THE THREAT OF GLOBAL CLIMATE CHANGE-
WHAT CAN NEW YORKERS DO?

STATE AND LOCAL STRATEGIES TO REDUCE GREENHOUSE GAS EMISSIONS IN NEW YORK STATE

Report of the Environmental Law Section
of the New York State Bar Association

William R. Ginsberg, Chair

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This Report has been prepared by:

J. Kevin Healy
Alice M. McCarthy
Co-Chairs, Committee on Global Warming

William C. Fahey
James J. Periconi
Co-Chairs, Committee on Transportation

Peter R. Paden
Co-Chair, Land Use Committee

Charles M. Pratt
Co-Chair, Energy Committee

Sarah Flanagan
David J. Abrams
Jill K. Gormley
Dennis Matarangas

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I. INTRODUCTION

Many scientists are predicting that the global temperature will rise dramatically over the next century, as a result of the so-called "greenhouse effect," the accumulation in the atmosphere of certain gases which trap the sun's heat energy on earth. While there is disagreement within the scientific community as to the timing and potential severity of this phenomenon, there is a growing consensus that some climate change will occur, and that its effects may be ecologically and economically disruptive.

A significant and well-respected segment of the scientific community is warning that to avoid catastrophic consequences, steps must be taken to control greenhouse gas emissions in the near future. Some of the more alarming consequences predicted include:

- increased rainfall in some areas and droughts in others, which would shift significantly the zones of agricultural productivity, causing widespread social, political, and economic dislocation;

- a rise in sea level, resulting in flooding and perhaps the permanent inundation of low-lying coastal areas;

- an increase in ocean temperature that would disrupt and could possibly devastate marine life by harming the temperature-sensitive microscopic ocean organisms which make up the bulk of the oceanic food chain;

- the extinction of those plant and animal species which are unable to evolve quickly enough to adapt to change in temperatures.[1]

While these ominous predictions are not universally accepted, they have been advanced by well-respected and credible sources, and have been given some endorsement by such governmental agencies as the NASA Goddard Space Institute, the National Academy of Sciences and the United States Environmental Protection Agency.[2] On the other hand, valid concerns have been raised regarding the economic impacts of undertaking the measures some say are needed to reduce adequately greenhouse gas emissions. As a result, a debate is raging on the national and international levels over the steps that ought to be taken to deal with this problem, in a classic example of the traditional tension between economic and ecological concerns.

It will probably take years to unravel the complex questions now at issue as to global warming. Unfortunately, those years may be critical to the long-term environmental well-being of the planet, if the more dire predictions turn out to be accurate. Prudence dictates, therefore, that state and local authorities do what they reasonably can to buy time for the development of a national and international strategy to deal with the problem of climate change. The purpose of this report is to provide information on what other jurisdictions are doing in this area, and to set forth recommendations as to what New York authorities might do.

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[1] The Greenhouse Trap - What We're Doing to the Atmosphere and How We Can Slow Global Warming, World Resources Institute, 1990, pp. 95-97.

[2] Global Environmental Change--Recommendations for President-elect George Bush, National Academy of Sciences, National Academy of Engineers and the Institute of Medicine, 1989, p. 2.

Our investigations lead us to believe that a variety of measures can be implemented at state and local levels of government in New York to reduce greenhouse gas emissions. It is important to note that the environmental benefits of many of these measures would not be limited to their effect on global warming and that significant reductions in air pollution also could be realized. Moreover, each of the recommended strategies are expected to be economically beneficial. The emission of greenhouse gases in New York State is closely linked to the consumption of fossil fuels for energy production. Accordingly, strategies designed to reduce those emissions will save energy and result in reduced energy costs across the State.

In the balance of this report, we review briefly the steps taken to date in New York State to reduce its contribution to the world's inventory of greenhouse gases, and then outline a variety of strategies by which the State, its localities and its concerned citizens could enhance efforts to reduce the greenhouse effect.[3]

A. Greenhouse Gas Emissions in New York State

Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFCs) are generally considered the most important contributors to global warming. Each of these compounds has a different effect on global temperature: CFCs cause the greatest amount of warming per molecule, CH_4 and N_2O are somewhat less potent, and CO_2 causes the least environmental damage per molecule.[4] Despite their relative lack of potency, CO_2 emissions constitute 49 percent of total greenhouse gas emissions, CFC emissions 27 percent, CH_4 emissions 10 percent, and N_2O emissions 5 percent.[5]

The volume of CO_2 emissions makes control of that compound a critical component of any strategy for reducing greenhouse gas emissions. Moreover, CO_2 emissions are associated with activities that in many cases can be readily influenced by governmental action at a state or local level. The main source of these emissions is the burning of fossil fuels for energy, especially in automobiles and at power plants using fossil fuels to generate electricity.[6] In contrast, the major

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[3] This Report does not address in any detail how emissions from motor vehicles could be reduced, although we recognize that those emissions are a significant component of overall greenhouse gas emissions in New York State. The issues surrounding mobile source emission controls are currently being addressed by state and local authorities in the context of New York's efforts to revise the State Implementation Plan under the Clean Air Act amendments of 1990. Those issues are sufficiently complex and significant to merit specific attention, as a separate effort. For example, the October meeting of the Environmental Law Section was devoted to a discussion of transportation-related environmental issues, especially those under the Clean Air Act.

[4] Analysis of Carbon Reduction in New York State, New York State Energy Office, June 1991, p. 9.

[5] Id.

[6] The Greenhouse Trap, supra, p. 10.

sources of CH_4 are the natural emissions of ruminant animals and the effluent from rice paddies.[7] Neither of these is easily controlled, and neither is a large source of CH_4 emissions in New York State.[8] CFCs are already being phased out, with ongoing research focused on finding acceptable substitutes for their few remaining uses.[9] N_2O emissions are responsible for relatively little of the greenhouse gas problem. Therefore, this report will focus primarily on means of reducing CO_2 emissions.

Worldwide CO_2 emissions have almost doubled over the last 20 years; in the United States these emissions have increased by 30 percent.[10] However, in New York State, CO_2 emissions actually decreased by 15 percent over that time period.[11] Based on 1988 figures, New York ranks forty-sixth among the states in per-capita CO_2 emissions, due primarily to the State's overall energy efficiency and relatively low dependence on the use of coal for energy.[12] Nevertheless, when compared with governmental entities outside the U.S., New York ranks as the twenty-seventh largest total contributor of CO_2, emitting 185 million tons of this greenhouse gas annually. This puts New York State ahead of, among others, Spain, Saudi Arabia, Argentina, and Venezuela.[13]

B. Summary of State Initiatives Now Under Way

New York State has made significant efforts to reduce energy use, thereby eliminating some of the greenhouse gas emissions associated with the burning of fossil fuels to generate electricity and power automobiles. In 1988, Governor Cuomo issued Executive Order No. 118, which directed the State Energy Office, with assistance from other state agencies, to develop a State Energy Plan ("SEP") detailing strategies for reducing the State's energy use by 20 percent by the year 2008.[14] The Executive Order required executive branch agencies to act in conformance with the findings of the SEP, and required independent bodies and public authorities to give due deference to its findings. The first SEP, completed in 1989, created an integrated energy resource planning process to be conducted biennially by the State Energy Office. It also required that New

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[7] Analysis of Carbon Reduction in New York State, supra, p. 10.

[8] Id.

[9] The Greenhouse Trap, supra, pp. 95-97.

[10] Id., p. 18.

[11] Id.

[12] Id. With about 7 percent of the United States' population, New York State was responsible for only 5 percent of the country's total CO_2 emissions.

[13] Cool Tools: State and Local Policy Options to Confront a Changing Climate, Center for Global Change, March 1992, p. 8.

[14] New York State Energy Plan, Vol. 1: Executive Summary, p. 1.

York stabilize CO_2 emissions at 1988 levels, while investigating the steps needed to achieve the goal of a 20 percent CO_2 reduction by 2008.[15]

In 1992, the State Legislature passed legislation creating statutory authority for the State's energy planning process.[16] This law is modeled on and replaces Executive Order No. 118. The first SEP under the new process will be adopted in May 1994, and a new version will be issued every four years thereafter. Under the new law, any energy-related action or decision of a state agency, board, commission, or authority must be reasonably consistent with the policies and objectives of the SEP, as opposed to merely showing "due deference."

While the State's initiative in developing a plan for the reduction of CO_2 emissions is to be commended, it appears that far more can be done without adverse economic consequences. By way of comparison, Connecticut's 1990 "Act Concerning Global Warming" sets energy performance standards for new and existing state buildings which aim to reduce energy use by 15 percent by 1995, 30 percent by the year 2000, and 50 percent by 2010.[17] A wide array of additional cost-effective strategies is available to reduce CO_2 emissions in New York State beyond the levels now required, as discussed below.[18] Moreover, these measures will be beneficial to the State's economy, regardless of their effect on greenhouse gas emissions.

II. CONSTRUCTION AND BUILDING INITIATIVES TO REDUCE ENERGY USE

Since the generation of electricity in New York's fossil-fuel fired power plants results in the emission of significant amounts of CO_2, reducing the demand for electricity would reduce CO_2 emissions. Similarly, greenhouse gas emissions can be reduced by minimizing the consumption of fossil fuels for heating purposes. Changing the way buildings are constructed, from the materials used to the fixtures installed, offers a great opportunity to reduce energy demands.

A. Upgrading the Energy Conservation Construction Code

The construction of energy-efficient buildings must begin with state and local building codes. In New York State, buildings account for 40.3 percent of CO_2 emissions. Of this building-related total, 20.1 percent is attributable to space heating, 4.7 percent to water heating, and 25.8 percent

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[15] According to a report recently issued by the State Energy Office, which we have not evaluated, state agencies are on target in meeting these goals.

[16] State Energy Law §§6-104 and 6-106.

[17] "An Act Concerning Global Warming," HB 5896 (1990).

[18] We note that some strategies have already been put in place. For example, the State has updated its energy-efficiency standards for all new and renovated public and private building construction and achieved a substantially expanded commitment from utilities to implement "demand-side management" programs. New York State Energy Plan, Vol. 1: Executive Summary, p. 25.

to lighting, cooling, and other uses of electricity.[19] Thus, raising efficiency standards for new buildings is a particularly important way to realize energy savings and cut CO_2 emissions. Over the last two decades, new technologies and building methods have been developed which can cut energy consumption to half that of older buildings. While state-of-the-art energy-efficient construction will undoubtedly continue to exceed standard building practice, stronger building codes would improve the current level of energy efficiency in new building construction.

Building codes, typically implemented and enforced at the local or county level, require one seeking to construct or renovate a building to comply with certain standards. Local or county codes are often based on a state model code, which is modified to fit local requirements. A number of model building codes have also been created by engineering societies, governmental agencies, and other organizations. These codes may or may not contain specific regulations regarding the energy efficiency of the buildings for which construction permits are sought.

A variant of the model building code is the model energy construction code, which sets out standards specifically aimed at achieving energy-efficient construction. The most widely accepted model energy standard is the Council of American Building Officials' Model Energy Code ("MEC"), which several studies have found to be cost-effective. A model energy code such as the MEC is not intended to replace the more general building codes, which must address health and safety aspects of building construction. Rather, it supplements local building codes.

New York State has its own Energy Conservation Construction Code ("Energy Code"), administered and enforced by the governmental entity responsible for the administration and enforcement of the local building construction code applicable within a municipality.[20] The Energy Code provides a minimum standard of energy efficiency, allowing any municipality to adopt a more stringent plan, but prohibiting any local energy code deemed by the State to be less stringent.[21] The New York State Energy Code is more stringent than the MEC standard and is generally considered one of the best energy efficiency codes in the country.

Although better than those of most states, New York's Energy Code does not reflect the level of energy efficiency that is economically feasible.[22] This fact is well illustrated by two recent examples of how buildings can be renovated to reduce drastically the amounts of energy they consume, while at the same time allowing their owners to enjoy a significant economic benefit.

The National Audubon Society has recently completed a major renovation of a 100-year-old, eight-story building located on lower Broadway in New York City, incorporating the most energy-efficient design and construction alternatives available at reasonable cost. As designed, the renovated building will use 68 percent less energy than it would if designed merely to comply

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[19] Analysis of Carbon Reduction in New York State, supra, p. 33, n. 3.

[20] State Energy Conservation Construction Code, 9 NYCRR §7810.9.

[21] State Energy Conservation Construction Code, 9 NYCRR §7810.10.

[22] The Energy Code was last amended in 1991. Dr. J. Delaine Jones, New York State Energy Office, personal communication, June 18, 1992.

with, but not to exceed, the standards in the New York State Energy Code.[23] These energy-efficient design measures are expected to save the building owners $100,000 a year in energy costs, giving the measures a payback period of five years.

In designing the building, the architects used skylights to maximize natural light, occupancy sensors to deactivate artificial lights when not in use, and special "T-8 triphosphor lamps" for the ambient lighting system. In doing so, they relied on technology that has been on the market for at least a year. This was done for the explicit purpose of demonstrating that this technology is readily available, and that integrated design geared towards energy efficiency can be cost-effective.

Another example of energy-efficient renovation can be found in the New York City offices of the Natural Resources Defense Council ("NRDC"), which were renovated several years before the National Audubon Society renovation. There, the top three stories of an office building were renovated using existing energy-efficient techniques. Many of the lighting fixtures and controls used in the Audubon Building were first installed in the NRDC offices. In addition, the insulation in the walls and ceilings was increased to capacities 2 to 2½ times the industry norm. To minimize heat loss from the windows and skylights, each double-paned unit was equipped with a reflective, transparent sheet called a "heat mirror." The heating and cooling system at NRDC saves the organization about $20,000 annually.[24]

These design efforts and the energy savings realized arise from the special attention paid to energy conservation techniques by the architects of the two buildings and their clients. However, they also illustrate the economic advantages that can result from designing a building to exceed the requirements imposed under the State Energy Code. With such advantages in mind, the following initiatives might be considered:

1. Incorporating Contemporary Efficiency Technology into Existing Standards

Certain of the requirements appearing in the current technical standards-based Energy Code could be revised to reflect the energy-efficient technology now available.

For example, the "watts per square foot" illumination standards in the Energy Code limit the maximum connected power load for lighting per square foot. The standards are derived using two factors: the appropriate light levels for various tasks, and the most efficient, commonly commercially available technologies to meet those standards. If the power load standards remain constant as efficiencies improve, buildings can be designed with increased lighting levels while still meeting Energy Code standards, thereby defeating the energy-saving potential of the new technologies. This could be avoided simply by revising the Energy Code's maximum lighting power loads downward as new technologies become easily commercially available.

New York State Energy Law Section 16-120, which was enacted in 1985 to regulate the sale and installation of fluorescent lamp ballasts in New York State, could also be amended to mandate the use of new, more efficient ballasts. Ballasts control the flow of electrical current to fluorescent lamps. A new generation of solid state electronic ballasts, which consume less energy

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[23] Kirsten Childs, Croxton Collaborative, personal communication, June 26, 1992.

[24] Mr. Ashok Gupta, NRDC, personal communication, June 18, 1992.

than the magnetic core and coil ballast contemplated by the Energy Law, has recently become available. Not only do such new devices use much less electricity; they are reported to eliminate the lamp flicker and hum of the old style ballasts.

The Energy Code could also be amended to require maximum use of daylighting. Design strategies to achieve this goal include the use of light shelves or diffuse reflecting panels located above eye level to project light from the building sides into the interior; better interior distribution of light; and carefully planned window systems and shading devices.

Other technology-based improvements can be made in space heating and cooling efficiency, both in new and existing buildings. For example, cooling equipment could be improved significantly by adding economizer cycles to existing air-conditioning systems and using high-efficiency components when replacing worn out equipment or when installing new equipment.[25] In addition, the Energy Code could strengthen insulation requirements.[26]

The Energy Code should be revised to reflect this new technology, and other advances in the area of energy conservation in building design and construction.

2. Update the State Energy Code on a Regular Basis

The state of the art with respect to energy conservation technology is constantly evolving. To ensure that the State Energy Code requirements keep pace with advances in the field, the Code should be reconsidered and updated on a two-year cycle.

3. Establishing Energy Efficiency Requirements Based Upon a "Reasonable" Payback Period

The usual measure of cost-effectiveness is the "payback period," the time required for an individual energy conservation measure to pay for itself. The payback period is determined by comparing the measure being analyzed to its alternatives, in terms of the initial cost, lifespan, and cost of installation, use, and maintenance. Energy savings are factored into this analysis.

If the payback period is within reasonable limits, a measure is considered cost-effective. What constitutes a "reasonable" payback period varies according to the type of measure involved and the circumstances of the person or entity making the investment. For the complete renovation of a building, a reasonable payback would be stated in terms of years. The installation of a new light fixture, however, generally should pay for itself within a matter of months.

One way to strengthen the State Energy Code would be to require the use of energy-efficient measures having payback periods deemed by the State Energy Office to be "reasonable." In order to put such a system into effect, the Energy Office could, in the context of bi-annual rulemaking proceedings convened to update the State Energy Code, establish appropriate payback periods for various categories of activities, with reference to the cost of the work being performed, the savings that could be expected to accrue, and other relevant factors. The State could then

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[25] Id.

[26] Kirsten Childs, Croxton Collaborative, personal communication, June 26, 1992.

mandate the use of measures with payback periods deemed reasonable. Requiring the use of energy-efficient technology with reasonable payback periods could serve the dual purpose of publicizing the economic benefits of utilizing energy-efficient building components, and forcing developers to use those measures when it is cost-effective to do so.

4. Converting to a Performance Code

Another suggested approach to improving the State Energy Code would be to shift from the current standards-based code to a performance-based code.[27] With a performance-based code, builders could employ any combination of technologies to meet an established energy consumption level for a building.[28] Currently, the Energy Code allows those designing new buildings the option of meeting certain technical criteria (such as minimum insulation levels), or demonstrating through a comparative analysis of the annual energy usage of the proposed building design and a comparable standard building design that the proposed building's annual energy usage is not greater than the standard building's usage would be.[29]

At present, there are problems with respect to the implementation of performance-based requirements, which preclude us from recommending an immediate conversion of the Energy Code to one based solely on performance-related criteria. Those problems relate to the complexity of the calculations required to demonstrate compliance with such codes and the difficulties that thereby arise with respect to enforcement. Other jurisdictions are making considerable progress in resolving such problems. For example, the California Energy Commission has developed publicly available computer programs to enable architects, contractors, and developers to calculate readily the predicted energy consumption of buildings. The State Energy Office should determine whether similar models could serve as a means for determining compliance with a performance-based code in New York. As and to the extent these problems are resolved, the State Energy Office should consider strengthening the performance-based provisions of the Code.

5. Energy Efficiency Requirements in Renovations

Currently, the New York State Energy Code applies to the construction and design of any new public or private building, and since 1987, to the substantial renovation of existing buildings. Specifically, when an existing building is renovated, if the alteration will result in the replacement of more than 50 percent of any building system, that portion of the system which is replaced must

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[27] Suggestions made by Carl Stein, Stein Architects; and Kirsten Childs, Croxton Collaborative.

[28] One substantial benefit of a performance-based code is the incentive it would give builders to incorporate life-cycle cost analysis into the building design process. Life-cycle cost analysis is a planning technique used to minimize the costs of occupancy, taking into account the net present value of operation, maintenance, and energy costs over the life of the building. The use of this analysis method as a planning tool disciplines the design process by requiring the design team to consider recurring energy and maintenance costs. In doing so, it encourages the use of energy-efficient materials.

[29] State Energy Conservation Construction Code, 9 NYCRR §7812.2.

conform to the Energy Code.[30] New York should adopt an energy code specifically applicable to renovations where less than 50 percent of a building system is replaced.[31] That renovation energy code, which should apply whenever work requiring a building alteration permit is performed, could be designed to account for the distinct problems and opportunities that arise in renovations, as opposed to new building construction.

6. Pre-Sale Energy Audit and Retrofit

Another method for the State to promote the use of energy-efficient technologies in existing buildings would be to develop a pre-sale energy audit and retrofit program. As a general rule, existing buildings are very energy inefficient, and under present law, are likely to remain so. If New York required that a building meet certain minimum energy standards as a condition for sale, building owners would have an incentive to invest in energy-efficient improvements.

San Francisco has passed several ordinances involving pre-sale energy audits and efficiency retrofitting. San Francisco's Residential Energy Conservation Ordinance, which applies only to existing residential buildings, requires owners to comply with certain minimal prescriptive efficiency measures as a condition to selling the building.[32] These requirements seek primarily to reduce demand for space and water heating. Enforcement of the ordinance is accomplished by an on-site energy audit inspection at the time of sale. The inspector must certify that the owner has met the requirements before title to the house can be transferred to the buyer.

For commercial building owners, San Francisco's Commercial Energy Conservation Ordinance requires that they undertake certain energy conservation measures in their buildings when they either transfer title, construct an addition that increases heating area by 10 percent or more, or make improvements in a building worth more than $50,000.[33] With respect to title transfers, an option is provided that allows an escrow account to be established in the amount of one percent of the building's purchase price, or $150,000, whichever is less. The buyer, who is required to install the energy conservation measures within 180 days from the date of transfer of title, retains this money in the fund to offset the cost of the conservation measures. The energy-efficiency measures required by the ordinance include a broad range of practices, controls, and equipment aimed at reducing energy demand from lighting systems, heating, ventilation, and air

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[30] State Energy Conservation Construction Code, 9 NYCRR §7810.6(d)(2). Systems most commonly affected include, inter alia, exterior walls, roofs/ceilings, floors, slabs, piping, lighting, furnaces, boilers, air conditioners, heat pumps, chillers, and water heaters. It must be noted that technical electrical reasons prevent some buildings from being retrofitted for electronic fluorescent ballasts.

[31] Existing buildings can obtain substantial energy savings using well designed retrofit programs. A recent study by the Lawrence Berkeley Laboratory calculated that energy efficiency in existing buildings could be doubled in the next 20 years. Phil Jessup, International Council for Local Environmental Initiatives ("ICLEI"), personal communication, July 25, 1992. See discussion of Audubon and NRDC retrofit programs, supra, notes 19-21 and accompanying text.

[32] San Francisco, Cal., Housing Law §1201.

[33] San Francisco, Cal., Housing Law §1301.

conditioning ("HVAC") systems, service hot water systems, commercial refrigeration equipment, and motor-driven equipment.

Prior to enactment of this statute, San Francisco conducted a study of the energy consumption of existing commercial buildings, which identified three major barriers to the implementation of cost-effective conservation measures: lack of information on the part of building owners; lack of access to capital; and split incentives (the benefits of efficiency measures are split between owner and tenant, with only 15 percent of the commercial space surveyed being occupied by the owner).[34] The ordinance attempts to address these barriers by using the mandated inspection process to deliver information to building owners; by tying the energy retrofit requirements to title transfers or renovations, when capital is generally available; and by overriding the split incentive by clearly identifying the owner as the one responsible for carrying out the measures. San Francisco estimates that the ordinance will reduce energy use by 4 to 20 percent, saving businesses over $50 million in energy costs in the first five years of implementation.[35]

While large property owners opposed the ordinance,[36] many of their concerns were alleviated by ordinance provisions exempting buildings with a demonstrable history of energy-efficiency. Nevertheless, implementation has not been trouble-free. Since the retrofit program took effect in July of 1989, noncompliance has been a problem, arising primarily from a lack of awareness among commercial real estate brokers, the difficulty of enforcement, and the City's inadequate capacity to process essential data for energy inspections and title transfers.[37]

Despite the inevitable problems with enforcement and processing of information, the San Francisco ordinances provide an example for New York. New York State should study San Francisco's measures to understand their strengths and weaknesses. If a retrofit program tied to the transfer of title could be established with reasonable enforcement measures, it would provide a means for significant energy savings.

Regardless of whether a mandatory retrofit program turns out to be appropriate for New York, pre-sale energy audits should be required whenever ownership of residential, commercial, or industrial properties is transferred. The State Energy Office should consult with PSC to determine whether utilities ought to perform such mandatory audits according to a prescribed protocol, for a reasonable fee.

7. Enforcing the Energy Code

State and local officials could take steps to ensure strict enforcement of the Energy Code. Inadequate enforcement allows builders who violate the Code to escape sanction. As a result, others--finding themselves at a competitive disadvantage--are encouraged to follow suit. New York

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[34] Innovative Municipal Initiatives to Reduce Energy Demand in Residential and Commercial Buildings: A Preliminary Survey, ICLEI Draft Report, November 1991, p. 15.

[35] Id.

[36] Id., p. 16.

[37] Id.

could increase random inspection at work sites to assess compliance with the Energy Code, and could impose more severe penalties on violators. This would act as a deterrent for builders tempted to bypass the code for a cheaper, less efficient alternative.

B. Other Strategies for Implementing Efficiency Measures

Beyond the Energy Code, there are many opportunities for increasing the energy efficiency of new and existing buildings. These generally all require some sort of action on the part of New York State and its subdivisions, though some also rely on the cooperation of State utilities and private institutions. The following strategies, if implemented, could have a measurable impact on reducing CO_2 emissions in New York State.

1. Increase Energy Efficiency in Public Buildings

New York State and its political subdivisions could significantly reduce the amount of CO_2 emitted by the generation of electricity by reducing the energy used in public buildings. Reducing energy in state and local government buildings would cut CO_2 emissions, and save tax dollars at the same time.[38]

State and local government facilities are major energy consumers. Nationwide, over $20 billion is spent annually to light, heat, and cool government-owned and leased building space.[39] It is estimated that the use of cost-effective, energy-efficient measures could conserve at least 25 percent of the energy used in federal buildings.[40] Presumably, these savings could also be achieved or exceeded at the lower levels of government.

In a 1990 Executive Order, New York established a goal of a 20 percent energy reduction in State buildings by the year 2000.[41] The State, in cooperation with the New York Power Authority, is currently undertaking a statewide effort to retrofit State facilities with cost-effective lighting and HVAC technologies. This program, known as Statewide HELP, is ultimately expected to reduce the State's energy use by up to 40 percent. However, more could be done to increase statewide energy efficiency.

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[38] We should note, in this regard, that New York may qualify under the National Energy Policy Act of 1992 for a $1,000,000 federal grant for the purpose of financing energy-efficiency improvements to public structures, "if it demonstrates a commitment to improving the energy efficiency of buildings." See 42 USC §6322.

[39] Of the 12.6 billion square feet of total floor space occupied by the government in this country, state, and local governments occupy 91 percent, and the federal government occupies the remaining 1.1 billion square feet. Energy Efficiency in the Federal Government: Government by Good Example?, Office of Technical Assessment, May 1991.

[40] Id.

[41] See Executive Order No. 132 (1990). As noted supra, more dramatic reductions might be achieved using the technology and retrofitting techniques available today.

While the Power Authority has incorporated life cycle cost analysis as part of HELP, New York and its subdivisions should require their agencies to identify energy costs in their budgets, and to employ life cycle cost analysis in the planning for all new buildings and for major renovations. The State Energy Office should establish the criteria needed for conducting such analyses--particularly with regard to the calculation of the overall energy costs of a proposed project.[42]

State, county, and local agencies should also be required to conduct energy audits on a regular basis, in order to identify opportunities for better energy management in existing public buildings. Initial audits should be required in the first instance, with follow-up audits to be conducted periodically thereafter. In addition, the State should update its lighting efficiency standards for existing public buildings, and provide for periodic reviews, so that the standards will continue to reflect advances in energy-efficiency technologies.[43]

Similarly, state and local governments should require the space they lease to be energy-efficient. Energy audits should be conducted before any lease is signed, and lease provisions should set out energy-efficiency requirements for the rented space, and, to the extent possible, the building as a whole. At the state level, minimum requirements for leased space should be established by the State Energy Office and the Office of General Services.

Moreover, by implementing the following measures in state, county, and local buildings, New York State would be able to achieve substantial reductions in energy use:

- requiring all public buildings to exceed the minimum requirements of the Energy Code, to serve as an example of the cost-effectiveness of energy-efficient improvements;

- mandating the use of solar energy in new or renovated public facilities wherever feasible, to show the public and the commercial sector that solar technologies exist, are functional, and conserve energy;[44]

- making the use of daylighting an important aspect of the design of all new public structures;

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[42] At the same time, the State Energy Office could develop protocols for the "commissioning" of buildings. Building commissioning is the process by which engineers document and test the performance of a building and all its systems, separately and together. Currently, it is quite expensive and time-consuming, and is therefore seldom done. One thing the State Energy Office could do in the development of a standard "building commissioning" protocol is to create a pilot program using building commissioning in State construction projects to gather information about the process.

[43] See Lighting Efficiency Standards for Existing Public Buildings, 9 NYCRR Parts 7820 and 7821.

[44] See, e.g., Ariz. Rev. Stat. §34-452 (1989).

- requiring the installation of occupancy sensors and dimmers,[45] and of automatic timers on heating and air-conditioning equipment in all public facilities;

- allowing only energy-efficient appliances to be used in public buildings--the State Energy Office, in consultation with the Office of General Services, should establish and update periodically energy-efficient procurement specifications for appliances, fixtures, and equipment;

- providing incentives for State employees to conserve energy;

- assigning an energy manager to each public building, who would be responsible for making sure that equipment and lights are turned off at the end of the day, and that any new equipment and fixtures procured for the building are energy-efficient;

- using photovoltaic technology wherever practicable--in particular, state and local agencies should determine whether it would be cost-effective to energize by solar power street lights, emergency telephones, or any other equipment which need not be hooked into the power grid;

- establishing an "energy job corps" program to retrain technicians and professionals previously employed in the defense industry to assist in the development of energy-saving technology.

In addition, state agencies such as the New York State Thruway Authority, the Triborough Bridge and Tunnel Authority, and the Port Authority could limit the unnecessary consumption of outdoor lighting along thruways and bridges, by utilizing energy-efficient bulbs and by replacing only a percentage of the lights now in use when the bulbs burn out. This would reduce costs for the State while also conserving energy. Of course, where outdoor lighting is needed to ensure safety it should not be compromised, but where such lighting is necessary, the State should insist that it be energy-efficient.

2. Energy Efficiency in Publicly Assisted Projects

Initiatives similar to those put into place for public buildings could be required for any development receiving assistance from public entities such as industrial development authorities, the Environmental Facilities Corporation, or the Urban Development Corporation. To the extent additional financing is needed to make such developments energy-efficient, it should be provided on terms that will ensure the additional debt can be repaid from energy cost savings. In public housing, existing inefficient refrigerators could be replaced by energy-efficient ones.

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[45] Occupancy sensors allow the lighting system to detect when a room is unoccupied and to switch off the lights.

3. Additional SEQRA Findings

The State Environmental Quality Review Act currently requires that an environmental impact statement ("EIS") be prepared for any discretionary public action that may significantly affect the environment. At the conclusion of the EIS process, findings must be issued by the lead agency affirming that the action is one that minimizes environmental impacts to the "maximum extent practicable."[46] While SEQRA now requires that the impact of a project on energy consumption be considered, an EIS seldom includes anything other than a perfunctory examination of the energy implications a project might have.

SEQRA could become a powerful tool for the achievement of energy conservation through the addition of an energy-efficiency "findings" requirement. Under such an amendment, an explicit finding would be required upon the completion of an EIS that:

> consistent with social, economic, and other essential considerations, the action will be designed and constructed to conserve energy to the maximum extent practicable.

4. Energy Cost Disclosure

The Truth in Heating Act, part of the New York State Energy Law, entitles anyone considering buying or renting a one- or two-family house, or a single apartment in a multiple dwelling (including a condominium or cooperative) where tenants are responsible for paying their own heating or cooling bills, to request and receive copies of actual bills, or a written summary thereof, for the most recent two-year period in which the residence was occupied.[47] This information enables the potential purchaser or lessee to compare the energy costs of his or her various choices, thereby creating a market incentive for building owners to improve energy efficiency.

While the energy cost information now available through the Truth in Heating Act is valuable, the impact of the law is limited by the fact that it applies only to certain residential transactions and that a potential buyer or renter must affirmatively request the information. The law should be extended to apply in the context of the sale or rental of industrial, commercial, and multi-unit residential buildings. Moreover, it should be amended to require disclosure of energy costs as a matter of course, placing the burden on the seller or landlord to come forward with the information.

Another means to enhance market incentives for energy efficiency in construction and renovation would be for the State to expand the use of its home energy rating system ("HERS") for assessing energy efficiency of individual buildings. This program, entitled New York State Energy Star ("NYSE-Star"), was developed by a partnership of the New York State Builders Association, the State Energy Office, the State Energy Research and Development Authority, and the State's investor-owned utilities. It provides for the "certification" of new homes constructed

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[46] New York Environmental Conservation Law §8-0109(8).

[47] New York State Energy Law §17-103.

with specified energy-efficient methods, materials, and equipment, and is designed to result in buildings that are at least 25 percent more efficient than those built according to the Energy Code. However, since it is purely voluntary and applies only to newly constructed, single-family and multi-family homes, the program has limited application.[48]

Like NYSE-Star, HERS programs in general have tended to be voluntary, primarily because potential participants such as realtors resist the practice out of fear that blanket ratings will reduce the property value of homes that cannot meet program standards.[49] Even without making ratings mandatory, however, the State could increase the utility of the program by developing a HERS for existing residential buildings in addition to newly constructed homes. While necessarily more complex than NYSE-Star, such a rating program would have the dual effect of raising consumer awareness and giving homeowners and landlords an incentive to make their buildings more energy-efficient.

In his January 5, 1994 Message to the Legislature, Governor Cuomo proposed expanding the HERS program to apply to existing homes as well as new construction. Under the Governor's proposal, the Home Insulation and Energy Conservation Act ("HIECA")[50] would be revised to provide for the development of a HERS for existing residential buildings through a partnership similar to that which developed NYSE-Star. This proposal is sound, and could result in a significant expansion in energy-efficient homes if participants can bring its benefits to the public's attention.

5. Incentives for Using Energy-Efficient Products

Technology development has produced many innovative energy-saving techniques, but many remain underutilized. New York could enhance incentives for manufacturers to market these devices more effectively, and at a price that makes them viable alternatives for architects and contractors. While modifying the Energy Conservation Construction Code, as discussed above, will help in this regard, the State can influence behavior in other ways.

a. State Incentive Programs

The State could provide energy conservation loans to projects that implement energy-efficient measures. By helping to defray the initial capital costs of installing efficient products, loans could encourage potential customers to choose energy-efficient methods over standard, less efficient, but frequently less costly products. The loans could be repaid out of savings enjoyed as

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[48] According to a press release from Governor Cuomo's press office, "more than 150 new homes have been certified as meeting the NYSE-Star standards" since the 1991 inception of the program. See Executive Chamber, Press Release, October 23, 1992.

[49] Innovative Municipal Initiatives to Reduce Energy Demand, supra, p. 30, n. 32.

[50] New York State Public Service Law §135-a, et seq.

a result of the steps taken to reduce energy consumption.[51] This assistance could be administered by the Environmental Facilities Corporation, the New York State Energy Research and Development Authority, or the Department of Economic Development.[52]

b. Utility Incentive Programs

As the providers of electricity, utilities are in a unique position to influence how their product is used. Based on the findings of an April 1992 New York State Public Service Commission ("PSC") report on Demand Side Management ("DSM"), New York's seven investor-owned utilities and the PSC have identified DSM as a key component in New York's plan for meeting consumer electricity needs in an efficient, cost-effective, reliable, and environmentally sound manner. The report notes that for DSM to work, regulatory incentives are necessary to make investments in cost-effective conservation measures equally as rewarding to the utilities as investments in electricity generating capacity. Consequently, the PSC has approved plans which tie utility earnings to the SEP's energy reduction targets.

The current PSC-supervised system, which involves the development of DSM programs in rate-setting proceedings, has caused each utility to come up with its own DSM program. Certain of those programs have been quite effective, while others have not. The State Energy Office and the PSC should work together to establish uniform, mandatory requirements for DSM programs for all regulated utilities, which would result at least in the achievement of the energy conservation goals called for by the State Energy Plan.[53]

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[51] Currently, for example, in addition to offering certain rebates, the New York Power Authority will finance the installation of energy-efficient technology through its conservation bank. The loans are repaid with money saved through lower electric bills. The State might also consider raising the gasoline tax and distributing the additional proceeds in the form of grants to builders who voluntarily exceed the energy efficiency standards of the Energy Code.

[52] The State already has several programs in place to assist the implementation of energy conservation projects. Under State Finance Law Section 127-a, certain facilities which are issued operating certificates by a state agency and are reimbursed for energy costs are eligible for full reimbursement of the costs of implementing energy conservation projects. In addition, under 9 NYCRR Part 7920, the State Energy Office administers the Not-for-Profit Energy Conservation Grant Program, which provides grants of up to $12,000 to not-for-profit organizations implementing energy-efficient improvements in space occupied and either owned or leased by the applicants. Similarly, under 9 NYCRR Part 7921, the State Energy Office administers a rebate program which applies to the implementation of energy-efficient improvements by not-for-profit organizations, municipalities, and state agencies. The rebates, which are awarded on a first-come, first-served basis until all funds available are exhausted, cover 50 percent of the total project cost, up to a maximum rebate of $25,000.

[53] With regard to DSM programs, it should be noted that the National Energy Policy Act of 1992 requires State rate-setting agencies to allow utilities to profit from their energy conservation investments. It also requires that such programs be "appropriately monitored and evaluated." See 42 USC §2621.

With respect to particular conservation incentive initiatives, the State Energy Office is currently working with utilities throughout the State to coordinate and assist in the conversion to energy-efficient technologies. It would be fruitful to target DSM funds to encourage energy conservation measures beyond those required by the Energy Conservation Code. In this context, the State Energy Office could encourage utilities to develop a coordinated program of incentives to encourage the manufacturers of high efficiency products to market those products in New York State; for example, by collaborating with utilities to offer rebates and marketing assistance for the most efficient products introduced each year. This would encourage research and development, and would also benefit utilities by facilitating their planning efforts.

High-efficiency appliances typically expend one-tenth to one-quarter the energy of older, inefficient appliances. Most utilities have developed incentive programs for consumers to replace inefficient appliances and equipment with newer, more efficient models. For example, Con Edison offers cash rebates to commercial customers who install energy-efficient equipment that reduces the lighting load. The rebate amounts are so substantial that in some cases the amount of the rebates covers 100 percent of the equipment costs.[54] This type of initiative could be offered on a statewide basis.[55]

A different, and somewhat more comprehensive incentive plan has been put into effect by the New England Electric System ("NEES") in Westborough, Massachusetts.[56] This five-year conservation and load management plan offers commercial and industrial customers eight different programs for energy-saving opportunities. Most of these programs help customers maximize their overall energy efficiency. One interesting exception is a lighting rebate program in which NEES gives cash incentives to lighting dealers. Through these payments, the utility intends to encourage dealers to sell energy-efficient lamps, ballasts, and fixtures to end-users at the same price as standard lighting products. Utilities in New York could consider developing such a program, to the extent they do not already have similar plans in place or underway.

Another method for utilities to encourage the use of energy-efficiency measures would be a program allowing homeowners to "lease" the improvements from the utility, thus amortizing the initial capital costs. One significant example of such a program was put in place in February 1991 by the Sacramento Municipal Utility District ("SMUD").[57] Using a "one-stop" approach, SMUD's

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[54] Frank Napoli, Consolidated Edison, personal communication, July 16, 1992. A similar program created by the Los Angeles Department of Water and Power offers cash incentives to commercial and industrial customers who make lighting system efficiency improvements which permanently reduce electricity use between 11 a.m. and 7 p.m.

[55] A utility program offering cash rebates or reduced rates for a period of time following the implementation of energy-efficient measures at new or existing buildings would provide businesses a double incentive for efficiency by reducing both energy rates and energy consumption. Moreover, when the savings period has expired and rates have become normalized, the participants would continue to benefit from their own reduced energy consumption.

[56] Combatting the Greenhouse Effect with the Statehouse Effect: Reducing Maryland's Contribution to Global Warming, Center for Global Change, June 1990.

[57] Innovative Municipal Initiatives to Reduce Energy Demand, supra, p. 22, n. 32.

energy consultant visits the customer and identifies all appropriate and cost-effective measures to achieve savings. These measures include the installation of insulation, windows and shades, and high-efficiency refrigerators, and the replacement of electric resistance furnaces and inefficient air conditioning. SMUD arranges for installation, inspection for quality control, and payment. The net cost of the appliances and the installation of the efficiency measures is rolled into one financing package based on a 15-year lease period. Monthly payments are paid out of the monthly energy savings. The balance of savings is money in the pocket for the homeowner.

Even though the program was only recently established, SMUD reports a backlog of 1,000 requests for energy consultant audits. The New York PSC should examine the possibility of creating its own long-term leasing program as a means of achieving a high level of public participation in energy conservation programs.

6. Public Education

Some progress has been made over the last several years to incorporate basic environmental issues into the public school curriculum throughout the State. Nevertheless, the public is ill-informed about the potentially catastrophic risks of global climate change, the link between those risks and energy consumption, and the economic benefits that could result from energy conservation. The curriculum for environmental courses given in upper-level classes in public schools could be revised to address such matters.[58] Moreover, trade schools training electricians, plumbers, and HVAC technicians could offer courses providing information on the specific equipment and construction techniques available to reduce energy consumption, and the environmental and economic benefits that the utilization of such equipment and technologies could provide. Similar courses could be made available throughout the state university system for students studying in the fields of architecture, real estate development, environmental sciences, law, and business.

7. Incentives for Landlords

New York State rent-stabilization regulations allow residential landlords to pass on to their tenants the costs of certain "major capital improvements," including the installation of new air-conditioning systems, boilers, burners, gas heating units, hot water heaters, or solar heating systems.[59] Currently, the regulations require that the item being replaced meet the requirements set forth in a "useful life schedule," which prevents landlords from replacing still-functional appliances as a means of obtaining an unwarranted rent increase, but does not address the energy efficiency of either the new or the old item.[60] The Division of Housing and Community Renewal

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[58] In his January 5, 1994, Message to the Legislature, Governor Cuomo proposed the formation of an "Energy Smart Schools" partnership to recognize schools that show leadership in teaching and practicing energy efficiency.

[59] 9 NYCRR §2522.4(a)(2)(i). The New York City rent-control laws contain a similar provision allowing landlords to pass on costs of major capital improvements required for the operation, preservation, or maintenance of the structure, amortizing the cost over a seven-year period. Administrative Code of the City of New York §26-405(g)(1)(g).

[60] 9 NYCRR §2522.4(a)(2)(i)(d).

("DHCR") should amend these regulations to mandate that any new system or unit installed must meet certain energy-efficiency standards. DHCR should also encourage electrical submetering for multi-family dwellings.

III. INCENTIVES FOR THE CONSERVATION OF HEATING OIL

Because the sale of heating oil is not a PSC-regulated industry, no counterpart to the DSM programs developed by the electric and gas utilities has been put into place to encourage the conservation of this fossil fuel. Initiatives aimed at increasing the efficiency of heating systems utilizing petroleum as a fuel should be developed. One such initiative could involve the imposition of a conservation tax on heating oil, the proceeds of which would be earmarked for a fund devoted to making buildings served by oil-fired heating systems more energy efficient. Such funds could also be targeted to provide financial assistance for energy conservation measures to low-income residents who depend on oil for heat.

IV. OTHER OPTIONS TO REDUCE ENERGY USE

Besides action on the state and local level to change the way that buildings are designed, constructed, and equipped for greater energy efficiency, there are a number of other measures that could significantly reduce energy use. Some of these initiatives can be advanced by appropriate amendment to the State enabling laws that empower local agencies to regulate development. With such amendments in place, local governments can adopt the zoning ordinances and regulations needed for their implementation. Others can be achieved only by the individual observance of an energy conservation ethic.

A. Planning and Development Schemes

The internal combustion engine is the single largest producer of greenhouse gas emissions in the United States. The level of such emissions from automobile usage in New York State is dictated in large measure by existing land-use patterns. New Yorkers must depend heavily on automobiles in their daily lives simply because where they live lies some distance away from where they shop or work. Thus, New York State and local governments within the State can have an impact on the global climate by planning communities so as to decrease reliance on the automobile. We recognize that the benefits of strategies designed to eliminate inefficiencies built into our current land-use scheme may take years to be realized. Nevertheless, we believe that the time has come to put into place a regulatory framework that will cause future development patterns in the State to be more energy-efficient.

1. Cluster Zoning

Probably the most familiar planning option to protect the environment is the cluster development. In these projects only a portion of a tract of land is developed, with the remainder preserved as open space. Density is figured based on the entire tract, not just the portion that is built upon, so the population in the developed portion is denser than would be permitted in non-

cluster plans. With clustering, the land need only be cleared in the section where the structures are placed, so cluster development means less expense to both the locality and the developer.

Currently, New York law allows developments to be clustered, where doing so would "encourage flexibility of design . . . facilitate the adequate provision of streets and utilities and preserve the natural and scenic qualities of open lands."[61] This provision could be expanded to allow cluster development wherever doing so would promote energy efficiency, whether by landscaping, the provision of district heating or cooling, or otherwise.

2. Mixed-Use Districts

Many New York communities have barriers to mixed-use development. Outside metropolitan New York, many zoning and planning regulations prohibit mixing residential space with retail or office uses on a single lot without a special permit.[62] In addition, many upstate communities require commercial uses to be located in designated areas, with residences in separate districts some distance from the commercial sections. Manufacturers and other large employers are typically relegated to the outskirts of the community.[63] This typical suburban and rural town plan encourages automobile traffic, and, as the locality grows, leads to sprawling development, thereby causing adverse environmental impacts.

An alternative exists in the European model of mixed use development, which favors low-rise buildings grouped together with offices or residences above or behind street-level retail establishments. This model is especially applicable to older cities or towns, which often were built on precisely these lines only to have various use restrictions imposed at some later date. Because the infrastructure and the buildings are already in place, such a scheme can be implemented with little or no adverse impact to the environment, and at relatively little expense. Bloomfield, Connecticut and Portland, Oregon are both exploring the European development model.[64]

All the impacts of this model are likely to be beneficial. Increasing the residential population of downtown areas can revitalize urban districts by increasing business for local shops and enlivening the downtown area. Underutilized urban space can be put to use, providing tax revenues for financially strapped cities and towns. People who live, work and shop in a well-defined neighborhood are likely to feel more attached to their community and will be more responsible toward its environmental resources, and the close proximity of home, business, entertainment, and shopping will reduce the need for cars. In addition, when converting underutilized space for residential or office use, energy-efficient measures can be cost-effectively incorporated into the renovation, as discussed above in Part II.

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[61] See New York State General City Law §83-a; Town Law §281; and Village Law §7-738.

[62] Dick Boos, New York State Department of State, personal communication, July 15, 1992.

[63] Id.; Cool Tools, supra.

[64] Tom Hooper, Town of Bloomfield Town Planner, personal communication, July 8, 1992.

Dade County, Florida, is experimenting with a related concept called traditional town development.[65] This scheme attempts to model new developments on the organization of American towns before the introduction of the automobile. The plan emphasizes dense, mixed-use developments centered around a square or plaza and surrounded by open space. Currently there is one proposal for such a development in Dade County.[66]

However, if the European model or the traditional town model is to be used in many communities in New York State, local zoning laws will have to be changed to permit mixed-use development.

B. Southerly Orientation

In addition to the many means of incorporating energy efficiency into the design, construction, operation, and maintenance of a building, correct placement of the structure can result in significant energy savings. In upstate New York, for example, where energy used to keep buildings warm in winter exceeds that used for cooling in summer, maximizing solar exposure in winter could be particularly effective.

Portland, Oregon, a locality which uses more energy for heating than for cooling, has taken the lead in promoting solar access as part of an integrated approach to energy-efficient development. In a study conducted in 1984, the Portland Energy Office found that buildings oriented so that sunlight struck their southern walls and roofs during the winter used 15 to 25 percent less energy for space heating than buildings without a southerly exposure.[67] This study examined conventional buildings constructed without any specific investment in solar equipment and design. The same study projected that if these buildings acquired solar technology like photovoltaic arrays and passive solar space and water heating units, an additional 20 to 30 percent reduction in energy use could be achieved.[68]

In this regard, Portland has enacted several ordinances designed to encourage the use of solar energy by protecting the solar access of existing structures and guaranteeing such access to new structures.[69] These ordinances require that 80 percent of new development be oriented to the south, and limit a neighbor's right to erect structures and maintain vegetation in a manner that shades 20 percent or more of the adjoining property owner's southern wall.

Portland also has established a "Solar Access Permit Program." This enforceable permit works like an easement, guaranteeing solar access to property owners by preventing their neigh-

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[65] Douglas Yoder, Assistant Director, Metropolitan Dade County Environmental Resources Management, personal communication, June 22, 1992.

[66] Id.

[67] Jim Claypool, Portland City Planner, personal communication, July 9, 1992.

[68] Id.

[69] Portland, Oregon, Ordinances 157991, 157992, 157993, and 160050.

bors from shading their southerly walls with either structures or vegetation. It is available to property owners who install passive or active solar water and space heating systems. The permit runs with the land, and notice of such a permit is also attached to the deed of the adjoining property. Since these ordinances were passed in 1985, the Portland Energy Office reports no substantial difficulties in implementation or acceptance, and resultant energy savings of at least 15 percent.[70]

Given Portland's success in implementing these measures and their effectiveness in reducing energy use, New York localities could adopt similar ordinances. Currently, it is illegal to prohibit the installation of solar collecting devices,[71] but New York has no law preserving and protecting solar access. The State might consider enabling legislation to allow cities and towns in New York to enact ordinances similar to those in Portland, and localities could consider enactment of such provisions.[72]

C. Tree Planting and Maintenance

Another simple way to combat global warming on a local level is through strategic tree planting and large tree maintenance. Trees combat global warming in three ways:

- growing trees remove CO_2 from the atmosphere and sequester the carbon within the living matter of the tree;
- trees provide windbreaks in the winter and shade in the summer which can significantly reduce energy use for heating and cooling;
- the process by which trees remove water from the soil and evaporate the excess through their leaves, called evapotranspiration, cools the surrounding air.

New York State is unusual compared to most of the rest of the country because the percentage of forested land in the state has actually increased in this century, from 30 percent in 1900 to 70 percent in 1985.[73] This is due mainly to better logging practices and to the abandonment and reforestation of large tracts of farmland.[74] Notwithstanding the relative abundance of forested land in New York State, strategic tree planting and maintenance in urban areas could have a measurable impact on the State's emissions of greenhouse gases, because healthy urban trees can counteract the urban heat island effect.

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[70] Susan Anderson, Portland Energy Office, personal communication, July 1, 1992.

[71] New York State General City Law §20, subd. 24, Town Law §263 and Village Law §7-704 all require zoning statutes to accommodate the placement of solar collecting devices.

[72] Robert Parella, personal communication, July 23, 1992.

[73] Andy Beers, The Nature Conservancy, personal communication, June 22, 1992.

[74] Id.

1. Urban Planting to Counter Heat Islands

The most densely built portion of a city or town can be two to eight degrees Fahrenheit hotter than the surrounding countryside.[75] In temperate and tropical climates, the urban heat island effect in major cities is even more striking. Heat islands in New York City and New Delhi can be 10 degrees hotter than the surrounding suburbs, and in Mexico City the difference can be as much as 18 degrees.[76]

Several factors explain these higher temperatures in built-up areas. In rural areas, a large percentage of daytime solar energy is expended on evaporating water from vegetation and soil, and the evaporation then cools the air. Where soil and living things are replaced with steel, glass, asphalt, and concrete, not only is the cooling evaporative effect lost, but the solar energy that would have been spent on evaporation is free to heat the air.[77]

In addition, the materials which make up the urban landscape generally have a very low capacity to reflect sunlight. Asphalt and concrete absorb rather than reflect sunlight, so the temperatures of these surfaces may become blisteringly hot in the daytime sun, and this heat will radiate out and warm the surrounding area. Buildings contribute to the urban heat island not only by absorbing light energy and radiating heat, but also by blocking cooling breezes.[78]

The urban heat island effect contributes to global warming directly, by actually increasing the temperature of discrete areas, and indirectly, by increasing the use of air conditioning. Air conditioning uses CFCs, a very potent greenhouse gas, and is powered by electricity, most of which is generated by the burning of fossil fuels. Thus, amelioration of the urban heat island effect can decrease greenhouse gas emissions in several ways.

Trees can be very effective in mitigating the urban heat island effect, but proper placement is crucial. In urban downtown areas, trees are most effective if planted on both sides of the street so that the mature canopy will shade both the sidewalks and at least part of the street between them. Filling empty street tree spaces can significantly reduce energy demand, especially if care is taken to ensure that the placement of the trees will not create a need for additional street lights.

Trees also offer significant cooling benefits when planted in plazas and parking lots. Shade trees planted throughout a parking lot or plaza are more beneficial than trees distributed only around the perimeter. In parking lots, trees provide the further benefit of cooling the parked cars, so that less air conditioning is required when drivers retrieve their cars. A well-designed and

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[75] Cooling Our Communities, A Guidebook on Tree Planting and Light Colored Surfacing, U.S. EPA, Jan. 1992, pp. 5-6.

[76] Id.

[77] Id.

[78] Id.

landscaped parking lot can provide a great deal of shade with a minimal diminution of parking capacity if the lot is designed to allow the cars' bumpers to overhang the planting space.[79]

Unfortunately, the effectiveness of strategic urban tree planting is often hampered by the early death of the newly planted trees. Urban trees generally have only one quarter the lifespan of their counterparts in the countryside, and most urban trees never reach full maturity.[80] This is due partly to the stress that urban life places on trees, and partly to inadequate or improper planting and maintenance.[81]

Local communities could enhance their urban forests by enacting ordinances which require the planting and continued maintenance of one or more replacement trees for each tree removed or killed by construction activities, and that such planting and maintenance be performed in accordance with good horticultural practice; by requiring that new parking lots or plazas be landscaped throughout to provide summer shade; by mandating the inclusion of a plantable median in street design whenever possible; by controlling the removal of existing mature trees; by requiring private paving to be done in brick or stone, which is permeable to water and so friendlier to trees than concrete and asphalt, and using these materials for paving where possible; and by striving to fund proper public tree maintenance.

In addition, local communities could attempt some creative outreach to achieve the proper maintenance of existing trees. In communities located near a correctional facility, prisoners eligible for special privileges or work-release could be trained to provide tree maintenance. Offenders sentenced to community service could likewise be assigned to a tree maintenance effort. The locality could also attempt to win a pledge of volunteer time from the local YMCA/YWCA, Girls' and Boys' Clubs, and other youth organizations to help provide tree maintenance, in return for which the volunteers could receive practical training in landscaping. Although all these ideas could present liability problems, if the risk could be contained, the programs would have the additional benefit of creating citizens who are cognizant of the needs of the urban forest, and more likely to care for their street trees in the future.

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[79] Id., p. 104.

[80] Id., p. 96.

[81] Although lack of adequate root space is probably the biggest problem for urban trees, they can thrive in a very small space if certain special measures are taken in their planting and maintenance. Widening the hole into which the root ball will be placed, loosening tightly compacted surrounding soil, and extending the rooting space under the pavement where possible, will greatly increase the likelihood that the tree will live to maturity. Proper planting in the first place is cost-effective, because it can reduce the need for maintenance over the long term. Secondly, lack of water and nutrients causes the death of most urban trees. Investing a few more hours at the time of planting to ensure the tree has access to necessary nutrients can add years to the life of the tree, allowing it to reach maturity and provide its full shade and aesthetic value. Id.

2. Residential Planting

In residential areas, proper planting by homeowners and developers can reduce energy demand significantly. In some areas, those savings can be as high as 50 percent.[82] Such energy savings can be derived by a variety of techniques, such as placing trees or other vegetation so that they will shade air conditioning units during the hottest part of the day;[83] making certain that only deciduous trees with a moderate to lightly dense canopy are planted along the southern walls of buildings (to allow for maximum winter sunlight); and planting dense stands of conifers in the path of the prevailing winter winds (to provide a windbreak). Planning Boards, Town Boards, and other local zoning entities could be empowered to consider such matters in their review of residential developments, and to require energy-efficient landscaping for projects requiring their approval. In addition, local building codes could require that all new developments be landscaped for energy efficiency.

3. Global Tree Maintenance by Local Procurement Policy

Because the sequestration of carbon from the atmosphere is a global dynamic, New York State and its localities can help to reduce global warming by amending their procurement practices so as not to encourage logging or other industries destructive to the tropical rainforests.

The destruction of the Amazon rainforest has potentially catastrophic consequences for the global climate because of the vast amount of carbon sequestered there. This carbon is released when the trees are cut or burned, and if the land is turned to grazing, there is a permanent loss of carbon sequestering capability. The New York State Finance Law was recently amended to prohibit the purchase of tropical hardwoods or tropical hardwood products by the State and any public agency, political subdivision, or public benefit corporation of the State.[84] This provision could be further strengthened to include prohibitions on the purchase of Central and South American beef grazed on the land that was once part of the forest, or any other item the production of which is directly linked to the destruction of the rainforest.

D. District Heating and Cooling Systems

Another method by which emissions of greenhouse gases can be reduced by local initiatives is through the use of district heating and cooling systems. These systems employ one central boiler and chiller for a cluster of buildings; steam, hot water, and cold water are pumped through

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[82] Id., p. 98.

[83] The temperature of the microclimate surrounding the unit can thereby be reduced by up to seven degrees Fahrenheit, increasing the unit's efficiency during peak periods by as much as 10 percent. Id., p. 97. See Cooling Our Communities, A Guide to Tree Planting and Use of Light Colored Surfacing, for other suggestions regarding the optimum placing of trees for energy efficiency.

[84] New York Finance Law §167-b.

underground pipes to heat or cool all the buildings in the cluster.[85] Although this is an old technology, developed in 1877, it fell out of fashion in postwar urban development.[86] However, district heating and cooling systems can have significant environmental benefits, and should receive greater attention in local planning and building regulations.

First, because district systems often burn natural gas, there is a benefit in terms of reduced CO_2 emissions.[87] In addition, because the systems employ only one carefully controlled and monitored unit, even those which burn oil produce fewer emissions than would be produced if each building had its own smaller, less well-controlled and monitored boiler and smokestack.[88]

There are economic benefits to the district system as well. Space which would normally house boilers and cooling apparatus can be turned into rentable commercial space. The knowledge that a secure, low-cost energy source is available can spur economic development. Most importantly, economies of scale mean that the central unit could use less fuel than individual units would. Thus, those entities in New York State which have recently installed district heating and cooling systems have seen a reduction in their energy costs. For example, the City of Jamestown has saved up to 33 percent of its annual energy costs, and the Rochester District Heating Cooperative has saved $3 million annually.[89] A recently installed system in Buffalo is expected to pay for itself in four to seven years.[90] The largest district heating system is probably Con Edison's New York City steam heat system, which provides heat to many of the City's commercial and residential buildings by means of an extensive network of pipes extending beneath much of the City.

The New York State Energy Research and Development Authority ("NYSERDA") is promoting the development of district systems around the State. However, many building owners are reluctant to install these systems. They are uncomfortable with their lack of control over the apparatus, and they question where the liability and responsibility would rest in the event of a system failure.[91] Legislation might be considered to address such issues.

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[85] New York State Energy Research and Development Authority, New York State District Heating and Cooling - Poised for Growth, June 1988.

[86] Id.

[87] Id.

[88] It is interesting to note that cooling technology is being tested in New Jersey which would use ammonia to run a water chiller. Such a system would allow buildings to be cooled without the use of CFCs. Don Liebowitz, Trenton District Heating and Cooling, personal communication, July 23, 1992.

[89] Dr. Fred Strnisa, New York State Energy Research and Development Authority, personal communication, July 16, 1992.

[90] Id.

[91] Id.

E. Strategies for Implementation of Trip Reduction Initiatives

In addition to amendments allowing mixed use, there are a number of ways in which state and local laws could be amended to promote environmentally conscious, energy-efficient development.

For example, New York State's Town Law, Village Law, General City Law, and General Municipal Law could be amended so that local planning boards can consider whether a proposed development makes optimum use of available public transportation facilities, and whether the development is designed to minimize vehicle use. Similar provisions could be included in the statutory provisions relating to cluster zoning.

Currently, Town Law Section 261-b, Village Law Section 7-703, and General City Law Section 81-b contain identical provisions allowing communities to offer incentives and bonuses in return for a developer's provision of certain community benefits or amenities.[92] These "community benefits or amenities" are defined as "open space, housing for persons of low or moderate income, parks, elder care, day care, or other specific physical, social, or cultural amenities, or cash in lieu thereof, of benefit to the residents of the community."[93] While these State zoning laws do not currently offer incentives in exchange for developer measures aimed at reducing energy use, including efficiency measures would be consistent with the intent of these enabling laws.

In 1991, the Village of Islandia, New York, enacted a local law which shows how energy-efficient measures could be incorporated into the development incentive system. Like the laws referred to above, Islandia's zoning law gives developers floor-area ratio bonuses in return for certain amenities. However, Islandia's definition of amenities includes "transportation management systems," described as van pooling, ridesharing, staggered work hours, and improved access to public transportation.[94] This concept could be extended to communities throughout New York State if "transportation management systems" were included in the list of the community benefits set out in the Town, Village, and General City law enabling provisions described above. Moreover, "transportation management systems" could be expanded beyond the elements listed in Islandia's ordinance, by covering additional measures to reduce automobile use, such as provisions facilitating bicycle and pedestrian traffic.

Although such amendments would not mandate the inclusion of transportation management systems in every new development, their explicit appearance in State law would raise awareness of the issue and might induce developers to consider more carefully how to reduce automobile usage occasioned by their projects, and could prod local planning boards to consider the impact of new developments on automobile use.

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[92] The incentives offered include adjustments to the permissible population density, area, height, open space, or use. Town Law §261-b(1)(a); Village Law §7-703(1)(a); General City Law §81-b(1)(a).

[93] Town Law §261-b(1)(b); Village Law §7-703(1)(b); General City Law §81-b(1)(b).

[94] Islandia, New York, Local Law 10 (1991).

In another example, Dade County, Florida, is exploring the idea of CO_2 emission penalties for new developments.[95] New developments which do not contain sufficient provisions for automobile trip reduction would be approved if, in return, the developer performed some specific emission mitigation service.[96]

Finally, local governments could enact ordinances which remove the incentive for increasing automobile use in their communities. One of the most important would involve the repeal of local ordinances which require a given number of parking spaces for each new commercial enterprise.[97] Planners could provide for several centralized parking areas throughout a business district, rather than street-front parking or small lots scattered throughout a city. Free parking in downtown districts could be eliminated, and parking fees raised. Secure parking places for bicycles could be established, and bicycle paths and pleasant pedestrian walkways could be provided wherever feasible. In residential areas, on-street parking could be eliminated, or at least restricted.

New Jersey recently developed a proposal which would require a variance for the construction of three-car garages. A similar law in New York would be worth considering. In any case, local governments might be made aware that the less automobile use in their community, the less noxious air pollution, the less stress on their roads and bridges, the less traffic congestion--in short, the more livable their community would be.

F. Factoring Environmental Considerations into the "Economic Dispatch" System

New York State's electrical energy needs vary widely according to season and time of day. They are met by numerous power-generating facilities that are inter-connected by the state-wide power grid. A protocol known as the "economic dispatch" is currently utilized by the power pool to establish the sequence for bringing the different inter-connected facilities on-line to meet demand at any give time. Economic dispatch does not account for the emissions levels from the participating facilities, which vary greatly in both amount and geographical location. Immediate greenhouse gas reductions could be realized by adjusting the currently existing dispatch system to minimize emissions in meeting the State's energy needs. However, such adjustments would also affect the price of electricity in the State, and may therefore not be a cost-effective method of reducing greenhouse emissions. The PSC, State Energy Office, and Department of Environmental Conservation are currently working on a study of all the environmental externalities associated with electrical generation. However, this study will not be completed or implemented for a number of years. In the interim, we recommend that these agencies prepare a report calculating the average cost of the emissions avoidance that would be achieved by dispatching electrical generating facilities on the basis of emissions minimization, and assessing whether such interim measures would cause significant adverse economic consequences. That report should be included in the next State Energy Master Plan.

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[95] Doug Yoder, personal communication, June 22, 1992.

[96] For example, the County might require developers to provide free or very low cost weatherization to low-income residents in exchange for a permit. Id.

[97] An alternative to this suggestion would be for localities to relieve developers of their obligation to provide parking where they put an alternative transportation system in place.

V. OTHER LOCAL OR STATE INITIATIVES

Several other measures, most appropriately implemented by local governments, may help to reduce greenhouse gas emissions and to slow global climate change.

A. CO_2

Any combustion of organic matter releases carbon in some form into the air, some of which will react with free atmospheric oxygen and form CO_2. Thus, communities which do not currently restrict the burning of leaves or trash could do so.

In an attempt to promote energy conservation, several Southern California communities have enacted ordinances which forbid prohibitions on clotheslines by groups such as neighborhood associations and coop boards, and require the installation of clotheslines in new multiple dwelling units. A similar measure might have some impact in New York.

B. Methane - CH_4

One molecule of methane has twenty times the potential to heat the global climate of one molecule of CO_2.[98] Thus, it is worthwhile to consider ways to reduce methane emissions. On a global scale, most methane emissions are the result of natural processes; rice paddies are major producers of methane, as are ruminant animals like cows and sheep. However, in the northeastern United States, the largest producers of methane are landfills.[99] Reliable technology exists to capture the methane which a landfill produces and use it to generate electricity.[100] Unfortunately, this technology is not widely used for a number of reasons.

The central difficulty is an economic one. It is generally supposed that a landfill must have over 1,000,000 tons of refuse in place and be over 30 feet deep to make placement of recapture technology cost-effective.[101] Fewer than thirty landfills currently in place in New York State meet these qualifications.[102] In addition, the efficiency of the methane recapture process is a function of landfill chemistry, which in turn is dependent upon the contents of the landfill and the rate of

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[98] Dr. William Moomaw, Tufts University Center for Environmental Management, personal communication, July 7, 1992.

[99] Id.

[100] Peter Skinner, Office of the New York State Attorney General, personal communication, July 6, 1992.

[101] Joseph Fiselli, New York State Energy Research and Development Authority, personal communication, July 22, 1992.

[102] Id.

decomposition within it.[103] Although the rule of thumb is that landfill gas is 55 percent CH_4 to 45 percent CO_2, a formula which is amenable to methane recapture technology, the proportions can vary a great deal.[104] In light of these restrictions, the consensus among solid waste professionals in New York State is that at the present time, methane recapture technology at landfills is not being significantly underutilized.

Moreover, the State's own environmental regulations make the future prospects for using methane to generate electricity at landfills dim. Regulations promulgated by the Department of Environmental Conservation in 1988 require double lined landfills and leachate collection. This results in extremely dry landfills, which impedes the bacterial activity needed for decomposition and methane production. Waste buried in these modern landfills is essentially entombed, slowing methane production substantially and making its extraction for electricity generation much less cost-effective.[105] Thus, ironically, while less methane is produced by these dry landfills, because it is uneconomical to recapture, more methane may actually escape over the long term than if greater amounts were generated and collected.

NYSERDA has come up with an idea to combat this problem, which would have the incidental effect of reducing greenhouse gas emissions. NYSERDA's proposal is to install leachate recirculation systems at state-of-the-art landfills. If this could be done the materials buried in the landfill would decompose, producing methane which could be recaptured and burned to generate at least enough electricity to run the pump. This would also eliminate the need to treat the collected leachate at a wastewater treatment facility and, therefore, the CO_2 emissions produced by the treatment process.[106]

Another solid waste disposal policy that should be evaluated in terms of greenhouse gas emissions is composting. Composting on a large scale requires the use of energy in the aeration process, and produces CO_2.[107] An alternative, also proposed by NYSERDA, is the idea of "recyclable" landfills. The theory is that readily putrescible materials which would normally be put in a compost heap could instead be buried in a landfill restricted to only these types of wastes. The leachate recirculation technology noted above would be employed, and, depending on the landfill size, soil composition, and bacterial population, the wastes would completely decompose in two to five years. The landfill could then be reused.[108]

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[103] Peter Skinner, Office of the New York State Attorney General, personal communication, July 16, 1992.

[104] Dennis Watterding, New York State Department of Environmental Conservation, personal communication, July 7, 1992.

[105] Joseph Fiselli, NYSERDA, personal communication, July 22, 1992.

[106] Id.

[107] Id.

[108] Id.

Economics work against this proposal at the present time: the energy costs of composting are cheaper than the materials cost of landfilling, and the energy produced at the landfill is less valuable than the compost produced at a compost heap.[109] However, should energy shortages or new energy taxes ever substantially shift this equation, recirculation technology and recyclable landfills may prove feasible.

VI. CONCLUSION

There are a myriad of state and local measures that could be taken to reduce greenhouse gas emissions. In fact, local initiatives may be even more effective in the long run than federal or international efforts, because local actions have a greater impact on individuals. Since many of these measures also would reduce energy consumption in the state, they could be put into place largely without adverse economic consequences.

This report contains numerous ideas for the State and its communities to consider as they attempt to take responsibility for protecting the environment. A list of specific recommendations that we suggest should be pursued follows.

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[109] Id.

RECOMMENDATIONS

The New York Energy Conservation Construction Code should be amended in the following ways:

1) to require the use of all readily available energy-efficient measures with "reasonable" payback periods, as defined by the State Energy Office;

2) to lower the maximum power load standard for lighting as more energy-efficient technologies become available;

3) to require the use of new, more efficient, fluorescent ballasts, the maximum use of daylighting, and more efficient space heating, cooling, and insulation;

4) to strengthen penalties for violators, and create bonuses for those exceeding Code requirements.

The State should update the State Energy Code on a regular basis, at two-year intervals, so that advances in the state of the art are reflected.

The State Energy Office should, in each of the biennial rulemaking proceedings commenced to update the State Energy Code, examine the extent to which performance-based requirements ought to be substituted for prescriptive standards.

A "Renovation Energy Code" should be developed, keyed to projects not covered by the State Energy Code (i.e. where less than 50 percent of any building system is being altered). Such a code should be designed to take into account the problems and opportunities that are specific to renovations.

The State and its political subdivisions should require the use of life-cycle cost analysis in planning for all new public construction and substantial renovations, using criteria to be established by the State Energy Office.

The State Energy Office should establish protocols for the process of "building commissioning."

Comprehensive energy audits should be conducted for all public buildings, on a regular basis.

The State and its political subdivisions should increase efficiency in public buildings by incorporating solar design, energy-efficient lighting design, modern energy-efficient appliances and fluorescent ballasts, occupancy sensors for lighting, and timers for heating and cooling; by periodically revising the building lighting power budget for public buildings to reflect advances in energy-efficient technology; and by creating incentives for State employees to conserve energy.

State and local governments should require the space they lease to be energy-efficient.

"Energy managers" should be assigned by governmental agencies to each public building, with the responsibility to assure that operations are energy-efficient.

The State Energy Office, in consultation with the Office of General Services, should establish energy-efficiency procurement specifications for equipment and fixtures. Agencies should be required to procure equipment meeting those specifications.

State agencies such as the State Thruway Authority and the Port Authority should limit outdoor lighting and utilize energy-efficient technology (particularly, photovoltaic cell-powered equipment) wherever practicable.

Businesses receiving state and local financial assistance should be required to exceed Energy Conservation Construction Code specifications in any buildings constructed with such public assistance.

An "energy job corps" should be created to retrain technicians employed in the defense industry to assist in the development of energy-efficient technologies.

SEQRA should be amended to require a finding that a project reviewed in an Environmental Impact Statement has incorporated cost-effective, energy-efficiency measures in its design and construction to the maximum extent practicable, taking into account social, economic and other essential considerations.

The New York Energy Law should be amended to require pre-sale energy audits and automatic disclosure of annual energy costs during real estate transactions involving industrial, commercial, and multi-family residential buildings.

New York should consider the adoption of mandatory, energy-efficiency retrofit requirements which would apply at the time title to a building is transferred.

State agencies, such as the Department of Economic Development, the Energy Research and Development Authority, and the Environmental Facilities Corporation should create incentives for energy-efficient projects through loan programs.

Uniform requirements for Demand Side Management Programs should be established and enforced, aimed at achieving, at a minimum, the goals set forth in the State Energy Plan.

The Public Service Commission should require utilities to develop a coordinated program encouraging the manufacture of high efficiency products.

The Public Service Commission should require utilities to develop incentive programs to encourage consumers to implement energy-efficiency measures, through such means as rebates or leasing programs.

The State Board of Education should incorporate climate change and energy conservation into its environmental studies curriculum.

Plumbers, electricians, and HVAC technicians should be trained in energy-efficient technology, and in the environmental and economic benefits such technologies would have.

Incentives should be put into place to conserve home heating oil. One possible initiative would be the imposition of a conservation tax, the proceeds of which could be used to make oil-heated buildings more energy-efficient.

State and local rent-stabilization regulations should be amended to require landlords who seek to pass on the cost of improvements to tenants to provide energy-efficient models, and to encourage electrical submetering.

State enabling laws should be amended to encourage localities to require or promote (as appropriate) the following:

- southerly orientation of a specified percentage of all new development;
- energy-efficient landscaping in new developments;
- maximum "daylighting"--planning development so that buildings will use natural light for indoor daytime lighting to the extent possible;
- the use of cluster zoning to make possible district heating and cooling and to allow for energy conservation;
- the optimum use of public transportation, and the minimization of automobile use.

Model zoning regulations incorporating the above ideas should be drafted. This would assist localities and provide an important educational tool.

Model regulations should also be drafted to protect solar access for those who have designed their buildings, or elements of their buildings, to use sunlight as a source of power.

Local governments should increase and improve tree planting by filling empty tree spaces along streets, planting trees throughout plazas and parking lots, and adding plantable medians when streets are widened.

Local governments should provide for proper planting and maintenance of trees. Ordinances prohibiting the removal of trees, or requiring the planting and maintenance of replacement trees should be considered.

Local governments should be creative in obtaining assistance with tree planting and maintenance, by involving inmates on work release, local youth groups, and other community resources.

Local governments should require developers to offset the increase in CO_2 emissions caused by new projects with off-site tree planting or the implementation of other CO_2 reduction strategies.

Local governments, as well as the State, should adopt procurement policies prohibiting the purchase of beef or other products raised or developed on land reclaimed from the tropical rainforest.

The PSC, State Energy Office, and Department of Environmental Conservation should prepare a report as to environmental and economic consequences of adjusting the "economic dispatch" system currently in place to meet energy demand, to reduce greenhouse gas emissions. That report should be included in the next State Energy Master Plan.

Local governments should revise zoning laws to permit mixed use development.

State and local laws should be amended to include provisions for transportation management systems and low cost weatherization for low-income residents as "community benefits or amenities," for the purpose of awarding zoning bonuses.

Local governments should prohibit the burning of leaves and trash.

Local governments should forbid prohibitions on clotheslines, and require the installation of clotheslines in new multiple dwellings.

The State should revise solid waste disposal regulations to provide for the recirculation of leachate in landfills.

State and local governments should consider "recyclable" landfilling, should energy costs increase sufficiently to make this a financially viable alternative.

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