Greening A BLOCK

A Project to Promote Community Health and Environmental and Economic Sustainability through Energy Efficiency on the Lower East Side of New York City

Feasibility Study

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Charles Komanoff
Komanoff Energy Associates

Jeff Perlman
Bright Power, Inc.

A Project of the Neighborhood Energy Network

Under the Sponsorship of the
Association for Energy Affordability, Inc.

www.greeningablock.org

Charles Komanoff

Economist and environmental activist Charles Komanoff was an expert witness for East River Environmental Coalition (EREC) in contesting Con Edison's East River Power Plant expansion. He has researched and reported on energy-efficiency policies at the local and national levels since the 1970s. He has managed a comprehensive Natural Resources Defense Council (NRDC) study of Con Edison's residential and commercial energy-efficiency programs conducted with the co-operation of Con Edison. Charles has been an expert witness on power plant economics, efficiency and environmental impacts for dozens of city and state agencies, including New York City and State, and has published numerous monographs and journal articles on energy and environmental issues. He also "re-founded" the bicycling advocacy group Transportation Alternatives in the mid-1980s and helped found the policy-oriented Tri-State Transportation Campaign in the 1990s. An economics graduate of Harvard, Charles lives with his wife and two children in lower Manhattan. A more detailed biography and links to publications are at www.komanoff.net.

Jeff Perlman

Energy efficiency, renewable energy and green buildings consultant Jeff Perlman has a wide range of experience in clean energy technology. His firm, Bright Power, Inc. (www.brightpower.biz), provides services ranging from advising building owners and architects on the most viable solar and energy efficient solutions for their buildings, to financial analysis and market research of green buildings and clean energy technologies. He has installed solar energy systems on building rooftops, conducted energy audits, and has designed small solar powered devices as well as a solar powered car. As a co-founder of the community solar energy outreach organization BASIC (www.basicsolar.org), he earned a reputation as a competent and enthusiastic community educator and organizer, as well as someone who can make complicated energy concepts simple to understand. Articles he has written on energy and science appeared in a variety of general interest publications. Jeff holds a degree in Applied Physics from Yale. A native New Yorker, Jeff spent his early years in Stuyvesant Town and currently lives in Brooklyn.

Neighborhood Energy Network

The Neighborhood Energy Network (NEN) is a coalition of community, health, social justice, environmental justice and energy advocates seeking better energy solutions for New York City neighborhoods. NEN created the venues and supplied much of the creative sparks that led Charles and Jeff to develop the conception of Greening A Block. To learn more about NEN, to join people working in your neighborhood, or to start a forum in your neighborhood, please contact NEN at http://www.neighborhoodenergynetwork.org.

Copies of the complete feasibility study, along with a spreadsheet of the underlying analysis, may be downloaded from
www.greeningablock.org

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- Former City Council Member (District 2) Margarita Lopez and her staffers Eric Lugo and Adelaide Connaughton.
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[1] A glossary of acronyms appears on pp. viii-ix.

Executive Summary

Greening A Block is an innovative project to transform a city block on the Lower East Side of Manhattan into a showcase of community-scale sustainability, energy efficiency and renewable energy. The project will improve air quality and indoor comfort while saving money for residents, merchants and property owners. It will create good jobs and spark economic activity in the community.

Greening A Block will demonstrate and quantify the benefits that community-based programs can achieve in delivering energy efficiency to middle- and low-income urban areas, making it a model for sustainability efforts on other blocks and in other communities.

The project has four primary components:

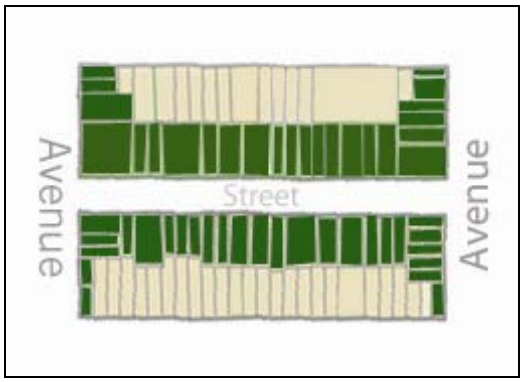
- Educating building owners and occupants about energy efficiency and sustainability.
- Performing energy efficiency improvements to buildings and units.
- Financing energy efficiency improvements to maximize participation.
- Monitoring improvements to ensure that they perform as anticipated.

The benefits of the project include:

- Energy savings.
- Monetary savings.
- Improved air quality.
- Improved comfort.
- New jobs in the community.
- Water savings.
- Defining new frontiers in energy efficiency and renewable energy in NYC multifamily residential buildings.

The pilot block, not yet selected, will be in Manhattan near the Con Edison East River Generating Station, just south of 14th Street between Avenues A and D. The envisioned "block" will consist of the entire north and south sides of a street, along with four short sides on the avenues bounding the street (see Figure ES-1). To ensure that the selection process is thorough and fair, the block will be chosen with community input after the project has received the necessary approvals from the Community Board. Preference will be given to blocks that are representative of the Lower East Side in terms of building stock (building size, age, heating systems, etc.) and demographics (owners vs. renters, proportions of children and seniors, income, etc.).

Figure ES-1: Diagram of a "Model Block"



Note: the shaded areas are the buildings to be covered under the project.

At an anticipated participation rate of 75%, Greening A Block will encompass roughly 40 buildings, 450 apartments and three dozen storefronts. Building heating systems, common areas (lobbies, hallways and stairwells) and "envelopes" (roofs, walls, exterior doors, windows and window frames) will be optimized for efficient energy performance – in both heating and electrical systems – with state-of-the-art equipment, materials, and design and installation techniques. Individual residential and commercial units will be made more efficient with Energy Star lighting, appliances and fixtures. Demonstrations of solar panels, green planted roofs and other emerging sustainable technologies will be installed on the block. The project will also include a program to care for and plant more street trees.

There is a strong outreach component included in Greening A Block to educate and inspire project participants. Building owners, supers and occupants will be invited to workshops and trainings to learn about methods for saving energy and improving comfort. These workshops will complement the installation of energy saving technologies. Maximum energy savings will be achieved through a combined effort of physical improvements to buildings and the proper use and maintenance of these improvements.

The occupants of the block will be encouraged to invest their effort in the project through signs and other visible indicators that they are living on a Green Block — something in which to participate and in which to take pride. "Friendly competition" between buildings will be encouraged, comparing progress and rewarding the buildings that achieve highest levels of participation or highest energy savings. Outreach will be vital to maximizing participation and ensuring seamless communication between the project management team and all parties on the block.

This study is written with the intention of encouraging Community Board No. 3 to allocate a substantial portion of a Con Edison Settlement Fund to Greening A Block. These funds, combined with funds from state and federal energy efficiency programs, will enable Greening A Block to offer energy efficiency improvements with little monetary investment by building owners and occupants, which will maximize participation in the project.

The participating buildings and apartments will reap energy savings equivalent to 190,000 gallons of fuel oil per year. This assumes average energy savings of 30%, a reasonable estimate given the concentrated, synergistic nature of Greening A Block and the rapid paybacks resulting from the project's unique access to public funding sources. After deducting participants' share of the up-front cost of these measures (that is, expenditures by building owners and occupants), these energy savings equate to net monetary benefits for participants of approximately $432,000 per year.[2]

Building owners and occupants will be asked to contribute, at most, only a small fraction of the costs of the work to make their properties energy-efficient. To protect renters, owners will be barred from increasing rents through the heavily-subsidized measures performed by Greening A Block, and a portion of the fund will be set aside to cover legal fees should any problems arise.

The block's reduction in energy consumption will generate environmental benefits, largely deriving from the reduction in the amount of fuel combusted in the buildings themselves for heat and hot water. Greening A Block will reduce ground-level air pollution, especially fine particulates that are exceptionally damaging to the health of children, seniors and other vulnerable groups. The primary benefit will be on the chosen block itself, but concentrations of particulates will also drop on surrounding blocks. Averaged across the 140 blocks of Manhattan Community Board No. 3, the air quality impact of Greening A Block will be superior to any other proposed expenditure of the Con Ed Settlement Fund.

Greening A Block will also create jobs — "direct" jobs installing, specifying and maintaining the energy-saving equipment, and "indirect" employment as workers spend some of their wages in the neighborhood and as residents and building owners spend and invest the savings from lower electricity bills and heating costs. The boost in New York City employment from Greening A Block is an estimated 96 "job-years," i.e., 96 jobs lasting one year each, with a majority of these jobs created on the Lower East Side.

Greening A Block is designed to serve as a model for similar energy-saving projects throughout Community Board 3 and other New York City neighborhoods. The project will lift energy efficiency out of a single-building paradigm and into a community activity at a single or multi-block scale. In this sense, the model block is the beginning, not the end, of an energy revolution in New York City — one that has been made more vital than ever by the recent spike in oil and gas prices along with the exploding geopolitical and climate ramifications of inefficiency in energy use.

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[2] Savings are computed with energy prices of $2.50/gallon for heating oil and $18.00 per thousand cubic feet of natural gas (the same price as heating oil on a "BTU basis") and 20¢ per kWh for electricity.

Greening A Block — By The Numbers

(all numbers are approximate)

Participating		
Buildings		**40**
Apartments		**450**
Commercial Units (stores, schools, etc.)		**36**
Annual Energy Savings		
Oil (gallons)		**95,000**
Natural Gas (therms)		**130,000**
Electricity (kilowatt-hours)		**770,000**
All energy savings as gallons of oil equivalent		**190,000**
Gross dollar value		**$478,000**
Net of participants' amortized costs		**$432,000**
Cost of Project		
Total (percentages don't equal 100% due to rounding)		**$3,839,000**
Occupant or building owner participant share	**14%**	**$537,000**
Government Energy Efficiency Programs	**25%**	**$957,000**
Con Ed Settlement Fund	**61%**	**$2,345,000**
Benefits		
Net Job-Years Created by Greening A Block		**96**
Impact on Occupants' Comfort		**Positive**
Water Savings (gallons per year)		**1,550,000**
Maximum Air Quality Improvement on one block (reduction in fine particulates in nanograms per cubic meter of air, in any year)		
from Greening A Block		**138**
from Fuel Switching (the alternative to Greening A Block)		**15**
Average Air Quality Improvement across CB3 (reduction in fine particulates in nanograms per cubic meter of air, averaged over 15 years)		
from Greening A Block		**2.6**
from Fuel Switching		**1.7**
Total Rent Increases due to Greening A Block		**$0**
Time from CB3 decision-to-support to		
"first shovel in the ground"		**12 months**
to completion of model block		**48 months**

Glossary of Terms/Acronyms

ACEEE	American Council for an Energy-Efficient Economy
AEA	Association for Energy Affordability, Inc.
AMP	Assisted Multifamily Program (State Program of NYSERDA, administered by HR&A)
Audit	Energy audit — a full walk-through survey of a building's energy consuming systems, equipment and practices
BTU	British Thermal Unit (measure of heat)
BTU/ft^2/HDD	BTU per square foot per heating degree day (a measure of heating system fuel efficiency
CB3	Community Board 3 in Manhattan
CEC	Community Environmental Center
CFL	Compact Fluorescent Light bulb
EPA	U.S. Environmental Protection Agency
GAB	Greening A Block
HDD	Heating Degree Day, the standard measure of cumulative cold weather. For a given day, it is calculated as 65 minus the day's average temperature (in Fahrenheit), so that a day with an average temperature of 40 is assigned 25 degree days. The sum of the daily heating degree days across an entire "heating season" from fall through winter to spring indicates the severity of the heating season and, thus, the energy needed to heat buildings.
HR&A	Hamilton, Rabinovitz & Alschuler, Inc. — a consulting firm that administers AMP on behalf of NYSERDA
LES	Lower East Side
NMIC	Northern Manhattan Improvement Corp (LES administrators of WAP)
NYC EDC	New York City Economic Development Corporation
NYCHA	New York City Housing Authority
NYPA	New York Power Authority

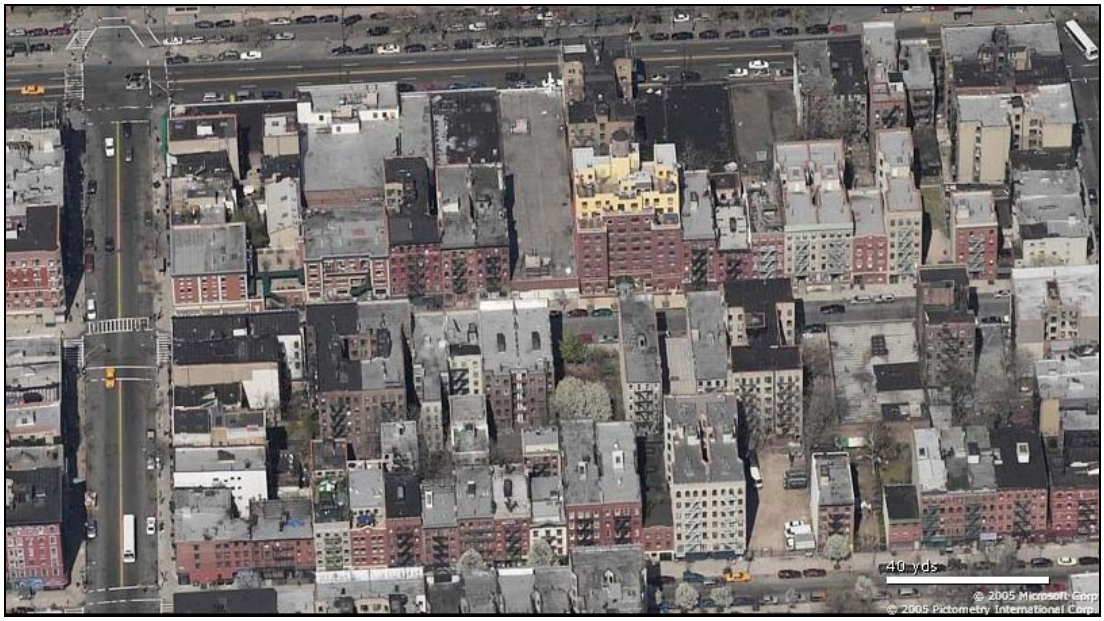
NYPIRG	New York Public Interest Research Group
NYSERDA	New York State Energy Research and Development Authority
ORNY	Open Road of New York (a Lower East Side community agency)
Payback	Simple payback — annual energy savings in year one divided into the cost of implementing a measure (it is generally a conservative figure because energy prices are increasing).
PCCD	Pratt Center for Community Development
$PM_{2.5}$	Particulate matter pollution of diameter 2.5 micrometers (microns) or less; also referred to as fine particulates
ResTech	Residential Technology Assistance (State Program administered by NYSERDA)
R-value	"Resistance value": A measure of the capacity of a material, such as insulation, to impede heat flow, with increasing values indicating a greater capacity.
SIR	Savings to Investment Ratio
TK	Abbreviation denoting "to come" (for pending information or data)
WAP	Weatherization Assistance Program (Federal)

1. Introduction

"I can afford to spend the money to conserve, but not everyone can." — Mike Matlock, Greenwich Village building owner, quoted in NY Post, Jan. 8, 2006

Greening A Block is a first-of-a-kind project to demonstrate and quantify the achievable gains in energy savings, air quality, jobs, and dollars from making energy-efficiency investments on a community scale rather than in one building at a time. The project will install state-of-the-art energy efficiency measures throughout buildings on a typical city block just south and west of the of Con Edison's 14th Street East River Generating Station. Environmental mitigation funds available from Manhattan Community Board No. 3's settlement with Con Edison over the expansion of the East River plant will cover a large portion of the costs associating with "greening" the first block. With support from local elected and appointed leaders, the New York State Energy Research & Development Authority (NYSERDA), and the East River Environmental Coalition (EREC), and with the participation of Community Board No. 3 (CB3) and the Neighborhood Energy Network (NEN), Greening A Block will develop a model urban Comprehensive Energy Target Zone in CB3. This first block will serve as a template for similar efforts throughout CB3 and other New York City neighborhoods.

Figure 1-1: Bird's-Eye View of Typical Blocks in the Project Area



Source: local.live.com

A City Block Approach

Greening A Block will focus on a single city block because a single block is the right size to permit the following:

- A broad sample of buildings and residents and a representative cross-section of the entire Lower East Side.
- Economies in project administration that can make energy efficiency cost-effective.
- Use of funds from the power plant settlement with Con Edison.
- Quick flow of information among participant neighbors.
- "Friendly competition" between neighboring buildings that will help maximize participation and savings rates, including public displays of energy savings encouraging neighbors to compete for higher savings.
- Circumventing concerns over "cherry-picking" (pushing up the numbers by choosing easy-to-retrofit buildings).

Primary Elements

Participation:

- At least 40 buildings, at least 450 residential units and as many commercial units as possible.
- Work completed in four years, with an additional year of monitoring.

Energy Improvements to Buildings:

- Energy Surveys (audits) at the site of each building to determine viable and needed improvements.
- Reducing heat and hot water fuel consumption by at least 30%, through measures such as:
    - balancing heat among units and reducing overheating.
    - reconfiguring and upgrading boiler controls and other elements of heat and hot-water-delivery systems.
    - weatherizing (insulating, caulking, sealing) walls, roofs, windows, doors and other parts of building "envelopes"
- Reducing electricity consumption by at least 30%, through measures such as:
    - increasing lighting efficiency with better light bulbs and lighting controls.
    - replacing power-hogging equipment and appliances with energy-efficient models.
    - reducing "phantom loads" — power use by appliances even when turned off.
- Stimulating community-based energy awareness, with neighbors educating and encouraging each other in more efficient energy usage.

Other Measures to be Included on a Pilot Basis:

- Rooftop Solar Power Systems, both for generating electricity and/or for hot water.
- Green (planted) Roofs on select buildings.
- Biofuels for heating.

Financial Support:

- Funds from:
    - the Con Edison East River Generating Station Settlement Fund,
    - Federal and State weatherization and energy-efficiency programs, and
    - the building owners themselves.
- Partnerships with local banks and credit unions to offer loans for energy-efficiency improvements.

Benefits:

- Energy Savings.
- Monetary savings.
- Comfort improvement in the buildings.
- Creation of new jobs in the community.
- Air quality improvement.
- Water savings.
- Defining new frontiers in energy efficiency and renewable energy in NYC multifamily residential buildings.

Community Empowerment:

- Education about energy efficiency for participants.
- Signs in buildings and on the block to establish pride in Greening a Block.
- Partnerships with local community organizations and students.
- A block party to kick off the project.
- Street Tree stewardship to make the block visibly greener.
- Establishment of a model for other blocks and urban neighborhoods to use in implementing energy-efficiency, non-polluting renewable energy and sustainability.
- A resource of energy efficiency information for the entire community, not just the Model Block.

2. History

Genesis of Greening A Block

This project grew out of a series of public forums and strategy sessions convened under the auspices of the Neighborhood Energy Network to advance energy efficiency in New York City. The catalyst of these meetings was Lois Sturm, a long-time environmental activist who lives a block from Con Edison's 14th Street East River Generating Station.

At one meeting, solar energy expert Jeff Perlman reported on a new initiative by NYSERDA to create "Energy Target Zones" — neighborhood-sized districts receiving technical assistance to attain energy-efficiency. Another participant, Charles Komanoff, had been a technical expert for Manhattan Community Board No. 3 in the contested state proceeding that licensed Con Edison's expansion of steam and electric capacity at the 14th Street Plant several years earlier. He noted that the 2002 Settlement resolving litigation from that proceeding had established community authority for a multi-million-dollar "environmental mitigation" fund endowed by Con Ed.

In a flash, Greening A Block was born. Applying the mitigation fund to pay for energy upgrades in an Energy Target Zone near the East River plant could simultaneously mitigate pollution from the plant's expansion and stake out a new frontier for energy efficiency, lifting it from a one-building-at-a-time process to an entire city block. As well, jobs could be created, fuel conserved, comfort improved, and the community empowered.

That was over a year ago, in late 2004. Since then, Komanoff, Perlman and Sturm have presented Greening A Block to Community Board members and local public officials; talked about landlord-tenant issues with Lower East Side building owners and residents; convened neighborhood forums to discuss the potential benefits and possible pitfalls of the project; developed a managerial structure for Greening A Block; calculated the expected costs and benefits (jobs, energy savings, dollar savings, improved comfort and air quality); and composed this Feasibility Study.

The Community Settlement with Con Ed

Sturm and Komanoff were both involved in the community struggle over the expansion of Con Edison's 14th Street East River Generating Station. In the end, the community was to benefit from over $4 million committed by Con Ed to improve environmental quality near the power plant. The majority of that money was earmarked for reducing emissions from the power plant during winter months by switching fuels from oil to natural gas. However, the community may transfer this money to other reasonable uses. Greening A Block, a project with far greater environmental and other benefits for the Lower East Side, will require and make productive use of a substantial portion of this settlement fund.

A Brief History of Energy Efficiency in NYC Multifamily Buildings

Programs to make buildings in New York City energy efficient have a long and worthy history. The "oil shocks" of the 1970s gave rise to the federal Weatherization Assistance Program (WAP) to mitigate the effects of high fuel prices for low-income families through energy efficiency. Thousands of NYC multifamily buildings with low rents and high maintenance costs have received WAP aid.

The Association for Energy Affordability (AEA)[3] has been at the forefront of multifamily building weatherization in NYC. As the New York State subgrantee for multifamily WAP, AEA has performed and/or reviewed energy assessments of thousands of multifamily buildings.

The New York State Research and Development Authority (NYSERDA) operates complementary programs providing energy efficiency assistance to buildings that do not qualify for WAP. The Assisted Multifamily Program (AMP) expects to commit over $45 million to affordable multifamily properties in the five boroughs of New York City, spread across more than 62,800 units citywide. One quarter of this money is earmarked for Manhattan. AMP also expects to provide an additional $3.8 million in Energy $mart Loan interest buydowns for these New York City properties.

These weatherization and efficiency activities rely on pro-active building owners and managers to seek them out. Many building owners find the present array of programs confusing, and are often unaware of the possibilities available to them.

The result is that the city building stock is upgraded in a piecemeal fashion. A key element of Greening A Block is that it involves a concentrated collection of buildings with a variety of ownership structures and program eligibilities. Instead of waiting for buildings to declare their eligibility for one program or another, Greening A Block will reach out to every building on one block and find or define programs that are appropriate for them.

The current WAP agency for the Lower East Side Greening A Block area is the Northern Manhattan Improvement Corporation (NMIC), based in Washington Heights. The local Adopt-A-Building that once administered WAP is no longer involved. The result is a relatively low energy efficiency presence on the LES, despite its history of activism and environmentalism. Greening A Block will once again give energy efficiency a face on the LES.

The spiraling energy costs of the 1970s coincided with a wave of abandonment of otherwise viable housing stock. Today, with energy prices again escalating, operating costs may become untenable unless building owners are given the wherewithal to improve heating efficiency. In this time of insecure energy and unstable prices, a project like Greening A Block seems all the more important.

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[3] Prior to June 1995 AEA was known as the New York City Weatherization Coalition.

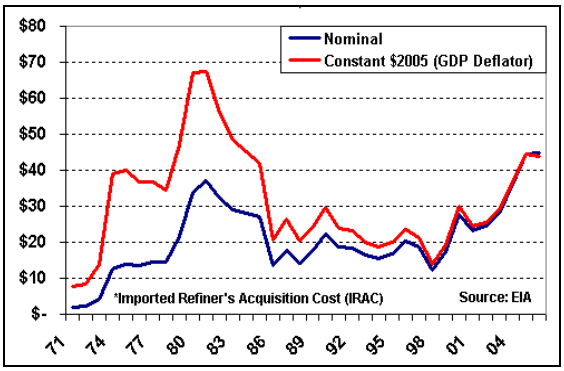
The Crisis in Oil and Gas Price and Supply

Almost all buildings in New York City, including the Lower East Side, are heated with fuel oil or natural gas. Between the conception of Greening A Block in late 2004 and completion of this study in early 2006, prices of these fuels have risen rapidly — locally, by an estimated 27% for heating oil and 39% for natural gas.[4] Because most of the electricity supply to the city is similarly generated with oil or gas, electric rates have also increased significantly. Although energy prices are notoriously volatile, most observers believe that these increases will prove permanent. If anything, prices are seen as more likely to rise further than fall on account of booming demand in newly industrializing China and India, ongoing exhaustion of domestic supplies, and chronic political instability in major oil-producing countries.

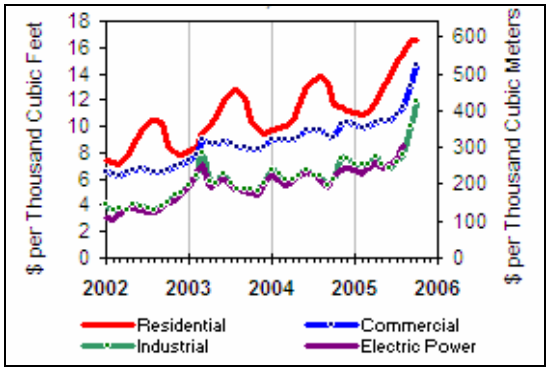
These developments strengthen the rationale for Greening A Block in two ways. First, they elevate the financial and societal value of saving energy by investing in efficiency and solar energy. The increase in oil and gas prices has raised the annual cost to heat and supply hot water to a typical Lower East Side apartment by over $500 per year.[5] Second, they reduce the already low probability that Con Edison will ever be able to draw down the environmental mitigation fund for its originally specified purpose of purchasing additional natural gas as a boiler fuel during the winter months.[6] This adds to the imperative of finding alternative productive uses for the fund.

Figure 2-1: Prices of Oil and Natural Gas

Crude Oil Prices



US Consumer Prices of Natural Gas



Source: www.eia.doe.gov

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[4] Average prices for residential fuel oil in New York City for the last 15 weeks of 2005 were 27% higher than for the same weeks of 2004. (Source: http://www.nyserda.org/Energy_Information/nyepd.asp.) Average prices for residential natural gas in New York State for Sept-Oct 2005 (the most recent data available) were 39% higher than for the same months of 2004. (Source: http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.html, Table 21.)

[5] Average LES apartment uses 117 million BTU per year for heat and hot water. Price increases in previous footnote average 33%, or $4.47 per million BTU.

[6] The East River Power Plant Settlement may be used to finance supplemental purchases of natural gas by Con Edison only when the utility's purchase price of gas is within 50 cents per million BTU of its price of fuel oil (see Section 7). With the recent energy price increases, the differential now almost certainly exceeds $1.00.

3. Greening A Block Structure

The authors envision Greening A Block as an autonomous not-for-profit entity funded primarily from the Con Edison Settlement Fund of 2002 as recommended and authorized by Community Board No. 3 (CB3). This entity will be formed after the project receives the necessary approvals from CB3 to move forward. A project management team will be selected by CB3 to implement the project.

The project management team of Greening a Block will be responsible for implementation of the project, both day-to-day operations as well as general oversight. The team will consist of:

- **Project Director (Executive Director)** – At minimum a half-time position responsible for overall project oversight and coordination. This person will be experienced and knowledgeable about both energy efficiency and the Lower East Side community, and will have experience in project management. This is the project's primary liaison to CB3.
- **Technical Coordinator** – At minimum a half-time position responsible for overseeing all technical aspects of the energy efficiency improvements made to the buildings, including supervising auditors and contractors, determining the appropriate package of energy measures for each building, and ensuring that work is implemented as intended. This person will be the primary contact for the contractors and consultants, who will include energy efficiency auditors, heating system contractors, building shell contractors (insulation, windows, etc.) and electrical appliance wholesalers/consultants.
- **Outreach Coordinator** – A full-time position responsible for the community outreach and education activities, including creation of educational materials for participants, running the energy hotline and website, designing and implementing training programs, and managing interns and other outreach. This person is the project's primary face in the community, and ideally will be from the community.
- **Account Manager / Administrative Assistant** – A full-time position responsible for handling accounts with building owners and occupants, managing the flow of paperwork, keeping track of internal accounting and ensuring that day-to-day operations run smoothly. This person will be the primary contact for the state and federal energy program representatives and the building representatives responsible for completing paperwork.

Greening A Block will open a small office on or near the chosen block to ensure it is an available and effective resource to the community.

Outreach Staff

Greening A Block will hire members of the community to perform a variety of outreach tasks for this project. These tasks include: holding forums, leading workshops, interviewing owners and occupants, filling out datasheets about participants and buildings, fielding questions and phone calls, etc.

These are envisioned as part-time positions ranging from as little as 3-5 hours per week to 20-30, depending on the tasks at hand.

Contractors

The work on the buildings themselves — both surveying them and making improvements to them — will be performed by independent contractors specializing in energy auditing, heating system efficiency, plumbing, electrical work, building control systems, building shell improvements (insulation, air-sealing, windows) and solar energy. Contractors will be selected based on the following criteria:

1. Demonstrated expertise working on NYC multifamily buildings.
2. Willingness to bid on a package of buildings.
3. Willingness to hire/train workers from the community. (Greening A Block will provide funding to help train local workers.)
4. Have in place a state-approved apprenticeship program and pay prevailing wages.

The goal will be to select 2-3 of each type of contractor to provide some choice and avoid dependence upon a single contractor.

By agreement with Greening A Block, the contractors will be obligated to perform work at discounted Greening A Block prices. Their incentive for agreeing to work for these prices is the volume of work they will receive. For this reason, all project participants will be encouraged to use Greening A Block contractors. (Alternative contracting arrangements are discussed in Section 13.)

Board

Greening A Block will be governed by a board comprising members of the community and members of the NYC energy efficiency community.

Reporting

Greening A Block will make quarterly financial and progress reports to CB3. The project will furnish audited financial statements and an annual report to the board.

4. Capacity for Energy Efficiency in LES Buildings

NYC buildings have capacity for efficiency gains in four major areas:

1. **Heating and Hot Water Systems**: improving efficiency through reducing overheating, balancing the heating distribution system (by reconfiguring steam pipes, radiators, air vents, etc.), tuning and retrofitting boilers, and insulating heating pipes. Hot water is often produced by the same boiler that provides heat. Its efficiency can be increased through proper boiler configuration, replacing showerheads and faucet aerators with more efficient models, providing Aquastat control of hot water circulation, and repairing leaks.

2. **Air Sealing & Insulating**: reducing airflow between the building interior and outdoors through caulking and sealing cracks and gaps in walls and around doors and windows and adding insulation to the roof and, if possible, exterior walls.

3. **Common Area Electricity Efficiency**: reducing electricity consumption in common areas by upgrading hallway lighting and exit signs, adding sensors to basement areas and closets so that lights switch on only when spaces are in use, and installing bi-level lighting in hallways and stairwells.

4. **Individual Unit Electricity Efficiency**: reducing electricity consumption in individual apartments and commercial units by replacing inefficient appliances (especially old refrigerators and air conditioners) and upgrading lighting fixtures and light bulbs.

An additional area for energy improvement is installation of renewable energy systems, such as solar power systems and green roofs, which are covered in Section 5.

Using existing technology and best practices, buildings and units can achieve an average 30% energy savings through Greening A Block. The savings will vary among buildings and units, depending on current energy inefficiencies and participants' willingness to adopt new technologies and practices. Some buildings may see heating system improvements as high as 50% while others only see 10-15%. Similarly, an apartment with a 25-year-old refrigerator and many frequently-used lights will see a large savings whereas a very efficient, little-used apartment will see smaller savings.

Building Characteristics

The blocks immediately south and west of the 14th Street East River Generating Station consist largely of buildings with the following characteristics:

- 4-6 stories.
- 8-24 residential units.
- 5,000-15,000 square feet.
- built in the early 20th Century.

- sometimes one or two commercial units at street level.
- steam heating systems as old as the buildings themselves.
- very few elevators or central air conditioning systems.
- little routine maintenance.

The exceptions to this are:

- Taller buildings including:
  - NYCHA Housing such as Campos Plaza.
  - Mitchell-Lama buildings such as Village East Towers and Tanya Towers.
- New construction low-rise residential housing.
- Single-story commercial buildings.

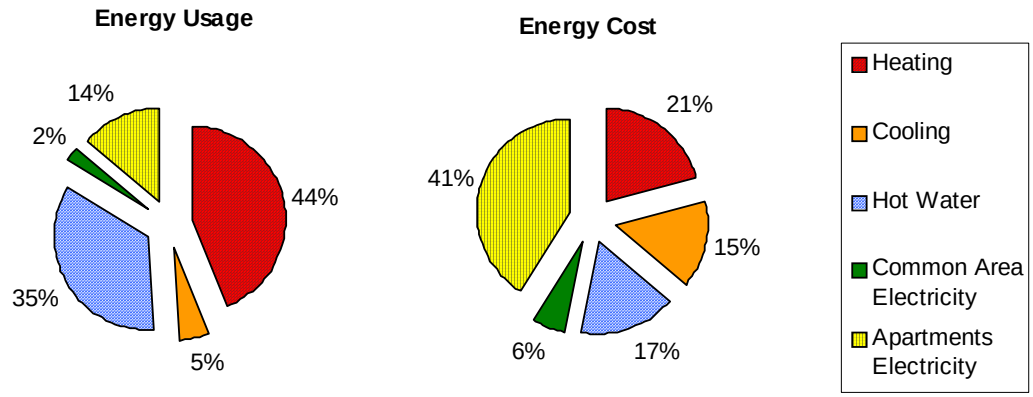
Table 4.1: Energy Consumption of Lower East Side Buildings (Average Annual Rates)

	Fuel Oil (in gallons, or natural gas equivalent)	**Electricity** (in kilowatt-hours)
Per Apartment	845	3,600
Per Storefront	1,400	24,000
Common Areas	Already allocated to apartments and storefronts	2,300

Source: Greening A Block calculations based on data from NYSERDA, Con Ed, Bobker, Padian, Gifford.

Similar-looking buildings can use energy in very different amounts. However, reasonable approximations can be made for the amount of energy going to different end uses, as shown in Figure 4.1. Note also that different energy usages are delivered by different sources that may have different unit costs. Electricity is a more expensive form of energy than oil or natural gas; accordingly, energy savings and dollar savings are not always the same, as shown in Figure 4.1.

Figure 4.1: Multifamily Building Energy Usage and Cost



Source: Steven Winter Associates, Inc.

Heating Systems

The heating systems in many LES buildings are old, improperly configured and poorly maintained, which makes them inefficient. Greening A Block will make efficiency gains through the following measures:

- Reduce overheating – balancing heat distribution between apartments to avoid the necessity for occupants to open windows to regulate temperature.
- Proper boiler tune-up.
- Fixing leaks.
- Replacing air vents.
- Re-piping as necessary.
- Insulating steam pipes in basements.
- Replacing/repairing steam traps (if applicable).
- Replacing boiler if economically sensible.

Heat energy is typically measured in BTUs, or British Thermal Units. The number of BTUs needed to heat a building depends largely on four things:

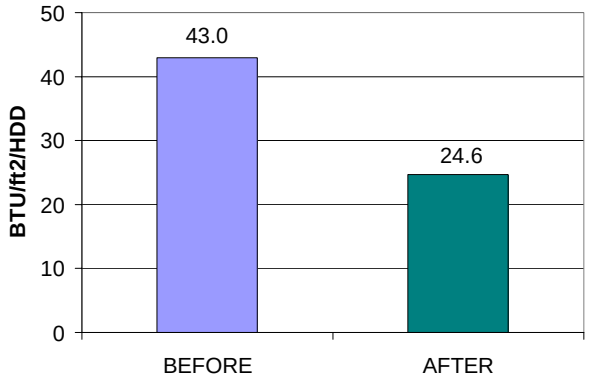
- Size of the building, measured in square feet.
- Climate (severity and length of the heating season), measured in "heating degree days" (see Glossary for definition).
- Exterior wall construction, insulation content (R-value), and impermeability to air movement between outside and inside.
- Efficiency of heating system (boiler, heat distribution systems, etc.).

An authoritative study of 400 low-income NYC multifamily buildings found that they consume about 24 "BTUs per square foot per heating degree day" (BTU/ft^2/HDD) for heating, and an additional 21 BTU/ft^2/HDD for hot water, for a total of 45 BTU/ft^2/HDD (not counting electricity).[7] This report estimates somewhat lesser annual energy usage by LES multifamily buildings, a total of 34 BTU/ft^2/HDD for heat and hot water. Most multifamily buildings waste 40% of their energy, providing plenty of room for savings.[8] This report assumes a more conservative savings rate of 30% for heat, hot water and electricity.

Previous energy efficiency efforts in NYC have seen wide ranges of success, from nominal savings to savings of over 50%. The programs with the greatest savings were those that were able to convince owners to implement complete workscopes and that kept contractors under tight supervision. Greening A Block has therefore been designed with high subsidization of measures, so that participants will want to implement full workscopes, and with a concentrated focus allowing close contractor oversight.

Figures 4.2 and 4.3 show heating system performance after improvements by boiler efficiency expert Henry Gifford. The work performed on these heating systems consisted of reducing overheating, reducing standby losses, balancing heat between rooms and floors, boiler tuning and maintenance, configuration and replacement of heating system controls, and some boiler room re-piping. Figure 4.2 shows nine Lower East Side buildings that averaged 43% energy savings. Figure 4.3 shows that for the three buildings with the most data, the improvements lasted for at least 9 years.

Figure 4.2: Heating System Efficiency Improvements for Nine Lower East Side Buildings (43% Savings)

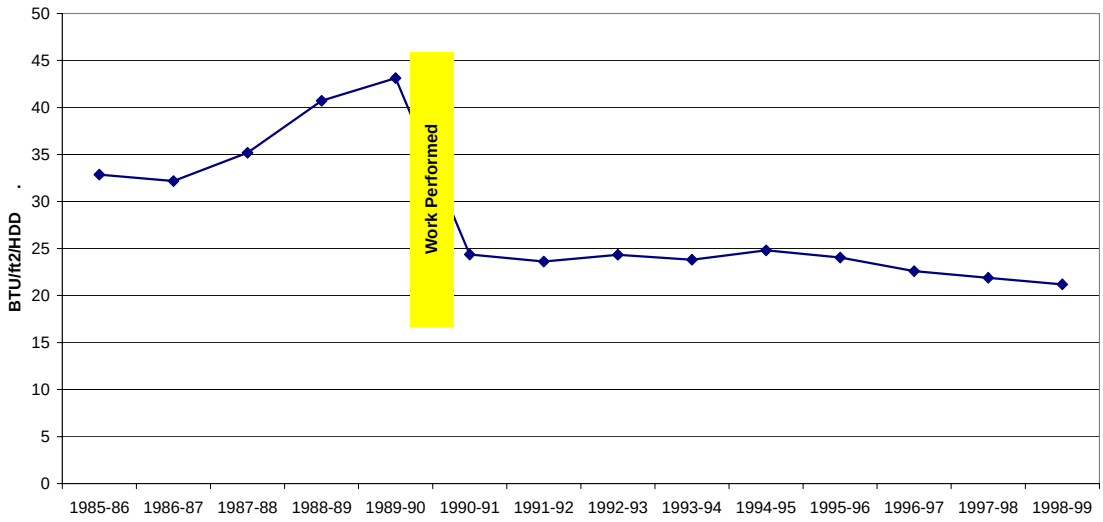


Source: Provident Management, Bright Power analysis. Heating system work performed by Henry Gifford, Gifford Fuel Saving. Both data points are five-year averages.

[7] Padian, F.L. Andrew. "Fuel Use in Multifamily Buildings." Home Energy Magazine, Nov/Dec 1999.

[8] Wardell, Charles. "House Call: An Energy Auditor Prescribes Savings." Multifamily Executive, August 2005.

Figure 4.3: Fuel Consumption by Heating Season for Three Lower East Side Buildings



Source: Provident Management, Bright Power analysis. Heating system work performed by Henry Gifford, Gifford Fuel Saving.

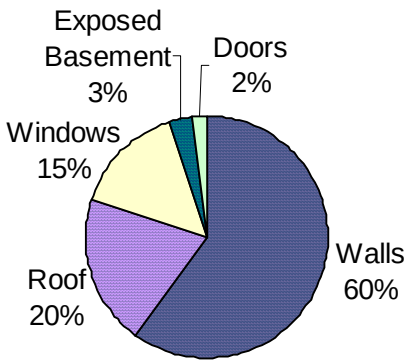
Air Sealing and Insulating

Old buildings, as well as many new ones, allow a considerable amount of air to pass through exterior walls. Air infiltration causes conditioned indoor air to be lost to the outdoors. This not only wastes energy in heating and cooling, but also leads to discomfort through drafts and excessively dry air (in winter) or humid air (in summer). Although some air infiltration is necessary to prevent interior air from getting "stale," most buildings have far more infiltration than they need. Building shell improvements to reduce infiltration include:

- Caulking gaps/filling holes in masonry, around windows, and along roof/skylights.
- Weatherstripping doors and windows.
- Adding storm windows or replacing single pane or poorly fitting windows with new Energy Star rated double-pane insulated windows with modern selective coatings.
- Insulating walls and roofs.

When people feel a draft, they often think first of replacing windows. However, windows are typically only a small percentage of the building exterior. While the exterior area can vary considerably with building type, Table 4.4 shows "envelope area" for a typical five-story walk-up building. The high percentage of the envelope taken up by walls points to the importance of insulating and air-sealing the walls themselves.

Figure 4.4: Envelope Area for 5-story Walkup



Source: Steven Winter Associates, Inc.

Electricity Efficiency

A typical NYC apartment consumes 300 kilowatt-hours (kWh) per month[9] — somewhat more in summer if the apartment has an air-conditioner, and correspondingly less than this average in winter. Where deemed cost-effective, Greening A Block will reduce electricity usage in apartments through the following measures:

- Replacing inefficient older appliances, especially refrigerators and air conditioners.
- Improving lighting efficiency through exchanging inefficient incandescent bulbs for efficient compact fluorescent bulbs (CFLs) and other measures.
- Encouraging turning and keeping lights off when not in use through reminders and/or automatic sensors.
- Reducing "phantom loads" — power use for internal circuitry by appliances whose power has been turned off, mostly appliances with clocks — by installing power strips and more accessible switches.

Figures 4.5 and 4.6 suggest the potential savings from replacing incandescent light bulbs[10] and older refrigerators. Upgrading a single 60-watt bulb that is used six hours a day saves over $17 in electricity costs per year. Similarly, replacing a large 20-year-old refrigerator with a new, efficient model saves close to $200 annually.

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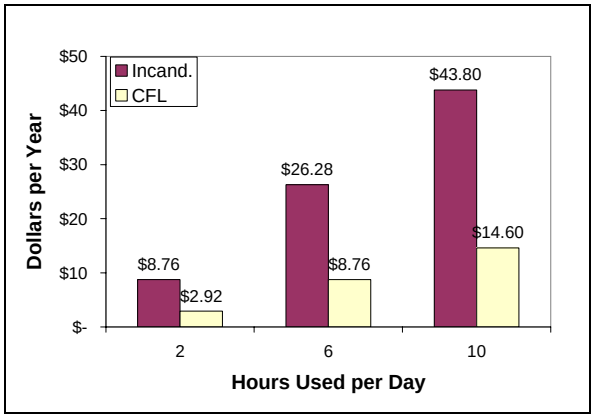
[9] A Con Edison spokesperson indicated that the median monthly consumption for a residential customer in New York City was about 300 kWh in 2004. Personal communication, Sept. 28, 2005.

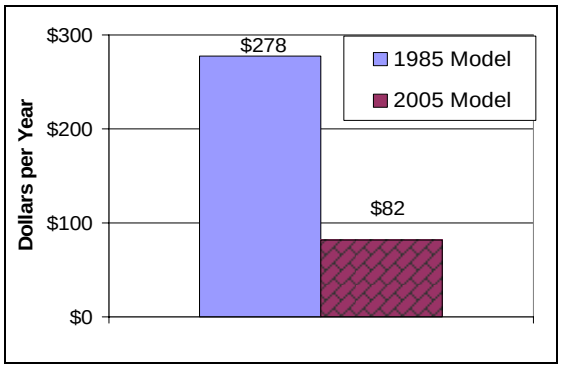
[10] Manufacturers claim that CFLs use 1/4 the energy of incandescent equivalents. This study more conservatively assumes that CFLs are only 1/3 as energy intensive.

Figure 4.5: Annual Cost to Run One 60-Watt (or equivalent) Bulb



Assumes electricity rate of $0.20/kWh.

Figure 4.6: Annual Cost to Run a Refrigerator



Assumes electricity rate of $0.20/kWh and 18 cubic foot GE model.

Most buildings' common areas also have electricity-saving potential through:

- Replacing old exit signs and hallway lighting fixtures with Energy Star equipment.
- Installing motion sensors in basements and other spaces where lights are often left on for days or weeks without getting noticed.

Table 4.2 shows expected electricity savings rates for sample measures:

Table 4.2: Expected Electricity Savings for Appliances			
Old Appliance	**Replace with**	**Power Savings (in watts)**	**Percentage Savings**
25 year old refrigerator	New Energy Star model	100-200	60%
Incandescent light bulb	Compact Fluorescent Light bulb (CFL)	40-60	70%
Inefficient Air Conditioner	Energy Star model	100-500	50%
CRT computer monitor	flat panel monitor	100	60%
Stereo or Cable Box	Install Power Strip	20-100	90%

A Note about Commercial Spaces

Different types of commercial entities have very different levels of energy consumption and potential for energy savings. Roughly a quarter of businesses in this part of the Lower East Side are restaurants, bars, cafes or delis. These typically have opportunities for improving the efficiency of refrigeration, which accounts for a substantial portion of their energy costs. Laundromats have opportunities for hot water and other energy savings. Offices have opportunities for lighting retrofits as well as computer energy management programs to ensure that computers go into a low-energy “sleep” mode when left on after use.

5. Solar Power, Green Roofs and Biofuels

Despite ongoing increases in the prices of conventional fuels and recent revivals of federal tax credits, the measures covered in this section typically do not satisfy conventional cost-effectiveness tests. Thus, they will not be included in the standard scope of work for participating buildings. However, Greening A Block will work to include at least one of each type of project on the model block in order to increase the project's visible presence and to gain experience retrofitting multifamily buildings with renewable energy systems.

Sustainable Rooftops: Solar and Green

Dark-colored roofs absorb heat during the summer, raising air conditioning needs and causing thermal stress to the roof. At a minimum, all rooftops in Greening A Block will be covered in a light, reflective coating.

Several buildings will be selected for more advanced sustainable rooftops such as solar energy systems and green roofs. These roof technologies can further lessen the environmental impact of buildings while providing amenities to the community.

Figure 5.1: A Rooftop that is Both Green and Solar Powered

Source: http://www.greenroofs.com/projects/

A sizeable portion of the total project budget, $300,000, is allocated to supporting installation of sustainable roofs on an estimated four to six buildings. This amount is assumed to be financed equally by (i) state and/or federal energy programs, (ii) building owners, and (iii) the Con Ed Settlement Fund (see Section 7). The energy survey for each building will include an assessment of sustainable roof viability. Greening A Block will facilitate meetings between sustainable roof contractors and building owners, and will review proposals for sustainable roof projects according to the following criteria:

- Roof is capable of supporting proposed design, including additional weight.
- Appreciation of benefits (roof access for residents, visible to neighbors).
- Willingness to regularly allow interested neighbors and visitors to tour the roof.

- In need of roof replacement — in such a case the building owner may be willing to invest more heavily in a sustainable roof.

As shown in Figure 5.1, it is possible to creatively combine multiple technologies on one rooftop.

Solar Energy

Systems that capture and use solar energy are non-polluting, with long-term cost savings because the fuel (sunlight) is free. Technological improvements, rising energy prices and state and federal support are making solar energy increasingly cost-effective. A typical flat Lower East Side roof can support two different types of solar energy systems — solar electricity generation (photovoltaics or PV) and solar water heating. A roof is a good candidate for a solar energy system if there are no taller structures to the south to cast shadows on the panels.

Solar Electricity (photovoltaics)

Solar electric (PV) systems are becoming increasingly common around the world. Of late the global PV industry has been growing at over 40% per year. In NYC, a typical PV system consists of:

- Solar PV modules mounted on the roof.
- An "inverter" that allows the power from the PV modules to interface with Con Ed and the building's electrical supply.
- Wires to connect it all together.

Figure 5.2: Photovoltaic System on a Rooftop in Brooklyn

Source: Solar Energy Systems, Inc.

Such a system does not use batteries. Instead, it ties in directly with Con Ed, providing power when the sun is shining and drawing power from the utility when sunlight is insufficient. Due to current limitations on connecting with the grid, a PV system often only makes sense in a building where all the units share one main electrical service, or in a situation where the PV system can supply one residential unit with electricity (such as in an owner-occupied building or a co-op/condo building where one or two units have "roof rights"). Dozens of PV systems are installed on a variety of different types of buildings around NYC. Several NYC-based companies specialize in the installation of PV systems.

Solar Hot Water

Most NYC multifamily buildings have a central hot water system that supplies all units. In these buildings, it is possible to install a solar powered system that uses the sun's energy to provide a substantial portion of the needed hot water without burning fossil fuels. A solar hot water system consists of:

- Roof-mounted solar collectors.
- A hot water storage tank in the basement.
- Heat exchanger, pumps, electronic controller.
- Piping, insulation, gauges, vents, etc.

Figure 5.3: Solar Water Heating System on a Rooftop in Brooklyn

Source: Quixotic Systems, Inc.

Several of these systems are installed and operating around NYC. The current generation of solar water heaters is more reliable and more effective in colder weather than their predecessors from the 1970s. They cost more to install than conventional hot water systems, but they typically pay for themselves in free fuel in 7-10 years. There are economies to building a solar hot water system that services several buildings, such as where the same

owner has multiple adjacent properties. One NYC-based company specializes in installation of solar water heating systems.

Green Roofs

Green roofs are vegetated covers for buildings, installed on roof decks. Properly designed and maintained, they offer a variety of benefits:

- Cleaner Air – Plant leaves remove ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide from the air.
- Energy Conservation – Evapotranspiration, the evaporation of water from leaf surfaces, lowers ambient temperature near the plants, which reduces the need for air conditioning in the summer. Green roofs also add to the insulation of the roof.
- Roof Protection – Studies from Europe, where green roofs have been in use for a long time, suggest that the protection from weathering and temperature stress can extend roof life by a factor of two to three.
- Water Management – A primary benefit of green roofs is their ability to manage storm water flow, absorbing precipitation and releasing it slowly so that it does not flood the sewers all at once.
- Amenity for building residents, who can gain access to a rooftop garden instead of just a bare roof.
- Attract Birds.

Figure 5.4: Green Roof on Chicago's City Hall

Source: http://www.asla.org/meetings/awards/awds02/chicagocityhall.html

Two main factors limit the viability of green roofs:

- Weight - Roofs must be able to support extra weight (60 to 150 kg/per square meter, or 12-30 lb/ft^2) of soil, plants and water. Some buildings will either not be suitable, or will need structural upgrades.
- Installation cost – Ranges from $20-$25 per square feet (includes labor, plants and impermeable membrane between soil and building roof).

Maintenance is not an issue if hardy sedums and grasses are used. However if the green roof is designed as more of a "roof garden" it may require some care.

Several NYC organizations have extensive experience in green roofs.

Biofuels

Oil-fired boilers can burn vegetable-oil derived fuels instead of 100% petroleum-derived fuels. These "biofuels" burn more cleanly than "straight" petroleum and make use of domestic plants, agricultural waste or restaurant waste rather than requiring fuel from environmentally and politically sensitive lands. They are also becoming cost-competitive with petroleum products. NYC has several projects involving biofuels, including one at Cornell University Cooperative Extension and a new biodiesel plant in Brooklyn. Provided a reliable supplier can be found, Greening A Block will encourage building owners with oil-fired boilers to switch to biofuels.

6. Choosing the Model Block

In developing the base of information and data for this report, the authors have surveyed buildings in the project area and talked to building owners and occupants. However, the model block has not yet been chosen. The selection process will be a collaborative effort between Manhattan Community Board No. 3 (after it has committed to moving forward with Greening A Block) and the project management team selected to implement the project.

Suggested selection criteria for the model block include:

- Location close to the Con Ed East River Plant at 14th Street.
- Demonstrated negative impacts to the block by the Con Ed Plant.
- Strong block community (block association, other examples of community cohesiveness).
- Diversity of occupants and buildings representative of the LES.

In calculating Greening A Block's costs and benefits, the authors have assumed that the model block will be the long sides of a street facing each other, supplemented by the four short block sides on the avenues bounding the street, rather than a four-sided block (see diagram in Executive Summary). The premise is that building owners and residents on, say, the facing sides of a block on East 11th Street, interact far more than do those on the south side of 11th Street with the north side of 10th Street. Such interaction will increase the owner and occupant participation that is key to the project's success. Including the four avenue block-sides will help ensure that storefronts are adequately represented.

Greening A Block is envisioned for a block consisting primarily of 4-6 story walk-up buildings, for the following reasons:

- The first block should be as representative as possible of the entire Lower East Side in terms of building stock (building size, age, heating system, etc.) and demographics (owners vs. renters, proportions of children and seniors, income, etc.), so that the experience of the first block is easily transferable to other blocks.
- The project should reach as many building owners as possible. While this will be more challenging than organizing a program for several larger buildings, it will include a larger segment of the NYC building owner community.
- Virtually all walk-up buildings purchase their own energy and thus are likely to be receptive and responsive to Greening A Block incentives. In contrast, energy for City-owned buildings such as schools and NYCHA housing is purchased for them from NYPA (not Con Ed), through a central NYC government office called the Department of Citywide Administrative Services (DCAS). Interacting with this separate energy-purchasing structure would require a separate project and would not be representative of most Lower East Side buildings.
- Village East Towers, a larger multifamily building complex in the project area, has already begun to improve the efficiency of its buildings and units through programs such as AMP. However, if the chosen block contains Village East Towers or Tanya Towers, these larger elevator buildings could be incorporated into the program.

7. The Con Ed Settlement Fund

Manhattan Community Board No. 3 has control over the funds that will enable Greening A Block to achieve high participation rates among building owners and occupants. In 2002, as part of a settlement permitting Consolidated Edison Company of New York, Inc. (Con Ed) to expand electricity and steam production at its 14th Street East River Generating Station, the utility set aside $4.25 million for quality-of-life improvement projects near the power plant.[11] These settlement funds include:

- $500,000 to widen the East River Esplanade in the vicinity of the power plant.
- $20,000 for scoreboards at the ballfields just north of the power plant.
- $500,000 to install a nozzle at Stack 3 of the East River Generating Station to increase the "exit velocity" of exhaust gases so that they are dispersed further and thereby reduce the pollution burden on the area closest to the power plant. (This has been completed.)
- $2,750,000 for a "Fuel-Switching Account" to subsidize purchase of natural gas in winter months and thereby increase use of that cleaner burning fuel if it is more expensive than oil (although the terms of this account have very specific language about price differentials and the amount of money that may be used each year).
- $480,000 for a "Steam Conversion Account" to assist local buildings in switching from on-site boilers to the Con Ed steam system (not yet implemented).

As defined in the settlement, monies from both the Fuel-Switching Account and the Steam Conversion Account can be reallocated for "alternative air quality improvement projects in the general neighborhood of the East River [Generating Station] Complex" that "relate to local air quality improvement, health improvement, or amenities programs in the vicinity of the East River Complex."[12] Reallocating funds requires the written notice of CB3 and, in the case of the Steam Conversion Account, the New York Public Interest Research Group. Approvals are also required from the Public Service Commission, New York City, and Con Edison.

At this writing, no funds have been spent from either the Fuel-Switching Account or the Steam Conversion Account. CB3 has authorized a maximum expenditure of $200,000 from the Fuel-Switching Account for the winter of 2005-2006. However, increases in the price of natural gas make it doubtful that any of that money will be spent this winter to displace the burning of oil at the East River plant. In fact, developments in fuel markets make it questionable whether the price conditions in the settlement will ever be met to allow fuel switching.[13]

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[11] The terms of the settlement, New York State Board on Electric Generation Siting and the Environment, CASE 99-F-1314, April 18, 2002, may be downloaded from this link: http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/44A1453A8517783A85256DF1007562F0/$File/doc11552.pdf?OpenElement.

[12] Settlement Appendix A, Sections VI.E.3.j, VI.E.4, VI.E.7.

[13] The settlement specifies that Con Edison may use money from the Fuel-Switching Account only when the price of natural gas is within 50 cents per million BTU of the price of power plant fuel oil — a condition that has not

Greening A Block presents an alternative way to improve comfort, quality of life and air quality for residents near the Con Ed plant. It has the further benefits of reducing fossil fuel dependence, creating jobs and stimulating the local economy through reduced energy expenditures. Table 7.1 compares the relative merits of the two options.[14]

Table 7.1: Fuel-Switching Plan vs. Greening A Block

	Fuel-Switching Plan	Greening A Block
Net Annual Savings, whole block	$0	$432,000/yr
Net heat + hot water + electric bill savings (building owner) *per participating building*	$0	$7,200/yr
Net electric bill savings *per participating apartment* *per participating commercial space (e.g., storefront)*	 $0 $0	 $210/yr $1,390/yr
NYC job-years created	0	96
$$ spent *outside NYC* *inside NYC*	 $2,345,000 $0	 $605,000 $3,234,000
Pollution reduction (averaged across CB3 over 15 years, in nanograms of $PM_{2.5}$ per cubic meter of air)	1.6	2.6
# of other NYC blocks that could potentially do same	0	6,000

All savings figures are calculated after deducting expenditures by building owners and occupants, which are shown in Table 9.5. Gross savings are $477,000 per year for the model block, $8,220 per year per participating building, $217 per year per participating apartment, and $1,415 per year per participating commercial space. Savings assume No. 2 fuel oil @ $2.50/gallon, natural gas at the same energy-equivalent price of $18 per million BTU, and electricity @ 20¢/kWh. Greening A Block expenditures reflect $2,345,000 allocated from Fuel-Switching Account plus other funds (see Section 9).

The settlement fund is essential to the project. Although Greening A Block will also use federal and state energy-efficiency funds, only the settlement fund can provide the resources to ensure rapid paybacks for project participants. This will maximize participation and also preclude Major Capital Improvement (MCI) claims by building owners. Indeed, it is the prospect of using settlement and other external funds to "match" building owners' and tenants' co-payment contributions many-fold that will maximize participation.

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been met in the two most recent winters and that appears unlikely to be met in the 2005-06 winter as well. Note that the No. 6 residual fuel oil burned at the East River power plant is much less expensive than the No. 2 distillate fuel oil burned in apartment buildings.

[14] The preliminary budget reflected in Table 7.1 assumes that Greening A Block receives $2,345,000 from the Settlement Fund, which would still leave close to $405,000 in the Fuel-Switching Account. But insofar as Greening A Block is effectively competing with fuel-switching for the same money, this study compares the two options for their effects on the attributes named in the settlement: local air quality, health and amenities.

8. Project Timetable

The estimated time to "green" the model block is four years (48 months), not including an additional year or more to monitor the performance of the buildings. Four years encompasses the time from the vote by CB3 to re-allocate Con Ed Settlement Fund resources to Greening A Block, through final installation of energy improvements in the estimated 450 participating apartments and three dozen commercial spaces in 40 buildings.

This timetable is built on these assumptions:

- Startup period of 3 months, to obtain approvals from Con Edison and other settlement signatories, create Greening A Block governance structure, hire project manager, etc.
- Buildings and apartments are retrofitted in three successive groups of roughly 10-15 buildings and 150 apartments each, with each group requiring 15 months from start to finish.

The timetable is shown on the following pages. It details the division of the 15 months for each group of buildings into these intervals:

- Nine months for preparatory work, including obtaining consents, conducting energy surveys, developing sets of recommended measures, and contracting the work.
- Four months to perform the retrofits and installations.
- Two months to monitor and evaluate the results in order to refine the approach for the next group of buildings (monitoring and evaluation will continue for the full 5-year duration of Greening A Block).
- Not shown in the timetable is an additional year of monitoring to ensure that improvements continue to perform as anticipated.

These assumptions allow for a "demonstration effect" by which the proven success of the initial Greening A Block measures convinces "undecided" property owners and residents to sign on for the next installment. In order to entice "early adopters," the first group of participants will receive the most favorable terms.

It is possible, of course, that the full target of 450 apartments and 40 buildings will be met with fewer than three groups, in which case the schedule shown here can be compressed. However, at this point, three groups seems prudent for planning purposes.

Table 8.1: Greening A Block Project Timeline

	Task	Schedule (months after project start)																																																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
1	CB3 votes to re-allocate funds from "Settlement Fund" to GAB																																																				
2	CB3 creates GAB governance structure, hires project manager																																																				
3	CB3/GAB obtain consent of the other settlement signatories (NYPIRG, Con Edison, NYC, NYS Public Service Commission)																																																				
4	Re-allocation of settlement funds to GAB account																																																				
	FIRST SET OF BUILDINGS (10-15)																																																				
5	Project Manager holds meetings and obtains consents from the first set of participating building owners and tenants																																																				
6	Eligible subcontractors bid on energy assessments work																																																				
7	Energy-efficiency providers conduct energy assessments of participating buildings and apartments																																																				
8	Participating buildings and apartments, under GAB guidance, agree to a set of energy-efficiency measures																																																				
9	Implementation work is subcontracted to qualified contractors and tradespeople; work commences																																																				
10	Implementation of measures																																																				
11	Monitoring of buildings																																																				
12	Analysis of process for initial set of buildings																																																				
13	Prepare for second set of buildings																																																				
	SECOND SET OF BUILDINGS (10-15)																																																				
14	Project Manager holds meetings and obtains consents from the second set of participating building owners and tenants																																																				
15	Eligible subcontractors bid on energy assessments work																																																				
16	Energy-efficiency providers conduct energy assessments of participating buildings and apartments																																																				
17	Participating buildings and apartments, under GAB guidance, agree to a set of energy-efficiency measures																																																				
18	Implementation work is subcontracted to qualified contractors and tradespeople; work commences																																																				
19	Implementation of measures																																																				
20	Monitoring of buildings																																																				
21	Analysis of process for second set of buildings																																																				
22	Prepare for third set of buildings																																																				
	THIRD SET OF BUILDINGS (10-20)																																																				
23	Project Manager holds meetings and obtains consents from the third set of participating building owners and tenants																																																				
24	Eligible subcontractors bid on energy assessments work																																																				
25	Energy-efficiency providers conduct energy assessments of participating buildings and apartments																																																				
26	Participating buildings and apartments, under GAB guidance, agree to a set of energy-efficiency measures																																																				
27	Implementation work is subcontracted to qualified contractors and tradespeople; work commences																																																				
28	Implementation of measures																																																				
29	Monitoring of buildings																																																				
30	Analysis of process for third set of buildings																																																				

Assuming that Community Board 3 votes at the meeting on March 28, 2006 to allocate Con Edison settlement funds to the project, the Greening A Block efficiency investments for the first group of 10-15 buildings could begin a year later, by April 1, 2007, and be completed four months later, by August 1, 2007.

Table 8.2 shows achievement milestones for Greening A Block, assuming a vote on March 28:

Table 8.2: Greening a Block Milestones	
March 28, 2006	CB3 votes to allocate Con Edison settlement funds to Greening A Block
July 1, 2006	GAB begins soliciting participants for first group of buildings
Nov-Dec 2006	Energy surveys of first group of participating buildings
April 1, 2007	Begin installing energy efficiency measures in first group of buildings
Aug. 1, 2007	Complete energy efficiency measures in first group of buildings
Oct. 1, 2007	GAB begins soliciting participants for second group of buildings
Feb-Mar 2008	Energy surveys of second group of participating buildings
July 1, 2008	Begin installing energy efficiency measures in second group of buildings
Nov. 1, 2008	Complete energy efficiency measures in second group of buildings
Jan. 1, 2009	GAB begins soliciting participants for third group of buildings
May-Jun 2009	Energy surveys of third group of participating buildings
Oct. 1, 2009	Begin installing energy efficiency measures in third group of buildings
Feb. 1, 2010	Complete energy efficiency measures in third group of buildings

9. Budget and Financing

The cost of Greening A Block will evolve as the project progresses. Based on certain assumptions, including participation by three-fourths (3/4) of building owners and occupants on the chosen block, this study estimates that the entire cost will fall between $3.8 and $3.9 million. A roadmap of how the money will be spent follows in Table 9.1.

Table 9.1: Greening A Block Allocation of Funds	
Labor, materials and equipment for construction and installation activities: • reconfiguring and upgrading antiquated heating systems • insulating and air-sealing buildings and windows • replacing incandescent light bulbs with efficient compact fluorescent lamps (CFLs) • replacing inefficient appliances such as air conditioners and refrigerators with efficient new ones	50%
Project Management and Oversight • project coordination and organization • reporting to CB3 and other involved parties • oversight of contractors • oversight of outreach personnel	20%
Energy Assessments: • detailed walk-throughs of the buildings and apartments • recommendations of cost-effective energy-saving measures for each property • finalize workscope with owners and occupants • cost covered almost entirely by NYSERDA	10%
Five years of monitoring and maintenance: • ensure that energy efficiency improvements yield expected energy savings • provide a unique dataset to analyze the effectiveness of each efficiency measure, for each apartment and building, and for the project as a whole	10%
Education programs for: • supers of participating buildings • residents of the block • training local energy efficiency advocates	5%
Legal Defense/Emergency Fund, Insurance, etc.	5%

Past energy efficiency programs have demonstrated high project management and construction oversight costs. Achieving high performance for energy efficiency measures requires careful and accurate product selection and installation. Ensuring that contractors adhere to the stringent standards necessary to achieve energy savings projections requires substantial work.[15]

[15] Communication with Cary Hirschstein, based on comments of Richard Leigh, CEC, January 2005.

Project Management

A significant portion of the cost of Greening A Block (30-35%) is for activities other than the direct costs of performing energy surveys and making improvements to buildings and apartments. The budget for these supporting activities is approximately $300,000 per year for four years. Activities subsumed in this budget include project management and administration; supervision and oversight of contractors; community and participant education; and monitoring and maintenance of savings.

This is broken down in Table 9.2:

Table 9.2: Annual Project Support Costs	
Primary Staff (4)	$180,000
Outreach Staff	$60,000
Office Costs (rent, supplies)	$30,000
Materials & Other Costs	$30,000
Total	**$300,000**

Primary Staff includes: Project Director (half-time), Technical Director (half-time), Outreach Director (full-time) and Office Manager (full-time). Outreach staff will be temporary part-time positions for members of the community.

In fact, it is likely that there will be initial start-up costs in the first year, and that the budget will be trimmed in years three and four once the necessary supplies and materials have been procured. Furthermore, a smaller amount will be needed to cover fifth year monitoring expenses. This leads to a five–year budget as shown in Table 9.3.

Table 9.3: Five-Year Project Support Budget (not including building improvements)	
Year 1	$330,000
Year 2	$300,000
Year 3	$280,000
Year 4	$280,000
Year 5	$140,000
Total	**$1,330,000**

Proposed Sources of Funds

Based on our current assumptions, residential and commercial occupants will each be asked to contribute only around 1% of the total cost of Greening A Block, with another 12% coming from building owners. One-quarter of the funds will come from established state and federal efficiency and weatherization programs, while the majority, 61%, will be provided by the Con Edison Power Plant Settlement Fund. While these figures will almost certainly change as the actual work goes forward, we believe that they will remain reasonable approximations of the eventual shares of funds from the various sources.

Figure 9.1 and Table 9.2 show a breakdown of proposed sources of project funds.

Figure 9.1: Greening A Block Sources of Funds

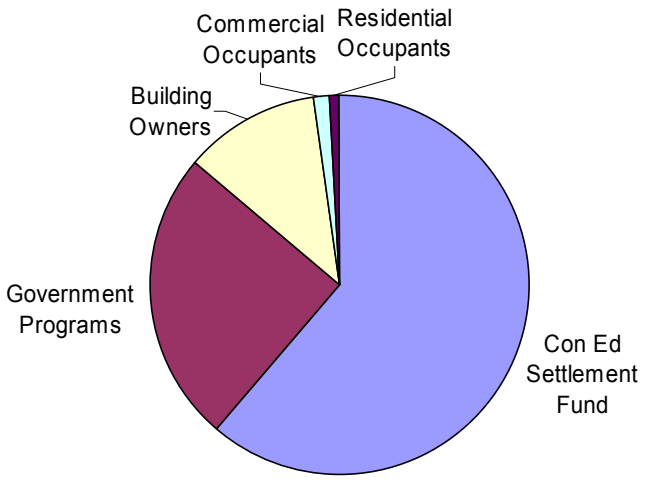


Table 9.4: Greening A Block Funding Sources (preliminary)		
Property Owners	$450,000	12%
Residential Occupants	$34,000	1%
Commercial Occupants	$54,000	1%
NY State Energy-Efficiency and Federal Weatherization Programs	$957,000	25%
Greening A Block Account (Con Ed Settlement Fund) #	$2,345,000	61%
TOTAL (rounded)	**$3,840,000**	

Dollar figure calculated as difference between sum of figures in four prior rows and total project budget.

The Greening A Block Account (GABA) — will be derived from the Con Ed East River Power Plant Settlement Fund and administered by an agent of Community Board No. 3. CB3 will be given full auditing privileges over this account and the project manager will provide quarterly reports to the community board.

Community Board No. 3 will be the agent to initiate and approve any re-allocation of settlement monies to Greening A Block. The dispersal of funds to the project may happen either as a single or multi-step process.

For maximum expediency, the authors recommend that all allocated dollars be transferred at the start of the project. This has the following benefits:

- It provides the project with all necessary funding.
- It transfers the money from the Fuel-Switching Account to a community account as soon as possible, where it can begin to earn interest for the community.

If CB3 wishes to see certain milestones accomplished before allocating the full sum to the project, the minimum initial allocation to get started is $400,000. This would cover surveys and workscope development for the first group of (10 to 15) participating buildings, assuming 50% sharing of that upfront cost by NYSERDA, as well as providing capital for community forums and the project staff's costs for the first year.

Who Pays for What?

Different ownership structures, occupant incomes and building types imply a need for a range of financing options and needs. To generate Table 9.4, the following approximations were made:

- **Property Owners** pay 50% of energy efficiency improvements and post-retrofit monitoring, and 33% of the cost of sustainable roofs. The funding will be somewhat flexible depending on the building's condition and the owner's financial situation. Building owners will be expected to contribute costs for measures under their jurisdiction (e.g., boilers, heating systems, building envelope, common areas' electricity usage) up to the point where their expected payback would exceed 1.5 years, as estimated in the energy assessment. Exceptions are solar energy systems and green roofs: for these sustainable systems, which will deliver fuel savings and amenities for decades, owners will be expected to cover one-third of costs. Financing will be available to help defray up-front costs.
- **Residential Occupants** pay an average of $75 per apartment to cover costs of replacing CRT computer monitors with more efficient flat-panel LCD monitors and replacing inefficient air conditioners with efficient new Energy Star models. Residential contributions are designed to pay for themselves in energy savings in one year or less.
- **Commercial Occupants** pay for 15% of improvements that reduce their energy bills.
- **State and Federal Agencies** are expected to cover 100% of the costs of the energy surveys (buildings that do not qualify for WAP or AMP can still receive energy audits through ResTech), 50% of additional costs to develop the workscopes for all

properties, 20% of energy efficiency improvements, and 33% of sustainable roofs. Nevertheless, brokering state and federal funding is a substantial piece of work in itself. Typically, the owner must float some of the money, to be reimbursed later by the state or federal program. Under Greening A Block, the project will provide this float to help eliminate one of the barriers to participation.

The Greening A Block Account (GABA) will cover all other costs. Compact Fluorescent Light bulbs, energy-saving power strips, and other electricity reduction measures for residential occupants will be paid entirely by Greening A Block. GABA will cover:

- All administrative and overhead costs of the Greening A Block project.
- All educational and outreach costs of the project.
- Costs for energy efficiency improvements above a 1.5 year payback for building owners and 1 year for occupants, as outlined above.
- A substantial portion of the costs for showcase projects such as solar panels and green roofs.

Refrigerators are a classic case of "split incentive," since they are typically supplied by the building owner, who does not pay for the electricity used, but used by the occupant, who must foot the power bill. In cases of refrigerator replacement in a rental unit, the cost will be split by the building owner and Greening A Block, with a contribution from the occupant if deemed appropriate.

Table 9.5: Greening A Block Costs and Savings

	Residential Units	Commercial Units	Buildings
Participating Units	450	36	40
Annual Energy Savings (gross) *total* *per unit/building*	 $98,000 $217	 $51,000 $1,415	 $328,500 $8,220
One-time Costs to Participants *total* *per unit/building*	 $34,000 $75	 $54,000 $1,515	 $450,000 $11,250
Payback Period (in months)	4	13	20
Annual Rate of Return	293%	99%	66%

Note: Payback Period and Rate of Return for Buildings (building owners) would be even more favorable — 13 months and approximately 100%, respectively — if not for the relatively high cost of 4 to 6 solar and green roof projects, which are averaged here over all 40 buildings.

Table 9.6 outlines the major government programs available to cover some of the costs of Greening A Block.

Table 9.6: Federal and State Programs for Energy Surveys and Efficiency Measures for Multifamily Buildings		
Program	**Eligibility**	**Benefits**
Weatherization Assistance Program (WAP) administered on LES by Northern Manhattan Improvement Corporation (NMIC)	50% of tenants: • receive public assistance, or • earn less than 60% of NYS median income.	Free or subsidized: • Energy surveys. • Construction management. • Energy efficiency rehabilitation of heating systems and building envelopes.
Assisted Multifamily Program (AMP) administered for NYSERDA by HR&A and CEC	All publicly-assisted multifamily buildings.	• Technical assistance such as free energy surveys, monitoring of energy savings, etc. • Incentives from NYSERDA, local utilities and other sources. • Grants or low-interest loans for pre-qualified custom energy efficiency measures. Some owner cost sharing required.
Residential Technical Assistance Program (ResTech) NYSERDA	All multifamily buildings not covered by WAP or AMP.	• Subsidized energy surveys. • Financial packaging. • Help with design and construction. • Post-construction energy use monitoring and analysis. • Recommendations for improving energy-efficiency, health, safety, and comfort.

Loans

The Energy $mart Loan Program, from NYSERDA, provides a facility through which building owners can obtain 10-year loans with a 4% (400 basis points) lower interest rate through participating banks (NYSERDA makes up the 4% difference to the bank). There is also the possibility of setting up a loan fund specifically for this project.

Greening A Block Loan Fund (GABLF). A local lending institution could administer a loan fund for this project using the money from the GABA as seed capital. GABLF would provide low-interest financing for building owners who might not be able to get it from conventional sources, thereby enabling additional owners to participate. GABLF could become a revolving low-interest loan fund that can hedge owners against high up-front costs

of energy efficiency work, while being replenished through owners' payments, generating funds that can be made available over time for use on other blocks.

Note on Co-ops and Condos

In this study, the discussions of financing and benefits assume a building with a single owner and occupants who are rental tenants. In co-op and condo buildings, the owners and occupants are one and the same. However, a single co-op or condo owner typically pays for energy like a renter — individually billed for electricity, with heating fuel and common area electricity included in a maintenance fee. Under this structure, it is reasonable to expect that energy savings that accrue to the "Building Owner" will be passed through to each co-op/condo owner in reduced maintenance fees.

The decision-making process is different in co-ops and condos (multi-owner buildings) than in buildings with a single owner. For multi-owner buildings, Greening A Block will have to present to the project to the board. The board's process for deciding whether or not to participate may take months.

10. Benefits of Greening A Block

Greening A Block will benefit the Lower East Side community in a number of ways:

- Energy Savings, including:
  - increased comfort through more even heating and more comfortable indoor humidity level.
  - cost savings for residents, businesses and building owners.
- Air Quality improvement from:
  - pollution reduction — lower emissions and concentrations of carbon monoxide, nitrogen oxides, sulfur dioxide, carbon dioxide and, most importantly, fine particulates — because less fuel will be combusted in building heating systems.
- Job Creation.
- Water Savings.

These benefits are described more fully in this section. Benefits of Community Empowerment are discussed in the next section.

Energy Savings

Buildings and apartments participating in Greening A Block will experience average reductions of 30% in their energy use — both in fuel oil or natural gas consumed annually for heat and hot water, and in electricity used in common areas (e.g., hallway lighting) and inside apartments. The energy savings yield appreciable cost savings as well as triggering other benefits discussed in this section.

In aggregate energy terms, Greening A Block will save approximately 190,000 gallons of petroleum (including natural gas expressed in petroleum units) per year — equivalent to removing 380 cars from the road, or roughly the number of automobiles typically parked on city streets in an area four times as large as the Greening A Block project area.

Improved Comfort

- Overheated buildings are uncomfortable. Windows must be opened to let the heat out which not only wastes energy but also leads to dry air and drafts.
- Drafts from poorly fitting windows and other cracks to the outside are also uncomfortable.
- Poorly maintained heat and hot water systems are a nuisance, especially when they malfunction for numerous days throughout the year.

These comfort measures and more will be addressed in the work done under Greening A Block

Monetary Savings

In aggregate monetary terms, Greening A Block will reduce annual energy bills by $432,000, even after amortizing building owners' and occupants' expenditures for the energy-efficiency investments. This is based on a projected average annual energy savings of 30%.

The expected returns on investment for participants in Greening A Block are extraordinary. Building owners and commercial occupants will realize average returns of 66% and roughly 100%, respectively, reflecting the respective average 20-month and 13-month paybacks on their investment. (The payback period and rate of return for building owners reflect the relatively high cost of 4 to 6 solar and green roof projects averaged over all 40 buildings; for buildings without such projects, the owner's expected payback averages 13 months and rate of return approximately 100%.) Residential occupants will realize returns averaging over 290%, commensurate with average payback periods of just 4 months.

The anticipated return for Greening A Block as a whole is 13.5%, with an 8-year payback. Because this figure counts, as costs, the investment of public moneys from both the Settlement Fund and ongoing state and federal energy-efficiency programs, it is considerably less than the return for occupants and building owners. Yet even 13.5% is an impressive rate compared to many other investments, particularly considering that the many societal benefits of Greening A Block — in improved health, cleaner air, job creation, and community empowerment — haven't been counted at all.

Moreover, the profitability of follow-on, block-size energy-efficiency projects will likely be higher. First, the same state and federal energy-efficiency programs should be available for similar projects at equal or greater value in the future. Second, Greening A Block has been budgeted conservatively as a first-time project; follow-on ventures should be able to build on the experience and trim costs.

Table 10.1: Cost-Effectiveness of Greening A Block for Participants

	Average Investment (one-time expense)	Average Annual Energy Savings	Rate of Return	Payback Period
Typical Building Owner	$11,250	$8,220	66%	20 months
Typical Residential Unit	$75	$217	293%	4 months
Typical Commercial Unit	$1,515	$1,429	99%	13 months
Project Total	**$3,839,000**	**$477,000**	**13.5%**	**8 years**

Average Investments will probably range widely, with lower-income occupants and building owners contributing less and owners of larger buildings contributing more. Average Annual Savings omits amortized cost of energy-efficiency investments. Net annual savings are slightly lower than gross savings because they include amortized costs, which are reflected in Rate of Return and Payback Period columns.

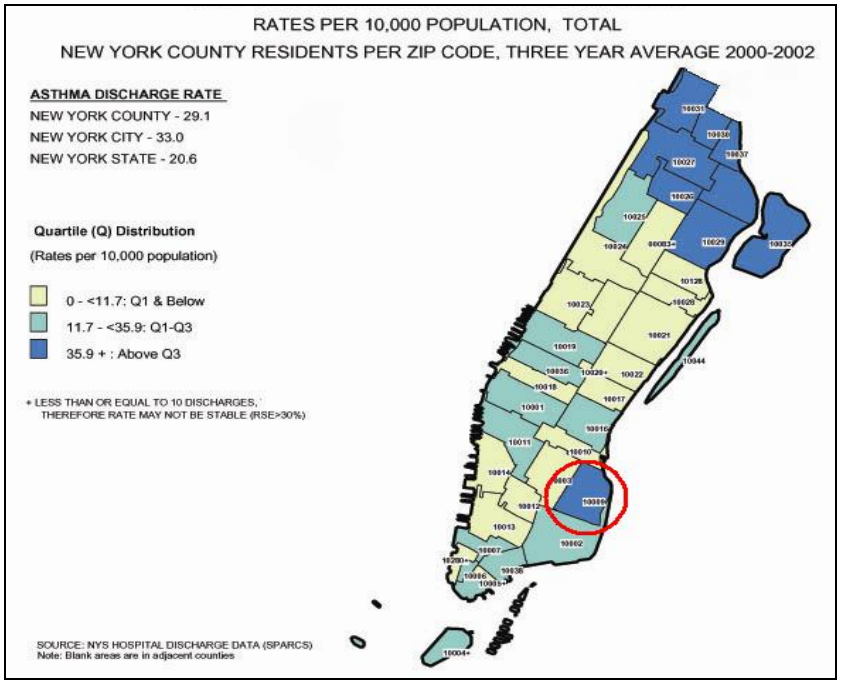
Rate of Return calculations assume:

- 5% annual increases in energy prices.
- Annual O&M expenditures to maintain initial levels of energy savings, estimated at 2% of total capital cost initially (in second year of project), increasing by 4% annually.

Air Quality – A Comparison of Greening A Block vs. Fuel-Switching

Asthma rates on the Lower East Side score in New York City's highest (worst) quartile, as shown in the following map. Asthma attacks are triggered by airborne pollution, and emphysema and other respiratory illnesses are exacerbated by pollution.

Figure 10.1: New York County Asthma Hospitalization Rates



Source: NYS Hospital Discharge Data (SPARCS)

Both options for spending settlement funds can contribute to improved air quality on the Lower East Side. The Fuel-Switching plan will reduce emissions by burning less-polluting natural gas in place of fuel oil at Con Ed's facility, until the fund is exhausted. Greening A Block follows a different route to improved air quality: reducing the amount of fuel oil and natural gas burned in the on-site boilers that provide heat and hot water to the buildings on the model block. These small boilers are notoriously dirtier in their combustion of fossil fuels than the highly regulated boilers at large generating stations. Greening A Block will reduce current emissions levels from these boilers by the same percent that it will reduce fuel use, which this report estimates to be 30%.[16]

Pollution and air quality comparisons are sometimes confounded by differences in types of pollutants between competing options. Fortunately, that is not a problem here. The Con Edison boilers and the on-site boilers in Lower East Side multifamily buildings both burn a

[16] Greening A Block will also improve air quality on the Lower East Side by reducing electricity consumption and, correspondingly, operation by in-city and other power plants that are the sources for the electricity used in the area. However, since this effect is both small and difficult to estimate, its effect on pollution reduction has conservatively been ignored.

mixture of fuel oil and natural gas, and harmful emissions from both are dominated by the same pollutants — sulfur dioxide, nitrogen oxides, and particulate matter. Thus, either option (substituting cleaner natural gas for fuel oil in the case of the Fuel-Switching option, or improving energy efficiency in buildings on the model block in the case of Greening A Block) will reduce emissions of the same pollutants.

Among the various pollutants, particulates, especially fine particulates (those of diameter 2.5 microns or less — a micron is one-millionth of one meter), increasingly have been pinpointed as the most injurious pollutant to human health, particularly for vulnerable populations such as children, seniors and people with asthma. For that reason, the New York State licensing process that gave rise to the Power Plant Settlement Fund focused on impacts of fine particulates, which are commonly denoted PM2.5. Table 10.2 summarizes the air quality gain in terms of reduced concentrations of fine particulates in ambient air across Community Board 3, for both options.[17]

Table 10.2: Air Quality Improvement of Fuel Switching vs. Greening A Block

Criterion	Fuel-Switching	Greening A Block
Maximum reduction in pollution on one block (in any year)	15 nanograms	138 nanograms
Longevity of pollution decrease	9-10 years	10-20 years
Maximum reduction in pollution on one block, averaged over 15-year life of GAB	9 nanograms	138 nanograms
Average reduction across CB3 (in any year)	2.7 nanograms	2.6 nanograms
Average reduction across CB3, averaged over 15-year life of GAB	1.6 nanograms	2.6 nanograms

Pollution is $PM_{2.5}$ (fine particulate matter less than 2.5 micrograms diameter), measured in nanograms (one-billionth of a gram, or one-thousandth of a microgram) per cubic meter of ambient air. Pollution concentrations are usually expressed in micrograms, but nanograms are used when the numbers are small.

All pollutant concentrations are estimated or measured at ground level. Background levels on the Lower East Side average 15,000 nanograms (15 micrograms) per cubic meter of air.

Average reduction is the mean drop in pollution across all of the approximately 140 blocks of CB3.

The last row of Table 10.2 indicates that Greening A Block will improve air quality, in terms of pollutants in air that people in Community Board 3 actually breathe, by 50% more than the Fuel-Switching plan. The key difference is that pollutants from the low-height chimneys atop buildings on the Lower East Side tend to settle more quickly and locally into the street-level air than pollutants from the Con Ed plant's taller smokestacks, which disperse over a wide area. Compounding this difference, the air quality gains from Greening A Block will persist for a longer period — 10-20 years (the average lifetime of the energy-efficiency

[17]All figures in the table are derived and explained in Appendix B.

measures, which, with proper care, maintenance and upgrades, can last even longer), vs. 9-10 years for Fuel-Switching.[18]

On the model block itself, the estimated impact (in terms of reduced concentrations of particulates in ambient air) from Greening A Block will be roughly 15 times as great as the maximum impact from Fuel Switching.

If Greening A Block catalyzes similar projects on other blocks across the Lower East Side, the air quality comparison will turn even more decisively in its favor. The air quality benefits of greening more blocks scale linearly such that the impact of, say, five "greened" blocks is roughly five times that of one.

Jobs

Greening A Block will create an estimated 96 jobs. A little less than half of these will be "direct" jobs in construction, renovation, retail and wholesale trades and services. The remaining jobs will arise from re-spending wages earned by workers employed in those jobs, and from spending monies saved from lower heat and power bills.[19]

In contrast, the Fuel-Switching plan will not create jobs in New York City. No gas or oil are extracted or processed here, and facilities and personnel to handle the incremental increase in net gas consumption that would result from fuel-switching are already in place. Thus, altering the mix of fuels burned at the East River plant will neither add to nor subtract from employment in the city.

As Table 10.3 shows, the spending of wages and other earnings generated from those jobs will also create jobs, and the subsequent re-spending of those wages will generate additional jobs, and so on. Similarly, building owners and occupants will spend much of the money they save on energy. By the time the cycle of energy savings, wage-earning, and re-spending reaches its limit, the estimated number of "indirect" jobs (attributable to re-spending) will exceed the number of direct jobs (attributable to direct employment). The result is that NYC can expect to gain approximately 51 indirect jobs in addition to the 45 direct jobs, making a total of 96 jobs altogether (before rounding) from Greening A Block.

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[18] The 9-10 year figure assumes that the $2.345 million in settlement funds that we estimate Greening A Block will require are instead spent on Fuel Switching, at a rate of $250,000 a year.

[19] Note that a "job" as used here is a year's employment by one person — the standard way in which employment impacts are discussed. In effect, 96 New Yorkers will each gain a year's employment from Greening A Block (or, equivalently, 32 New Yorkers will each gain a job lasting 3 years).

Table 10.3: Jobs from Greening A Block (each job = one year's employment for one person)						
Direct Jobs from Greening A Block						
	Project Expenditures		**Jobs Created**			
					In NYC	
Sector	**Percent**	**Amount**	**Per $1,000,000**	**Total**	**Percent**	**Number**
Construction	35%	$1,344,000	15.3	20	95%	19
Manufacturing	10%	$384,000	9.7	4	15%	1
Wholesale trade	5%	$192,000	9.6	2	80%	1
Retail trade	5%	$192,000	20.8	4	100%	4
Services	45%	$1,728,000	12.8	22	90%	20
Total Direct	**100%**	**$3,839,000**		**52**		**45**
Indirect Jobs from Greening A Block (re-spending wages and money savings)						
Re-spending direct job wages						**17**
Re-spending energy-efficiency savings						**34**
Total Direct and Indirect Jobs (rounded)						**96**

Source for "Usual NYC jobs per $1,000,000": Minnesota IMPLAN Group (Stillwater, MN), based on 2001 input-output database for the United States, as compiled and presented in U.S. PIRG Education Fund, "Redirecting America's Energy," Feb. 2005, available at http://newenergyfuture.com/reports/redirectingamericasenergy.pdf; figures therein have been divided by 1.2 to reflect estimated 20% higher wage levels in NYC. Percentages for various sectors and percentages of jobs going to NYC are Greening A Block estimates. Remaining figures are calculated from other columns. For Indirect Jobs, a 0.5 re-spending multiplier was assumed (i.e., each direct job creates an additional one-half job through re-spending of wages), with 75% of these jobs created in NYC. For jobs stemming from re-spending energy cost savings, net savings were calculated for building owners/residential occupants/commercial occupants by assuming that the three groups spend 90%/100%/95% of those savings, with 50%/75%/60% of that spending occurring in NYC. Assuming 14 jobs per $1,000,000 in spending yields 3.4 jobs per year, or 34 jobs over 10 years of energy savings, as shown. Sums may not equal totals due to rounding.

Water Savings

Water and energy are intrinsically related. Reducing hot water use saves the energy required to heat that water as well as conserving water itself. Reducing water demand overall also reduces the amount of energy necessary to deliver water to the city as well as saving on capital investments and operations costs to maintain the city's water supply.

Greening A Block will reduce water use in participating buildings and apartments, benefiting building owners, by reducing water bills, and the city as a whole by easing demand on New York's water supply and distribution system. Many of the water savings will come as a consequence of hot water savings. Other measures that don't save hot water, such as replacing toilets with high-quality, low-flow models, can provide quality of life improvements for the occupants.

The primary means of water savings from Greening A Block will be through replacing conventional high-flow showerheads with efficient, high-performance heads that deliver satisfying high pressure at lower flow rates. Per head replaced, estimated water savings are nearly 7,000 gallons per year, or nearly 10% of current water usage by a typical apartment. This should translate into water bill savings of almost $40 annually for each head replaced. Still, on an aggregate basis, savings in water bills from replacing showerheads for the entire Greening A Block project are modest — an estimated $9,000 per year, or just 2% of the annual monetary value of the energy savings — and for simplicity have not been included in the financial analysis of this project.[20]

Further water savings may arise if building owners take advantage of their Greening A Block energy survey to replace conventional toilets with low-flow models. As noted in Section 13, each building's energy survey will list the number, type and usage rates of all toilets in the premises and will also specify the costs, parameters and payback periods for replacing these with new models that are far less water-consuming. Building owners will be encouraged to implement cost-effective replacements, but all aspects of that work — specifying, contracting, managing, financing, etc. — will be the sole responsibility of the building owner rather than Greening A Block.

[20] These figures assume 4 gallons per minute (gpm) for current showerheads and 2.5 gpm for replacements, 10-minute showers, 1.25 showers per day per showerhead, 50% replacement in the 75% of apartments that participate, and (optimistically) 100% metered billing at current NYC water rates.

11. Community Empowerment

Greening a Block is a project by, of and for the Lower East Side community. For it to be fully successful, the owners and occupants must willingly participate. High and rising energy prices may make it easier to pique their interest. Nevertheless, Greening A Block includes an array of educational and outreach programs to keep community members informed and to convert interest into participation. All steps will be simplified to cut through the confusion that too often surrounds energy matters and to minimize the time participants must expend. The continuous presence of Greening A Block staff will ensure that there is an ongoing community dialogue between participants and staff.

Preliminary Meetings

Before beginning energy surveys of individual buildings, Greening a Block will host several meetings to introduce the project to the community. All potential participants (residential occupants, commercial occupants, supers, and building owners/managers) on the chosen block will be encouraged to attend at least one of the 1-2 hour sessions. Attendance will also be encouraged for other stakeholders in the community, including community housing groups, block association representatives and other local religious and political leaders.

The preliminary meetings will provide an overview of the potential energy improvements in buildings and apartments and will outline ways to ensure their effectiveness. The members of the project management team will introduce themselves, explain the steps for greening a building (as outlined in Section 13), and describe the types of participation needed at the different stages. Emphasis will be placed on the measures available through Greening A Block that will enable occupants and building owners to realize and maintain improved comfort and monetary savings.

These initial meetings will welcome questions from the community but will otherwise be relatively formal presentations. Translators will be available for those members of the community who would benefit from hearing the details in their native language. If there is sufficient demand, Greening A Block will consider holding a meeting in Spanish.

Block Party

Greening A Block will kick off the project with a block party within the project area. The party will be planned with residents of the block, so the specifics cannot yet be defined. But it will certainly include food, music and brief appearances by the project organizers, CB3 members and local politicians. There will be tables with information about the project, T-shirts for members of the community, and energy-saving light bulbs, in addition to the usual games, vendors and artists. Greening A Block will work to ensure that the block party is truly an event of the community, featuring local vendors that reflect the neighborhood character.

Ongoing Meetings

Follow-on community meetings, to be held quarterly, will be less formal. They will focus on questions, concerns, problems, challenges and successes of project participants. These meetings will emphasize participant involvement.

These will be supplemented by smaller gatherings led by individuals trained by Greening A Block to teach small groups of 4-6 people about energy efficiency in a format that is more personal (the "Tupperware" approach).

Meetings with occupants of individual buildings will be held at the start of the greening process, and as necessary throughout.

Signage

Greening A Block will develop a comprehensive sign program to identify the buildings on the block as participants in the project. Participants will be invited to post Greening A Block signs on their doors and windows. As energy savings results begin to show, these will be posted as well.

Posters with frequently asked questions and answers about the project will be made available for posting in the hallways of participating buildings.

Information for Participants

A series of informational sheets on energy efficiency will be designed, printed and distributed in both English and Spanish. There will be different sheets geared towards different participants, including:

- Renters
- Co-op/condo owners
- Commercial tenants
- Supers
- Building Owners

Examples of the recommendations to be found in these printed materials are given in Appendices D and E.

A telephone hotline and online discussion board will be set up for Greening A Block participants to ask questions and get answers about energy choices (such as optimizing for energy efficiency when purchasing appliances, placing furniture without blocking radiators, etc.). These services will also provide opportunities to voice concerns about the program, specific products, maintenance not performed, etc. Participants will always be welcome to stop by the Greening a Block office for more information.

Others in the community who don't live or work on the Model Block will be welcome to take advantage of the Greening A Block information resources, and will be welcome at the office as well as at meetings and other Greening A Block events.

Community Partners

The authors of this study have forged a relationship with Open Road of New York (ORNY), a non-profit organization that runs a variety of programs for students at a community garden in the project area, including Science and Ecology Classes, Homework Help, Art & Poetry Workshops, Gardening Projects, Sports and Internships.

The authors envision making ORNY a mainstay of the Greening A Block outreach program. Open Road students live in the community and are frequently bilingual (Spanish and English), an important asset in Lower East Side neighborhoods where many households are primarily or entirely Spanish-speaking. Their active partnership is key to gaining a 75% participation rate among residential occupants.

Students from ORNY will be recruited for internships and assigned to the many community outreach tasks necessary for Greening A Block to achieve maximum participation and penetration. The most qualified students will be eligible for paying jobs in tasks such as scheduling and facilitating the energy surveys, answering occupant questions about the project, devising and distributing outreach materials (posters, flyers, brochures), obtaining participant signatures on energy-retrofit and -purchase consent forms, and other tasks that are far more rewarding than typical high-school employment.

Other organizations with whom Greening A Block will seek to work closely include:

- Churches and other religious institutions.
- Local political leaders.
- Other community development non-profits on the Lower East Side.

Street Trees

Street trees are the most visible green element that can be placed on a block. They provide a number of benefits, including:

- Aesthetics
- Cleaner Air – Tree leaves remove ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide from the air.
- Cooling/Energy Conservation – Evapotranspiration, the evaporation of water from leaf surfaces, lowers ambient temperature near the plants. Combined with shade from the trees, this keeps the sidewalks and lower building floors cooler.
- Attract Wildlife – birds and other creatures.

Street trees are generally planted by NYC Department of Parks and Recreation (Parks) free of charge, but must be requested and the request may take time to be processed. An individual or community can choose to plant a tree on its own, as well. Parks does not have

resources to adequately care for the quantity of street trees city-wide, so in order to ensure street tree health, a community effort should allocate some resources to tree maintenance.

Greening A Block will work to increase the health and number of street trees on the chosen block. The project will include:

- An inventory of street trees on the block, including their species, size and health.
- A tree stewardship program – involving community gardeners, young adults and other interested community members – to help street trees combat their many nemeses including dehydration, compacted soil, confined roots, vandalism, abuse by vehicles, Asian Longhorned Beetle infestations, animal excrement, etc;
- Repairing/installing attractive guards that protect trees from vehicles and from soil compaction.
- Assessment of additional tree-planting opportunities.
- Working with building owners request trees from Parks. Nearby building owners must provide consent before Parks or anyone else can plant.
- Educating the community about the benefits of and care for street trees.

A street tree planting program in the Hunts Point section of the Bronx launched by "Greening for Breathing," Sustainable South Bronx and the NYC Parks Department may be a good model for this aspect of Greening A Block.[21] This is also an excellent project in which to include students from ORNY, who already learn about trees and the environment through their Gardening and Ecology classes.

A Global Leader

The Lower East Side is renowned as both a cultural capital and the genesis of community-based activism in community gardening, co-operative housing, bicycling and the like. Greening A Block has the potential to spur neighborhoods and communities to take charge of their energy consumption citywide, nationwide and even globally, making the Lower East Side an example of how communities can develop and thrive by investing locally in energy efficiency.

[21] More about the Greening Hunts Point project is available at: http://www.nycgovparks.org/sub_your_park/trees_greenstreets/ny_tree_trust/images/pdf/greening_hunts_point.pdf

12. Legal Issues

Tenants and Building owners

Relationships between tenants and building owners are notoriously contentious, and often adversarial. Situations can become especially troublesome when an apartment is rent-controlled or when the building owner has only been providing substandard service to the tenants. Yet Greening A Block requires some cooperation between these two entities.

Before Greening A Block personnel or contractors perform any surveying or physical work on a building or unit, the party responsible for the premises (the building owner in most instances, the unit-owner or lease-holder in others) will be required to sign a binding agreement intended to protect both parties from possible abuses.

The agreement will include:

- Acceptance of participation in Greening A Block, including acknowledgment that this is a collaborative effort to reduce energy consumption in the building and that all parties will work in good faith towards this goal.
- "No MCI" (Major Capital Improvement) language, explicitly barring any rent increases from Greening A Block measures, similar to the following used in WAP agreements:

  > *The owner agrees that the rents for eligible dwelling units shall not be increased solely due to the improvements paid for by owner investment funds and Greening A Block Program Funds. The Owner is specifically prohibited from applying for and/or receiving a Major Capital Improvement rent increase for the total work completed under this Agreement.*

  Although the contractual agreement should ensure that no building owner even seeks to impose a rent increase tied to the Greening A Block energy improvements, up to 3% of the total project budget — roughly $100,000 — will be set aside for a legal fund should any problems arise.

- Recourse for building owners in the event that tenants incapacitate or otherwise undermine building-level energy efficiency improvements (e.g., in common areas) or prove unwilling to allow reasonable adjustments to be made to heating, plumbing and other common systems within their apartments.

To recap, three lines of defense will be put in place to ensure that improvements made under Greening a Block do not lead to rent increases: (i) by statute, subsidized work cannot qualify for a "major capital improvement"; (ii) property owners participating in Greening A Block will be required to sign consent forms acknowledging that they will not seek MCI-based increases; and (iii) up to 3% of Greening A Block investments, approximately $100,000, will be set aside for a legal fund that can be used to address any problems, should they occur.

Insurance

Greening a Block will carry its own general liability policy. Furthermore, Greening A Block will require that all contractors are fully ensured for any work they perform, with at least $1 million of liability coverage (the standard amount in NYSERDA contracting). In order to work on Greening A Block projects, contractors will need to list Greening a Block as an additional insured.

Warranty of Work

All Greening A Block contractors will be required to warranty their workmanship for a period of 5 years. All products installed will carry manufacturers' warranties and preference will be given to those that carry longer warranties and/or those from companies with good customer service histories.

Participation Agreement

Before any work commences on a building, the owner must agree in writing to take part in the project. The binding document, signed by both the property owner and a Greening A Block representative, will state the terms of the project. Rental occupants will have a somewhat simpler agreement to sign.

Release of Information

Dissemination of information is essential to Greening A Block's function as a demonstration project. Therefore, Greening A Block will record and publish energy consumption data for apartments, buildings and the entire block without revealing the identities of individual apartments or buildings. Language to this effect will be in the participation agreement.

Greening A Block will encourage participants to make their building identities publicly available along with the energy information. This will help to inspire "friendly competition" between neighbors. However, Greening A Block will not release such information without first receiving written confirmation from the participant, and participants will retain the right to insist that particular pieces of information not be released. In order to preserve anonymity when requested, data will only be released in clusters so that it is impossible to tease out the data on a specific building, owner or occupant.

Adequate Provision of Services

Building owners/managers are required by law to provide base levels of heat and hot water. Dropping below basic levels of comfort in the pursuit of lower energy bills will be strongly discouraged. Any building owner found providing substandard services (below legal levels) will be expected to correct the problem in a timely manner or forfeit eligibility to participate in Greening A Block. In the participation agreement, Greening A Block will reserve the right to demand a return of funds in situations where the money was used towards illegal ends.

Building Violations

It is likely that Greening A Block will uncover building code violations during some building surveys. Building owners will be given a confidential list of code violations discovered in their buildings and will be expected to fix them. In order to maintain neutrality with owners and tenants, Greening A Block will refer violations to the city only in the event that such violations are deemed immediately hazardous, and if the building owner fails to take good faith efforts to correct them. Greening A Block personnel will be permitted to exercise reasonable discretion to decide whether or not they feel safe and comfortable continuing work in the building before violations are corrected.

In Case of a Problem

Problems may arise

- from occupants or owners complaining of a loss of heat or power.
- from occupants or owners complaining about energy bills.
- as sensed by an automatic energy management system that may be installed in the building.

In the event of any problem with a building's energy systems, Greening A Block will bring in a contractor to investigate as soon as possible, at no charge. Occupants and owners will be encouraged to use Greening A Block as their first place to report energy-related problems.

Greening A Block strongly prefers to field such calls (rather than have them go to an outside contractor), so that any aberrations in energy consumption can be readily understood. If the problem is determined to be the result of Greening A Block work that is still under warranty, it will be fixed at no charge. If the problem has arisen elsewhere, a fair price will be worked out between the contractor and the project participant, with Greening A Block mediating if necessary.

Reporting and Controls

Greening A Block will make quarterly financial and progress reports to CB3. The project will have audited financial statements and an annual report that will be furnished to the board. The project will also develop written policies and controls to insure proper financial management.

13. Greening a Building — Step By Step

Each participating building will be taken through the following 8-step process.

Step 1: The Energy Survey

Each building on the chosen block will receive, at no charge, a complete "energy survey" (sometimes called an energy audit). The outcome of this survey is a written report listing all of the energy-saving opportunities for that building and rating them for cost-effectiveness.

The survey process begins with a walk-through of the building's common areas and several representative apartments, in which the auditor tabulates building characteristics such as dimensions, layout, and door and window types, sizes and locations. These data are entered into a computer program which calculates the estimated capital cost, fuel savings, and "payback period" for dozens of possible measures to improve the building's energy efficiency. (The payback period is the number of months or years for energy savings to pay back the up-front capital costs.) An alternative measure of cost-effectiveness to payback period is "savings-to-investment ratio" (SIR). SIR consists of the lifetime energy savings of a measure (discounted over time, as dollars saved in the future are less valuable than dollars saved today) divided by the total cost of implement the measure. An SIR greater than one is deemed cost-effective because the savings outweigh the costs.

Participating units will be surveyed for electricity saving opportunities in lighting and appliances.

Based on the survey results, the Greening A Block team will recommend measures for each building and each unit. The Greening A Block team will prepare reports, one addressing the building as a whole prepared for the building owner, as well as individual reports for participating units, giving recommendations for improving energy performance and the approximate costs. For residents who declined to participate in the initial round, the team will prepare a generic apartment report for each building to encourage the non-participating residents to have their apartment surveyed. For each measure, the energy survey reports will state the expected implementation cost, energy savings, monetary savings, and expected lifetime of the savings.

Step 2: Outreach to Participants

When each building's survey reports have been completed, the Greening A Block outreach coordinator will arrange meetings with participants — one set of meetings with several or more occupants, and a separate, private meeting with the building owner. These meetings will inform the occupants (and, separately, the building owner) about the overall project and the specific measures recommended for their premises.

The goal of these meetings is to arrive at consensus on the exact measures to be implemented in the building. Participation will become easier to obtain as Greening A Block gets under way and "early adopters" on the block (both occupants and building owners) attest to the trustworthiness of the Greening A Block representatives and the improved

comfort levels and lower energy bills from the installed measures. A parallel learning curve by Greening A Block personnel is also anticipated. Precise time and cost records will be maintained for this step, since it is these very "transaction costs" that often prevent well-intentioned energy-efficiency programs from reaching full fruition, and that this block-size project is intended to minimize.

Step 3: Work Scope Development

Once the measures have been agreed upon in Step 2, the Greening A Block team, with the help of AMP, WAP and ResTech, can determine the specific work scope for the building. The work scope is the document that will be provided to contractors with the specific details of the measures to be implemented. It is to this work scope document that contractors will be asked to assign costs.

Step 4: Financing Procurement and Contract Execution

Greening a Block will work with building owners and residents to implement all cost-effective measures (those with an SIR greater than one), using a combination of capital from the settlement fund, building owners, and federal and state government programs, including WAP, AMP and ResTech.

With the completed work scope in hand, Greening A Block can determine what financing will come from federal and state energy programs, the extent of Greening A Block funds to be used, and how much will be requested of the owner. This information will be presented to the building owner. If the building owner requires financing in order to proceed with implementing the work scope, Greening A Block will work to obtain financing on favorable terms. Once the work scope and financing arrangements have been agreed upon by the building owner, occupants, Greening A Block and necessary state and federal funding entities, a contract will be signed with the building owner and work can commence.

Step 5: Implementation — Property Owners

Close to 70% of the energy savings in Greening A Block will be realized through measures to be implemented for property owners — upgrading heating systems and common space lighting as well as insulation, air-sealing, windows and doors. Upgrading refrigerators, too, is a measure for which owners are responsible, even though the bill savings accrue to occupants. This is because refrigerators are typically supplied with rental units.

As shown in Figure 4.4, replacing a 20-year-old large refrigerator with a state-of-the-art model saves approximately $200 per year in electricity costs, making refrigerator replacement, where appropriate, a key element in Greening A Block. Since implementation of this and some other efficiency measures will require access to individual apartments, this step requires coordination with building occupants in addition to owners.

Building owners will be encouraged to use Greening A Block contractors to implement their work scope. However, if a building owner or resident prefers to use an outside contractor

with whom they have a relationship, they may do so. Greening A Block will reimburse the participant for external contractor costs, up to the rate that the Greening A Block contractor would have been paid, upon completion of the work and subsequent inspection. (This contrasts with work done by a Greening A Block contractor, for which Greening A Block will pay some portion up front.)

Participants and contractors will be encouraged to cooperate on timing to minimize delivery and installation costs. This means that certain items, such as refrigerator replacement, probably will not be completed until all units have been surveyed and one big order for refrigerators can be made.

Step 6: Implementation — Residents

The major items to be upgraded in individual apartments are light bulbs, electronic appliances with "phantom loads," refrigerators, computer monitors and air conditioners.

Light bulbs — Greening A Block will employ established "Direct Installation" practices in which residents choose from a selection of products that are brought to their apartment by Greening A Block installers. In this way, occupants get to try out different energy-saving compact fluorescent bulb replacmeents for each incandescent or other inefficient bulb in their home. When the installers return, generally within a week, the occupants can choose to keep the new bulbs, try different ones or have their old bulbs re-installed, with no obligation or cost to themselves. This approach has been proven to maximize acceptance of CFLs in place of incandescent bulbs.

Phantom loads from always-on electronics — Using the same Direct Installation approach, Greening A Block personnel will offer to plug any and all electronics that "drain" power 24/7 even when shut off — TV's, cable boxes, cell phone chargers and the like — into power strips that are easily turned on and off with the flip of an accessible switch. To convey the rationale, Greening A Block installers will calculate the prospective energy and dollar savings from connecting each device to a power strip. For example, for a cable box that consumes 20 watts of power "24/7" but is in actual use just four hours a day, a power strip can save $30 a year.[22] As with CFLs, Greening A Block will install the power strips on a trial basis, and residents will retain authority to have them removed within several weeks.

Refrigerators — These were discussed in the previous step since owners of rental buildings own the refrigerators used by occupants. However, residents will have an opportunity to review decisions on replacement models to ensure their criteria for size, functionality, etc. are respected.

Computer Monitors and Air Conditioners — Greening A Block will cover part of occupants' costs of purchasing high-efficiency flat-panel computer monitors and air conditioners to replace existing models that use more electricity. For purposes of this report, an occupant's expenditure per item is assumed to be $50, with one to two items replaced per apartment.

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[22] Calculated at 365 days/year x 20 hours/day x 20 watts divided by 1000 watts/kilowatt x last year's residential rate of $0.20/kWh.

(The resulting per-apartment expenditure of $75 constitutes the entire contribution assumed to be made by residential occupants in Greening A Block.) Each appliance replacement is expected to generate $30 per year in electricity savings. Greening A Block will ensure that the replaced appliances are appropriately disposed of rather than resold.

Step 7: Follow-Up / Operations and Maintenance

Metering/Monitoring

It is axiomatic in the energy-efficiency field that individuals and households more aggressively conserve energy when their rate of consumption is visible and tangible. At present, appliances and "plug loads" (stereos, computers, etc.) are not built with electric meters, nor do thermostats or showers indicate how much fuel is being burned for heat and hot water. However, technology does exist to allow Greening A Block to "wire-up" a building, gather energy-use data, and present it to residents in real time — either on each device, on a computer, or on a dedicated screen in the building or home.

The simplest and least costly level of energy monitoring is bill analysis. Greening A Block will request access to participants' monthly electric, natural gas and oil bills. This will allow the project manager to monitor the performance of the building and the improvements. This information will be kept confidential, if so desired by the owner or occupant.

However, with energy bills, there is a lag between when the energy was consumed and when the information is obtained, which lengthens the time before large energy problems can be spotted and fixed and makes it difficult to catch small energy leaks. Furthermore, it is a non-trivial bureaucratic task to procure and analyze hundreds of energy bills each month.

A more desirable solution is an advanced energy monitoring system that provides real-time energy consumption data. The data can be supplied both to occupants and owners as well as to Greening A Block through a computer, allowing energy usage for all buildings to be monitored from one place. Greening A Block will seek several interested buildings in which to pilot real-time energy monitoring systems. Based on the success of these pilots, the technology will be included in all future Greening A Block buildings. The project manager will seek additional outside funds to help support this work.

Greening A Block will obtain permissions from building owners and residents before making any of this information publicly available. However, project participants will be encouraged to share their energy information with the public, both to provide more tangible results and to encourage a bit of "friendly competition" between neighbors. One true measure of success for Greening A Block is when neighbors and friends start comparing electric bills with each other and sharing tips on how to lower usage.

Routine Maintenance

Proper operation and maintenance (O&M) is crucial to energy efficiency. Housing authorities routinely achieve energy savings of 10% or more just through improved O&M practices. Diligent O&M also lengthens equipment life. Proper O&M may require additional time by the maintenance staff, but the savings more than pay for it.

In general, the maintenance staff will be the building supers. Greening A Block will hold trainings for building supers to ensure that they are familiar with expected maintenance practices. The Association for Energy Affordability has an established curriculum and training program, including Energy Efficient Multifamily Building Operators Specialist Training at their Energy Management Training Center in the Bronx for this purpose. The cost of the course in 2005 was $1450 per student, with some subsidies available. A high estimate for training costs, assuming 50 buildings with one super in each, is $75,000. Since Greening A Block should be able to run its own dedicated trainings, in conjunction with AEA and NYSERDA, costs should be less than this.

A good O&M program includes the following elements:[23]

Accessible Equipment Information. Maintenance staff should have all manufacturer's instructions and manuals available in an accessible location, in addition to a master list describing each piece of equipment, its purpose, its operation and its maintenance requirements. They should be used when operating equipment or performing maintenance.

Routine maintenance and operations checks. Maintenance staff should routinely check equipment and systems for proper operation and control settings and perform preventive maintenance on a defined and written schedule.

Record keeping. All O&M checks and procedures should be recorded in an O&M log. This helps ensure that necessary O&M items are performed and are not duplicated by other maintenance staff. It also provides a record for management.

Training. Maintenance staff should be trained to operate and maintain equipment, existing and new. Maintenance contracts should be encouraged for more complicated equipment.

Step 8: Bi-Annual Checkup

In much the same way that prudent humans make regular visits to the doctor to ensure good health, so should buildings. Building doctors must come to their patients, of course, and instead of stethoscopes they carry combustion analyzers and hand-held computers.

Under Greening A Block, building check-ups will be performed in Spring and Fall, when climate conditions are temperate enough that both heating and cooling systems can be fully tested and repairs made without inconveniencing residents.

The Greening A Block checkups will include analysis of energy bills as well as inspection of the energy systems in the building. Bi-Annual checkups will be performed for at least 5 years as part of Greening A Block.

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[23] Much in this section is derived from: Nolden, S. et al. "Chapter 6: The Role of Proper Operations and Maintenance." *Energy Conservation for Housing: A Workbook*. Abt Associates, Inc. January. 1998. pp. 6-1 to 6-11. www.abtassoc.com/reports/D19980034.pdf

Appendix A: Draft Letter from Community Board 3 to Con Ed

Following is a template for the letter to be sent by Manhattan Community Board No. 3 to Con Edison to begin the process of allocating settlement funds to Greening A Block.

The City of New York
Manhattan Community Board No. 3
59 East 4th Street
New York, NY 10003

DATE [to come]

Mr. Eugene McGrath
President and CEO
Consolidated Edison Co. of New York
4 Irving Place
New York, NY 10003

Re: Supplemental Joint Stipulation between Con Edison and Manhattan Community Board No. 3

Dear Mr. McGrath:

Manhattan Community Board No. 3 ("CB3") herewith requests that Con Edison transfer [choose either: <the balance of> or <$400,000 from>] the "Fuel-Switching Account" that was established pursuant to the Supplemental Joint Stipulation under the authority of the Public Service Commission in Case 99-F-1314, to an account maintained by CB3 known as the "Greening A Block Fund."

CB3 has established The Greening A Block Fund (GAB Fund) as a financing mechanism to assist in carrying out Greening A Block: an innovative project to apply cost-effective energy-efficiency measures to several dozen buildings and several hundred apartments and commercial establishments on a city block on the Lower East Side of Manhattan near the Con Edison East River Generating Station.

The objectives, parameters and benefits of Greening A Block are spelled out in the Greening A Block Feasibility Study, dated January 31, 2006, which we have attached for reference. The report establishes that the air quality benefits of Greening A Block resulting from the energy-efficiency measures and the resulting decrease in on-site fuel consumption for heat and hot water are likely to at least equal, and probably exceed, the air quality benefits of the fuel-switching program at East River Units 6 and 7 described in the Supplemental Joint Stipulation. Accordingly, CB3 finds that Greening A Block satisfies the criteria of an alternative air quality improvement project in the general neighborhood of the East River Complex, as delineated in Section VI.E.3.i of the Amended Certificate Conditions.

CB3 also finds the project structure and timetable delineated in the Feasibility Study for implementing the energy-efficiency measures in the Greening A Block program to be

thorough and achievable; accordingly, we conclude that expenditures of funds on this alternative air quality improvement project qualify as prudent and thus meet the requirements of Section VI.E.6 of the Amended Certificate Conditions.

For these reasons, and because CB3 is excited by the potential of Greening A Block to improve quality-of-life and save energy and money for residents, merchants and property-owners on the chosen block while improving indoor comfort, creating good jobs and sparking economic activity in the community, CB3 passed a formal resolution on [DATE] to make the following designation provided in the Amended Certificate Conditions:

> CB3 may, by written notice to the Certificate Holder [Con Edison], the City and NYSDPS, designate that a specified portion of the remaining balance of the Fuel-Switching Account be … used for alternative air quality improvement projects in the general neighborhood of the East River Complex, as set forth in Paragraph VI.E.6 below. (Section VI.E.3.i)

Pursuant to this provision of the Amended Certificate Conditions, we have also on this date written to the City of New York, the New York State Department of Public Service, and the NY Public Interest Research Group (NYPIRG) to solicit their support for the designation of funds requested here.

As you know, the Supplemental Joint Stipulation provided, inter alia, that Con Edison fund the Fuel-Switching Account in the amount of $2,750,000, to be applied toward the combustion of natural gas in place of residual oil in Unit Nos. 6 and 7 at the East River Generating Station during the Winter Period November 15 through March 31. It is our understanding that Con Edison has not yet drawn upon this account, which would leave the entire amount available for alternative air quality improvement projects near the East River Complex such as Greening A Block.

As you can see from the Greening A Block Feasibility Study, the originators of the project envision spending $3,840,000 to retrofit the buildings on the model block with state-of-the-art energy efficiency systems, along with ancillary measures such as solar hot-water heating, solar-electric systems, green roofs and street trees. The majority of the funding, an estimated $2,345,000, would be provided by the re-allocated Fuel-Switching Account. (These figures are preliminary and are subject to change as the project evolves.)

Based on the comparative air quality analysis in the Feasibility Study, it is likely that such investments would create air quality benefits on the Lower East Side equaling if not exceeding the benefits of allocating equivalent monies toward combustion of natural gas in place of residual oil in Unit Nos. 6 and 7 at the East River Generating Station during the Winter Period. Accordingly, CB3 resolved that the entire balance of the Fuel-Switching Account be transferred to the GAB Fund. Of course, CB3 reserves the right to transfer funds back to the Fuel-Switching Account if conditions warrant.

Alternative Paragraph to the Preceding Paragraph, if CB3 seeks only $400,000

As you know, on [DATE TK] CB3 instructed Con Edison to expend up to $200,000 from the Fuel-Switching Account toward combustion of natural gas in place of residual oil in Unit

Nos. 6 and 7 at the East River Generating Station during the 2005-2006 Winter Period. Allocating an additional $400,000 to the GAB Fund is consistent with the proviso in the Amended Certificate Conditions that Con Edison not draw down the Fuel-Switching Account by more than $600,000 during any Winter Period (Section VI.E.3.d). The requested $400,000 allocation will finance startup of the Greening A Block project. Insofar as the project budget is many times greater, and insofar as constraints in funding from ongoing weatherization programs require tapping alternative sources of funds, CB3 envisions that the majority of the full budget would come from the Fuel-Switching Account. Thus, CB3 reserves the right to seek additional transfers of funds from the Fuel-Switching Account to the GAB Fund as conditions warrant.

The GAB Fund in which the requested funds of $[TK] should be deposited is Account [TK] at Bank [TK]. Please let us know if you require any further information from CB3 to implement the designation of funds requested here.

Sincerely,

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David McWater, Board Chair Susan Stetzer, District Manager

Appendix B: Air Quality Analysis

This appendix documents the methodology used to derive the air quality comparison presented in Section 10 between Greening A Block and the Fuel Switching plan specified in CB3's 2002 settlement with Con Edison over expansion of its East River (14th Street) Generating Station.

The methodology involved two steps. The first step was estimating the annual reductions in emissions of fine particulates (PM2.5) under either alternative. The assumptions and calculations for this step are described further below.

The second step was converting these reductions into estimated reductions in concentrations of fine particulates in ambient air in Community Board 3. Greening A Block retained Mr. Dan Gutman to perform this analysis. Mr. Gutman was the air quality expert retained by CB3 and the East River Environmental Coalition in the New York State Article X proceeding that gave rise to the Power Plant Settlement, and air quality modeling is one of his areas of expertise.

Mr. Gutman used EPA's most advanced computer model, ISC-PRIME (the Industrial Source Complex model with Plume RIse Model Enhancements). Following standard practice, calculations were made hour-by-hour using meteorological parameters measured at LaGuardia Airport. Mathematical receptors were placed every 100 meters covering the entire area of Community Board 3 — 492 receptors in all. Two hypothetical model blocks were modeled for the Greening A Block option: a block bounded by 12th and 13th Streets and Avenues B and C, and a block bounded by 10th and 11th Streets and Avenues A and B. (Note that the fact that these two blocks were modeled in the air quality analysis in no way implies that one of these two blocks will be the selected block for the project.)

The results were averaged for presentation in Table 10.2.

Emission Reductions from Greening A Block

Here we present the sources and calculations used to determine that the annual reduction in PM2.5 emissions from implementing the Greening A Block energy-saving measures will be 279 pounds.

EPA maintains an exhaustive set of "emission factors" for virtually every important pollutant and every known industrial and automotive process. The PM2.5 emission rate for boilers burning distillate oil (the light heating oil used in oil-fired boilers in multifamily residential buildings) is 2 for "filterable PM" and 1.3 for "condensable PM."[24] These figures, which sum to 3.3, are in pounds of PM2.5 per 1,000 gallons burned. For natural gas-fired boilers, the EPA emission factor for PM2.5 is 7.6 pounds per million cubic feet of gas.[25]

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[24] http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf. Tables 1.3-1 and 1.3-2.

[25] http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf

The respective emission factors are expressed in different units of fuel burned and thus are not directly comparable. In order to compare these figures, it is helpful to convert each to "emissions per BTU burned." One thousand gallons of light fuel oil have 138,690,000 BTUs, leading to an emission factor of 23.8 pounds of PM 2.5 per billion BTU. One million cubic feet of gas has 1,027,000,000 BTUs, leading to an emission factor of 7.4 pounds of PM 2.5 per billion BTU. Thus, the emission factor for oil is more than triple that for gas.

To calculate current emissions, we assumed that fuel-burning on the model block is equally divided between oil and gas, and is done at a rate of 34.0 BTUs per year, per square foot of space provided with heat and hot water, per "heating degree day." We applied this fuel-burn rate to 75% of the apartments on a typical Lower East Side block, on the assumption that three-quarters of buildings on the model block will participate in the energy-efficiency program.

Based on Greening A Block estimates that participating buildings have a total of 370,000 square feet of apartments and commercial spaces, and applying a standard degree-day figure of 4,750 for an average NYC heating season, we calculate that the current fuel burning for these buildings is approximately 60 billion BTUs per year, and the associated emissions of PM2.5 (calculated with the EPA emission factors given above) are 710 pounds from oil burning and 221 from gas burning, for a total of 931 pounds per year.

We assume that the heat and hot water efficiency measures implemented under Greening A Block will reduce fuel burning requirements by an average of 30%; thus, the estimated annual reduction in PM2.5 from GAB is 30% of 931 pounds, or 279 pounds. Note that we took no credit from possible reductions in emission *rates* (pollution per unit of fuel burned) that might result from upgrading or tuning burning mechanisms in the boilers. We also ignored the air quality gain from reduced use of power plants attributable to the *electricity* efficiency measures under Greening A Block; these are difficult to model (electricity supply to the Lower East Side originates in many different power plants) and would tend to be widely distributed around New York City and the surrounding region rather than concentrated on the Lower East Side.

Fuel-Switching at Con Edison's East River (14th Street) Generating Station

Here we present the sources and calculations used to calculate the annual reduction in PM2.5 emissions from boilers 60 and 70 at the Con Edison 14th Street Station due to the Fuel-Switching alternative.

We assume that $250,000 of the Fuel-Switching Account is applied annually to finance increased gas burning (and correspondingly reduced oil burning) at Boilers 60 & 70. (The actual amount isn't critical because total expenditures for fuel-switching will be "trued up" to equate to Greening A Block expenditures when the longevities of the respective options are incorporated into the calculations.)

How much fuel switching can be purchased for $250,000? In recent years, and currently, the price of natural gas during the winter heating season easily exceeds that of oil; indeed, this is precisely the price premium that the Fuel-Switching Account was intended to overcome. Under the Settlement Agreement, the maximum price premium under which the Fuel-

Switching Account may be drawn down is 50 cents per million BTU; at higher differentials the Account may not be tapped for fuel-switching.

Thus, if fuel switching takes place at all, it almost certainly will "buy" only one million BTUs worth for each 50 cents expended, or 2 million BTUs per dollar. Accordingly, $250,000 will buy 500,000 million BTUs worth of fuel switching from oil to gas.

We now ask, by how much will emissions of PM2.5 from Boiler 60 or 70 be reduced by replacing 500,000 million BTUs of oil with 500,000 million BTUs of gas? Answering this requires applying PM2.5 emission factors for oil and gas firing.

The PM2.5 emission rate for utility boilers burning residual oil (the grade of oil used at East River Boilers 60 and 70) is given by the EPA, in pounds of PM2.5 per 1,000 gallons burned, as 4.3 times "A," where "A" equals 1.12 times "S" + 0.37, where "S" equals the sulfur content of the oil in percent.[26] Inputting 0.3 for S (since Con Edison burns 0.3%-sulfur fuel oil at Boilers 60 & 70), the emission factor computes as 3.0 pounds of PM2.5 per 1,000 gallons of fuel oil. Substituting the BTU value of residual fuel oil (149,690 BTU per gallon) yields a PM2.5 emission factor of 0.0203 lb of PM2.5 per million BTU of fuel oil burned. Therefore, eliminating 500,000 million BTU of fuel oil would eliminate 500,000 x 0.0203 lb of PM2.5, or 10,100 lb of PM2.5.

The same procedure must now be followed for natural gas. As just discussed for Greening A Block, gas has an emission factor of 7.6 pounds of PM2.5 per million cubic feet of natural gas burned. Applying the heat content of natural gas, 1,027 BTU per cubic feet, thus yields a PM2.5 emission factor of 0.0074 lb of PM2.5 per million BTU of natural gas burned. Therefore, burning 500,000 million BTU of natural gas (in place of the same quantity of residual fuel oil) would create 500,000 x 0.0074 lb of PM2.5, or 3,700 lb of PM2.5. Accordingly, substituting 500,000 million BTU of natural gas for the same quantity of residual fuel oil yields a net annual reduction in PM2.5 emissions of 6,400 lb (10,100 less 3,700).

This analysis makes clear that the overall reduction in PM 2.5 emissions from Fuel-Switching exceeds that of Greening A Block by a factor of more than 20. However, it is important to discuss where this reduction will occur. The chimneys in the buildings improved by Greening A Block are relatively low to the ground, an estimated 55 feet high, and they disperse pollution sluggishly, at only 3-4 feet per second, causing it to settle into the surrounding air of the block. By contrast, the Con Ed stacks are 367 feet high (7 times as tall as the chimneys on the Model Block), and they exhaust pollution at a velocity of 29 feet per second (8 times as fast as the chimneys on the block). Thus, the emission reductions from the Fuel Switch option will be dispersed over a very wide area, including not only Brooklyn, Queens and Long Island, but also the Atlantic Ocean and Long Island Sound. When these differences are inputted into the EPA plume-rise model used to calculate the reduced concentrations of PM2.5 in ambient air, the result is that on the Model Block itself,

[26] http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf. Table 1.3-4

the estimated impact of Greening A Block is 9 times more than that of Fuel Switching in any one year, and 15 times more when averaged over the respective lifetimes of each option.

The most comprehensive air quality comparison encompasses the full 140 blocks of Community Board No. 3 and extends over the course of the expected life of each option (9-10 years for Fuel Switching, 15 years for Greening A Block). The methodology for estimating and comparing the average impact of either option on this area was described at the beginning of this appendix. The result is that across the full expanse of CB3, the impact of each option in any given year is about the same (a reduction of 2.7 nanograms per cubic meter of air for Fuel Switching, 2.6 nanograms for Greening A Block). However, the greater longevity of Greening A Block allows it to have a greater overall impact than the Fuel Switching. Averaged over 15 years, Greening A Block will reduce average concentrations of PM2.5 in ambient air in CB3 by 2.6 nanograms per cubic meter, vs. 1.6 nanograms for Fuel Switching.

This result does not account for the other community benefits of Greening A Block. Nor does it include the fact that Fuel Switching may not occur at all, given that the current market price differential between fuel oil and natural gas precludes spending the money on substituting natural gas for oil at the East River Power Plant.[27] Or that Greening A Block has the potential to transform many blocks, extending the air quality improvement to many neighborhoods over many decades.

[27] In theory, the Stipulation governing the Fuel-Switching Account could be amended to permit Con Edison to substitute natural gas for oil even when the price of the former exceeds that of the latter by more than 50 cents per million BTU. However, this would dilute the amount of fuel switching, thus, proportionately shrinking the pollution reduction achieved by Fuel Switching per dollar expended.

Appendix C: Energy Survey

(Note: Greening A Block will employ the term Energy Survey, to avoid possible negative connotations from the term Audit.)

Steven Winter Associates (SWA) gives the following description of their ResTech Energy Audits:

The SWA team will prepare an energy audit which has a very simple layout:

- *Title page and contents of report*
- *Executive summary of building condition*
- *Table of all cost-effective items with financial cost-effectiveness*
- *Scope of work which describes each building area in greater detail*
- *Digital photographs of building details/deficiencies that cannot be easily explained*
- *Appendices showing fuel usage, computer modeling output, and other data*

Each instrumented audit will review all of the following measures:

a) Lighting (indoor and outdoor)
b) Heating and heat distribution systems
c) Cooling systems and related equipment
d) Automatic temperature control systems and equipment
e) Air distribution systems and equipment
f) Outdoor ventilation systems and equipment
g) Exhaust systems and equipment
h) Hot water systems
i) Electric motors, transmission and drive systems
j) Special systems (kitchen/dining equipment, swimming pools, elevators, laundry equipment, etc.)
k) Renewable energy systems
l) Other energy using systems
m) Water consuming systems (restroom fixtures, swimming pools, irrigation systems, etc.)
n) Building envelope
o) Other as directed by building management/owner

SWA will examine fuel, electricity, and water use for a minimum of one year, and preferably two. SWA will perform a detailed examination in an attempt to break out, where available, energy use for domestic hot water (DHW), heating and cooling usage adjusted for weather, and electricity end-uses. As most occupants pay for their own electricity, SWA will review, as available, a representative sample of the buildings' systems installed in typical apartments, where the energy use is paid for by the occupant. In most cases, it is not possible to get utility usage by apartment without occupant consent, which would be difficult. Post audit consultation to clarify Final Report and discuss installation options will be provided.

The following pages contain more detailed descriptions of the various aspects of an energy survey.

Before the Energy Survey

The following information, gathered in advance of the survey, gives the auditor a reference point from which to begin analyzing the building.

Owner/Property Manager	Unit Occupant
Basic Property Information • # of floors • # of units • # of people per unit • contact person for each unit • name and contact information for super	Basic Unit Information • # of rooms • # of occupants
Energy Information • Heating fuel used • Hot Water fuel used • Con Ed account number • Fuel oil supplier (if appropriate) • one year of Con Ed bills (electric & gas) • one year of oil bills (if any)	Energy Information • Con Ed account number • One year of Con Ed bills (electric & gas) • Any known energy problems, e.g. drafts, lack of heat, overheating, moisture/mold, high bills

Interviews with Building Owner, Occupants, and Super

The people who live and work in a building tend to know it best. It is through talking with these people that the energy surveying team will get the best clues about where to find the energy problems. Interviews will be conducted with the help of student interns from Open Road of NY.

Purpose of the Interviews
• Learn about problems that are specific to individual apartments concerning heating, cooling, drafts or internal air quality. • Learn about heating problems, drafts, leaks, mold/mildew build-up, blown circuit breakers, and other symptoms of possible energy problems. • Understand resident lifestyles that impact energy consumption. • Gauge residents' willingness to try energy-saving devices and practices. • Teach residents about the project and increase their comfort with Greening A Block staff. • Address serious health and safety issues before proceeding with Greening A Block measures.

The Building Survey

For most buildings the bulk of the survey will be completed in one day. To analyze issues at the building level requires access to only a representative sample of the units (at least one facing each exterior wall and several on the top floor). Additional days may be necessary to complete audits of all units or to comprehend a particularly confounding situation.

Action	Purpose
External Inspection • Dimensions of the building • Windows: number and type • Exterior lighting: number and type • Façade issues such as cracks, missing bricks, badly fitting windows, etc. • Presence of window air conditioners	• Overview of building • Basis for conducting internal survey
Basement to Roof Walk-through of Common Spaces and Representative Units • Heating/HVAC system components (radiators, steam pipes, ducts, etc.) • Lighting (types, wattages, uses) • Window sizes and types • Sources of air infiltration from outdoors (poorly sealed doors and windows, cracks/holes in exterior walls, etc.)	• Overview of building • Gathering information for the energy model
Heating System Test • Read nameplate ratings of boiler and hot water heater and note current settings • Test the boiler's operating efficiency • Measure the temperature and content of the exhaust gases • Note the operating pressure • Determine the time it takes for all radiators to receive heat • Inspect boiler room piping, ventilation and insulation • Inspect distribution system (pipes & radiators) in as many units as possible, esp. top floor and units complaining of discomfort	• Find gauges, sensors and safety switches not configured for optimal efficiency • Find misaligned and mis-installed pipes in the boiler room
Unit surveys • Refrigerators and other appliances (models, brands, sizes) • Air conditioning • Appliances • Lighting • Showerheads • Phantom Loads	• Comprehensive assessment of the systems consuming energy within the unit. • May also include temperature readings to help in optimizing heating system
Solar Energy/Green Roofs Viability • Measure and assess roof and basement to decide if a solar energy system or green roof might be viable for the building.	• A solar roof must have several hundred feet that are free and unshaded throughout the year. • A green roof must be able to support the additional weight of dirt and plants.

After the Survey

Action	Purpose
Load Calculations • Calculate the necessary heat load for the building (the maximum amount of heat (measured in BTUs) that needs to be delivered through the building's radiators) • Same for individual apartment air-conditioning units	• Reveal if building heating systems (or apartment's air-conditioning units) are oversized and can be modified to improve both efficiency and comfort, especially if work done to insulate building shell.
Energy Model of Building • Performed on a computer in one of several programs dedicated to this purpose	• Useful for understanding dynamics of energy use in building and determining recommendations and SIRs
Write-up Recommendations, including • Measure • Approximate cost • Approximate SIR	• To present to building owner and (for units) occupants

Appendix D: Recommendations for Whole Building

This section contains typical recommendations that might be made to a building owner or co-op/condo board. They address issues with the heating system, common spaces and building shell. It is assumed that the building owner pays for the building's heat and hot water while individual residents pay for electricity and cooking gas.

Note that the survey consists of a full building inspection. In the course of this inspection, the surveyor may discover non-energy issues, including water leaks, foundation problems, general building repairs, facade issues, asbestos, electrical or plumbing issues, etc. Often these are straightforward matters of which owners and superintendents are already aware. But sometimes the act of inspecting a building thoroughly may turn up a critical issue that has been overlooked. Any such issue that would compromise the health or safety of building occupants or Greening A Block contractors would need to be addressed before work can continue on the building.

Cost-Effectiveness of Common Energy Efficiency Measures

Energy Savings from Typical Efficiency Measures in Multifamily Buildings						
Building Measures	**Payback (years)**	**SIR**	**Typical Cost**		**Fuel Oil Savings (gal/yr)**	**Electricity Savings (kWh/yr)**
Insulate Steam Piping	0.4	11.7	$18	per ft2 pipe	17	0
Replace Windows	17.1	0.9	$792	per window section	22	0
Weatherstrip Door	0.6	15.6	$78	per door	87	0
Upgrade Common Area Lighting	6.5	1.3	$100	per fixture	0	155
Replace Vacuum Pump Package	3.0	5.0	$500	per pump	94	1
Replace Steam Traps	1.4	4.4	$70	per trap	29	0
Install Thermostat	0.7	13.7	$150	per thermostat	87	637
Replace Washing Machines	2.1	5.4	$1,500	per machine	440	134

Source: NYSERDA AMP Projects completed in the recent past, including several large buildings on the Lower East Side.

Payback and SIRs (Savings to Investment Ratios) are calculated from the audits based on energy prices at that time (early 2000s), before the recent runup in both energy and construction costs (particularly the former) .

Heating System		
Item	**Action**	**Purpose**
Boiler	• Replace all constant-burning pilot lights on gas burners with automatic electric ignition. • Install mechanical vent dampers on all electronic ignition boilers. • Upgrade boiler gauges and controls. • Clean boiler. • Adjust pressure and fuel/air ratio. • Replace boiler, in extreme cases.	• save money on fuel bills • improve provision of heat and hot water • Prevent heat from escaping up the chimney when boilers are not producing heat. • Ensure optimal performance.
Piping	• Upgrade insulation for steam or hot water pipes to standard practice (unless the pipes are providing necessary heat to a space): o 1” insulation for pipes < 3” diameter o 2” insulation for pipes = or > 3” diameter[28] • Repair leaks in heating system piping. • Replace rusty pipes as necessary. • Overhaul vacuum pumps. • Conduct piping tightness test, if appropriate. • Consider conversion from steam to hot water heat distribution in rare situation where buildings use 2-pipe steam.	• Optimize distribution system efficiency.
Radiators	• Install thermostatic radiator valves (TRVs) wherever feasible. • Repair broken steam traps. • Replace valve packing if leaking. • Pitch radiators properly to avoid leaking. • Remove unnecessary radiators and downsize steam capacity if appropriate.	• TRVs allow residents to control heat from individual radiators, affording personal control of temperature and averting chronic overheating. • Steam risers often provide sufficient heat without radiators.
Thermostats	• Install night setbacks on thermostats. • Replace simple thermostats with digital programmable thermostats in cases where apartments have individual thermostats.	• Reduce temperatures during hours residents are sleeping; prevent overheating. • Allow residents to set temperature based on individual preferences.
Upgrade/replace motors[29]	• Upgrade or replace old, inefficient motors, such as those found in ventilation systems, and hydronic (hot water) heating or cooling systems, where appropriate.	• New motors are more efficient than old motors.
Ductwork	• Seal and insulate ducts in the rare situation where buildings use forced-air heating or central air	• Prevents leakage and loss.

[28] Commoner, B. and L. Rodberg, et. al. *Energy Conservation for NYC Low Income Housing*. NYSERDA Report 87-9, November 1986, p. B-8.

[29] Abt Associates Inc., p. 7-145.

Water		
Item	**Action**	**Purpose**
Water Temperature	• Adjust the building water tank to deliver water at 120° F. • Adjust mixing valves appropriately.	• Hot water temperatures greater than 120° F waste energy and can be hazardous to occupants.
Hot Water Tanks	• Replace old, inefficient tanks. • Insulate un-insulated hot water tanks. • Install vent dampers.	• Prevent heat loss. • Prevent heat from going up chimney.
Reducing Waste	• Insulate exposed hot water pipes. • Replace leaky pipes. • Equip kitchens with faucet aerators. • Use low-flow showerheads.	• Reduce water usage without degrading performance by increasing pressure and aerating water with high-comfort modern products (not to be confused with flow restrictors of decades past).
Toilets	• Replace with low-flow toilets where appropriate.	• New models reduce water consumption.
Washer/Dryer[30]	• Replace all inefficient laundry machines with high efficiency (i.e. front-loading) models. o If laundry machine service is provided by an outside vendor, renegotiate contracts to include such machines. • Convert to cold rinse. o Warm or hot water is necessary for washing many types of clothing, but not for rinse cycles, which can be performed with cold water with no change in results.	• Use 25% less gas or electricity. • Use 50% less water. • Warm or hot water is necessary for washing many types of clothing, but not for rinse cycles.

[30] Abt Associates, p. 7-24.

Building Envelope

Note on Maintenance Issues

- The energy survey will almost certainly reveal maintenance issues causing energy waste and/or occupant discomfort. These may include façade problems such as cracks, loose bricks, broken windows, broken doors and damaged roofs. Repairs that will lead to improved energy performance and comfort will be included in the Greening A Block workscope.

Item	Action	Purpose
Air Infiltration (undesirable entry of outside air)[31]	• Fix gaps and cracks in masonry • Insulate walls. • Caulk or insulate around windows and door frames. • Weatherstrip windows and doors. • Caulk any holes, gaps, cracks, and electrical outlets, especially on outside walls.	• Reduces heating and cooling bills. • Improves comfort by preventing drafts.
Insulation[32]	• Improve insulation in walls and/or roofs where possible.	• Lowers energy costs. • Increases comfort by keeping heat inside building in winter and preventing heat from entering in summer.
Windows[33]	• Replace all single-pane windows and windows with extremely poor fit to the building frame, with new Energy Star double-pane argon-filled thermal windows. o (or supplement single-pane windows in good condition with storm windows installed on inside) • Encourage residents to install reflective blinds during summer months to reduce solar heating. o (or install external sun shades that block summer sun while allowing winter sun to reach internal spaces)	• Replacing windows, while highly visible, is often not as cost-effective as other measures.
Exterior Doors[34]	• Weatherstrip. • Replace uninsulated doors with insulated ones. • Install storm doors on apartments with direct entrances from outside if feasible. • Install storm doors on building entrances without a vestibule.	• Reduces air infiltration. • Prevents drafts.
Roofs	• Cover roof in high-albedo (white or reflective) paint. • Insulate if possible.	• Lowers summer heat load. • Increases comfort by keeping heat inside the building in winter and preventing heat from entering in summer.

[31] Abt Associates, Inc. p. 7-37.

[32] Abt Associates, Inc. pp. 7-25 - 7-36.

[33] Abt Associates, Inc. pp. 7-9 - 7-17.

[34] Abt Associates, Inc. p. 7-21.

Common-area Lighting[35]

There are opportunities to realize major savings in hallways where lighting is on "24/7."

- All lighting prescribed in Greening A Block will have a color rendition index (CRI) of at least 80 and meet US EPA Toxic Characteristic Leaching Procedure (TCLP) criteria for mercury release.

Item	Action	Purpose
Conventional (incandescent) light bulbs	• Replace with compact fluorescent lamps (CFLs).	• Provides equivalent lighting with only one-third the power consumption.
Older model (T-12) fluorescent lighting fixtures	• Replace with either compact fluorescent fixtures or thinner and more efficient T-8 fluorescent fixtures with electronic ballasts.	• Provides equivalent lighting with 20-30% less power consumption.
Fixtures on High Ceilings	• Consider hanging fixtures that rest no more than 8-10 feet above the floor where ceilings are high.	• Requires less energy to deliver equivalent light than fixtures mounted on tall ceilings.
Infrequently Used Lights	• Install sensors to turn off lights in basements and other infrequently used spaces when unoccupied. • Upgrade infrequently used light fixtures (less than 2 hours per day) on a case-by-case basis.	• Ensures that lights turn off in unoccupied spaces.
Hallway lighting	• Consider bi-level lighting for public hallways at night when traffic is low. o A light fixture with two settings. o An ultrasonic sensor in the fixture detects motion and sets fixture to full output for 15 minutes when motion detected.	• The low setting uses 30% of the energy of the high setting.
Emergency Exit Signs	• Replace all exit signs with incandescent or older fluorescent lightbulbs with Energy Star products (e.g. LED-based).	• LEDs save electricity. • LEDs eliminate need to change lightbulbs. • With battery backup LEDs will run for many hours even in the event of a blackout.
Exterior Lighting	• Replace exterior halogen lamps with high-pressure sodium, metal halide, or high-intensity discharge (HID) lamps. • Replace exterior incandescent bulbs with outdoor CFLs. • Place light sensors on all external lights.	• Lamps provide equivalent light using less energy. • Unnecessary to run outdoor lights during daylight hours.

[35] Abt Associates Inc. pp. 7-113 - 7-140.

Billing-Related Recommendations		
Item	**Action**	**Purpose**
Peak demand Of special concern to • owners of buildings with central air conditioning, central laundry rooms, and/or a master meter • commercial tenants	• Shift energy use from peak times. • Encourage residents to do laundry at off-peak times such as evenings. • Add intelligent controls to central air-conditioning systems to reduce A/C when other electric loads go up temporarily.	• Avoids high peak demand charges. • Adds margins to and reduces stresses on local distribution network and overall NYC power grid.
Remove Extraneous Meters	• Combine meters for hallway lighting, water pumps and other devices. • Each utility customer needs only one meter	• Avoids flat monthly fee per electric meter.
Submetering[36] • For "Master Metered" buildings where electricity is included in the rent (e.g. Mitchell-Lama properties).	• Encourage conversion to individually metered apartments: o Bill occupants for the electricity they use in their unit.	• Makes occupants more mindful of their energy use. • Creates financial incentive to conserve electricity (by turning off lights and air conditioners when not home, for example). • Reduces electricity use in entire building.

[36] Abt Associates Inc. p. 7-157.

Appendix E: Recommendations for Individual Apartment Units

Most apartment residents pay only for their electric and cooking gas costs. Heat and hot water are typically included in rent (for tenants) or as part of a maintenance fee (for co-op or condo owners). In situations where buildings are master-metered for electricity and gas, residents pay no utility bills directly, and all benefits of energy savings will accrue to the building owner or to the building as a whole. Thus, in such situations, one would expect the building owner or co-operative corporation to cover many of the costs for the measures discussed in this section.

In contrast, some recently constructed buildings provide each unit with a separate heat and hot water system, typically fired by natural gas. In these cases, the workscope for the unit resident will include some of the items in the previous appendix.

Cost-Effectiveness of Upgrading Lighting and Refrigerators in Individual Apartments					
Apartment Measures	**Pay Back (years)**	**SIR**	**Cost**	**Energy Savings (mmBtu/yr)**	**Energy Savings (kWh/yr)**
Apartment Lighting	5.6	2.1	$56 per light	0	103
Refrigerator Replacement	6.9	1.2	$550 per refrigerator	-2	1,002

NOTE: The negative energy savings shown for refrigerator replacement reflects the fact that more-efficient appliances give off less heat, which requires the heating system to work slightly harder. Lamp replacements have a similar effect but it is too small to show up in the table. Of course, the tiny heating losses are far outweighed by the electrical savings.

Figures are calculated from our analysis of NYSERDA AMP audits performed on several larger Lower East Side buildings.

Recommendations for Saving Electricity in Your Home

(The following is adapted from Ben Jervey's *The Big Green Apple*, Insiders' Guide, 2006, pp. 14-16, and is indicative of the information Greening A Block will seek to share with Model Block residents and supers through appropriately designed educational materials — flyers, posters, hands-on instruction, etc.)

- ✓ **Lights and Lighting**
  - Turn off the lights when you leave home
  - Turn off the lights when you leave a room
  - Replace incandescent bulbs with compact florescent bulbs
  - Replace halogen torchieres with dimmable fluorescent ones
  - Maximize use of natural light by opening blinds, etc
  - Use Energy Star lamps
- ✓ **Kitchen**
  - Refrigerator
    - Replace an old, inefficient refrigerator with a new Energy Star model.
    - Set the refrigerator temperature at 38 - 42°F and freezer at 0 - 5°F.
    - Use power save switch (if your fridge has one).
    - Make sure to close the doors and that they seal tightly.

            - Quick Tip: You can test this by closing a dollar bill in the door - if it slides out easily, the molding should be replaced.
        - If not automatic, defrost your freezer on a regular basis.
    - Oven
        - Don't preheat or peek inside more than necessary.
        - Check seal on oven door.
    - Dishwasher
        - Use dishwasher only when full.
        - Avoid rinse hold, longer settings, and pre-rinse for all but the dirtiest dishes.
        - Avoid heat dry. Dishes dry naturally when washer is cracked open.

✓ **Electronics and home entertainment**
    - Unplug chargers when not in use.
    - Use power strips for TV, stereo, computer and other home entertainment components, and when not in use, shut off the power strip.
    - Buy Energy Star rated appliances when available.
    - Use flat panel screens instead of conventional, large CRTs.
    - Shut off or put your computer in sleep mode when not in use.

✓ **Laundry**
    - Use warm instead of hot water (this cuts electric load in half).
    - Use cold water instead of warm/hot whenever possible.
    - Use full loads instead of half loads (small loads use same energy as large ones, just less water).
    - Clean lint filter after every dryer use.
    - Dry heavy and light fabrics separately.
    - Use clothesline/clothes rack instead of dryer.

Recommendations for Climate Control in Your Home

(The following is adapted from Ben Jervey's *The Big Green Apple*, Insiders' Guide, 2006, pp. 23-25, and is indicative of the information Greening A Block will seek to share with Model Block residents and supers through appropriately designed educational materials — flyers, posters, hands-on instruction, etc.)

✓ **Heating**
    - Turn off radiator rather than opening window to regulate temperature.
    - Put up storm windows and/or seal windows from the inside with plastic.
    - Check all exterior doors and windows for leaks and seal them (caulking, weather-stripping, etc.).
    - Use the sunlight — leave shades open during the day close curtains at night to retain heat.
    - If you have control over your heat (i.e. at least one thermostat):
        - Leave thermostat no higher than 68 degrees Fahrenheit when home.
        - Leave thermostat at 55 degrees Fahrenheit when not at home and when sleeping.
        - Close doors and heating vents in unoccupied rooms.

✓ **Cooling**
    - Try using a fan or opening a window first.
    - Keep the sun out by drawing the curtains or blinds during the day.

- Air-conditioners
  - Use an Energy Star model.
  - Make sure that the unit fits tightly in the window and seal gaps.
  - Vacuum the filter weekly.
  - Replace old/inefficient units.
  - Use a fan to circulate the air-conditioned air rather than lowering the temperature on the unit.
  - Close doors to unoccupied rooms.
  - Make sure all doors and windows are tightly sealed to retain cool air (storm windows can help — even in summer).
  - Shut off unit when you are not at home. (More energy is used when you leave the unit on a low setting than to turn unit on to restore temperature.)
  - Use an appropriately sized unit — one that is too big will use more energy and be less comfortable, e.g.
    - 100-150 ft^2 = 5,000 BTU
    - 150-250 ft^2 = 6,000 BTU
    - 250-300 ft^2 = 7,000 BTU
    - 300-350 ft^2 = 8,000 BTU
    - 400-450 ft^2 = 10,000 BTU
    - 450-550 ft^2 = 12,000 BTU
    - 550-700 ft^2 = 14,000 BTU

    (for complete chart see www.energystar.gov)

Appendix F: Checklist for Operations and Maintenance

Note: Some O&M items overlap with conservation measures mentioned earlier. Items such as weatherstripping are recurring tasks and thus fall under both categories

Architectural		
Item	**Maintenance Task**	**Purpose**
Holes & gaps in building envelope	o Scrape out and replace cracked or deteriorating old caulking. o Caulk & Fill.	Prevents air infiltration. Improves comfort.
Windows and doors	o Caulk and fill gaps around window/door frames. o Weatherstrip with flexible rubber or plastic strips, installed around door frames and between the edge of operable window and sash.	Prevents air infiltration. Improves comfort.
Storm windows and doors	o Install at start of heating season, if applicable.	Provides better insulation.
Cracked window panes	o Repair as temporary measure before replacing.	Prevents air infiltration. Improves comfort.
Automatic door closing mechanisms on exterior	o Adjust so they close quickly and completely.	Minimizes air infiltration.
Unit air conditioners	o Remove or cover in winter.	Minimizes air infiltration.

Heating System		
Item	**Maintenance Task**	**Purpose**
Burners	o Keep clean. o Adjust when: • flame edge touches combustion chamber • tip of flame is orange • fiery droplets are present in flame • smoke above the chimney o microscreen filter on oil burner may reduce clogging	Clogging reduces efficiency.
Boilers and Furnaces	o Check fuel-to-air ratio and adjust using controls that determine mixture of air to fuel. o Calibrate and adjust controls according to manufacturer's equipment manuals. o Keep fireside surface where combustion occurs clean .	Proper ratio is necessary to achieve maximum efficiency. Increases efficiency. Soot acts as an insulator and reduces heat transfer.

	o Look for worn or damaged parts and replace as necessary: e.g. gaskets, casings, linkages.	
Oil-fired boilers and furnaces	o Preheat oil to recommended temperature (135˚F for No. 2 oil). o Clean strainers regularly/replace damaged oil screens. o Clean nozzle or rotary cup on burner.	Ensures proper viscosity (density) at the burner head. Maintain proper flow rate of oil to burner. Breaks oil into fine mist for efficient burning. If cups are dirty or nozzles are clogged, smoke and soot can result.
Boiler: heat exchanger and waterside surface	o Clean to remove scale buildup when shut down for maintenance. o If problem, chemically treat water to reduce future buildup.	Scale buildup from minerals in boiler water decreases heat transfer and reduces boiler efficiency.
Boiler make-up water	o Monitor consumption (don't just leave on auto feed). o Add water periodically.	Sudden increases indicate leaks in the system that should be repaired.
Blowers, motors, fans, and bearings	o Lubricate and maintain as specified by manufacturer.	Prolongs life and efficiency.
Forced-air system filters	o Every 1-2 months • replace disposable filter as recommended by equipment manufacturer, or • clean permanent filters according to manufacturer's instructions	Dirty filter reduces efficiency.
Vents in hot water radiators and baseboard units	o Open manual vents at least once yearly at beginning of heating season.	Allows trapped air to escape.
Steam distribution: valves on steam risers and air vents on radiators	o Adjust to control balance of temperature between units.	In many steam-heated multifamily buildings, the #1 source of inefficiency is uneven heating.
Air vents	o Check and repair/replace as necessary.	Vents allow proper operation of radiators.
Steam pressure	o Reduce to lowest level required by adjusting pressure control.	Most buildings operate on pressure that is too high, which wastes energy.
Steam traps (2-pipe steam, rare on LES)	o Replace when not opening properly, every 5 years or so.	Cause numerous problems when stuck open or closed.

Cooling		
Item	**Maintenance Task**	**Purpose**
Cooling systems	o Turn off in unoccupied areas.	Saves energy.
Air filters	o Clean or change monthly during use.	Improves efficiency and indoor air quality.
Evaporator coils	o Clean every 3 to 5 years.	Dirty evaporator coils result in inefficient cooling and shorten the life of the blower and compressor.
Condenser coils	o Clean whenever dirt accumulates.	Improves efficiency.
Blower	o Clean when dirt accumulates on blower blades.	Dirt reduces their ability to blow air over the evaporator coils.

Domestic Hot Water System		
Item	**Maintenance Task**	**Purpose**
Water temperature	o Lower so that delivered temperature is about 120˚F.	Any hotter wastes of energy.
Leaks	o Check for and repair immediately. o Encourage residents to report water leaks on faucets, showers, tubs, toilets, or garden hoses.	One leaking faucet can waste over 1,000 gallons per year as well as the 500,000 Btus necessary to heat it.
Hot water pipes	o Insulate pipes. o Turn off supply to areas that don't need, such as utility rooms, boiler rooms.	Reduces piping energy losses.
Tank-type water heaters	o Flush periodically. o Drain into a bucket until it runs clear.	Removes sediment.
Burners on gas and oil water heaters	o Clean/adjust as necessary.	Buildup of soot or other residue decreases combustion efficiency.
Electric water heaters	o Check and clean electrodes.	Removing scale buildup will increase heat transfer.

Lighting		
Item	**Maintenance Task**	**Purpose**
Spare bulbs/lamps	o Stock only energy-efficient bulbs/lamps for replacement.	Avoids temptation to install inefficient incandescents.
De-lamp fluorescent fixtures in over-lit areas	o for two-lamp fixtures, remove one lamp in each fixture or both tubes in alternate fixtures; o for three-lamp fixtures, remove the lamp in the middle; o for four-lamp fixtures, remove the two middle lamps; o remove ballasts from fixtures in which all the tubes have been removed; o maintain minimum light levels according to code and security requirements.	Reduces energy demands while still delivering sufficient (and often more pleasing) light.
Lighting fixtures	o Clean.	Dirty fixtures block light transmission and decrease lighting efficacy.
Walls	o Clean or paint walls with non-glossy white paint.	Walls should be kept clean to maximize brightness.
Exterior lighting	o Check to ensure proper setting of timers and sensors.	Lights on during daylight waste energy.

Appendix G: AMP Eligibility Survey

The following indicates the type of information gathered in one of New York State's primary multifamily energy efficiency programs, as well as the criteria for building eligibility for this program. (Adapted from DRAFT — June 2005)

Determine your eligibility for AMP by completing the following **3** steps.

(1) Building Eligibility

Does your property consist of 5 or more units? ☐ Yes

(2) Systems Benefit Charge Eligibility

Please indicate that you pay at least one monthly bill to one of these utility companies:

☐ Con Ed ☐ Orange & Rockland ☐ NY Gas & Electric (NYSEG)
☐ Niagara Mohawk ☐ Central Hudson ☐ Rochester Gas & Electric

(3) Income Eligibility

AMP serves multi-family residential buildings in which the average household income of the residents is no greater than 80% of the State median income. This section will help you determine whether your building may be income eligible.

A. Income eligibility through building financing

Most publicly assisted buildings have a subsidy built into the underlying financing. The subsidy requires that the owner dedicate a certain number of units to tenants in certain income ranges.

NOTE: AMP applicants need to provide documentation supporting only ONE of the following income eligibility proxies. Please CIRCLE the eligibility proxy that applies.

Eligibility Proxy	Details	Type of Documentation
HUD-Regulated Affordable Housing	Properties that receive one of the following subsidies from HUD are eligible for AMP: ☐ Section 8 Contract ☐ Section 236 ☐ Section 202 ☐ Section 811 ☐ Public Housing Authorities	Provide a copy of HUD contract or contract award notice
DHCR-Regulated Affordable Housing	Buildings with subsidized mortgages or contracts that place them under the regulatory control of DHCR may be eligible for AMP.	Provide a copy of DHCR contract or contract award notice
CDBG or HOME funding	Properties that use these funding sources are eligible for AMP.	Provide a copy of contract/terms of funding.
Low Income Housing Tax Credits	Properties that receive tax credits for at least 50% of its units are eligible for AMP.	Submit a copy of tax credit award notice from DHCR or HPD

Eligibility Proxy	Details	Type of Documentation
HPD-Regulated Affordable Housing (or other local housing agency)	Properties with loans, mortgages, or deeds of purchase (HDFC incorporation) from HPD or other local housing agencies may qualify for AMP.	Provide documentation of current mortgage, loan closing, HDFC incorporation, or deeds.
SONYMA mortgage insurance	Properties subsidized for low- to moderate-income multi-family residents with SONYMA subsidized financing through the HFA are eligible for AMP.	Provide a copy of loan closing/mortgage insurance award documents.
Mitchell-Lama Housing	Mitchell-Lama properties are automatically eligible for AMP. Buildings south of 96th St. in Manhattan must submit additional information to determine AMP eligibility. Call Cary Hirschstein at 212.977.5597 x237 to discuss.	Submit documentation of Mitchell-Lama status.
Weatherization Assistance Program (WAP)	Properties that have completed work using funds from WAP in the last ten years are eligible for AMP (unless there have been any major changes in the building's tenancy).	Provide a copy of signed WAP Apartment Building Work Summary (ABWS)

If you can prove income eligibility through one of the above proxies, skip B.
If you cannot prove eligibility by these measures, proceed to B.

B: Direct tenant public assistance:

Properties that do not receive direct public subsidy may have tenants who receive public assistance. To be eligible for AMP, tenants in at least 25% of the units must receive portable subsidies, including:

- Section 8 vouchers
- Supplemental social security income (SSI)
- Food stamps
- Senior Citizen Rent Increase Exemption (SCRIE)
- Low Income Home Energy Assistance Program (LIHEAP)

Documentation: **Owners should provide copies of vouchers, subsidy checks or rent exemption certificates (last names may be scratched out) for 25% of the units.**

Note: **A subset of properties that do not meet any of the requirements above may still be eligible due to the fact that average tenants earn below 80% of the State Median Income. If you feel that your property may still be eligible for AMP, contact Cary Hirschstein at 212.977.5597 x237.**

If your multifamily building is not eligible for AMP, please contact NYSERDA's Residential Technical Assistance Program (ResTech) at 1-866-NYSERDA.

Appendix H: Advanced Metering Pilot Project

Greening A Block presents a superb opportunity to première the use of advanced energy monitoring technology in small New York City multi-family residential buildings. While many large office buildings now contain some form of energy management system, it is rare to find such systems in small multifamily residential buildings, especially those built 50-100 years ago. However, with advances in wireless technology, sophisticated and comprehensive metering can now be implemented for relatively low cost (especially in comparison to wired solutions).

With advanced energy monitoring technology, residents and owners will be able to keep tabs on their real-time energy consumption. It will also allow the Greening A Block team to receive consumption information without having to prompt participants for utility bills.

Several innovative energy monitoring systems exist. One system, AWARE@HOME, is a WiFi-based system designed by researchers at the University of Michigan, with the goal of giving customers a means to monitor their utility expenditures without having to put in more than 5 minutes of effort per month. Its premise is that our built infrastructure is designed so that people are highly unaware of the resource demands they are placing on society and the planet, and that the presence of simple, comprehensible information will spur efforts to conserve.[37] Another, Lucid Design Group's IRIS system, provides data-logging both at the building and individual unit scale, as well as attractive display tools to convey this information within the building and on the internet. Further, there are several companies in New York, such as Genergy, P.E. Controls and others that have deep experience designing and installing energy monitoring and control systems.

Many systems have the capability of being networked to a central computer, allowing energy usage to be monitored by people outside of the building. Greening A Block will obtain permissions from building owners and residents before making any of this information publicly available. However, the hope is that most project participants will share their energy information with the public, both to provide more tangible results and to encourage a bit of "friendly competition" between neighbors. Greening A Block will be considered a true success when neighbors and friends start comparing electric bills with each other and sharing tips on how to lower usage.

Greening A Block will seek several interested buildings in which to pilot real-time energy monitoring systems. Based on the success of these pilots, the technology will be included in all future Greening A Block buildings. The project manager will seek additional outside funds to help support this work.

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[37] Clarens, A. et al. "AWARE@HOME: A Case Study in Technological Design to Promote Environmental Conservation in the American Home." Department of Mechanical Engineering, University of Michigan, Ann Arbor, 2005. Received through personal communication with one of the authors: Steven Skerlos, Assistant Professor.

Appendix I: Solar Energy Financing

Solar power holds the promise of providing a substantial portion of our energy needs in the future. However, the current generation of technology is more costly than many building owners are willing to bear. The technology typically pays for itself over time (the fuel —sunlight — is, after all, free) but the upfront costs can be a barrier to adoption. Fortunately, there are a number of state and federal programs that can be used to help pay for solar energy systems. Greening A Block will further subsidize the technology to ensure that solar energy systems are installed on a few buildings on the block.

Note that all prices discussed in this section are approximate and subject to change with the market.

Financing Solar Electricity

Solar electricity — photovoltaics or PV — particularly embodies cutting-edge technology and has captured the public imagination. Photovoltaic devices convert the sun's light directly into electricity with no moving parts. They are based on semiconductor technology, and are typically made out of the element silicon.

The building block of a typical PV system is the *module*. Each module typically consists of many *cells* (generally 4"-6" diameter, often cut rectangular) soldered together and encapsulated with glass on the top and a waterproof sheet on the back. Other technologies, such as thin-films, are deposited onto substrates, which can be rigid (glass) or flexible (thin metal or plastic), and then encapsulated to form a module. A number of modules are wired together to form an *array*.

Photovoltaic (PV) systems are typically discussed in terms of watts, kilowatts (kW) and megawatts (MW). A watt (W) is a unit of power equal to $1/746^{th}$ of a horsepower.

- 1 kilowatt (kW) = 1,000 watts (W)
- 1 megawatt (MW) = 1,000 kW = 1,000,000 W
- 1 kilowatt-hour (kWh) is the power needed to run a 1 kW load for 1 hour. The kWh is the unit of electricity in which utility bills are measured.

If a 1kW PV system is under the right sunlight and temperature conditions to continuously produce 1 kW of power for one hour, at the end of that hour, it will have produced 1 kilowatt-hour (kWh). Similarly, when a 1 kW load has been running for 1 hour, it has consumed 1 kWh of power. If a 100 W lightbulb is on for 10 hours, it, too, will consume 1 kWh of power.

PV system cost data is typically expressed as dollars per watt ($/W). Each square foot of roof can hold about 10 Watts of PV. On a typical NYC lot there may be 300-500 available square feet on which to install a PV system, enabling a system size of 3-5 kW. Each kW of PV produces about 1200 kWh of power annually.

In New York State, a PV system receives:

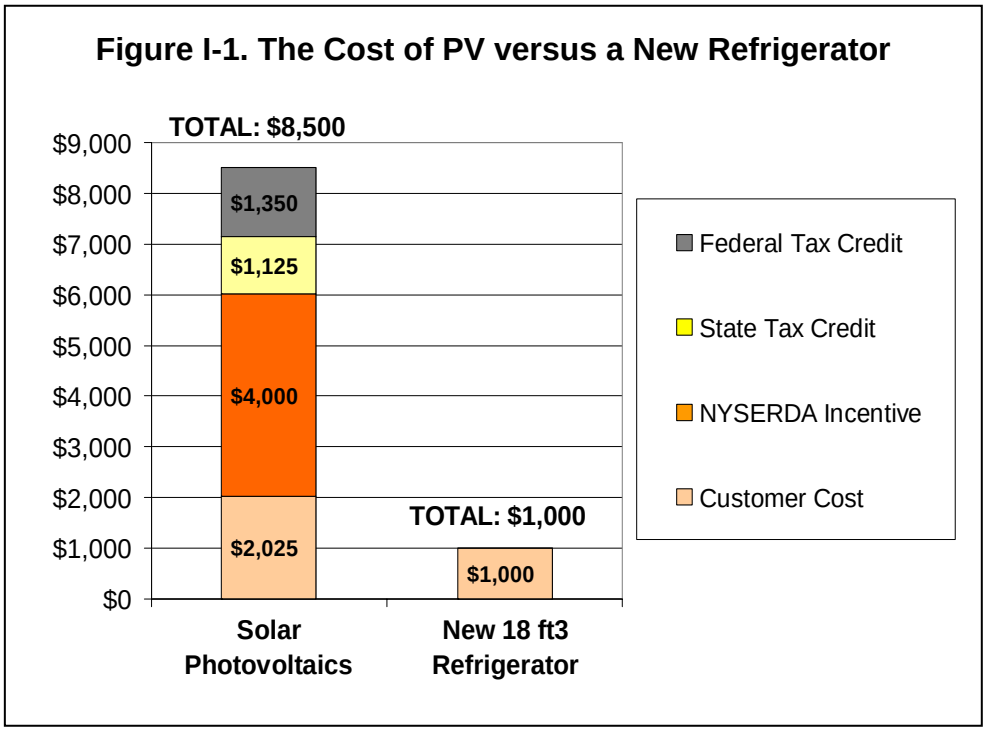
- A cash incentive (rebate) from NYSERDA of $4 per Watt, which typically covers at least 45% of the upfront cost.
- A federal tax credit of 30%.
- If the system is installed on a residential electrical meter (not the case for the "common load" meters of multifamily buildings, which are commercial meters), the Federal tax credit is limited to $2,000 but there is an additional state tax credit of up to $3,750.

Table I-1 summarizes the costs and benefits of residential PV systems in New York City.

Table I-1: Detailed Spreadsheet for Residential PV Installation in NYC

Customer Cost	$13,500	cost before tax incentives		
TAX INCENTIVES				
State Tax Credit	($3,375)	25% Customer Cost up to	$3,750	
Federal Tax Credit	($2,000)	30% Customer Cost up to	$2,000	
FINAL COST	**$8,125**	*(Note: Tax credits are subject to your particular tax status, please consult your accountant to confirm your eligibility.)*		
ANNUAL ENERGY SAVINGS				
			Assumptions:	
Annual Energy Saved	3600 kWh/year		kWh/kW/year	1200
Annual $ Saved	$720 $/year		$/kWh	$0.20
Simple Payback	11.3 years			
EMISSIONS SAVINGS				
	One Year		25 Years	
Carbon Dioxide (CO2)	5430 pounds		135750 pounds	
Oxides of Nitrogen (NOx)	5.97 pounds		149.25 pounds	
Sulfur Dioxide (SO2)	2.91 pounds		72.75 pounds	
Carbon Monoxide (CO)	0.69 pounds		17.25 pounds	
Volatile Organics (VOC)	0.114 pounds		2.85 pounds	
Soot (PM10)	0.114 pounds		2.85 pounds	
Mercury (Hg)	10.8 milligrams		270 milligrams	
EQUIVALENT TO				
A Car Driving	4,887 miles		122,175 miles	

It is enlightening to compare the cost of an energy efficiency improvement to the cost of a solar photovoltaic system. Consider a building with a 20-year-old refrigerator. Replacing this refrigerator with a new Energy Star model will save 1200 kWh per year. Installing one kilowatt of PV will also generate 1200 kWh per year. The relative costs of each are shown in Figure I-1.



From Figure I-1, it is clear that to reach the same end — saving 1,200 kWh of fossil fuel-derived electricity — energy efficiency (replacing the refrigerator) is the better investment by far.

This is not an argument against solar and other forms of renewable energy, which the authors have supported for many years. Rather, it underscores that it is generally more cost-effective to reduce energy consumption first, and then to use renewable energy to deliver power to these efficient systems.

Solar Water Heating

Systems that heat water with sunlight have been around for decades. Systems being installed today are far more efficient and reliable than those installed in the late 1970s and early 1980s. A typical Lower East Side building requires a system with approximately 550 square feet of panels on the roof, plus a large tank in the basement, to deliver 50% of the building's hot water needs.

The economics of such a system follow (note that assumes the current hot water employs a natural gas-fired hot water heater, with gas prices of $1.80 per therm, or $18.00 per million BTU).

Table I-2: Solar Water Heating System for a 5-story Walkup

Hot Water Use (gallons/day)	900
Total Absorber Area (square feet)	550
Solar Output (therms/year)	1450
System Cost	$55,000
Federal Tax Credit (30%)	($16,500)
Final Cost	$38,500
Annual Fuel Savings	$2,610
Payback (years)	14.8

Note that there are economies of scale to employing a single, larger solar water heating system to serve multiple adjoining buildings. Where neighboring buildings are owned by a single individual, company or co-operative, this is a good opportunity to make a system that is more substantial and more economical.

Appendix J: Local Energy Auditors, Contractors and Other Useful Contacts

This appendix lists some businesses and individuals whose services may be retained to perform some of the work of Greening A Block.

Association for Energy Affordability, Inc. (AEA)
AEA is committed to the principal of using energy efficiency to maintain affordable and healthy housing for low and moderate-income families and communities.

Contact: David Hepinstall/Michael Bobker
505 Eighth Ave. Suite 1801
New York, NY 10018
(212) 279-3902
hepinstall@aeanyc.org
mbobker@aeanyc.org
www.aeanyc.org

Community Environmental Center (CEC)
CEC's mission is to assist people throughout the New York metropolitan area in achieving a healthier, more affordable life by improving their home and community environments with educational and technical assistance. Build it Green! is a program of the CEC providing a one stop shop for products, services, and resources.

Contact: Richard Leigh
43-10 11th Street
Long Island City, NY 11101
(718) 784-1444
rleigh@cecenter.org
www.cecenter.org

Jeff Eichenwald
Jeff is a noted teacher and heating consultant in the New York area with over 25 years of experience in the construction and heating industry. Since 1980, he has been teaching classes in heating systems, building maintenance, and construction management for a variety of housing organizations including the ***Urban Homesteading Assistance Board, Housing Conservation Coordinators,*** and ***Enterprise Foundation.***

(212) 982-4803
Fax: (212) 533-7470
jeffeichenwald@netscape.net

EME Group
EME Group is a nationally recognized, full service engineering consulting firm with expertise in building system design, construction management and administrative services. Their clientele include the U.S. department of energy, U.S. Housing and Urban Development, and the U.S. Parks Department.

159 West 25th St.
New York, New York 10001
(212) 529-5969
info@emegroup.com
www.emegroup.com

Gifford Fuel Saving
Gifford Fuel Saving, Inc. is the company of Henry Gifford, an individual who has devoted his career to diagnosing and fixing dysfunctional, wasteful systems in apartment houses in New York City and designing new systems to avoid performance problems and energy waste. His expertise includes boiler, steam, and hydronic heating systems, water pressure boosting systems, ventilation systems and any other system that is part of a building's energy bill.

Contact: Henry Gifford
(212) 662-2768
hgiffford@nyc.rr.com
www.henrygifford.com

Northern Manhattan Improvement Corporation
Since 1979, Northern Manhattan Improvement Corporation (NMIC) has provided legal, social, workforce and community development services to help stabilize a rapidly growing, low-income and immigrant community.

Contact: Daniel Reiber
76 Wadsworth Avenue
New York, NY 11106
212-822-8338
drieber@nmic.org
www.nmic.org

The Steam Balancing Company (Jonathan Flothow)
Contact: Jonathan Flothow
45 Withers Street #2R
Brooklyn, NY
(718) 387-5291
Fax: (718) 387-5892
Jonathan@steambalancing.com
www.steambalancing.com

Steven Winter Associates (SWA)
SWA is a New York based firm specializing in high performance building design including energy efficiency. New York client base includes City, State, and Federal agencies, and owners of a wide array of buildings from small residential to well-known sustainable buildings, such as Battery Park City, 4 Times Square, AOL/Time Warner and Hearst Headquarters.

Contact: Andrew Padian
307 7th Ave
Suite 1201

New York, NY 10001
(212) 564-5800
padian@swinter.com
www.swinter.com

Fred Goldner
(516) 481-1455

Solar Energy Contractors

For Hot Water and/or Electric Systems:

Quixotic Systems Inc.
Contact: Richard Klein
90 Bedford St., Suite A
New York, NY 10014
(212) 367-9161
info@quixotic-systems.com
www.quixotic-systems.com

For Electric (Photovoltaic) Systems:

AltPower Inc.
Contact: Anthony Pereira
160 Fifth Avenue, Suite 807
New York, NY 10010
Phone: (212) 206-0547
Fax: (212) 206-0893
anthony@altpower.com
www.altpower.com

Duce Construction Corp.
Contact: John Messerschmidt
412 West 127th Street
New York, NY 10027-2516
Phone: (212) 316-2400
Fax: (212) 316-2429
john@ducecc.com
www.ducecc.com

Solar Energy Systems Inc.
Contact: David Buckner
1205 Manhattan Avenue
Suite 1-2-10
Brooklyn, NY 11222-1058
Phone: (718) 389-1545
Fax: (718) 389-2820
dbuckner@solaresystems.com
www.solaresystems.com

Tri-State Solar
Contact: Douglas Roether
66-10 52nd Drive
Maspeth, NY 11378
Phone: (718) 606-2258
Fax: (718) 458-4835
roether@tristatesolar.com
www.tristatesolar.com

Green Roofs and Street Trees Resources

Earthpledge Foundation
The Earth Pledge Green Roofs Initiative supports the development of green, vegetated rooftops in urban areas to prevent stormwater runoff pollution, lower urban temperatures, and improve air quality. (http://www.earthpledge.org/GreenRoof.html, http://www.greeninggotham.org)

Greening for Breathing. (GFB)
Greening for Breathing (GFB) is a coalition of individuals and community-based organizations whose mission is to improve air-quality, health, and well-being through strategic planting and care for green space in the Hunts Point section of the South Bronx. Their continual work and website are solid resources and examples for greening neighborhoods.
http://www.parks1.org/node/679. More about this project is available at:
http://www.nycgovparks.org/sub_your_park/trees_greenstreets/ny_tree_trust/images/pdf/greening_hunts_point.pdf

Sustainable South Bronx
A community organization dedicated to the implementation of sustainable development projects for the South Bronx that are informed by the needs of the community and the values of Environmental Justice. Programs have included green roofs and street trees.
http://www.ssbx.org/

NYC Parks
http://www.nycgovparks.org/sub_your_park/trees_greenstreets/street_tree_info.html
http://www.nycgovparks.org/sub_your_park/trees_greenstreets/ny_tree_trust/stewardship.html

Trees New York
http://www.treesny.com/

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