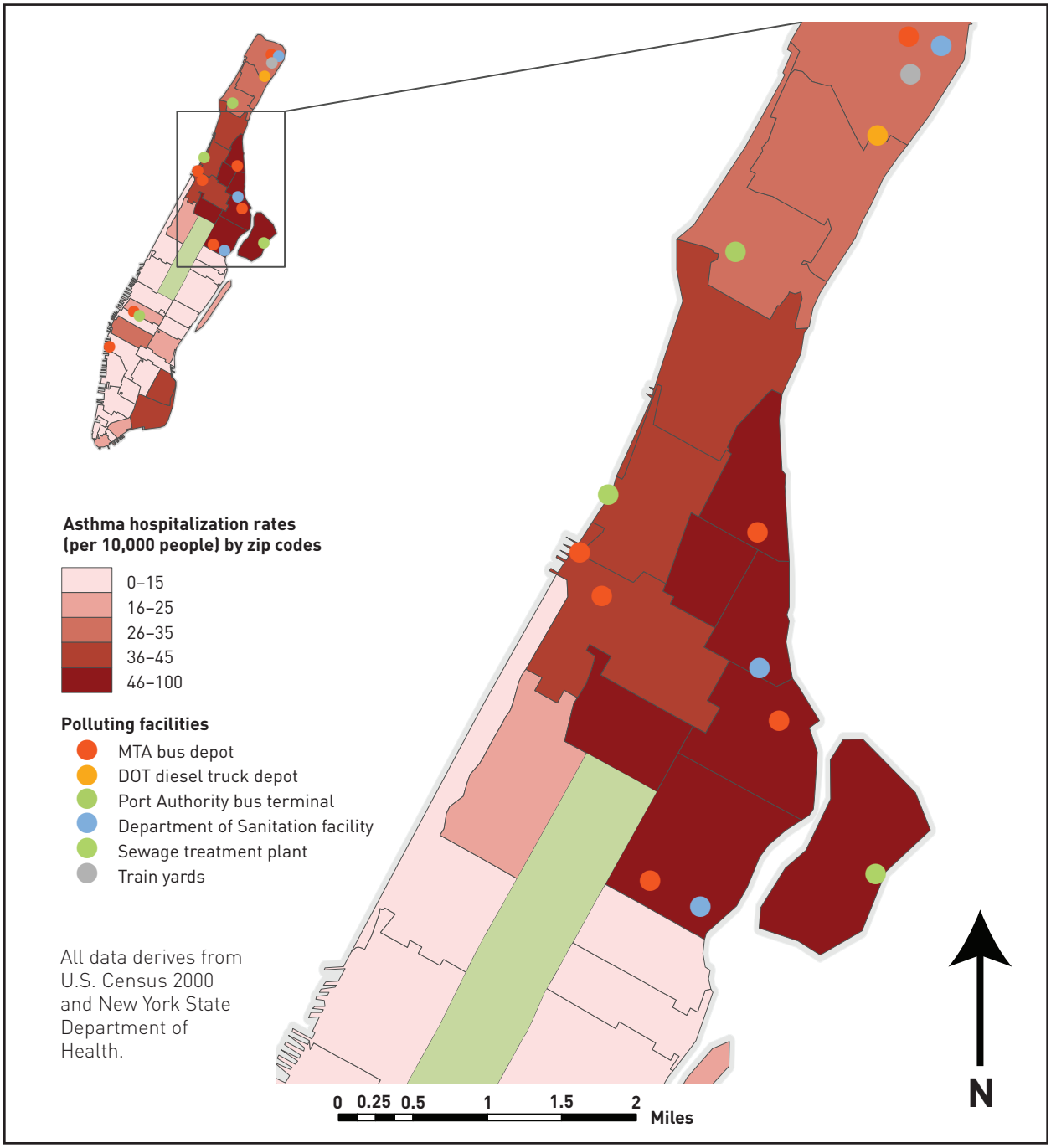

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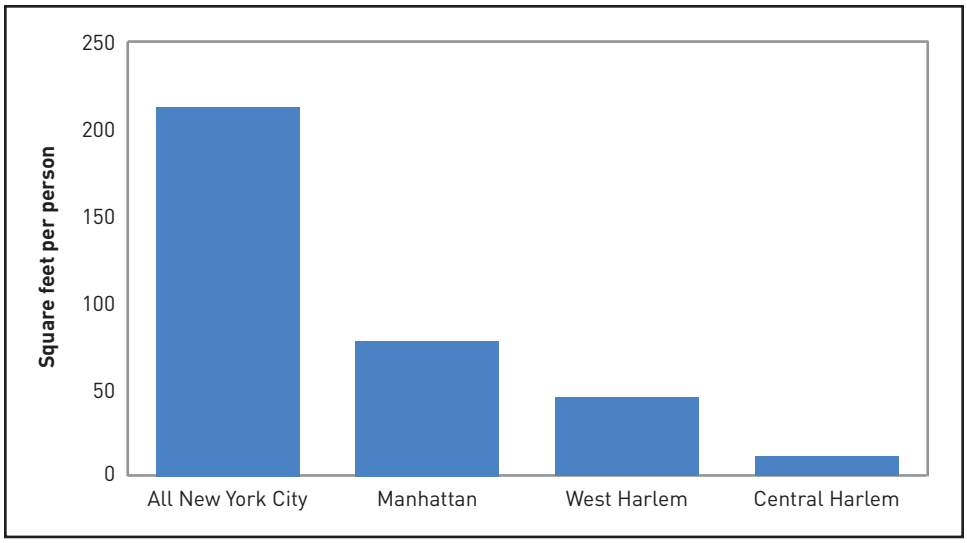
FIGURE 2

Open space per person in New York City and Harlem



SOURCE: NEW YORK CITY DEPARTMENT OF PLANNING

Diesel exhaust concentrations in Harlem are influenced by vehicular traffic as well as by point sources such as bus depots, where large numbers of diesel vehicles congregate.[27] In fact, six of the seven bus depots in Manhattan are located in Harlem. The quality of air in Harlem is further burdened by pollution from industrial facilities (such as auto shops[28]), truck routes and major highways,[29] and two sewage treatment plants that border Harlem on each riverside.

In addition to these permanent sources, transient construction activities are also a large contributor to pollution in Harlem. As discussed in the next section, an enormous amount of development is planned for Harlem over the next decade. This construction will bring in large numbers of off-road diesel vehicles, which are among the dirtiest mobile sources of air pollution.

All of these sources contribute to poor indoor air quality in Harlem buildings, because ventilation systems without good filters allow polluted outdoor air to migrate and concentrate inside. Poor indoor air quality from mold, pests, pesticides and secondhand smoke also contributes to the precarious state of health in the community.

LIMITED AVAILABILITY AND ACCESS TO OPEN SPACE

Maintaining a healthy lifestyle through physical activity is particularly difficult for Harlem residents who have inadequate access to clean, safe parks and other open spaces. As Figure 2 demonstrates, West and Central Harlem have just one quarter of the amount of open space per person that Manhattan has overall.[30] Availability and access to open space has a profound influence on levels of physical activity, and Harlem is a prime example of this. More than one in four adults in Central Harlem do not exercise,[31] the health consequences of which are magnified by the lack of healthy food choices and abundance of fast-food outlets in the area. This contributes to high obesity and diabetes rates (25% and 9% respectively for West and Central Harlem) and poor cardiovascular health.[32] Constructing the built environment with an eye toward providing open space and recreational facilities would greatly increase opportunities for physical activity in Harlem.[33]

The challenge

The 125th Street corridor abounds with new and proposed investment. For example, the Pathmark SuperCenter, built in 1999 and anchored at 125th Street and Lexington Avenue, was one of the first major investments in the growing process of Harlem's revitalization.[34] Just ten months later, Grid Properties cut the ribbon on an ambitious 275,000-square-foot retail and entertainment complex known as Harlem USA, which includes a movie theater developed by former basketball star "Magic" Johnson's company.[35] In 2002, Abyssinian Development Corporation partnered with Forest City Ratner to develop the 126,000-square-foot Harlem Center—Harlem's first commercial office space facility. And in 2006, Harlem Auto Mall, the largest car dealership and repair shop in the city, opened at East 127th.[36]

This activity has successfully captured tax revenues and attracted jobs to the

FIGURE 3

Recent and proposed development in Harlem

MONICA BANSAL FOR ENVIRONMENTAL DEFENSE

community. As an example, Harlem USA facilitated employment opportunities for 370 Harlem residents.[37] The opening of the Pathmark SuperCenter added 275 jobs, 75% of which are held by local residents.[38] But these developments have also brought more truck traffic and construction machinery to the area, worsening congestion and pollution in the community. Projects totaling over one million square feet of space have either already been redeveloped or secured the required approvals for redevelopment.[39] Figure 3 shows the extent of the recent and proposed development in the area.

Harlem, and 125th Street in particular, is currently the second-most-visited area in New York City. Anticipated development projects on 125th Street are likely to spur this trend even further. In particular, with its 17-acre campus expansion plan, Columbia University is assembling one of the largest development projects in the city. The new campus would span from 125th Street to 133rd Street, and from Broadway to Twelfth Avenue.[40] The campus expansion plan is expected to bring 10 years or more of continuous construction to the Manhattanville area in the first phase of the project, and an additional 15 to 20 years of construction in the later phases of the project.[41]

How can this next wave of investment be harnessed to protect the environment and improve the health of Harlem residents? The answer depends on how new projects are designed and how those designs are realized.[42] Poorly designed developments could exacerbate existing problems, leading to more pollution and negative health outcomes. On the other hand, well-designed developments—planned in partnership with the community—can harness millions of dollars in private investment to enhance the environment and public health and bring new employment opportunities for Harlem residents.

PART 2

The process for good development

Federal, state and local New York City laws regulate, to some degree, the impacts of new development. Such laws may prohibit an environmental impact, may require mitigation, may require disclosure, or may ignore the impact. Disputes about whether studies have been adequately undertaken and impacts mitigated can take a long time to resolve and often involve costly litigation.

Across the country, less litigious models are evolving. These models show that active partnership with the community can yield environmental improvements, win public support and faster and smoother project approvals, and can identify the specific environmental improvements of greatest concern to the local community.

For example, community benefits agreements are emerging as a powerful way to integrate environmental issues and community concerns into project design. A community benefits agreement (CBA) is a mutually enforceable contract signed by developers and community leaders that contains commitments to improve a project's environmental performance and win local support. In a CBA, developers agree to mitigate a project's impact, for example, by using clean diesel technologies in construction equipment, incorporating access to green space in their designs, shifting truck routes and deliveries in ways that address specific local concerns, taking steps to cut traffic generated by the project, reducing run-off, improving energy efficiency and ensuring open communication as the project moves ahead. In return, community groups agree to support the development as it travels along the cumbersome road of political endorsements, government permits and subsidies. Additionally, community groups pledge not to impede the development with lawsuits if the developer lives up to its end of the agreement.

In Harlem, where large-scale developments are often seen as a potential threat to the local environment, a CBA would provide a developer with the opportunity to build trust within the community. Developers can also be responsible neighbors and set an example for New York City by promoting developments that protect health and improve the environment.

While this document focuses on environmental benefits, CBAs can include a wide range of commitments, such as:

- Environmental improvements
- Job creation and training for local residents
- Educational programs and training
- Community facilities and programs
- Affordable housing
- Historic preservation.[43]

Community benefits agreements

Two CBAs attracted national attention in the last few years, providing important lessons for the future.

▶EXAMPLE: THE STAPLES CENTER EXPANSION

In May 2001, a coalition of 29 community groups, five labor unions and hundreds of residents negotiated a CBA covering the proposed expansion of the Staples Center stadium and convention complex in the heart of Los Angeles.

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The plan for the Los Angeles Staples Center included a ground-breaking community benefits agreement.

The developer's plan included residences, a theater, a hotel, an addition to the current convention center and retail areas—all in the heart of one of the poorest communities in Los Angeles. Over the course of several months, developers, government leaders and community representatives came together around a negotiating table to address local concerns about the project. In the final CBA, the developers agreed to use green designs for their buildings, shift truck routes, assess and invest in local parks, include environmentally and socially conscious specifications in their contracts and leases, create affordable housing, train local residents for jobs related to the project and maintain clear communications with local groups. The local groups committed their support to the project as a whole, promising to speak in support at key public hearings before the city council and other decision-making bodies.[44]

▶EXAMPLE: LOS ANGELES INTERNATIONAL AIRPORT EXPANSION

In 2004, in the largest CBA to date, Los Angeles International Airport (LAX) reached a $500-million agreement with a broad coalition of local groups to mitigate environmental and other impacts from a proposed expansion of the LAX airport. A coalition of 22 groups, including environmental, community, labor and religious organizations, negotiated with developers for over ten months. The final CBA has three hallmarks. First, the LAX CBA includes studies of the environmental and health impacts that will result from the airport expansion.[45] Second, the CBA provides for environmental mitigation measures such as retrofitting diesel construction and operations equipment, electrifying airplane gates in order to avoid jet engine idling, using green building principles and clean energy sources, and taking steps to minimize noise, air pollution and traffic generated by airport users. Third, the CBA requires the developer to provide local employment, and to soundproof nearby schools and residences affected by increased air traffic.

Across the country, CBAs have also helped foster stronger relationships between large research universi-

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Planes fly over a school located near the Los Angeles International Airport. The LAX CBA included soundproofing for nearby schools.

ties and their neighboring communities. In 2003, Harvard University agreed to build 50 units of affordable housing, give $20 million to nonprofit organizations that work to build affordable housing, provide open space, implement traffic reduction measures and increase mass transit in a CBA for its 48-acre expansion.[46] Similar agreements have been negotiated by the University of Pennsylvania (see Part 3, "Public and open space") and Temple University as part of their expansion plans.

PART 3

Rebuilding to address community needs: Some real-world examples

When developers deliver projects that address community and environmental needs, they often find benefits not only for the environment, but also for their bottom line, from cost savings to more efficient project approval processes. For example, green building techniques increase worker productivity, reduce energy use and encourage longer tenant occupancies.[47] Similarly, investing in open space initiatives can increase property values, improve neighborhood safety and facilitate community support of project proposals.

The environmental needs in Harlem's 125th Street corridor are acute. This section provides examples of what developers and tenants can do to address the most critical of those needs, as outlined earlier. Success stories are presented for a diverse range of issues, from open space and energy use to air quality and waste reduction. The common theme among these examples is that private sector leadership and neighborhood support can deliver quality redevelopment in ways that protect the environment, the community and the long-term interests of financial stakeholders. Each subsection introduces a topic, highlights a real-world case study and offers additional ideas on achieving greener and more responsible development.

Energy efficiency and clean sources of electricity

Nationally, the building sector accounts for over 34% of total greenhouse gas emissions, mainly as a result of the energy used to power building systems, appliances and other electrical demands. In comparison, energy use in buildings accounts for 79% of greenhouse gas emissions in New York City.[50] Peak energy demand in New York in the

LEED

The Leadership in Energy and Environmental Design (LEED) system is a tool to help design teams and owners determine environmental goals for a project, measure progress toward those goals, and document success in achieving them. LEED is administered by the U.S. Green Building Council, whose diverse membership includes architects, manufacturers, contractors, builders, engineers, energy service companies, trade associations, designers, nonprofit organizations and local governments. LEED focuses on integrative and whole-building design, incorporating site design and the construction process as well as architectural elements. Ratings range from Certified to Platinum and are determined using a point system which depends on the type of project (such as new construction, existing building or commercial interior). Points are awarded in five categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources and indoor environmental quality. Projects can also get "innovation credits." LEED certification is attractive for reasons ranging from marketing benefits and exposure, to qualification for state and local incentives and tax credits. The U.S. Green Building Council website (http://www.usgbc.org/) provides a broad array of information about product developments and industry research.[48]

summer—due to air-conditioning needs—places extraordinary stress on the energy grid, leading to energy shortages and blackouts in some neighborhoods.

Energy efficient measures are advantageous for builders because they deliver immediate and long-term financial rewards along with environmental benefits. Even builders who intend to sell can benefit, because energy efficient buildings command a higher premium on the real estate market. A number of studies have attempted to quantify the financial benefits and costs of constructing energy-efficient buildings.[51] According to a study of 33 LEED-certified projects in the United States, green buildings are on average 28% more efficient than conventional buildings and generate 2% of their power on-site from photovoltaics.[52] Outside of that particular study, hundreds of buildings have cut energy use by more than 25%.[53] And green buildings that have reduced energy consumption by 40% or more are increasingly commonplace.

For example, the National Audubon Society in Manhattan's Greenwich Village, a successful daylighting strategy decreased the National Audubon Society headquarters' reliance on electric lighting by 75%, reducing electricity bills by $60,000 per year, and overall energy consumption by 66% (when compared with a conventional New York City code-compliant office building). The project invested $430,000 in energy-efficient and environmentally sensitive products designed to have a five-year payback. Incentives from utility companies further reduced the expected payback to three years.[54]

Similarly, in Manhattan's South Street Seaport Historic District, ten geothermal wells, energy star appliances, low-e insulating glass (which reflects heat instead of absorbing it) and programmable thermostats produce an estimated annual energy savings of $29,900. The incremental capital cost ($219,100) of investing in energy-efficiency measures was reduced by 70% to $65,730 through incentives provided by the New York State Energy Research and Development Authority (NYSERDA).[55]

> Energy-efficiency retrofits for existing buildings and new buildings designed for energy-efficient performance have high economic returns. Typical lighting retrofits that take advantage of natural light have a three-year payback. The same retrofit may also cut energy use by 50 cents or more per square foot.[49]

The Ridgehaven office building in San Diego also cut its energy consumption, in this case by 70%, saving $80,000 a year, using a low-bid contractor. Utility financing of the efficiency improvements turned a three-year payback into an instantaneous payback.[56]

Assuming an electricity price of $0.08/kilowatt-hour, the financial benefit of reducing power consumption by 30% is about $0.30/square foot/year, with a 20-year net present value of close to $6 per square foot.[57] In comparison, the average incremental cost associated with building green is $3 to $5 per square foot.[58] Thus, energy savings alone can exceed the average increased capital cost associated with building green. The availability of government incentive funds and tax credits can reduce capital costs even further. (Incentive and tax credit programs available in New York are listed in Appendix A at the end of this report.)

Property developers and owners who pursue energy-efficient strategies can save in the capital budgeting

The Ridgehaven office building in San Diego.

CITY OF SAN DIEGO ENVIRONMENTAL SERVICES DEPARTMENT

phase of a project, not just the operating phase. For example, investing in high-performance building components—like advanced glazings, daylighting devices, better lighting, raised floors and more efficient mechanicals—can provide opportunities for downsizing or eliminating other building elements. In Chicago, designers renovating a typical glassed-in skyscraper with 200,000 square feet of office space determined that state-of-the-art windows, increased daylighting and efficient lights and appliances would reduce the building's cooling load by 85%. Consequently, the original cooling system could be replaced by new, advanced equipment that is three-fourths smaller, four times more efficient, and $200,000 cheaper. This reduced the annual energy bill by 75%, or by $1.10 per square foot per year. The savings from this change were used to subsidize other improvements.[59]

The following two examples provide a look at new developments that embraced holistic solutions to create energy-efficient, integrated designs with exceptional environmental and economic performance.

▶EXAMPLE: THE CONDÉ NAST BUILDING AT 4 TIMES SQUARE

The Condé Nast Building at 4 Times Square is a large-scale and successful model of the greening of an existing building. The building is mixed use, with 47 stories of office space and ground floor commercial space, and was delivered at market cost with a core and shell price of $125 per square foot. One of the building's green hallmarks is its integration of alternative energy sources and its energy efficient lighting, cooling and heating systems. According to the developer, the building achieves a 40% energy reduction over similar buildings subject to the New York State code, and saves $1.76 million through reducing energy use by almost 21 million kilowatts per year. This level of energy efficiency means the building avoids emitting the equivalent of over 9,000 tons of CO_2 each year.[60]

The designers of 4 Times Square explored on-site power generation. This avoids the tremendous generation and transmission losses of centralized power production, since 42% of all energy produced in the U.S. is lost as waste heat in combustion and transmission. Possi-

ble sources of onsite generation, including wind turbines, gas turbines, fuel cells and photovoltaic (PV) panels were all assessed for feasibility. Although PV panels are often viewed as being prohibitively expensive, the developer was able to markedly reduce the payback period by substituting PV panels for spandrel panels (between stories) on the building's façade. PV panels integrated into the building façade can supply up to 15 kilowatts (kW) of supplemental power. Future PV panels may generate even greater savings, with the potential to generate 5–10% of the building's energy needs. Alternative energy sources also meet 100% of the building's nighttime electrical demand, through two 200-kW fuel cells, which chemically react natural gas for power generation. Fuel cell usage provides a clean energy source, since it requires no combustion and emits hot water and carbon dioxide as the only waste products. The system closes the energy loop by using the hot water to help heat the building during winter and to help generate hot water for domestic uses.[61]

The Condé Nast building at 4 Times Square.

DAVID SUNDBERG/ESTO

Efficient lighting design was also used to reduce energy use in 4 Times Square. Lighting controls are installed in public spaces, the building has highly efficiency LED (light emitting diode) exit signs, and there are occupancy sensors in unoccupied areas, such as stairwells. Daylighting limits the usage of artificial lighting. High-performance window glazing allows light in around the building's perimeter, while keeping solar heat and ultraviolet rays out. Not only does this glazing reduce the cooling load during the summer, but it also decreases heat loss in the winter.

Further measures were adopted to conserve energy when heating and coolingthe building. The building's absorption chillers/heaters, which supply cold/hot water to cool/heat the building, are powered by natural gas and therefore do not use ozone-depleting CFCs (chlorofluorocarbons). The system includes units of different sizes that can be used alone or in combination to exactly match the building's requirements at any given time. The designers also made an effort to avoid wasteful energy usage. Therefore, individual floor-by-floor fan units only operate when spaces are occupied. All mechanical systems are programmed to operate precisely at their most efficient specification in order to prolong equipment life and limit energy usage.[62]

EXAMPLE: THE SOLAIRE

The Solaire, a 27-story, 293-unit residential tower in Battery Park City, is one of the country's first green apartment buildings. The primary building components and site plan were all dictated by the Battery Park City guidelines—a set of design criteria adopted to guide the development of commercial, residential and public space on 92 acres of New York City waterfront land. The incorporation of high-performance casement windows, efficient mechanicals and better lighting design allowed for the inclusion of a more efficient gas-based chiller system and energy-conserving fixtures. In addition, the use of 3,400 square feet of photovoltaic panels to capture unobstructed sun exposure to the west generates 5% of the building's energy at peak loading. According to the developer, the Solaire uses 35% less energy than a similar building designed to New York State code requirements, and 65% less electricity during peak demand periods.[63]

The Solaire in Battery Park City.

ROBIN HOLLAND PHOTOGRAPHY

The Solaire was built with the developer as the intended long-term owner and operator. This financial structure allowed investors to adopt a whole-system costing approach. Whole-system costing refers to setting a budget for the completed building as a whole, allowing some costs to be higher than conventional costs but factoring in savings generated from other capital and operating costs.[64] Some technologies used in the building had higher than normal capital costs that often preclude their usage. However, those green components have significantly lower operating costs that reduce the payback period to just a few years. For example, both the $375,000 photovoltaic and the $125,000 lighting control systems have estimated after-tax payback periods of four years.[65]

The developer also took advantage of a suite of public incentives aimed at improving overall energy efficiency. The project qualified for the New York State Green Buildings Tax Credit program (see Appendix A), which enabled the developer to save $2,800,000 over a five-year period. NYSERDA also provided several grants and incentives to fund many green aspects of the project. Under NYSERDA's New Construction Program the project obtained grants for $100,000 for LEED design assistance and energy modeling and $319,080 for mortgages that reduce electricity use. The project was also able to incorporate PV panels into the plans with an addi-

"Investing in high-performance building components that could facilitate a 1% gain in productivity can bring a financial benefit that is even greater than energy savings, since personnel costs are generally more than 100 times energy costs."

ENERGY
What else can you do?

- Integrate decisions about Heating, Ventilating and Air-Conditioning (HVAC) and other systems with choices about building orientation, windows, lighting, appliances and other factors to allow for offsetting costs and savings.
- Employ advanced lighting designs that fully coordinate ambient electrical lighting with daylighting strategies to maximize comfort and productivity of building occupants, enhance lighting quality and increase efficiency.
- Reduce heating and cooling costs by using properly sized, energy-efficient systems in conjunction with a thermally efficient building shell, and employing light colors for roofing and wall finish materials.
- Consider alternative energy sources that are now available in a variety of products and applications.
- Consider green roofs, which can reduce the energy costs required for summer cooling, decrease the heat-island effect and help trap heat during the winter.

tional $90,000 grant from NYSERDA. For commissioning the building, NYSERDA and the U.S. Department of Energy contributed $119,000 and $100,000 grants, respectively.[66]

Indoor air quality

For many, indoor air quality offers a daily reminder of the link between the built environment and public health. Studies demonstrate a relationship between healthy indoor air and productivity in working environments.[67] There is also abundant evidence that poor indoor air quality in homes (from mold, for example) can be linked to asthma attacks and other respiratory distress.[68]

According to the City of New York Department of Design and Construction, improving indoor air quality benefits employers by increasing employee attention, productivity and morale. Added benefits can include a decrease in worker compensation claims, medical expenses, union grievances and legal expenses.[69] These benefits can be significant, although they are rarely tracked and quantified.

Many of the same measures that are used to increase the energy performance of buildings also help produce gains in productivity. But not just any energy retrofit can boost productivity. Only those designs and actions that improve visual acuity, indoor air quality and thermal comfort—such as increased ventilation control, temperature control, lighting control and daylighting—seem to result in such gains. This speaks directly to the need for an integrated design approach that seeks to improve the quality of workplaces. On a square foot basis, personnel costs-annual salaries, benefits and other employee costs—are generally more than 100 times energy costs.[70] Hence, investing in high-performance building components that could possibly facilitate a 1% gain in productivity can bring a financial benefit that is even greater than energy savings.[71]

There are many other ways in which developers and tenants can address indoor air quality. Establishing, monitoring and enforcing minimum indoor air quality performance standards can help maintain appropriate ventilation rates to ensure occupant comfort. Using products that eliminate or minimize volatile organic compounds (VOC) can reduce sources of particulate air pollution. Preventing moisture infiltra-

tion can discourage pests and dust that may trigger asthma attacks. Requiring the use of low-toxicity cleaning products, pesticides and oil- or alkaloid-based paints and solvents can also help avoid exacerbating asthma.

EXAMPLE: 1400 ON FIFTH

The $40 million 1400 on Fifth residential building in Harlem is both the first affordable *and* green residential building in New York City and the largest such building in the U.S.[72] Heralded during construction for its innovative use of filtration and energy conservation features, the building maximizes fresh air, removes allergens and saves residents at least 37% annually in electricity costs.[73] Residents are attracted by the building's geothermal system, which provides heating and cooling through water that is sent into the bedrock, making regular heating or air-conditioning systems unnecessary.[74]

Fresh air is provided to each apartment through mechanical means. The building's structure alone reduces outside air infiltration 85% more than a conventional building.[75] Outside air is then filtered twice through high-efficiency filter systems. This system removes particulate matter and many common allergens from the air, eliminating the environmental triggers for allergy attacks. The building also uses low or no VOC materials for all of its adhesives, sealers, caulks and paints.

The greater volume of fresh air and the selection of materials that do not off-gas contribute to the long-term health of the residents, while the use of clean geothermal energy reduces peak energy demand by providing an on-site energy source.

The building cost about $200 per square foot to develop, which is within the cost range of affordable housing elsewhere in New York City.[76] Construction was made possible through a unique public-private partnership between Full Spectrum (the developer), the New York City Department of Housing Preservation and Development, Bank of America and Fannie Mae. Research,

POSRO MEDIA

1400 on Fifth is the first affordable and green residential building in New York City.

INDOOR AIR QUALITY
What else can you do?

- Provide fresh, outside air to all occupied spaces to increase comfort and conserve energy.
- Provide minimum standards for indoor air quality upon occupancy. Use filters to capture allergens, particulates and other health threats.
- Minimize sources of chemical and particulate air contamination by using low VOC paints, glues and carpets.
- Minimize moisture, leaks and humidity in order to prevent mold growth.

design, and green infrastructure costs were covered in part by a $500,000 grant from NYSERDA. The building also qualified for the New York State Green Building Tax Credit Program.[77]

Outdoor air quality

Harlem suffers from chronic and severe air quality challenges caused, in part, by emissions from diesel trucks, equipment, buses and facilities that continue to burden the neighborhood with some of the city's highest childhood asthma rates. Developers and business owners have a unique opportunity to help mitigate these adverse effects by adopting cost-effective strategies that help solve rather than contribute to air quality problems.

Encouraging employees to shift from using personal vehicles to public transportation can reduce traffic congestion, air pollution and greenhouse gas emissions. Commuter Choice programs give employers incentives to support employees' use of transit. For example, in New York City, Commuter Choice programs like TransitChek allow transit costs to be deducted from paychecks in pretax dollars—saving commuters over $400 every year on average.[78] Commuter Choice programs can help employers save, too, through lower payroll taxes. EPA estimates that if just half of all U.S. commuters worked for Commuter Choice employers, air quality would improve due to a reduction in traffic equivalent to taking 15 million cars off the road.[79]

Transitioning to clean-fuel heavy-duty vehicle fleets can cut particulate matter pollution by up to 90%.[80] Manhattan Beer Distributors made New York trucking history in 2002 when it rolled out 15 medium-duty delivery trucks powered by John Deere compressed natural gas engines. According to NYSERDA, these vehicles will keep 123 tons of pollution out of the South Bronx air over a ten-year period.[81]

Scheduling truck deliveries at off-peak hours and rerouting diesel vehicles away from areas considered sensitive to the community minimizes congestion and adverse health impacts. In Long Beach, California, 2.5 million truck trips were diverted from peak daytime traffic during the first full year since the launch of the Ports of Los Angeles and Long Beach's OffPeak program. The program was set up to reduce traffic congestion caused by the overabundance of cargo industry trucks working during the daytime. Each week, the program eliminates 60,000 truck trips from daytime freeway traffic patterns by charging a fee for cargo movement during peak hours, producing a notable reduction in daytime congestion on roads near the ports.[82]

▶EXAMPLE: REBUILDING LOWER MANHATTAN WITH CLEAN DIESEL

The reconstruction of lower Manhattan includes many large projects in a neighborhood filled with homes, offices, parks, schools and visitors. Diesel pollu-

ENVIRONMENTAL DEFENSE

An extractor being used in the South Ferry construction in lower Manhattan. The inset depicts an enlarged version of the sticker that certifies that the equipment has been retrofitted.

tion from hundreds of construction machines working downtown could have posed a significant threat to local air quality. Instead, lower Manhattan is becoming a showcase for the most advanced diesel pollution reduction measures available on the market today.

Construction machinery is notoriously polluting, in part because federal guidelines have been lax and the machines often stay in use for many years—often several decades. In fact, the nonroad diesel sector (construction, locomotives, marine, etc.) emits more fine particulate matter than cars and on-road trucks *combined*.

New state and city rules call for all public contracts in New York City to use the best available pollution reduction technologies—and that means technologies like diesel particulate filters (DPFs) that can cut particulate pollution by 90% or more.[83]

As a result, more than 100 pieces of construction equipment downtown have been retrofitted with DPFs. The Lower Manhattan Construction Command Center monitors adherence to the strict environmental performance guidelines. All downtown builders, from the Metropolitan Transportation Authority to New York City Transit, and even private sector projects like 7 World Trade Center, have built these technologies into their contract specifications.[84] Consequently, backhoes, front-loaders and other machines of similar scale at the World Trade Center site, the South Ferry subway stop reconstruction and other downtown sites have all been successfully retrofit with DPFs and run on ultra-low-sulfur diesel.

Stationary generators, which run on engines similar to those used in construction, have either been electrified or retrofit.

Cranes have been retrofit with diesel oxidation catalysts, despite some initial concerns about the availability of appropriate technologies.[85]

Similarly, at the Croton filtration plant construction site in the Bronx

OUTDOOR AIR QUALITY
What else can you do?

- Include contract specifications that call for the use of ultra-low-sulfur diesel fuel and the best available emissions reduction technologies, such as diesel particulate filters, in all construction and on-road truck fleets.
- Strictly enforce anti-idling rules (3 minutes maximum) and provide alternatives, like truck-stop electrification units or small auxiliary power generators, which can be used to provide needed air-conditioning, heating or other power.
- Manage and schedule deliveries and truck traffic to avoid congested times and sensitive sites like schools, playgrounds and busy pedestrian streets.
- Offer commuter benefits as part of standard employee benefit packages to encourage the use of transit.
- Install bike racks for workers and customers to reduce automobile use.

(managed by New York City's Department of Environmental Protection), 24 pieces of construction equipment, including large earth-moving machines, have been retrofit with particulate filters.[86]

Every dollar invested in advanced retrofit technology can yield at least $12 in health benefits by removing pollutants linked to asthma attacks, bronchitis, strokes, lung cancer and cardiac arrest.[87] Additionally, because they run more cleanly, diesel machines burning ultra-low-sulfur diesel fuel have reduced maintenance costs. Everyone benefits—from workers to neighbors. Initial capital costs for diesel particulate filters can range from $7,000 to $12,000, and these costs are expected to drop as the technologies become more widespread in the market.[88] With New York already in the lead, it makes sense for all projects built here to take advantage of these opportunities. (For more information, see the *Cleaner Diesel Handbook* at http://www.cleanerdieselhandbook.org.)

Public and open space

Developers and tenants can embrace a range of measures to improve the supply, quality and accessibility of public and open space in the 125th Street corridor, from building green roofs to connecting to larger waterfront park community proposals.

Today, the waterfronts on each end of 125th Street are crumbling—yet on the Hudson and Harlem Rivers, community plans are in place to provide new access to the water's edge. When these plans are implemented, tree-lined bike and pedestrian paths, ferry stops and kayaking facilities will connect the Harlem waterfronts to the rest of the city. These, together with community gardens, pocket parks and playgrounds, are all part of a vision for a greener Harlem. While government will play a big role in this vision, private developers can contribute extensively to it through partnerships with community groups.

New York City temperatures can be seven degrees warmer than in surrounding suburban and rural areas because of the "urban heat island effect."[89] The urban heat island effect occurs because of the abundance of dark surfaces in a city, such as pavement or building roofs, which absorb sunlight and warm the surrounding area. This additional heat is of special concern in the summer, when it drives higher electricity demand for air-conditioning, contributes to the formation of smog and creates special heat-related health risks for sensitive populations. Increasing the amount of green space in Harlem could ameliorate this effect.

Although 26% of Manhattan is devoted to open space,[90] only 20% of West Harlem is open space, and a meager 5.4% of Central Harlem is open space.[91] Augmenting Harlem Corridor's green space through street trees and green roofs can promote energy savings, cool nearby buildings and surfaces that store heat, increase property values, prevent soil erosion, create bird habitat and improve the quality of life on neighborhood streets.

Investing in community gardens can diversify open-space experiences, reduce the need for more costly manicured landscaping and promote pedestrian activity. Likewise, planting low-maintenance trees and shrubs can reduce the amount of pesticides and other chemicals in runoff. Further measures aimed at revitalizing the streetscape, such as street lighting improvements, can contribute to reductions in both crime and water pollution. Safer and cleaner streets align well with commercial objectives aimed at transforming the 125th Street corridor into a thriving 24-hour destination.

Public space in University City.

UNIVERSITY CITY DISTRICT

▶EXAMPLE: UNIVERSITY OF PENNSYLVANIA-UNIVERSITY CITY

According to the University of Pennsylvania, University City (UC) was in a period of decline during the early 1990s, in both population and economic health. UC was experiencing growing disinvestment and higher poverty incidence, with 25% of residents living below the poverty level, and therefore an increased need for development assistance.[92]

In response, the University of Pennsylvania (UPenn) assembled a coalition of families, community groups, businesses and other local institutions to set up programs to facilitate visible change in the community. Under the UC Green Program, UPenn students, faculty and staff joined community members to improve vacant lots, unmaintained parks and residential landscaping in a 25-block area. More than 400 trees and 10,000 flower bulbs were planted. In addition, three children's gardens and four public gardens were added to the neighborhood's open space network.[93] Under the UC BRITE Program, the University partnered with homeowners to help finance the purchase and installation of more than 2,500 exterior lights on 58 city blocks.[94]

Improved street lighting and landscaping have helped contribute to a 36% drop in the overall crime rate in the neighborhood during the past five years.[95] In comparison, the costs of

PUBLIC AND OPEN SPACE
What else can you do?

- Use green street designs such as street trees, landscaped swales and special paving materials that allow infiltration and limit runoff.
- Establish partnerships with local communities in the creation and design of new open spaces, for example, along Harlem's waterfronts.
- Use plant species that need neither intensive maintenance nor heavy use of pesticides.
- Where feasible, link vegetated sites to existing green spaces.
- Facilitate pedestrian access to and through development sites by providing or supporting neighborhood, community, visitor and commuter walkways.

implementing the UC BRITE and UC Green programs were modest. The UC BRITE program, for example, provided $35,000 in matching funds to reimburse property owners for the purchase of lighting fixtures.[96]

Water and waste reduction

Together with energy use, the water and waste related aspects of development can produce large impacts on natural resources and city infrastructure. Many of New York's sewage treatment plants, drinking-water reservoirs, landfills and waste transfer stations have been in use for generations, and as the city has grown the increased burden has often taxed these systems to the limit. The City has recently passed a new solid waste management plan, and efforts are underway to improve recycling and filter drinking water. The many combined sewer outfalls, which pour raw sewage into the East and Hudson Rivers during heavy rains, are an increasing threat to the ecosystem of the river and to the people who are returning to its shores. New development can help address the challenges by using these resources efficiently.

Specifically in Harlem, the North River Sewage Treatment Plant on the Hudson River poses a challenge to quality of life in the community. The plant handles sewage from the west side of Manhattan, an area slated for extraordinary development and growth. Community residents have long protested the pollution and odors emanating from the plant due to the associated health impacts, and residents are concerned about development that would put pressure on the plant to expand. At present, when the sewage system cannot handle volumes of water caused by heavy rainfalls, the street and waste sewerage systems combine, discharging an unhealthy stew of household, commercial and street sewage directly into the city's waterways. Efficient use of water decreases the volume of discharge from buildings, and measures to capture and slow rainwater flows from hard surfaces accomplish dual goals: reducing the burden on the North River plant and the risk of overflows.

Buildings and developments can help lessen the frequency of combined sewage overflow events by using water-efficient appliances, capturing rainwater on-site and avoiding hard, nonporous surfaces. Green roofs, gardens and green sidewalks all provide measurable benefits. They help reduce the amount of wastewater coming from the building, diminish the heat island effect and provide pleasant green spaces for people. Use of porous concrete and other permeable material to build sidewalks, parking areas and driveways decreases the impervious surface and permits on-site water infiltration. Finally, appliances like low-flow toilets can reduce water

demand and the amount of wastewater sent into the sewage system.

Developers can limit solid waste in many ways. By specifying recycled materials, big development projects help grow the local market for recycled goods and construction materials. There are many ways designers and builders can help improve the city's recycling rate, including recycling demolition debris, and designing kitchens, offices and apartments in ways that make it easy for occupants to separate recyclables from trash. Buying from local and regional producers decreases freight transportation pollution and boosts local businesses.

All buildings, new and old, can benefit from aggressive solid waste management and reduction plans. Carting costs can be reduced and the amount of space dedicated to trash storage can be made smaller. There are economic and efficiency gains associated with an organized way of disposing of goods. Landfills in the East Coast are filling up and their tipping fees are rising rapidly. The more garbage that can be diverted through a recycling program, the fewer financial resources that the developer will have to spend. Sometimes one business' trash is another's treasure. For example, there are carters that will charge nothing for picking up recyclable paper waste because it is profitable to resell it. By not recycling paper, a commercial building might end up paying more to dispose of a heavier load of garbage.

▶EXAMPLE: THE BANK OF AMERICA TOWER AT ONE BRYANT PARK

New York City will be home to the Bank of America Tower, designed to be among the highest performance skyscrapers in the world. The building has applied for the LEED Platinum rating and is slated for completion in 2008. Designed to be very water-efficient, technologies such as waterless urinals and a gray water recycling system mean that the building will save 10.3 million gallons of water each year.[97]

ARCHITECTURE BY COOK PLUS FOX. RENDERING BY DBOX

The Bank of America Tower is designed to be water-efficient.

The design includes a series of cascading tanks which provide enough space to capture and distribute the typical peak stormwater volume. Each tank has a filtering system, which filters stormwater within 24 hours. This filtered stormwater is used for flushing toilets as well as for the cooling tower in the air-conditioning

WASTE AND WATER REDUCTION

What else can you do?

- Minimize wastewater by using ultralow flush toilets, low-flow showerheads and other water-conserving fixtures.
- Use recirculating systems for centralized hot water distribution and install point-of-use hot water heating systems for more distant locations.
- Select sustainable construction materials and products by selecting characteristics such as high reused and recycled content, zero or low toxicity, sustainably harvested materials, high recyclability, durability and local production.
- Reuse and recycle demolition materials, for example, by employing inert components as a base course for parking lots.
- Require recycling and waste reduction in leases with commercial tenants.
- Provide training and outreach to local commercial operations and residential building maintenance staff on best practices for recycling.

system.[98] The positive environmental effects of the system are two-fold: the building's stormwater runoff contribution to the city's wastewater system is almost zero, even during peak flow, and the amount of potable water lost through the air-conditioning system is minimal. As a result, the building will consume 50% less water from the City's potable water system than an average comparable building. Even though water costs have increased by 40% since the developer broke ground, this design saves so much water that the New York City Department of Environmental Protection decreased the building's water costs by 25%.[99]

As potable water becomes a precious resource in the future, this kind of system will be very valuable in making development high performance and cost-effective. The water saving innovations in the Bank of America Tower are already expected to save over $60,000 annually.[100]

Conclusion

Development in Harlem's 125th Street corridor can bring the community healthy air, clean and the more efficient transportation, pedestrian-safe streets, parks and trees, and more efficient use of resources. With well-planned investments, Harlem could be a model for urban redevelopment that addresses environmental challenges from asthma to climate change. To ensure a better future for the neighborhood, development planning should include the needs of the environment and the community early in the process. The result—as the examples in this guide indicate—will be better developments, a better community and, often, a better bottom line.

APPENDIX A

The policy landscape

Guidelines and incentives for green development

New York City is moving to the forefront of green development, with several prominent buildings completed or in the works, including the examples discussed in this report. These buildings represent residential and commercial projects as well as public and private ventures. Nine projects had been LEED-certified by the date of publication and there are over 100 that have been registered with the U.S. Green Building Council.[101]

New York's current building boom is so green because the government is taking the lead by offering tax and other incentives, starting to incorporate greener commitments into building codes and promising to use green building techniques in public sector projects. Additionally, private-sector projects are leading the market by going green—with positive results for the environment and the bottom line. Several prestigious and successful projects in New York are proving this concept; it is no accident that green buildings are also called high-performance buildings. Developers are also building green more often because it can be profitable. Although green construction and certification can add to the initial cost of projects—increases are generally accepted as 1–2% on large-scale projects—it also adds more to the prices that can be commanded for the finished space, such as an extra 5% in the case of the Solaire.[102] Energy-efficiency measures can also pay for themselves within a short period of time because of reduced energy bills.

The following sections give a general overview of the regulatory and market climates that promote high-performance building and renovation, followed by a description of some of the current best practices.

Government requirements[103]

EVOLVING BUILDING CODES

New York City has several important conditions that promote efficiency and health, such as a mature transit system and dense and vibrant urban centers with many opportunities for walking. The zoning philosophy in the city promotes these conditions, which are also consistent with the LEED standards. The standards encourage alternative transportation, enhanced access to public transit, enclosed bike racks, dedicated car-pool parking and alternative vehicle refueling capabilities. For example, recent rezoning of the Brooklyn and Queens waterfront neighborhoods includes a commitment to waterfront parks and revitalization. There is still a great deal to be done, however, to incorporate a full range of green commitments into city zoning, especially in rapidly growing communities like Harlem.

The New York City building codes describe the specifications that owners, architects, engineers and builders must follow to receive a certificate of occupancy. The codes are not designed to promote advanced green buildings, but a move in 2002 to align New York Standards with the International Building Code does require buildings to be higher performance. Tri-yearly modifications to the code will be based on recommendations from an advisory committee with an eye to enabling the use of green technologies.

The New York State Energy Conservation Construction Code (The Energy Code) is the state legislation that governs energy efficiency in

buildings. This compulsory code applies to all new buildings and those undergoing "substantial rehabilitation," with the exception of designated historic buildings. It was last updated in 2002, and is modeled on the LEED system. The Energy Code standards also conform to the International Energy Conservation Code of 2001. At the time of its implementation, New York was one of the more aggressive codes in the country, although by 2007, most other states had also brought codes in line with international standards.

PUBLIC SECTOR PROJECTS

New York City and State are both beginning to recognize the key role they play as owners and buyers in the property and equipment market. New York City alone owns 2,500 major assets containing 200 million square feet, plus an additional 22 million square feet in leased space.[104] The City pays the direct cost of construction, operating and maintenance costs for these buildings. But the government and taxpayers also shoulder many of the indirect costs related to indoor and outdoor air quality, solid waste disposal and water treatment.

The state and city governments have passed laws that encourage green technologies and energy efficiency for the sake of the benefits they will receive and with the explicit intent of enhancing market growth. For example, New York City recently enacted Local Laws 77 and 86. The former promotes clean air by mandating that city owned and contracted diesel construction vehicles use ultra-low-sulfur fuel and the best available emission-control technology to reduce soot and smog pollution. Local Law 86 requires that new City construction be designed to achieve a LEED rating of Certified or Silver and that renovations use energy and water more efficiently than current codes require. Similarly, New York State's Executive Order 111 requires a significant reduction in overall energy use by state agencies by 2010 and includes provisions concerning energy conservation, building renovation and construction, and the purchase of energy-efficient equipment, clean-technology vehicles and renewable power. State buildings are required to reduce energy usage by 35% below 1990 levels, and all new state buildings must be 20% more energy efficient than otherwise mandated by the Energy Code. The Executive Order also includes provisions requiring that 20% of state energy purchases are from alternative energy sources and 100% of new light-duty vehicles (except emergency vehicles) use alternative fuels.

Incentives

State and federal incentives to use green building technologies can help bring down initial costs. For instance, in 2000, New York became the first state to offer a comprehensive green building incentive package. The Green Building Tax Credit offers personal and corporate tax credits against state tax bills. The credit regulations were being rewritten as of the date of this publication, but the most recent extension of the credit, in 2005, provided additional funding and another period for the utilization of credits. The credit amounted to $7.50 per square foot for exterior work and $3.75 for interior work.[105] The tax credit also includes allowances for design and equipment concerning energy use and production, materials selection, indoor air quality, waste disposal and water use. Certification by a licensed architect or engineer and ongoing record keeping and building management systems (commissioning) were required to receive the credit.[106]

There are slightly different provisions for new or renovated buildings. For

example, in order to qualify for the credit, new buildings' energy use must be at least 45% below the level required by the New York State Energy Code; for rehabilitated buildings energy use must be 25% below the requirement. Specifications for building materials and furnishings minimize toxicity and emphasize use of recycled content and renewable materials. Efficient HVAC systems and appliances and water conservation tools and techniques are also covered. Different elements are each eligible for certain levels of credits, depending on the technology used. For example, 100% of the additional cost of building-integrated photovoltaic solar panels is recoverable but only 10% of the cost of ozone-friendly air-conditioning equipment can be recouped.[107]

While these credits can be substantial, eligibility requires an integrated approach to sustainable development and renovation. For instance, a building owner can get credit for a solar heating installation only if the rest of the building is certified under the Green Building Initiative.

A more incremental approach can benefit from two NYSERDA-administered programs, both part of the larger New York Energy $mart program. The New Construction Program, with $16 million available through March 2008 (with the potential for extensions), provides funds to conduct technical assessments of energy-efficiency measures in building designs. The funds can also be used to offset up to 70% of the incremental capital costs to purchase and install energy-efficient equipment. It covers prequalified equipment or can provide funding for efficient technology based on the scale of reductions in electricity use.[108] The $mart Loan Fund provides below-lender rates for energy-efficient investments, such as appliances and HVAC equipment, as well as renewable energy technologies.[109]

The federal government also offers many incentives, including:

- Corporate tax deductions of up to $1.80 per square foot for energy-efficiency investments in new or existing commercial buildings.
- Multiple tax credits and accelerated corporate depreciation for renewable energy-generating technologies.
- Nontaxable status for public utility-provided subsidies on residential properties.

The Peak Load Reduction Program, run by New York State's Independent Systems Operators, provides multiple opportunities for cost reduction by reducing peak load, including the installation of equipment that reduces permanent demand or can curtail demand specifically in response to a request by the local energy provider. Of course, this is above and beyond any savings that arise from lower peak usage charges, which themselves can be substantial.[110] Similarly, the New York City Comprehensive Water Reuse Program provides a 25% cut in water rates to buildings with an on-site treatment system that captures wastewater and recycles it for use in toilets and other areas.[111]

Best practices and guidelines[112]

Even without government mandates and incentives, building green makes sense. Owners, developers, builders and tenants of sustainable developments often cite the tangible benefits they receive in terms of energy savings from lower heating, cooling, ventilation and lighting costs, lower maintenance effort and costs, and reduced water usage.

There are other benefits that are somewhat harder to quantify, but are frequently reported. These include higher worker productivity with lower absenteeism and turnover, improved health and a greater sense of well-being, reduced neighborhood noise and light pollution, and improved behavior in institutional settings. There are also broader social benefits, such as smaller streams of solid waste and water, lower use of fossil fuels and the accompanying production of global warming gases, reduced air, water and ground pollution, and preservation of biodiversity.

Organizations such as the Battery Park City Authority and the Lower Manhattan Development Corporation have successfully implemented green building design, construction and maintenance. Development in these two areas will eventually encompass 16 million square feet of green residential, commercial and retail space. To steer this development, they have published guidelines to which developers must adhere. These guidelines closely mirror LEED and are quite rigorous, but do not require the same level of peer review. Adherence does not guarantee certification and the attendant market validation. Sometimes the guidelines add important aspects, such as the use of clean diesel machinery, that are not yet fully reflected in the LEED framework. (Please refer to Appendix B for the organizations' websites and further details.)

The following description of best practices in green building is broken into six categories. Perhaps the key concept is that sustainable development is an area where the whole is significantly greater than the sum of the parts. Piecemeal efforts can be made, but the greatest benefits are achieved when developers use an integrated approach to architecture, infrastructure and mechanical elements. When considering green development, it is important to consider all the elements below and their interconnecting relationships.

PLANNING

The high level of systems interdependence in a green building requires an even greater emphasis on planning and interdisciplinary cooperation than a typical large project. The planning team should include representatives from groups ranging from architects to those responsible for building maintenance. The first question the involved parties must decide is, "How green do we want to be?" LEED categories can be used as a general goal, but the uniqueness of each project requires that specific decisions about which tools to implement be based on an integrated model of the final desired outcome.

Planning is also important in that work should be scheduled in a sequence that ensures proper sizing of infrastructure. For instance, in a building renovation that involves significant exterior changes, those changes should be performed in conjunction with determination of heating, cooling and ventilation loads. In new buildings, decisions about mechanical equipment sizing should take into account decisions about site utilization, materials and layout. It is critical to keep this interconnection principle in mind throughout the design and construction phases.

SITE SELECTION, MANAGEMENT AND INTEGRATED BUILDING DESIGN

Site selection and utilization rely on an understanding of soil types, land contours, sun angles throughout the daily and annual cycle, and prevailing wind direction and intensity. These factors have a large impact on lighting, heating and cooling, and can be taken advantage of to reduce the size of energy-driven

building systems. NYSERDA, the U.S. Department of Energy and others have developed sophisticated computer models to anticipate energy usage under different scenarios. For instance, utilization and enhancement of natural light for illumination and temperature control via skylights and high ceilings permit reduced reliance on artificial lighting and more pleasant and productive work environments. At Environmental Defense's offices in New York City, for example, clerestory windows and gently sloping ceilings draw natural light into internal office spaces.

Careful consideration or manipulation of local landscapes can also reduce the volume and speed of runoff, especially during severe storms. This can be done with solutions as simple as filter strips and minimizing impermeable surfaces. Landscaping and the use of native or other selected plants can help absorb pollutants, reduce the need for irrigation and the use of pesticides and other chemicals. Trees also provide cooling shade in the summer, and can break chilling winds in the winter. Semi-permeable pavement, and even minor lateral pathway slopes will direct water away from channels, reducing erosion and peak flows. Green roofs stabilize temperatures and reduce runoff, and have a longer life than conventional roofs because of reduced thermal expansion and contraction.

MATERIALS SELECTION

Every aspect of design involves the choice of building materials, and those choices have profound consequences for the sustainability of a building. The selection of interior materials such as carpeting, paint and adhesives, among others, makes an important difference in the quality of indoor air. Choosing certain versions of these materials will improve indoor air quality, especially ones which reduce off-gases such as volatile organic compounds. Exterior materials selection has a strong effect on temperature, both inside the building and in minimizing the heat island effect outside. For example, the reflectivity and permeability of roofing and paving materials affect heat gain and water runoff. Battery Park City requires roof areas not covered by a green roof to have a minimum albedo (a measure of heat reflectance) of at least 0.3 after three years, and paving systems of at least 33% permeability. Materials with a high recycled or renewable content can also be selected. Ceramic tile, toilet partitions and wallboard can all be economically made from recycled materials, and bamboo is a good, rapidly renewable alternative for flooring. Wood products, from lumber to furniture, can be sourced from certified sustainable sources. The ability to recycle construction waste—60% by weight gets a LEED point—is partially driven by the choice of materials.

Energy, lighting and HVAC systems. Energy, lighting, and HVAC systems are core building systems which highlight the level of interdependence in a green building. For instance, site selection and utilization decisions dramatically affect lighting and temperature systems and thus power requirements. Material choices such as low-emissivity glass (which reflects heat instead of absorbing it) affect thermal efficiency, and therefore influence heating, cooling and airflow. Focusing on the efficiency of energy, lighting amd HVAC systems has led to some impressive gains. The New York Hall of Science's $35 million addition anticipates 37% operational savings beyond the current code. The Solaire proudly points to 35% less energy usage than required under the New York State Energy Code, and a 65% reduction in peak summer energy load.[113]

Often, greater investment in one area can mean less is needed elsewhere. The use of passive or underfloor air-delivery systems with CO_2 sensors and airflow controls can reduce the need for high-energy, high-maintenance mechanical fans. Optimization of duct sizes reduces pressure loss. Air leakage can be reduced with high R-value (better insulating) materials, low-leakage sealing and thermal buffer zones. Guidelines recommend jointly optimizing cooling system components, such as chiller cooling-tower (preferably closed-loop) pumping and distribution. A combination gas heater and chiller can also be more efficient than two separate systems. Right-sized mechanical equipment with components that can respond to load changes can save energy and space, minimizing up-front costs.

Photovoltaic cells, solar water heating, Energy Star appliances and computers, green roofs, compact fluorescent bulbs and motion sensors for public spaces can also save energy. Design elements such as open and inviting staircases can shift traffic from elevators, with positive health and energy benefits.

Pervasive in green building design is the use of controllable daylight to minimize the need for artificial lighting. This is augmented by high ceilings, open interiors, light shelves, skylights, courtyards and atriums. Typical design elements for artificial lighting include efficient distribution with low ambient lighting supplemented by focused higher-intensity lighting.

Equally important in green building design is the precept that individuals should have the ability to regulate their own lighting and temperature, including operable windows.

WATER SYSTEMS

Water flows through and around buildings for many uses and from many sources, both human and naturally generated. Green buildings emphasize conservation of potable water and avoid using it for nonhuman consumption, encourage recovery and reuse of wastewater, and reduce the impact of stormwater. The Hearst Headquarters building is designed to reduce stormwater flows by 25%, which is the LEED requirement.[114] The Solaire, with numerous mechanisms in place for all aspects of the water cycle, uses 50% less potable water than other buildings its size.[115]

There are numerous water conservation and reuse technologies. Simplest is the installation of water-saving fixtures, including dishwashers, showerheads, toilets, front-loading washing machines and waterless urinals. High-performance buildings like the Solaire incorporate a water capture and retention system for rainwater runoff from roofs and setbacks, and use timer-controlled drip irrigation rather than spray systems. Rainwater has lower treatment requirements than gray water, but both can be used for building maintenance, irrigation and sidewalk washing. Filtration and other ecology-based treatments are preferable to chemical systems.

COMMISSIONING, MAINTENANCE AND OPERATIONS

Commissioning is the process of ensuring that operating and monitoring systems perform individually and together according to design specifications. It is a critical part of green building success, and typically includes a computerized integrated monitoring system that covers HVAC, electrical and water systems. The process starts during the design phase and ensures that design intent has been met.

For long-term, low-effort maintenance, some of the most important work comes

in the design and planning stages. It requires thinking ahead to providing the most efficient cleaning methods and lowest-maintenance equipment, incorporating dedicated and ventilated space for recycling and perhaps composting throughout the building. Also, ongoing decisions and activities such as staff training, the use of nontoxic cleaning products and integrated pest management continue to affect the quality and efficiency of buildings, inside and out.

APPENDIX B

Internet resources

General

U.S. Green Building Council: http://www.usgbc.org/

Government

New York City Department of Buildings main site: http://www.nyc.gov/html/dob/html/home/home.shtml
- Model Code Program: http://www.nyc.gov/html/dob/html/model/model.shtml
- Building Code: http://www.nyc.gov/html/dob/html/reference/code_internet.shtml

New York City Department of Design and Construction Office of Sustainable Design: http://www.nyc.gov/html/ddc/html/ddcgreen/

New York City Department of City Planning: http://www.nyc.gov/html/dcp/
- Zoning main page: http://www.nyc.gov/html/dcp/html/subcats/zoning.shtml

Local Law 86: http://home.nyc.gov/html/dob/downloads/pdf/ll_86of2005.pdf
- Interpretation and associated forms: http://www.nyc.gov/html/ddc/html/ddcgreen/ll86.html

Local Law 77: http://www.nyccouncil.info/pdf_files/bills/law03077.pdf
- Manual: http://www.nyc.gov/html/ddc/html/ddcgreen/documents/lowsulfur.pdf

Executive Order 111: http://www.nyserda.org/Programs/exorder111.asp

New York State Energy Conservation Construction Code: http://www.dos.state.ny.us/code/energycode/nyenergycode.htm

eCodes (New York State and international codes): http://www.ecodes.biz/

International Code Council: http://www.iccsafe.org/

Incentives

New York State Green Building Tax Credit: http://www.dec.ny.gov/energy/1540.html

New York State Energy Research and Development Authority (NYSERDA): http://www.nyserda.org/
- Incentives page: http://www.nyserda.org/incentives.asp
- Green building services: http://www.nyserda.org/programs/Green_Buildings/default.asp
- New Construction Page: http://www.nyserda.org/programs/New_Construction/default.asp
- $mart Loan Fund: http://www.nyserda.org/loanfund/default.asp
- Peak load reduction program: http://www.nyserda.org/programs/peakload/default.asp

New York resources for water conservation:
- Comprehensive Water Reuse Program requirements: http://www.nyc.gov/html/dep/pdf/waterrates.pdf
- Water reuse application and instructions: http://www.nyc.gov/html/dep/pdf/waterreuse.pdf

Database of State Incentives for Renewable Energy: http://www.dsireusa.org/index.cfm

Federal incentive overview: http://www.dsireusa.org/library/includes/genericfederal.cfm?currentpageid=1&search=federal&state=US&RE=1&EE=1

- Financing for Energy-Efficient Buildings: http://www.eere.energy.gov/buildings/info/plan/financing/
- Federal Tax Incentive Assistance Project (for energy-efficient buildings): http://www.energytaxincentives.org/

EPA Energy Star Buildings and Plants page: http://www.energystar.gov/index.cfm?c=business.bus_index

Best practices/Guidelines

Lower Manhattan Development Corporation World Trade Center Site Sustainable Design and Construction Policies: http://www.renewnyc.com/plan_des_dev/construction_guidelines.asp

Battery Park City Authority Residential Environmental Guidelines: http://www.batteryparkcity.org/page/page23.html

Design Trust documents:

- High Performance Building Guidelines: http://www.designtrust.org/projects/project_98hpbg.html
- High Performance Infrastructure Guidelines (w/DDC): http://www.designtrust.org/publications/publication_03hpig.html
- Implementing the High Performance Building Guidelines: http://www.designtrust.org/projects/project_99imphpbg.html

Organizations

WE ACT: http://www.weact.org/

Environmental Defense: http://www.environmentaldefense.org/

- Cleaner Diesel Handbook: http://www.cleanerdieselhandbook.org
- All Choked Up: Heavy Traffic, Dirty Air, and the Risk to New Yorkers: http://www.allchokedup.org

Earth Pledge Green Roofs Initiative—Greening Gotham: http://www.greeninggotham.org/home.php

GreenHomeNYC (works with builders, suppliers, and owners in NYC to support green building): http://www.greenhomenyc.org/

Building Green (includes green building product information and Environmental Building News for subscribers): http://www.buildinggreen.com/

Natural Resources Defense Council—Building Green From Principle to Practice: http://www.nrdc.org/buildinggreen/

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