

ARTICLES

CLIMATE CHANGE ADAPTATION: FOSTERING PROGRESS THROUGH LAW AND REGULATION

EDNA SUSSMAN, DAVID C. MAJOR, RACHEL DEMING, PAMELA R. ESTERMAN, ADEEB FADIL, AMY FISHER, FRED FUCCI, ROBERTA GORDON, CAROLINE HARRIS, J. KEVIN HEALY, CULLEN HOWE, KATHY ROBB, & JEFF SMITH*

“Responses to climate change have grown beyond a focus on mitigation to include adaptation measures in an effort to minimize the impacts of climate change already underway and to prepare for unavoidable future impacts.”¹

Drawing on a large and growing body of scientific information, the U.S. Global Change Research Program concluded in June 2009 that the warming of the climate is “unequivocal” and is “due primarily to human induced emissions of heat trapping gases.”² Climate related changes have already been observed; in

* For individual author biographies, please see the footnotes accompanying the various sections of this paper. Edna Sussman, SussmanADR LLC and Lead, Law and Adaptation, New York City Panel on Climate Change, and David C. Major, Columbia University Earth Institute Center for Climate Systems Research and Lead, Adaptation Planning, Science Planning Team, New York City Panel on Climate Change, served as coordinating authors. Edna Sussman authored the introduction, the sections on Law and Adaptation, Building Infrastructure, Transportation, and Communications, and the conclusion of the article.

¹ N.Y. CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION 5 (2009) [hereinafter NYPCC], available at http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf.

² U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES 9 (2009) [hereinafter GLOBAL CHANGE REPORT], available at <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>.

the coming years, they are expected to continue while new impacts develop.³

All levels of government, not-for-profit organizations, and business interests have devoted enormous resources in response to concerns about climate change and its impacts. However, most of the climate change initiatives to date have focused on mitigation, the reduction of greenhouse gases (GHGs), to avoid the most extreme projected climate change impacts.⁴ Progress in addressing adaptation, which focuses on building resiliency to the impacts of climate change, has been slow.⁵ This is largely due to the fear that turning to adaptation measures would divert resources from the essential need to mitigate by reducing GHG emissions.⁶ While reducing GHGs continues to be critical, achievement of the requisite reductions remains elusive, as shown by the current stalemate over climate legislation in Congress. Meanwhile, as the scientific certainty grows and provides ever more cautionary predictions as to climate change impacts, attention is increasingly turning to adaptation along with mitigation.⁷ It is now recognized that even if emissions were reduced dramatically over the coming decades, many of the impacts from prior GHG emissions would be unavoidable—adaptation is thus essential to effective climate planning.⁸ Moreover, many communities have concluded that rather than discouraging a commitment to mitigation, calling attention to adaptation can actually inspire a greater commitment to mitigation as the specter of future consequences is highlighted.⁹

It must be noted that adaptation strategies have long been recognized as essential to countering the impacts of climate change and have been part of global climate commitments since the inception of the worldwide effort. For example, the 1992 United

³ *Id.*

⁴ Roger Pielke, Jr., Gwyn Prins, Steve Rayner & Daniel Sarewitz, *Lifting the Taboo on Adaptation*, 445 *NATURE* 597, 597–598 (2007) (arguing that obsession with researching and reducing human effects on climate has obscured the important problems of how to build more resilient and sustainable societies).

⁵ *Id.*

⁶ CTR. FOR SCI. IN THE EARTH SYS. & KING COUNTY, WASH., *PREPARING FOR CLIMATE CHANGE: GUIDEBOOK FOR LOCAL REGIONAL AND STATE GOVERNMENT 10–11* (2007), available at <http://www.cses.washington.edu/db/pdf/snoveretalgb574.pdf>.

⁷ *Id.* at 10.

⁸ NYPCC, *supra* note 1, at 5.

⁹ CTR. FOR SCI. IN THE EARTH SYS., *supra* note 6, at 30.

Nations Framework Convention on Climate Change (UNFCCC), which the United States signed and the Senate unanimously ratified, included a commitment to formulate and implement “measures to mitigate climate change by addressing anthropogenic emissions . . . of all greenhouse gases . . . and measures to facilitate adequate adaptation to climate change.”¹⁰ Despite its early inclusion, adaptation has long remained the neglected stepsister to discussions about mitigation at international climate change negotiations. Only recently have discussions concerning how to address adaptation become a central and ongoing part of the post-Kyoto negotiations.¹¹

As many of the measures necessary for adaptation require numerous years of planning and implementation and call for major shifts by governments, businesses, and the population at large, adaptation planning must commence now.¹² Moreover, many required measures have the co-benefits of both reducing GHGs and serving adaptation goals. For example, energy efficiency measures promote both mitigation (by reducing energy demand) and adaptation (by offsetting the increased stress on electricity systems caused by projected warmer weather). Water conservation also mitigates by reducing energy demand for the electricity generation utilized in water distribution and treatment, and fosters adaptation by adjusting to projected water scarcity. Green roofs mitigate GHGs, but they also absorb more water on site—a critical response to likely flooding and severe storm events tied to global warming. In addition, many adaptation measures can be implemented today at minimal additional expense during initial construction, while those same measures will cost considerably more to retrofit in the future.¹³ This is an important factor that is

¹⁰ United Nations Framework Convention on Climate Change [UNFCCC], *adopted* May 9, 1992, 1771 U.N.T.S. 107.

¹¹ UNFCCC Conference of the Parties, *Decision 1/CP.13: Bali Action Plan, Report of the Conference of the Parties on Its Thirteenth Session: Addendum*, ¶ 1(c)–(e), U.N. Doc. FCCC/CP/2007/6/Add.1 (Mar. 14, 2008); UNFCCC Conference of the Parties, *Copenhagen Accord* (advance unedited version) ¶ 3 (Dec. 18, 2009), *available at* <http://unfccc.int/resource/docs/2009/cop15/eng/107.pdf>.

¹² *See, e.g., Bali Action Plan, supra* note 11, ¶ 1.

¹³ For example, a municipality planning a stormwater infrastructure improvement can include a larger sized culvert at minimal additional cost that will contain extreme weather events and avoid flooding damage to the community in the future. Building a replacement stormwater infrastructure in the future to deal with such flooding would cost much more than the installation

increasingly being considered in current decision making.

NEW YORK CITY ADAPTATION INITIATIVE AND CLIMATE CHANGE PREDICTIONS

New York City has launched a comprehensive adaptation initiative. In August 2008, Mayor Michael Bloomberg launched the Climate Change Adaptation Task Force (Task Force) to develop adaptation strategies to secure the city's infrastructure from the effects of climate change.¹⁴ The Task Force, one of the 127 initiatives proposed in the City's long-term sustainability plan, *PlaNYC*,¹⁵ is made up of city and state agencies, authorities, and private companies that operate, maintain, or control critical infrastructure in New York City.¹⁶ The Task Force is advised by the New York City Panel on Climate Change (NYPCC), a group of academic experts on climate change and experts from the legal and insurance industries.¹⁷ In order to provide the localized predictions that are essential for planning purposes, the NYPCC analyzed and reported on the future impacts of climate change locally for New York City,¹⁸ and developed a variety of tools and recommendations for use by the Task Force. This article expands upon the recommendations prepared for the City by the NYPCC, focusing on the use of law to foster and to remove impediments to adaptation. The suggestions are intended to further the City's planning process and suggest areas of possible consideration for other municipalities, though additional details and analysis may be

of larger culverts now. See CITY OF KEENE, N.H., ADAPTING TO CLIMATE CHANGE: PLANNING A CLIMATE RESILIENT COMMUNITY 33–35 (2007), available at http://www.ci.keene.nh.us/sites/default/files/Keene%20Report_ICLEI_FINAL_v2_1.pdf.

¹⁴ Press Release, Office of the Mayor, Mayor Bloomberg Launches Task Force to Adapt Critical Infrastructure to Environmental Effects of Climate Change (Aug. 12, 2008) [hereinafter Task Force Press Release], available at <http://www.nyc.gov/portal/site/nycgov.html> (follow “News and Press Releases” hyperlink on left side, select “2008 Events”, “August 2008”, then “Read the press release” for this document).

¹⁵ CITY OF N.Y., *PLAN NYC: A GREENER, GREATER NEW YORK* 138 (2007), available at http://www.nyc.gov/html/planyc2030/downloads/pdf/full_report.pdf.

¹⁶ Task Force Press Release, *supra* note 14.

¹⁷ *Id.*

¹⁸ NYPCC, *supra* note 1, at 3.

required prior to their implementation. The NYPCC Report and the final Task Force Report, scheduled for release in early 2010, may be read along with this article to provide a broader understanding of the impacts of climate change on New York City and the range of measures that can be pursued to meet the challenges of adaptation.

The U.S. Global Change Research Program report provides analysis and predictions specific to the various geographic regions in the U.S.¹⁹ For the Northeast, the annual average temperature has increased by 2°F since 1970, with winter temperatures rising twice as much. This warming has resulted in many climate-related changes.²⁰ Drilling down to even more localized predictions for New York City, the NYPCC concluded that warmer temperatures are extremely likely in New York City and the surrounding region. Global climate models (GCMs) project mean annual temperatures to increase by 1.5°F–3°F by the 2020s, 3°F–5°F by the 2050s, and 4°F–7.5°F by the 2080s.²¹ The NYPCC concluded that total annual precipitation in New York City and the surrounding region will more likely than not increase. Mean annual precipitation increases projected by GCMs are: 0–5 percent by the 2020s, 0–10 percent by the 2050s, and 5–10 percent by the 2080s.²² Rising sea levels are extremely likely; GCM-based projections for mean annual sea level rise in New York City are 2–5 inches by the 2020s, 7–12 inches by the 2050s, and 12–23 inches by the 2080s.²³ Because these models do not capture all of the processes which may contribute to sea level rise, the NYPCC also included an alternative method that incorporated observed and longer-term historical ice-melt rates.²⁴ This “rapid ice-melt” approach suggests sea levels could rise by approximately 41–55 inches by the 2080s.²⁵ Short-duration climate hazards were also identified by the NYPCC.²⁶ Heat waves are very likely to become more frequent, more severe, and longer in duration.²⁷ Brief, intense

¹⁹ GLOBAL CHANGE REPORT, *supra* note 2, at 107–152.

²⁰ *Id.* at 107.

²¹ NYPCC, *supra* note 1, at 3, 16–17.

²² *Id.* at 3, 17.

²³ *Id.* at 3, 17–18.

²⁴ *Id.* at 3.

²⁵ *Id.*

²⁶ *Id.* at 3–4.

²⁷ *Id.* at 3, 18–19.

precipitation events that can cause inland flooding are also likely to increase.²⁸ Storm-related coastal flooding due to sea level rise is very likely to increase. It is more likely than not that droughts will become more severe.²⁹

The NYPCF found that these climate changes will have consequences for New York City's critical infrastructure. Temperature-related impacts may include increased summertime strain on materials, increased peak electricity loads in summer, and reduced heating requirements in winter.³⁰ Precipitation-related impacts may include increased street, basement, and sewer flooding, and reduction of water quality.³¹ Sea level rise-related impacts may include inundation of low-lying areas and wetlands and increased structural damage and impaired operations.³²

THE LAW AND ADAPTATION

Our experience with such seminal environmental laws as the Clean Air Act³³ and the Clean Water Act³⁴ demonstrates that the law can be and has been utilized as an important tool to address environmental challenges. Laws and regulations, at all levels of government, can similarly be used to promote adaptation to climate change. This article examines environmental, land use, and energy laws through an adaptation lens, focusing on how well laws and regulations serve to reduce vulnerability, increase resilience, enable effective preparation for disasters, and increase capacity to respond to disasters.

The focus here is on adaptation; measures and laws that foster mitigation of GHG emissions are not included unless they also significantly serve adaptation purposes, which, as noted above, many do. While the focus of this article is on New York City, much of the material is relevant to other jurisdictions. The article both discusses initiatives New York City has already undertaken, and suggests additional measures that might be useful in the City's program of adaptation to climate change.

²⁸ *Id.* at 4, 21.

²⁹ *Id.* at 4, 19.

³⁰ *Id.* at 4.

³¹ *Id.*

³² *Id.* at 4, 25–28.

³³ Clean Air Act, 42 U.S.C. §§ 7401–7671q (2006).

³⁴ Clean Water Act, 33 U.S.C. §§ 1251–1387 (2006).

Implicit in the discussion is the recognition that the law must be flexible and responsive as the science evolves and we learn more about the likely impacts of climate change on our individual communities. Where possible, laws and regulations should be crafted to facilitate ready adjustments to unfolding realities or more certain predictions.³⁵ This would help reduce legislative and administrative delays. Where that is not possible, any recommendations implemented must be reviewed and revised on a periodic basis to address the latest scientific predictions at the level of certainty determined by the decision makers.

In assessing the level of certainty necessary to trigger adaptation, it must be remembered that if changes that compel appropriate responses to new facts are not already drafted into the law, adaptation can be significantly delayed. Accordingly, serious consideration should be given to the desirability of applying the precautionary principle as specific policy decisions are made and alternatives are considered. As the precautionary principle provides:

Where threats of serious or irreversible damage to people or nature exist, lack of full scientific certainty about cause and effect shall not be viewed as sufficient reason . . . to postpone cost effective measures to prevent the degradation of the environment or protect the health of its citizens. Any gaps in scientific data uncovered by the examination of alternatives will provide a guidepost for future research, but will not prevent protective action being taken³⁶

Thus, reasonable, prudent, and feasible measures should not be deferred pending scientific unanimity, and adaptation measures should be regularly reviewed in light of our evolving scientific understanding.

This article aims to provide a broad outline of the principal areas of the law that can be explored to advance adaptation measures. A complete menu of possible revisions or an

³⁵ For discussions of adaptive management, see J.B. Ruhl, *Regulation by Adaptive Management*, 7 MINN. J. L. SCI. & TECH 21 (2005); Alejandro E. Camacho, *Adapting Governance to Climate Change: Learning to Manage Uncertainty*, 159 EMORY L. J. (forthcoming 2009), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1352693; Robin Kundis Craig, *Adapting to Climate Change: The Potential Role of State Common Law Public Trust Doctrines*, 34 VT. L. REV. (forthcoming 2010), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1431663.

³⁶ S.F., CAL., ENVIRONMENT CODE § 101 (2003).

identification of all laws and regulations at the federal, state, and local levels that may be useful to an adaptation analysis is beyond the scope of the article, and indeed some of the investigations required to undertake such a comprehensive review remain to be done. Moreover, an examination of how existing laws and regulations can pose an obstacle to adaptation is also critically important to enabling effective adaptation.

Section I discusses zoning, an area of signal importance in a review of adaptation measures, as the use of land directly impacts both water and energy. Section II examines the use of environmental impact reviews for adaptation planning. Section III reviews energy-related issues, as climate change will have significant impacts on energy demand and reliability. Section IV focuses on greening the city's building stock, which offers tremendous opportunities for reducing energy and water demand, increasing on-site water retention, and building more climate resilient structures. Section V describes strategies related to water, which, due to climate change, threatens to be at times in short supply and at other times to create flooding. Section VI discusses the regulation of transportation networks to increase resilience in the face of climate impacts. Section VII provides a forward-looking review of possible air quality impacts of climate change and how they can be addressed through adaptation measures. Section VIII describes the regulations that can be utilized to protect telecommunication networks from climate-related interferences with service. Section IX analyzes how brownfields and hazardous waste issues that are exacerbated by climate change can be addressed through law and regulation. Section X discusses the utilization of financial assurance mechanisms in connection with climate change-related risks. Section XI reviews the measures in place for emergency preparedness, as both preparing for and responding to emergencies, which are likely to increase in frequency and severity with climate change, are essential components of adaptation. Section XII identifies the constitutional principles that must be considered in determining the existence and scope of limitations on local power to pass laws or promulgate regulations. As funding is a critical element of most adaptation measures, Section XIII provides a summary of the many funding streams and funding mechanisms that can be explored to finance adaptation. Section XIV presents conclusions. While these discussions offer

some promising avenues for improving adaptation through law and regulation, it must be noted that all of these will require significant legal and administrative effort to implement effectively.

I. ZONING³⁷

The City of New York is a densely developed coastal metropolis with approximately six hundred miles of developed or developable shoreline, and extensive climate change sensitive infrastructure.³⁸ The risks attendant to climate change will either be minimized by sound public planning or exacerbated by government decision makers' inattention to future risks. Land use decisions are an essential component of the required planning effort.

Land use decision-making in the United States is decentralized; virtually all of the states provide their own framework for thousands of local governments, each of which have broad authority to exercise land use control.³⁹ Because of the city's control over land use within its borders, an emphasis on the area of law and regulations within the city's control is appropriate, but laws at the state and federal levels also play a significant part in adaptation. Moreover, although zoning and other land use regulations generally affect future rather than current uses and may not have as immediate an impact as other measures, the extended period of time in which climate change will take place means that these methods will affect an increasing proportion of land use. New York City's control over land use should be exercised with close attention to the likely impacts of climate change. Sea level rise may cause the permanent loss of land or otherwise impact (through storm surge and salt water intrusion, for example) important portions of New York City's land mass,⁴⁰ requiring planning as to what, where, and how development should occur.⁴¹

³⁷ This chapter was written by Caroline Harris, a partner at GoldmanHarris LLC, with the assistance of Zara F. Fernandes, an associate at Carter, Ledyard & Milburn LLP.

³⁸ Association of Metropolitan Water Agencies, *Climate Change: New York City, N.Y.*, <http://www.amwa.net/cs/climatechange/newyorkcity> (last visited Oct. 13, 2009).

³⁹ James C. Nicholas, *State and Regional Land Use Planning: The Evolving Role of the State*, 73 ST. JOHN'S L. REV. 1069, 1069 (1999).

⁴⁰ See NYPCC, *supra* note 1, at 21.

⁴¹ Cf. Jianjun Yin et al., *Model Projections of Rapid Sea-level Rise on the Northeast Coast of the United States*, 2 NATURE GEOSCIENCE 262, 265 (2009)

Flooding is likely to increase with the expected increase in intense precipitation events if care is not taken in land use planning.⁴² Appropriate land use measures can blunt the impacts of warmer weather resulting from climate change, and can soften increases in demand for energy in the hotter summer months ahead. Substantial interventions such as the creation of defensive infrastructure would likely require land use planning and review. Thus, land use planning is critical to the achievement of adaptation goals.

New York City was the pioneer in the field of zoning policy, enacting the first comprehensive zoning resolution in the United States in 1916.⁴³ Zoning determines the types of uses permitted in different districts and the relationships among those districts. It sets the parameters for the sizes and shapes of buildings, the densities of the city's varied neighborhoods, and the streetscape. The process of land use planning and development of the regulations contained in New York City's Zoning Resolution⁴⁴ can be powerful tools in adapting to climate change. Adapting to new conditions and policies is an integral part of planning: "[As] time passes, land uses change and zoning policy accommodates, anticipates and guides those changes. . . [Z]oning is never final; it is renewed constantly in response to new ideas—and to new challenges."⁴⁵ Adaptation to climate change is just such a new challenge that must be met.

New York's Zoning Resolution divides land in the city into three general districts: residential, commercial, or manufacturing, with numerous sub-districts and Special Districts.⁴⁶ Within each district, the Zoning Resolution regulates the bulk of structures allowed on a lot,⁴⁷ the specific uses permitted on the lot, parking

("Compared with those at many other coastal cities, the dynamic [sea-level rise] at New York City is large, with relatively small model-to-model variation.")

⁴² See NYPCC, *supra* note 1, at 21.

⁴³ Nicholas, *supra* note 39, at 1070.

⁴⁴ NEW YORK, N.Y., ZONING RESOLUTION (2009) (effective Dec. 15, 1961).

⁴⁵ New York City Dep't of City Planning, About NYC Zoning, <http://www.nyc.gov/html/dcp/html/zone/zonehis.shtml> (last visited Oct. 13, 2009).

⁴⁶ NEW YORK, N.Y., ZONING RESOLUTION arts. II–IV (governing residential, commercial, and industrial districts).

⁴⁷ Within the category of "bulk," the Zoning Resolution addresses the amount of floor area that may be incorporated in a building, the maximum height of the building, setbacks, lot coverage, open space, yards, permitted obstructions

requirements, signage, and a host of other topics. For manufacturing districts, the Zoning Resolution also establishes performance criteria in order to limit the negative impacts of any noxious qualities of the industry.⁴⁸

A. *Precipitation, Flooding and Stormwater Management*

Precipitation, flooding, and stormwater management are problems that demand correct and periodically updated information, including flood hazard and topographical maps. These maps should be based on future predictions—not just historical data—regarding areas vulnerable to flood hazard and sea level rise so they may guide planners’ decisions regarding the appropriate zoning districts and regulations needed to reduce flooding and mitigate the impacts of climate change.

As part of the implementation of PlaNYC, New York City released its PlaNYC Sustainable Stormwater Management 2008,⁴⁹ a comprehensive study of stormwater management. Stormwater management is a key aspect of adaptation planning, as climate change is expected to increase extreme weather events and flooding in the New York area.⁵⁰ The Task Force continues to assess the many possible solutions to determine which are most suitable for New York City. Some solutions are city-agency controlled—literally at the street level or at the “end of the pipe”—and are not affected directly by the text of the Zoning Resolution.⁵¹ Others are affected by changes to the zoning map, rezonings, and changes in density and use. Thus, the planning considerations for any rezoning should include how the proposed rezoning interacts with the city’s infrastructure for stormwater. If the capacity to manage the runoff that would be generated by the development that results from a rezoning does not exist, the rezoning should not

above the stated height and in the required yards, requirements for recreation space, and plazas. It also addresses waterfront accessibility and protection of natural areas. *Id.* § 12-10 (defining “bulk”).

⁴⁸ *Id.* § 42-20.

⁴⁹ NEW YORK, N.Y., PLANYC: SUSTAINABLE STORMWATER MANAGEMENT PLAN (2008) [hereinafter STORMWATER MANAGEMENT PLAN], available at http://www.nyc.gov/html/planyc2030/downloads/pdf/sustainable_stormwater_plan.pdf.

⁵⁰ NYPCC, *supra* note 1, at 21–23 (discussing potential flooding due to climate change).

⁵¹ Waste-water treatment plants are an example of “end of pipe” solutions. See STORMWATER MANAGEMENT PLAN, *supra* note 49, at 15–18.

be approved, or it should be approved with enhanced requirements for on-site and local street stormwater management. This analysis does not always occur now, when combined sewer outflow events are a known problem; it will be even more urgent as acute precipitation events and flooding increase due to climate change, exacerbating the problem of combined sewer overflow.

As the stormwater management report recognizes, other solutions target the source of the storm water runoff at the site.⁵² New zoning regulations can improve stormwater management and reduce flooding on privately owned property. To reduce flooding and decrease the incidence of combined sewer overflow events and related pollution, best practices for on-site storm water management could be incorporated throughout the Zoning Resolution as well as in the Building Code.

Two recent amendments to the Zoning Resolution recognize the importance of vegetated and pervious surfaces,⁵³ which assist in stormwater management. One imposes minimum requirements for vegetation and pervious surfaces in R1–R5 districts.⁵⁴ It requires, for example, that 50 percent of the front yard of a zoning lot with street frontage equal to 60 feet or more must be planted.⁵⁵ The other increases the requirements for planting street trees.⁵⁶ The efficacy of these measures will depend on broadening their applicability and setting proper design standards.

To broaden their applicability, the Zoning Resolution could impose minimum requirements for vegetated surfaces or surfaces composed of pervious materials in all residential districts and all commercial and manufacturing districts. Strengthening the existing requirements could also be considered. Concerns about proper drainage and the potential of flooding basements or cellars could be addressed through design standards. Satisfaction of the vegetation and pervious surface requirements could be allowed

⁵² Rain barrels, cisterns, green roofs, and permeable pavement are examples of on-site solutions. *See id.* at 35–44.

⁵³ For example, Section 23-451 of the New York City Zoning Resolution sets forth requirements for vegetation in yards in residential districts. NEW YORK, N.Y., ZONING RESOLUTION § 23-451 (amended Apr. 30, 2008).

⁵⁴ The zoning amendment was adopted to enhance yards and open space by preventing excessive paving and encouraging landscaping and plantings in yards. *Id.*

⁵⁵ *Id.*

⁵⁶ The Street Tree Planting amendments, which are interspersed throughout the Zoning Resolution, were adopted April 30, 2008. *See id.* § 23-03.

through the installation of green roofs and green walls, which have excellent water retention properties. A green roof is an extension of the existing roof of a building that is partially or completely covered with vegetation and soil, in a growing medium, planted over a waterproof membrane that serves several environmentally valuable purposes, including absorption of storm water.⁵⁷ Similar to a green roof is a green wall, in which the layer of vegetation is installed on the vertical exterior wall of a building. Green roofs and green walls also can be encouraged by allowing green roofs to qualify as open space, where the roof surface would not otherwise qualify.⁵⁸

To improve their efficacy, proper design standards can be incorporated into the zoning texts relating to “open space,” yards, plazas, esplanades, and tree plantings. Proper design standards, such as grading surfaces towards vegetated areas; tree guard-type low fencing instead of curbs that create hydrologic barriers; curb inlets that direct water to soil; permeable pavement or porous concrete, stormwater controls in parking lots; converting asphalt fields, playgrounds, and school yards to turf; and Greenstreets—a local program to plant traffic islands—can provide water retention, improve drainage, and prevent flooding.⁵⁹ However, it should be noted that the effects of permeable surfaces in waterfront areas can be limited by high water table levels.

New York City is evaluating various techniques for on-site water retention systems. Certain storm water retention mechanisms being considered, such as cisterns, are bulky; they may take up a substantial amount of area in a yard or on a roof. If such additions are to be encouraged, then to the extent that they form obstructions in a yard or exceed the maximum permitted height of a building, the Zoning Resolution should be amended to

⁵⁷ N.Y. REAL PROP. TAX LAW § 499-aaa(10) (McKinney 2009) (defining green roofs).

⁵⁸ The Zoning Resolution requires a portion of a residential zoning lot to be open and unobstructed from its lowest level to the sky and accessible and usable by all persons occupying dwelling units on the zoning lot, among other requirements. The amount of open space required varies depending on the district and the height of the building. The roof or a portion of a roof may not qualify for various reasons, such as the lack of accessibility to all of the occupants. *See generally* NEW YORK, N.Y., ZONING RESOLUTION § 12-10 (2009).

⁵⁹ For example, “Requirements for Planting Strips and Trees” includes design standards that encourage proper drainage. *Id.* § 26-23 (amended Apr. 30, 2008).

permit them. Other measures could be expanded, such as increasing the required amount of vegetated or permeable surfaces in privately owned public plazas.⁶⁰ A new Waterfront Text Amendment addresses accessibility of the waterfront in certain areas of the city.⁶¹ Additional attention could be given to how the waterfront should be designed and managed in light of climate change.

Stormwater management is a significant issue for the city. Source controls are a primary tool for ameliorating the problem.⁶² Until city-wide or flood-prone neighborhood-specific standards are adopted, large scale projects; every project that requests a special permit or variance for increased bulk; and every rezoning could be required to explain how it is addressing storm water management on site.

The principal bulk regulation controlling the size of buildings in New York City is set forth in the Zoning Resolution is “Floor Area Ratio” (FAR). As defined in the Zoning Resolution, the Floor Area Ratio is the ratio of a building’s floor area to the area of its zoning lot. Each zoning district has a FAR control which, when multiplied by the lot area of the zoning lot, produces the maximum amount of floor area allowable in a building on the zoning lot.⁶³ However, many of the land use-related climate adaptation measures could restrict the use of parts of a building. For instance, in areas susceptible to flooding the zoning regulations could bar certain uses that attract vulnerable populations (such as nursery schools or nursing homes) from certain lower floors. Mechanical equipment and emergency generators could be required to be located above the flood hazard levels. Just as buildings are now required to provide bicycle racks,⁶⁴ buildings in high-risk neighborhoods could be required to provide emergency flood and evacuation equipment. To the extent these protective measures utilize floor area or cause the height of the building to be taller than it otherwise would have been, the Zoning Resolution should be amended to exclude such space from the Floor Area definition

⁶⁰ Recent amendments to the Zoning Resolution mandate permeable surfaces surrounding the bed of some of the trees in public plazas. *Id.* § 37-726 (amended June 10, 2009). These requirements should be expanded to promote adaptation.

⁶¹ *Id.* §§ 62-00 to -97 (adopted Apr. 22, 2009).

⁶² STORMWATER MANAGEMENT PLAN, *supra* note 49, at 35–49.

⁶³ NEW YORK, N.Y., ZONING RESOLUTION § 12-10 (2009).

⁶⁴ *See id.* §§ 25-80, 36-70 (adopted Apr. 22, 2009).

and to allow the height of the building to be increased proportionally.

The Zoning Resolution could provide additional flexibility for buildings in flood-prone areas to provide “freeboard,” additional elevation of the finished floor level above the FEMA Base Flood Elevation (BFE) levels. Currently, for buildings in flood zones within most districts, the base plane from which building heights are measured is established at the FEMA BFE.⁶⁵ Buildings providing freeboard can earn discounts on their flood insurance; however, they are subject to the same zoning height limits as buildings that do not. Allowing additional height commensurate with the freeboard provided would eliminate this disincentive for improved flood resistance.

The Zoning Resolution also can be used to create a comprehensive “bluebelt program” for suitable areas within the city limits. Staten Island’s Bluebelt program directs storm water from private and public land towards streams, ponds, wetlands, and other natural drainage systems to create an integrated solution that preserves public open space while controlling pollution and flooding.⁶⁶

A new approach to mapping zoning districts and new zoning regulations in flood-prone areas can also minimize the impacts of flooding and facilitate safety and evacuation during floods. Uses in flood-prone locations can be restricted, and restrictions on the location of mechanical and safety equipment can be adopted.⁶⁷

B. *Flooding and Sea Level Rise*

There are several substantial initiatives underway in New York State relating to sea level rise. The New York State Energy Research Authority (NYSERDA) has sponsored the ClimAID study, a state-wide assessment of adaptation potential, including

⁶⁵ See *id.* § 12-10 (defining Base Flood Elevation and Base Plain).

⁶⁶ N.Y. City Department of Environmental Protection, Staten Island Bluebelt, http://www.nyc.gov/html/dep/html/dep_projects/bluebelt.shtml (last visited Oct. 13, 2009).

⁶⁷ For example, consideration could be given to prohibiting vulnerable populations, such as children and the elderly and infirm in day-care centers or nursing home beds, respectively, from the ground floors of buildings in flood-prone areas, or requiring flood-proofing, back up generators, and detailed evacuation plans.

coastal adaptation measures for sea level rise and storm surges.⁶⁸ The state legislature created a Sea Level Rise Task Force⁶⁹ to protect New York's remaining coastal ecosystems and natural habitats and increase coastal community resilience in the face of sea level rise. All planning in the coastal areas must continue to be informed by updated facts and predictions, but planners should not wait until certainty is achieved. Good planning and cost-effective steps taken now, as new development takes place or properties are retrofitted, can prevent significant losses in the future.⁷⁰

The Federal Coastal Zone Management Act of 1972 calls for state implementation of coastal zone management plans and provides the backbone for state and local planning and regulatory action in coastal areas.⁷¹ The 1990 amendments explicitly reference potential sea level rise as a factor that should be "anticipated and addressed" in the state plans.⁷² In New York, the Department of State oversees the plan and implements it by means of the Local Waterfront Revitalization Program, pursuant to which New York City has authority to prepare its own program.⁷³ In New York City, the Department of City Planning is responsible for this effort and is currently in the process of reviewing and revising the City's Comprehensive Waterfront Plan and its Local Waterfront Revitalization Program. These plans should also be developed with an eye towards the possibility of increased coastal flooding and be reevaluated in light of that potential.

The prospect of rising sea levels has precipitated a national

⁶⁸ GABE COWLES ET AL., CLIMATE CHANGE ADAPTATION STRATEGIES IN NEW YORK CITY AND NEW YORK STATE (2009), available at http://www.earth.columbia.edu/sitefiles/file/education/Student_Research/hsbc/Gabe%20Cowles%20Poster.pdf; Samantha Roberts, *911 Response to Climate Change in New York State: ClimAID*, ONEARTH, Oct. 15 2005, available at <http://www.onearth.org/node/1499>.

⁶⁹ 2007 N.Y. Sess. Laws 1301 (McKinney).

⁷⁰ Hurricane loss prevention steps and preparedness measures have reduced damage by as much as 85 percent. In one case, an investment of \$2.5 million resulted in \$500 million in avoided losses. THE HEINZ CENTER AND CERES, RESILIENT COASTS: A BLUEPRINT FOR ACTION 1 (2009), available at http://www.heinzctr.org/publications/PDF/Resilient_Coasts_Blueprint_Final.pdf.

⁷¹ 16 U.S.C. §§ 1451–1466 (2006).

⁷² U.S. OFFICE OF TECH. ASSESSMENT, PREPARING FOR AN UNCERTAIN CLIMATE 37 (1993).

⁷³ The Waterfront Revitalization of Coastal Areas and Inland Waterways provisions of the New York Executive Law provide for local implementation when a municipality adopts a local waterfront revitalization program. *See, e.g.*, N.Y. EXEC. LAW § 915 (McKinney 1996).

conversation about what coastal developments should be permitted and how they should be built. The basic choices have been summed up in the advice “armor, elevate, or retreat.”⁷⁴ These options can be applied individually or in combination, and decisions about these approaches should carefully consider the context of the area. The higher the density, the more construction, and the more people located in a flood-prone area, the worse the impacts of the flooding and the harder it may be to respond to an emergency. However, this does not mean that the city should necessarily retreat from highly populated and developed areas. In some cases, a safer approach may be to decrease density by the waterfront and increase the requirements for vegetated and pervious surfaces, establishing landscaped buffer areas between flood-prone waterfront and new development. In areas of greatest risk and vulnerability to sea level rise, stricter restrictions on development or permitted uses could be considered.⁷⁵ While perhaps not widely feasible in New York City, zoning and land use policies can be changed to provide for a systematic retreat from vulnerable areas to allow for migration of beaches and the creation of replacement natural wetlands in coastal areas that are not already built up.

Finally, while not part of zoning regulations, other land use management techniques are at the disposal of municipalities. For example, “rolling easements” have been enacted in a few jurisdictions to balance wetlands preservation with private property rights.⁷⁶ As the sea advances, the easement automatically

⁷⁴ U.S. CLIMATE CHANGE SCI. PROGRAM, COASTAL SENSITIVITY TO SEA LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 519–21 (2009), available at <http://www.epa.gov/climatechange/effects/coastal/SAP%204.1%20Final%20Report%2001.15.09.pdf>. A tangible example of using elevation to adapt major infrastructure was the construction of the Third Water Tunnel on Roosevelt Island in New York City, which was built higher than originally specified to accommodate climate change related sea level concerns. DAVID C. MAJOR & RICHARD A. GOLDBERG, COLUMBIA UNIV. CTR. FOR CLIMATE SYS. RESEARCH, METRO EAST COAST STUDY, PUB. COMMENT DRAFT 9 (2000), available at http://metroeast_climate.ciesin.columbia.edu/reports/water.pdf.

⁷⁵ See *infra* Section XII (discussion as to the constitutional law limits on such regulation). See also Christine Klein, *The New Nuisance, An Antidote to Wetland Loss Sprawl and Global Warming*, 48 B.C. L. REV. 1155, 1170–75 (2007). See generally Michael Hiatt, *Come Hell or High Water: Reexamining the Takings Clause in a Climate Changed Future*, 18 DUKE ENVTL. L. & POL’Y F. 371 (2008).

⁷⁶ James Titus, *Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners*, 57 MD. L.

rolls landward, thus permitting the creation of new wetlands and preserving public access to the shore.⁷⁷ The private owner can develop and use the land as long as the land is above sea level; the owner can plan for the future based upon sea level rise projections.⁷⁸

The coastal development permit program, run by the New York State Department of Environmental Conservation in concert with New York City Department of Buildings guidelines, regulates construction procedures and other activities that may contribute to increased coastal erosion.⁷⁹ Open space acquisition along the coast can be pursued under the New York State Environmental Protection Fund.⁸⁰ Permits are a traditional mechanism for regulating all aspects of project development from planning and siting through construction, operation, and maintenance; structural modification; and waste discharges into coastal areas, floodplains, wetlands, and other environmentally sensitive areas. Adjusting permit criteria to reflect anticipated changes could significantly decrease vulnerability.

C. *Increased Air Temperatures and Energy Efficiency*

Climate change is expected to produce an increase in annual temperatures and extreme temperature events such as heat waves.⁸¹ These could cause an increase in peak electricity usage and resulting power outages, potentially disrupting electrical service.⁸² City-wide zoning regulations can facilitate increased energy supply, even on a small scale.⁸³ These measures can increase

REV. 1279, 1313–17 (1998); NOAA Office of Ocean and Coastal Res. Mgmt., Erosion Control Easements, http://coastalmanagement.noaa.gov/initiatives/shoreline_ppr_easements.html (last visited Nov. 14, 2009).

⁷⁷ NOAA, Erosion Control Easements, *supra* note 76. See *infra* Section XII for discussion of the constitutional takings ramifications of such easements.

⁷⁸ U.S. CLIMATE CHANGE SCI. PROGRAM, *supra* note 74, at 442–444; ELLINA LEVINA, ORG. FOR ECON. CO-OPERATION AND DEV., POLICY FRAMEWORKS FOR ADAPTATION TO CLIMATE CHANGE IN COASTAL ZONES: THE CASE OF THE GULF OF MEXICO 36–46 (2007).

⁷⁹ N.Y. COMP. CODES R. & REGS. tit. 5, § 505.1 (2008).

⁸⁰ N.Y. State Department of Environmental Conservation, Open Space Funding From the Environmental Protection Fund, <http://www.dec.ny.gov/lands/5071.html> (last visited Nov. 14, 2009).

⁸¹ NYPCC, *supra* note 1, at 3, 9–10.

⁸² *Id.* at 26–27.

⁸³ Emergency energy use reduction measures can provide immediate reductions in energy usage during heat waves, and building code reforms can

system resilience and help the city adapt to climate change.

Specific amendments to the Zoning Resolution can assist in increasing energy supply and reducing the likelihood of power outages, helping with both mitigation and adaptation. The Zoning Resolution currently limits the ability to install power substations⁸⁴ and renewable energy resources, both of which would contribute to minimizing the number and scope of power outages. The Zoning Resolution allows power substations on an as-of-right basis in commercial and manufacturing districts. They are allowed in residential districts only with a special permit, issued on a site-by-site-basis.⁸⁵ The special permit process is discretionary in nature; it formally requires review by the community board and approval by the City Planning Commission and may involve the City Council. As a consequence, it is often difficult to gain approval of a substation.

However, if a city-wide zoning text change authorized the installation, on an as-of-right basis, of power substations in districts that were underserved or documented to be vulnerable to brown- and black-outs, permitting and installation would be easier and those neighborhoods would not be as severely impacted by climate change. In this regard, an approach that targets specific districts, based on a citywide study, may be more appealing than a site-by-site approach. In any event, even without a text change, the provision of this critical information to local decision makers may positively influence their decision to approve a special permit for a substation in a particular residential district.⁸⁶

Modifications of the Zoning Resolution could foster the installation of alternative renewable energy resources. Currently, the Zoning Resolution lists specific items that are allowed to breach the proscribed maximum height of a building or obstruct

require cool roofs, changes in building materials, and energy saving technologies. Value engineering, efficient interior space, and systems planning also can have an impact on the energy usage of individual buildings.

⁸⁴ See NEW YORK, N.Y., ZONING RESOLUTION §§ 42-00, 42-15 (2009); Hope Cohen, Comment, *Putting The Sub Back In Substations*, ARCHITECT'S NEWSPAPER, Feb. 18, 2009, available at http://www.manhattan-institute.org/pdf/_putting_the_sub_back_hcohen.pdf.

⁸⁵ The N.Y. City Board of Standards and Appeals may issue the special permit in the case of smaller sites (under 40,000 square feet), and the City Planning Commission may issue it in the case of larger sites (over 40,000 square feet). NEW YORK, N.Y., ZONING RESOLUTION §§ 73-16, 74-61.

⁸⁶ See Cohen, *supra* note 84.

the rear yard.⁸⁷ Amending the Zoning Resolution to allow for the installation of solar energy panels, small wind turbines, and other innovative renewable energy and energy saving mechanisms on the roof, above the maximum permitted height of a building, or in the rear yard, while complying with safety and fire standards, would facilitate their installation.⁸⁸

In addition, the Zoning Resolution might foster the installation of neighborhood-oriented geothermal heat or hot water generating facilities, reducing energy demand.⁸⁹ Given the anticipated warming of New York City, the supplemental power provided by these renewable energy resources might help avert a power outage or minimize its scope from a building or neighborhood perspective.

An innovative approach to adapt to, and perhaps mitigate, these impacts of climate change is to examine these problems on a neighborhood- or district-wide basis and to use zoning to affect localized reductions of ambient air temperature heat or increases in energy efficiency. These neighborhoods or districts could be identified from historical data of neighborhoods that experienced brown-outs or black-outs, thermal maps, and other data regarding the heat generated in different neighborhoods, and tracking of energy usage by different types of facilities.⁹⁰ Using this information, zoning regulations can be adopted on a targeted neighborhood-wide basis to reduce air temperature and energy demand, and to reduce the likelihood of power outages.

Specifically, the City could designate “Special Heat Reduction Districts” or “Special Energy Districts” (SED). Borrowing the concept of performance standards contained in the manufacturing district regulations of the Zoning Resolution,⁹¹ these special districts would have a set of design and performance standards that foster reduction of heat and promote energy efficiency.

⁸⁷ *E.g.*, NEW YORK, N.Y., ZONING RESOLUTION §§ 23-44 (Permitted Obstructions in Required Yards or Rear Yard Equivalents), 33-42 (Height and Setback, Permitted Obstructions to the Height of a Building).

⁸⁸ Provisions would have to be made to protect adjacent property owners from noise or unsightliness by requiring a minimum distance from existing windows, noise attenuation, and screening, for example.

⁸⁹ *See infra* note 95.

⁹⁰ *See* NYPCC, *supra* note 1, at 38.

⁹¹ *See* NEW YORK, N.Y., ZONING RESOLUTION § 42-20.

Existing and new buildings in these districts would have to meet the new heat reduction standards. These new standards could include the provision of green roofs, green walls, more vegetated surfaces as part of their open space, and more shading. Even if the green space were not accessible to the public, the public would benefit from the better air quality. Through the implementation of these requirements, existing and new buildings could reduce ambient air temperature on a neighborhood-wide basis.⁹² Such measures may enable the city to reduce the heat in particularly vulnerable neighborhoods and thereby reduce demand on energy resources during extreme heat events.⁹³ These measures would contribute to both mitigation and adaptation to climate change.

Buildings that are located in Special Energy Districts would have to meet the city's Building Code requirements relating to energy efficiency and reduction of GHG emissions by weatherizing or insulating their buildings, and by engaging in other energy saving activities. Businesses in those buildings would also have to alter their processes to be more energy efficient, and consideration could be given to pairing uses that have complementary energy needs (peak/off peak) and allowing them in the same building, even if they would not otherwise be allowed even in the same district.⁹⁴

All landowners in a Special Energy District could be required to participate in collective measures to reduce energy consumption. They could contribute to hybrid transportation to and from mass transit stations to encourage the use of mass transit by employees and discourage car usage, or could participate in a program to provide renewable energy resources on a neighborhood-wide basis.

Special Heat Reduction Districts and Special Energy Districts

⁹² The installation of green roofs and green walls throughout a neighborhood might reduce ambient air temperature in that neighborhood and provide additional environmental and health benefits. See PLAN NYC, *supra* note 15, at 60.

⁹³ Since much urban heat is caused by automobile usage, other city policies would have to be engaged to address reduction of heat on the streets in the heat reduction districts. "Mass-transit only" districts during peak heat periods, green walls, second story window boxes, more tree plantings, and more natural or artificially shaded areas in parks and public spaces are several ideas.

⁹⁴ For example, residential units where most of the occupants work during the day and use energy at night complement a business that uses energy during the day and is dormant at night.

are a novel zoning concept. They have a cousin in small facilities that generate heat or energy for local consumption.⁹⁵ They also bear a resemblance to special energy districts that have been established by several communities as a vehicle for funding energy efficiency and the installation of renewable energy on a local or neighborhood basis.⁹⁶ The Special Heat Reduction District and Special Energy District concepts expand the district funding mechanism into a planning and development tool designed to reduce a neighborhood's temperature or increase its energy efficiency and foster the use of renewable energy.

The City already identifies public buildings that can serve as emergency cooling centers in heat waves.⁹⁷ It could identify emergency evacuation centers in the case of floods. Such centers located in neighborhoods recognized as vulnerable to brown-outs and black-outs should be best prepared for extreme weather conditions. Evacuation plans that focus on surface mass transit (instead of subways or private cars) could be developed for all flood-prone areas. When a portion of a flood-prone or a "heat reduction district" is being considered for rezoning or a large-scale plan, these emergency measures could be identified in the applications and reports.

D. *Rezoning, Variances, and Special Permit Findings*

Rezoning, variances, and special permit findings are other land use tools relevant to climate change adaptation. In addition to

⁹⁵ For example, geothermal heat districts enable the provision of heat for multiple buildings, and district hot water heating facilities burn biomass in a boiler to produce steam (that can be used to create energy) or hot water for residential and commercial heating. See TRAVERSE CITY LIGHT AND POWER, HIGHLIGHTS OF THE NEW WORLD OF BIOMASS ENERGY CONFERENCE (2006), available at http://www.tclp.org/biomass_conference.pdf.

⁹⁶ Eagle and Pitkin Counties in Colorado have considered adopting Energy Smart Local Improvement Districts which create a loan fund that allows owners to borrow money for energy efficiency and renewable energy improvements. See *Morning Newscast* (Aspen Public Radio broadcast Nov. 4, 2009), available at http://www.aspenpublicradio.org/news_archive_detail.php?story=518. Massachusetts is encouraging the integration of smart growth and smart energy into comprehensive planning at the local level; the state identifies a district energy system. See Smart Growth/Smart Energy Toolkit – Glossary, http://www.mass.gov/envir/smart_growth_toolkit/pages/glossary.html (last visited Nov. 14, 2009).

⁹⁷ See, e.g., N.Y. City Office of Emergency Mgmt., NYC Hazards: Cooling Centers, http://nyc.gov/html/oem/html/hazards/heat_cooling.shtml (last visited Nov. 27, 2009).

the zoning proposals described above, variances could recognize adaptation to climate change as a potential hardship, giving landowners more flexibility to promote adaptation measures. Finally, every proposed discretionary approval—variance, rezoning, and special permit—could include a finding discussing, from a land use perspective, how adaptation to climate change is being addressed in that project and, if not, why it is not necessary or appropriate to do so. This finding may dovetail with information that could otherwise be found in an Environmental Impact Statement, if one were required for the action. If one were not required, the finding would serve to cause the applicant and the decision-maker to consider climate change when planning a new development, even if no changes in the project were ultimately required. The goal is not to prevent or inhibit development or to overburden developers. Rather, it is to promote development that sensibly considers the risk of climate change.

II. ENVIRONMENTAL IMPACT STATEMENTS⁹⁸

The National Environmental Policy Act (NEPA),⁹⁹ the New York State Environmental Quality Review Act (SEQRA),¹⁰⁰ and the City Environmental Quality Review (CEQR)¹⁰¹ procedures contain requirements that relate to climate change adaptation across sectors at the federal, state, and city levels. NEPA requires the preparation of an Environmental Impact Statement (EIS) for “major Federal actions significantly affecting the quality of the human environment.”¹⁰² An EIS must address not only direct effects, but also indirect effects that are reasonably foreseeable.¹⁰³ Many states, including New York with SEQRA, have enacted “little NEPAs” creating similar requirements for many governmental actions on the state and local level. New York City

⁹⁸ This section was prepared by J. Kevin Healy, a partner in the Environmental Practice Group of Bryan Cave LLP, and Pamela R. Esterman, a partner at Sive, Paget & Riesel, PC, with the assistance of Ashley S. Miller, an associate at Sive, Paget & Riesel, PC.

⁹⁹ National Environmental Policy Act, 42 U.S.C. §§ 4321–4370f (2006).

¹⁰⁰ N.Y. ENVTL. CONSERV. LAW §§ 8–0101 to –0017 (McKinney 2008).

¹⁰¹ CITY OF N.Y., CEQR TECHNICAL MANUAL, *available at* <http://www.nyc.gov/html/oec/html/ceqr/ceqrpublish.shtml> (includes the CEQR Rules of Procedure for City Environmental Quality Review).

¹⁰² 42 U.S.C. § 4332(C).

¹⁰³ 40 C.F.R. §§ 1502.3, 1502.16 (2008).

developed its own additional procedural requirements with CEQR.¹⁰⁴

SEQRA, the regulations adopted under SEQRA by the New York State Department of Environmental Conservation (DEC) (the DEC Regulations),¹⁰⁵ and CEQR requirements provide a framework that is potentially well-suited to planning for adaptation to the problems of climate change. The basic legal structure for utilization of such laws and regulations for that purpose is already in place. However, the State and the City could include in their climate change planning document descriptions of the analyses expected in connection with adaptation to climate change, and provide guidance on how such analyses should be conducted. The development of such guidance will require focused—and perhaps difficult—legal, administrative, and technical efforts as well as climate change projections detailed enough for site-specific analysis.

SEQRA, the DEC Regulations, and CEQR currently require that State and City agencies carefully examine the potentially significant adverse environmental impacts of their proposed actions. Impacts subject to review may include not only the direct and indirect effects that the actions proposed may have on the environment, but also the effects that the environment may have upon the action. In certain instances, for example, DEC and involved City agencies require the examination of noise and air pollution which may be emitted not only from the action or project under review, but also from pre-existing sources that may affect a project.¹⁰⁶ Thus, the opportunity exists under current law to assure that climate change adaptation issues relating not only to the effects *of* proposed actions, but also *upon* proposed actions, i.e., impacts of climate change on a project, are factored into the environmental review process. Injecting these considerations into governmental decision-making at the earliest possible time is generally required to be consistent with the purposes of environmental review statutes and regulations.

Federal and State coastal zone management requirements are also relevant to climate change adaptation.¹⁰⁷ New York's coastal

¹⁰⁴ 62 R.C.N.Y. § 5-01 to -11 (1991).

¹⁰⁵ N.Y. COMP. CODES R. & REGS. tit. 6, § 617 (2000).

¹⁰⁶ CEQR TECHNICAL MANUAL, *supra* note 101, ch. 3Q-1, 3R-18.

¹⁰⁷ *See generally* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE,

management program requires that State agencies certify—either independently or in conjunction with a SEQRA review—that actions in coastal areas will not substantially hinder the policies of the New York State Coastal Management Program (CMP), as well as any applicable Local Waterfront Revitalization Program.¹⁰⁸ To aid in the evaluation of agency actions, the New York Department of State has created the Coastal Assessment Form to be completed at the outset of the review process for an agency action.¹⁰⁹ Since certain policies adopted under the coastal zone management program are relevant to climate change adaptation, the requirements of the program can also be used as a vehicle for climate change planning.

A. *SEQRA Basics*

Under SEQRA, an environmental assessment is prepared to determine whether a proposed action (either alone or in combination with related actions) may have significant short-term or long-term adverse impacts on the environment.¹¹⁰ If, as a result of the initial assessment, one or more potentially significant environmental impacts are identified, an EIS is prepared to examine all potentially significant impacts, consider alternatives that could avoid or minimize those impacts that are identified as significant, and discuss measures that could be implemented to mitigate them.¹¹¹ Upon completion of the EIS and prior to taking the action under consideration, the agency issues findings under SEQRA certifying that the requirements of the law have been satisfied, and that the action will, among other things, include measures to mitigate identified environmental impacts to the maximum extent practicable.¹¹²

CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 316–57 (2007) (Coastal Systems and Low-Lying Areas), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm.

¹⁰⁸ 16 U.S.C. §§ 1451–66 (2006); 15 C.F.R. 930 (2009); N.Y. EXEC. LAW §§ 910–23 (McKinney 2009); N.Y. COMP. CODES R. & REGS. tit. 19, § 600 (2008).

¹⁰⁹ Coastal Management Program, N.Y. Department of State (DOS), Coastal Assessment Form, *available at* http://www.dec.ny.gov/docs/permits_ej_operations_pdf/coastassess.pdf; Coastal Management Program, N.Y. DOS, Federal Consistency Assessment Form, *available at* <http://www.nyswaterfronts.com/downloads/pdfs/fcaf2.pdf>.

¹¹⁰ N.Y. COMP. CODES R. & REGS. tit. 6, §§ 617.2(b), 617.3(a) (2000).

¹¹¹ *Id.* §§ 617.3(c), 617.9.

¹¹² *Id.* § 617.11.

Climate change adaptation issues fit into the SEQRA framework. The identification of impacts that climate change may have on a project and the consideration of alternatives and measures to mitigate such impacts could create a vehicle for assessing adaptation needs and enable more informed adaptation planning. Accordingly, there appears to be no necessity for amending the existing environmental review laws or regulations to address adaptation to climate change.¹¹³

B. *Assessment Documents to Address Adaptation*

Relevant agencies could usefully issue planning and guidance documents to assure that the analyses prepared under SEQRA effectively align governmental actions and public and private projects with the new realities of climate change. DEC is currently revising various SEQRA-related documents, and a revised Environmental Assessment Form (EAF) has been released for comment to a group of stakeholders.¹¹⁴ DEC has also recently finalized a new technical guidance document to assist project sponsors in calculating GHG emissions in EISs where DEC has permitting authority,¹¹⁵ and the City is working on the issue as well. Other states, including California and Massachusetts, have also developed such additional planning tools related to climate change, although the work done to date has focused on mitigation rather than adaptation.¹¹⁶ However, a significant adaptation

¹¹³ In evaluating whether adaptation is practicable, it may be reasonable for the agency preparing an EIS to consider the costs of including reasonable adaptation measures in a project design from the outset in light of the potential costs of retrofitting a project post-construction at such time as those measures are required to protect a project against climate change-related impacts.

¹¹⁴ N.Y. Dep't of Env'tl. Conservation, Full Environmental Assessment Form, Preliminary Review Draft 2 (Sept. 17, 2008) [hereinafter Draft EAF] (on file with New York University Environmental Law Journal); Letter from Anne Reynolds and Betty Ann Hughes, N.Y. Department of Environmental Conservation, to Interested Stakeholders (Sept. 17, 2008), *available at* <http://www.nyupstateplanning.org/EAFLetterToStakeholders.pdf>.

¹¹⁵ N.Y. DEP'T OF ENVTL. CONSERVATION, GUIDE FOR ASSESSING ENERGY USE AND GREENHOUSE GAS EMISSIONS IN ENVIRONMENTAL IMPACT STATEMENT (2009), *available at* http://www.dec.ny.gov/docs/administration_pdf/eisghgpolicy.pdf.

¹¹⁶ *See, e.g.*, Cal. Governor's Office of Planning and Research, CEQA Guidelines and Greenhouse Gases, <http://www.opr.ca.gov/index.php?a=ceqa/index.html> (last visited Nov. 23, 2009); MASS. EXEC. OFFICE OF ENERGY AND ENVTL. AFFAIRS, GREENHOUSE GAS EMISSIONS POLICY 1 (2009), *available at* <http://www.env.state.ma.us/mepa/downloads/RevisedGHGPolicy>.

planning effort is now underway under the state environmental review laws in Massachusetts, where an advisory committee has been convened to analyze strategies for adapting to the predicted impacts of climate change.¹¹⁷ Among other things, an approach is being developed under the auspices of that committee to consider the potential effects of reasonably foreseeable climate change on projects subject to review under the Massachusetts analogue to SEQRA.¹¹⁸

The EAF could be further revised to address adaptation issues. For example, the queries in the current draft of the revised EAF issued by DEC seek information about whether the project is in a floodway, a 100-year flood plain, a 500-year flood plain, or within a designated Coastal Erosion Hazard Area.¹¹⁹ As new policies related to climate change adaptation are developed, these inquiries could be expanded to include questions relevant to updated regulations and climate change predictions. For example, consideration could be given to including such inquiries as whether and how the project is likely to be affected by anticipated sea level rise, by severe storm events, and by significant and prolonged increases in temperature. The EAF could also include inquiries on other elements, such as whether the site is at risk of leaching hazardous materials in the event of flooding, whether water conservation elements were incorporated into the design, and whether measures to reduce stormwater runoff were incorporated into the design.¹²⁰

C. *The Coastal Assessment Form*

For properties on the coast, expanded coastal assessment forms¹²¹ could be developed. The expanded forms could further

pdf.

¹¹⁷ See Press Release, Mass. Governor Deval Patrick, Patrick Administration Appoints Advisory Committee to Assess Adaptation Strategies (June 4, 2009), available at http://www.mass.gov/?pageID=eoeepressrelease&L=1&L0=Home&sid=Eoeea&b=pressrelease&f=090604_pr_cca_committee&csid=Eoeea.

¹¹⁸ See Climate Change Adaptation Advisory Committee, Presentation on Potential Strategies (Oct. 20, 2009), available at <http://www.mass.gov/dep/public/committee/1009pres.pdf> (suggesting consideration of adaptation needs in “reviews and permits for private developments”).

¹¹⁹ Draft EAF, *supra* note 114, at 13.

¹²⁰ The proposed draft EAF issued by DEC already asks whether energy conservation elements were incorporated into the design. *Id.* at 9.

¹²¹ See Coastal Assessment Form, *supra* note 109.

explore not only the effect of the project on the environment but the potential effects of the environment on the project and determine consistency with the state's coastal policies.¹²² The new forms could require an analysis of the project based on specified updated climate change predictions. They could ask whether any measures are being taken to adapt the project to meet potential rising sea levels, and whether any steps are being taken in the project design to facilitate and lessen the potential cost of later retrofits. The forms could also ask whether project siting or design could be modified to lessen the impact of such rising sea levels.

D. *Revising the Technical Guidance*

The City and/or DEC could also issue technical guidance that (1) explicitly requires the consideration of climate change impacts upon the proposed project or action under consideration, (2) sets forth a protocol for analyzing such impacts in environmental reviews, and (3) calls for the consideration of reasonable measures to avoid or mitigate these impacts in appropriate cases. In addition, the guidance could be updated periodically to revise the analysis parameters and climate change scenarios in light of new information related to the effects of climate change. DEC could revise its technical guidance addressing climate impacts under SEQRA to incorporate impacts on a project, a topic currently excluded from that document. Likewise, the CEQR Technical Manual could be revised to consider similar issues. The DEC regulations could be amended to assure that such an analysis is required and binding on all lead agencies.

E. *Adoption of an Official Adaptation Plan*

One of the criteria of significance under SEQRA relates to the conformity of an action to an officially adopted plan of a community. The City could therefore include in any climate change adaptation plans the considerations it deems relevant or necessary in the context of planning for infrastructure projects, as well as planning for climate change.¹²³ Specific guidance could also be prepared and incorporated into the CEQR Technical Manual with respect to the analyses required to address such

¹²² N.Y. EXEC. LAW §§ 910–23 (McKinney 2009).

¹²³ New York is preparing a Climate Action Plan pursuant to Executive Order by Governor Paterson. N.Y. Exec. Order No. 24 (Aug. 16, 2009).

issues. The EAF form could further be revised to include a question regarding consistency of the proposed action with the City's (or other locally adopted) climate change adaptation plan.

III. ENERGY¹²⁴

Climate change is expected to impact energy infrastructure in many significant ways.¹²⁵ Concerns identified include: (1) sustained higher summer temperatures and extended heat waves which can periodically cause temperature spikes far above average and create unpredictable demand for electricity;¹²⁶ (2) increased severity of rain and wind storms which can wreak havoc on aged grid equipment and can flood underground natural gas pipelines and buried transmission lines;¹²⁷ and (3) permanent sea level rise, which could negatively affect generation facilities sited along coastlines (as most of New York City's are), unless protective measures are implemented to address coastal erosion and increased salinity of intake water.¹²⁸ A permanent sea level rise will also likely interfere with maintenance of New York's underground

¹²⁴ Amy Fisher, Esq., wrote this chapter.

¹²⁵ GLOBAL CHANGE REPORT, *supra* note 2, at 53–60.

¹²⁶ Much of New York City's fleet of power generation plants was built for continuous use and those plants are poorly adapted to serve this episodic peaking demand. See Jeanne Rubner, *Oh What a Tune-Up*, PICTURES OF THE FUTURE, Spring 2009, at 27, available at http://w1.siemens.com/innovation/pool/en/publikationen/publications_pof/pof_spring_2009/life_cycle_planning/power_plant/pof109_lifecycle_powerplant_en.pdf (Siemens AG, a major power equipment manufacturer, discusses the need to upgrade older plants to provide greater operational flexibility.). Some of New York City's oldest generation facilities have recently been supplemented by newer units, such as the Ravenswood 250MW combined cycle natural gas plant developed by KeySpan, which came on line in 2004, and the recently-financed 500 Astoria II combined cycle natural gas unit owned by a consortium of independent developers which is due to reach completion in 2011, but much of the existing energy infrastructure, especially transmission and local distribution lines, is aged, making it vulnerable to stress resulting from high demand, and resulting in repeated local outages. See KAREN L. ANDERSON ET AL., FITCH RATINGS, FRAYED WIRES: US TRANSMISSION SYSTEM SHOWS ITS AGE 1 (2006) (detailing the limited investment in refurbishment of existing transmission infrastructure resulting in reliability concerns). See generally LITOS STRATEGIC COMMUNICATION, THE SMART GRID: AN INTRODUCTION (2008), available at http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages.pdf (providing a general overview of the national electric grid written for a non-technical audience).

¹²⁷ NYPCC, *supra* note 1, at 25–27.

¹²⁸ *Id.*

electric power infrastructure.¹²⁹

Despite the best efforts of New Yorkers to use energy wisely, there is no current proposal to eliminate our longstanding reliance on the complex infrastructure chain that begins with fuel delivery and ends with electric distribution to end users. Several natural gas pipelines reach New York from the Gulf of Mexico and Canada and the new Millennium pipeline comes south from Lake Erie.¹³⁰ Diesel fuel oil is most often transported by barge on the East and Hudson Rivers.¹³¹ Both fuels are delivered to power generating plants located in and around New York City, which due to New York's island geography, primarily lie along waterways. To protect against power disruption, the New York Independent System Operator (NYISO), which manages New York's electric transmission grid, requires that each New York City electric power supplier obtain at least 80 percent of its load requirements from power plants located within New York City.¹³² New York's electric transmission and distribution grid was buried underground before 1900 and the system has undergone limited upgrades since that time, resulting in expensive and disruptive repairs.¹³³ Because of these factors, and the difficulty in siting and constructing any new infrastructure in New York, much of the system is old and inefficient as well as insufficient to meet projected load increase.¹³⁴

In 2008, in response to the many concerns about energy policy in New York, Governor David A. Paterson established a

¹²⁹ *Id.*

¹³⁰ Energy Info. Admin., State Energy Profiles, New York, http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=NY (last visited Nov. 14, 2009).

¹³¹ ENERGY INFO. ADMIN., THE NORTHEAST HEATING FUEL MARKET: ASSESSMENT AND OPTIONS 56–57 (2000), available at <http://www.eia.doe.gov/oiaf/servicrpt/nehfuel/appendix.html>.

¹³² N.Y. STATE RELIABILITY COUNCIL, NYSRC RELIABILITY RULES FOR PLANNING AND OPERATING THE NEW YORK STATE POWER SYSTEM 64 (2009), available at www.nysrc.org/pdf/Documents/RRManualVer23Final1-9-09.pdf. Although certain of the recently-built transmission lines which can provide power from outside New York City (such as the 660MW HVDC Neptune Cable under the Hudson from New Jersey and the 330MW HVDC Cross Sound Cable under Long Island Sound from Connecticut) are eligible to be included towards this requirement, inclusion is based on performance characteristics of a line and its owner's annual designation of how the line will be treated for resource adequacy studies.

¹³³ PLAN NYC, *supra* note 15, at 103.

¹³⁴ *Id.* at 101–03.

State Energy Planning Board to consider New York's energy needs.¹³⁵ The Board released an interim Energy Plan on March 31, 2009 and a draft State Energy Plan in August 2009,¹³⁶ with a final plan scheduled for release in December 2009.¹³⁷ The draft plan, although not addressing adaptation to climate change directly, will influence energy policy throughout the State. It focuses on five key objectives: maintaining energy reliability; reducing GHG emissions; stabilizing energy costs and improving New York's economic competitiveness; reducing public health and environmental risks associated with energy production and use; and improving the State's energy independence by promoting more in-state generation.¹³⁸ The New York State Energy Research and Development Authority (NYSERDA) is also at work on its "Integrated Assessment for Effective Climate Change Adaptation Strategies in New York," which is expected to be issued in the summer of 2010.¹³⁹

However, complicated regulatory and market frameworks impede easy reform. Numerous stakeholders, including federal, state, and local regulators (many with overlapping jurisdiction), and private companies who own portions of the energy infrastructure, are involved in New York City energy issues. At the federal level, the U.S. Department of Energy (DOE) advances federal policy by providing grant money for certain investments.¹⁴⁰ Under the 2009 stimulus package, the DOE is charged with providing loans and grants for renewable energy and transmission

¹³⁵ N.Y. Exec. Order No. 2 (April 9, 2008), *available at* http://www.state.ny.us/governor/executive_orders/exeorders/pdf/eo_2.pdf.

¹³⁶ N.Y. STATE ENERGY PLANNING BD., DRAFT 2009 STATE ENERGY PLAN (2009), *available at* <http://www.nysenergyplan.com/DRAFT%20Energy%20Plan%20FINAL.pdf>.

¹³⁷ N.Y. State Energy Plan, Events, <http://www.nysenergyplan.com/events.html> (last visited Nov. 16, 2009). The plan is currently posted online at <http://www.nysenergyplan.com/stateenergyplan.html> (last visited Jan. 8, 2010).

¹³⁸ DRAFT 2009 STATE ENERGY PLAN, *supra* note 136, at xi. The Draft Plan, for example, encourages "development of in-state clean energy supplies, including natural gas, wind, solar, geothermal, bio-energy, hydropower and hydrokinetic capacity," which would assist in addressing the need for additional electric power discussed below. *Id.* at 6.

¹³⁹ N.Y. STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, INTEGRATED ASSESSMENT FOR EFFECTIVE CLIMATE CHANGE ADAPTATION STRATEGIES IN NEW YORK STATE: PROJECT UPDATE, *available at* www.nyserda.org/programs/Environment/EMEP/10851_project_update.pdf.

¹⁴⁰ *See generally* 42 U.S.C. §§ 7101–7385 (2006).

upgrades, including “smart grid” equipment that can provide precise and prompt information regarding line outages and instability.¹⁴¹ The Federal Energy Regulatory Commission (FERC) is an independent regulatory agency within the DOE that regulates natural gas transmission (including siting of new natural gas pipelines), electric transmission, and wholesale sale of electricity; oversees electric transmission reliability; and monitors and regulates electric markets such as New York’s.¹⁴² The North American Electric Reliability Corporation (NERC), an independent authority overseen by FERC, promulgates reliability standards for the “bulk power system”, which it defines as generation facilities and the high-voltage transmission system.¹⁴³ The first set of standards was accepted by FERC in 2007 and is now mandatory.¹⁴⁴ Other federal agencies having significant impact on energy matters are the U.S. Environmental Protection Agency, the Internal Revenue Service, which provides substantial incentives for certain energy-related activities such as renewable energy, and the Department of Transportation, which regulates natural gas pipeline safety.¹⁴⁵

Energy generation, transmission, and use are also heavily regulated at the state level. The New York State Public Service Commission (PSC) regulates some of the state’s electric utilities, and, through its rate-making authority, sets “just and reasonable” charges for retail electricity and natural gas.¹⁴⁶ Investor-owned utilities (IOUs), like Consolidated Edison and National Grid, provide power to consumers in New York City. Special purpose governmental entities not subject to the jurisdiction of the PSC, such as New York Power Authority (NYPA), procure power under

¹⁴¹ American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115, 143–144.

¹⁴² 16 U.S.C. §§ 791–828 (2006).

¹⁴³ See North Am. Elec. Reliability Corp., About NERC: Reliability Terminology, <http://www.nerc.com/page.php?cid=1|15|122> (last visited Nov. 26, 2009) (defining “bulk power system”).

¹⁴⁴ See generally NORTH AM. ELEC. RELIABILITY CORP., RELIABILITY STANDARDS FOR THE BULK ELECTRIC SYSTEMS OF NORTH AMERICA (2009), available at http://www.nerc.com/files/Reliability_Standards_Complete_Set_2009Feb25.pdf. See also 18 C.F.R. § 40 (2009) (making standards mandatory).

¹⁴⁵ See Clean Water Act, 33 U.S.C. §§ 1251–1387 (2006); Clean Air Act, 42 U.S.C. §§ 7401–7671 (2006); I.R.C. §§ 45, 48 (2006) (establishing renewable energy credits); 49 U.S.C. §§ 60101–60137 (2006) (establishing natural gas pipeline safety standards).

¹⁴⁶ N.Y. PUB. SERV. LAW § 66(5) (McKinney 2000).

special circumstances and act through a board of trustees with oversight by the New York State Public Authorities Control Board¹⁴⁷ and the New York State Reliability Council (NYSRC), an independent not-for-profit organization subject to FERC oversight which imposes grid reliability requirements.¹⁴⁸

Other state agencies, while not focused exclusively on energy, also impact the development and enforcement of energy policy. The New York DEC implements federal environmental law and state standards and, through its Voluntary Cleanup Program, assists in redevelopment of contaminated property for proposed new generation projects. Other state agencies include the New York State Department of the Budget, the Empire State Development Agency, and NYSERDA, which conducts research on renewable power and energy efficiency and is funded through a “system benefit charge” added to all utility bills.¹⁴⁹ NYSERDA also administers New York’s participation in the Regional Greenhouse Gas Initiative (RGGI), a cap-and-trade program regulating power plant carbon dioxide emissions. The New York State Consumer Protection Board advocates on behalf of ratepayers in various regulatory proceedings.

In New York City, the New York City Department of City Planning (City Planning) is the primary siting and zoning agency.¹⁵⁰ City Planning is also the lead agency considering land use and community development issues, and a mayoral agency, the Office of Environmental Coordination, conducts relevant environmental reviews.¹⁵¹ The New York City Department of Buildings administers the Building Code, the Electrical Code, and the New York State Energy Conservation Construction Code, which requires that new construction comply with certain energy efficiency standards.¹⁵² The New York City Office of Emergency

¹⁴⁷ N.Y. PUB. AUTH. LAW § 1005 (McKinney 2004).

¹⁴⁸ See N.Y. STATE RELIABILITY COUNCIL, NEW YORK STATE RELIABILITY COUNCIL AGREEMENT 6 (1999), available at http://www.nysrc.org/pdf/Agreements/nysrc_agreement.pdf.

¹⁴⁹ See NYSERDA, SYSTEM BENEFIT CHARGE, REVISED OPERATING PLAN FOR NEW YORK ENERGY SMARTK PROGRAMS 1–2 (2002), available at <http://www.nyserda.org/sbc2001-2006.pdf> (describing history of New York’s system benefit charge).

¹⁵⁰ See N.Y. City Dep’t of City Planning, Our Mission, <http://www.nyc.gov/html/dcp/html/subcats/about.shtml> (last visited Dec. 27, 2009).

¹⁵¹ N.Y. CITY CHARTER § 192(d),(e) (2004).

¹⁵² See New York City Dep’t of Bldgs., Energy Conservation Constr. Code of

Management has responsibility for coordinating emergency preparedness, and the Bloomberg administration's city planning initiative, PlaNYC 2030,¹⁵³ proposes numerous energy-related recommendations.

Another relevant stakeholder is the NYISO, which has operational control over the electric transmission grid and administers bid-based markets for energy, generating capacity, and certain generation-based ancillary services in which merchant (uncontracted) generation resources and others participate. Additional players are the independent power producers, private companies which are not vertically integrated utilities and which own many of the generating plants in New York (their trade organization in New York is IPPNY),¹⁵⁴ and independent retail power suppliers (sometimes referred to as "ESCOs"), with whom industrial, commercial, and residential customers are entitled to contract, to provide them with electricity in lieu of their IOUs (using the IOUs' distribution system).¹⁵⁵ With this large number of stakeholders, major changes in energy policy are difficult to effectuate.

Nonetheless, there are a number of adaptive efforts which could be undertaken in the short term which can meaningfully blunt the impacts of climate change. As described below, each of the regulatory stakeholders has considerable discretion by statute or regulation, and limited new legislation is needed to provide requisite regulatory authority to effectuate these modifications. In addition, most of the regulatory bodies conduct public hearings prior to determining policy. New York City should consider participating actively in these sessions to make sure climate change adaptation is appropriately considered. Finally, measures

New York State Guidelines, <http://www.nyc.gov/html/dob/html/reference/ecccnys.shtml> (last visited Nov. 27, 2009).

¹⁵³ PLANYC, *supra* note 15, 101–15.

¹⁵⁴ In some cases, these facilities have power purchase agreements to sell power to an IOU or NYPA on a long-term basis; alternatively, these facilities bid their electricity into the NYISO market and are dispatched based on bids. *See* Indep. Power Producers of N.Y., <http://www.ipny.org> (last visited Nov. 27, 2009).

¹⁵⁵ In 2007, ESCOs made approximately 42 percent of the electric retail sales in New York State. *See* Energy Info. Admin., New York Electricity Profile (2007), *available at* http://www.eia.doe.gov/cneaf/electricity/st_profiles/new_york.html (last visited Jan. 16, 2010) (listing total amounts of deregulated electricity sales and overall electricity sales).

to increase efficiency and foster distributed generation can make a significant contribution to meeting the challenges presented.

A. *Enable Development of New Power Generation Resources by Providing Long-term Contracts or Market Revenue Predictability*¹⁵⁶

Most commentators agree that an adaptation plan should include additional efficient and flexible generating resources to address climate-related increases in electric use.¹⁵⁷ These resources are sometimes referred to as “peaking generation” because they are technically able to cycle on and off rapidly and without excessive damage to the equipment to serve higher than average, or “peak”, electric demand. Currently, it is difficult for developers of power generation resources that would replace old, inefficient facilities to rely solely on the NYISO power markets as a revenue source. The relevant stakeholders recognize that it may be necessary, based on reliability needs, to procure power through a long-term contract with a load serving entity, such as Con Edison.¹⁵⁸ NYPA currently is entitled to procure power through a competitive solicitation and has recently done so.¹⁵⁹

In February 2009, the PSC adopted guidelines establishing a

¹⁵⁶ Most of the current in-city generation resources use either oil or gas as a fuel. Both of these fuels are well-suited, utilizing today’s turbine and generator technology, to provide the type of rapid-cycle, flexible electricity that can be used to support the increasingly volatile power needs which will arise as climate change accelerates. However, these fuels also release carbon dioxide (as well as other pollutants), which exacerbates climate change. Other technologies which do not emit carbon dioxide, such as wind and solar, are currently considered intermittent resources, as the electric output generated depends on weather conditions. Advances in battery storage technology and the developments in plug-in electric automobiles may soon mitigate the disadvantages of these renewable technologies. Until that time, planners will need to balance the desire to mitigate climate change with the needs of adaptation.

¹⁵⁷ PLANYC, *supra* note 15, at 107; N.Y. STATE ENERGY PLANNING BD., *supra* note 136, at 7, 75.

¹⁵⁸ *E.g.*, N.Y. State Pub. Serv. Comm’n, Policy Statement on Backstop Project Approval Process, Case 07–E–1507, at 20–21 (Feb. 18, 2009).

¹⁵⁹ *See* N.Y. PUB. AUTH. LAW § 1005 (McKinney 2004) (establishing NYPA’s procurement powers); *see also* Press Release, N.Y. Power Auth., N.Y. Power Authority Selects Proposal For New Clean Generating Plant to Serve New York City Governmental Customers (Apr. 29, 2008), *available at* <http://www.nypa.gov/press/2008/080429d.htm> (describing a recent procurement by NYPA of the output of the 500 MW Astoria II plant in New York City for twenty years).

process to approve non-market (regulated) projects to facilitate development of new resources.¹⁶⁰ The Regulated Reliability Guidelines state that merchant development which relies solely on revenues from NYISO markets is preferred, but in the event of reliability concerns, the PSC would consider all relevant proposed projects and award long-term contracts to the projects that best address the stated needs.¹⁶¹ The Regulated Reliability Guidelines provide flexibility to the PSC to consider numerous factors, not limited to price, in determining the most advantageous projects. Although these regulations appear well designed to address the need for “peaking” resources or other adaptive resources *when* they are determined to be required, NYISO and the NYSRC have not determined that such resources are currently required.

NYISO and NYSRC forecasts do not specifically address climate change. However, the PSC is about to develop a long-range electricity infrastructure plan based on the forthcoming report of the State Energy Planning Board. Referred to as “Initiative III,” the planning process will solicit public comment.¹⁶² New York City should consider participation in this docket to raise adaptation concerns that can ultimately be reflected in NYISO/NYSRC reliability planning. The Regulated Reliability Guidelines also provide for a streamlined permitting process for regulated resources, with the PSC as the coordinating agency. Although not yet in practice, this change should allow more efficient and timely permitting of needed resources.

Since the Regulated Reliability Guidelines provide that NYISO market incentives for new generation resources are to be preferred over long-term contracts, PSC and NYISO/NYSRC determinations that make market rules affecting energy and capacity prices more predictable could encourage new merchant development.¹⁶³ For example, the NYSRC sets the requirement for State electric generating capacity based on projected demand and a reserve margin to ensure reliability.¹⁶⁴ This margin is adjusted

¹⁶⁰ N.Y. State Pub. Serv. Comm’n, *supra* note 158, at 8–12.

¹⁶¹ *Id.* at 5–6.

¹⁶² N.Y. State Pub. Serv. Comm’n, Order Initiating Elec. Reliability and Infrastructure Planning, Cases 07–E–1507 & 06–M–1017, at 3 (Dec. 24, 2007).

¹⁶³ *Id.* at 5.

¹⁶⁴ See N.Y. STATE RELIABILITY COUNCIL, INSTALLED CAPACITY SUBCOMMITTEE WORK SCOPE 1 (2002), available at www.nysrc.org/pdf/documents/ICSScope.pdf.

annually and has been reduced over the last few years. Because reducing this margin reduces demand for generation resources, it has the effect of reducing the price that generators receive for their installed capacity. Since independent power producers relying solely on merchant revenues must make assumptions on likely pricing over a long period, it is disruptive when regulators make significant changes that affect these assumptions. New York City should consider participating in the relevant proceedings to advocate for greater pricing stability in order to promote construction of new generation resources. Further, a proposal being considered by NYISO is the creation of a “forward capacity market” which would pay generation resources for *being available* to generate electricity.¹⁶⁵ This modification would be particularly attractive for peaking resources that are intended to function as reserve power, to be used only in the extreme conditions anticipated. New York City should consider participating in the stakeholder processes at the NYISO, the PSC, and FERC to advocate for this type of market.

B. *Encourage Development and Siting of Distributed Generation and Demand Response Resources*

Small, flexible generation resources distributed near load centers such as hospitals can effectively provide emergency power or reduce peak demand on the grid.¹⁶⁶ In addition, these resources can provide “baseload” power for certain operations, mitigating the severity of localized weather-related electric outages, for example, when a lightning strike hits a transformer on the distribution system.¹⁶⁷ Further, because these “distributed

¹⁶⁵ N.Y. INDEPENDENT SYSTEM OPERATOR, 2009–2013 STRATEGIC PLAN 6, available at http://www.nyiso.com/public/webdocs/company/strategic_plan/2009–2013%20STRATEGIC%20PLAN.pdf.

¹⁶⁶ See N.Y. STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY, COMBINED HEAT AND POWER PROGRAM GUIDE 2 (2009), available at www.nyserda.org/programs/pdfs/CHP%20brochure.pdf. In the Federal Energy Policy Act of 2005, FERC was directed to complete a study on the benefits of cogeneration and small power production. Energy Policy Act of 2005, Pub. L. No. 109–58, 119 Stat. 1130; see also DEPARTMENT OF ENERGY, THE POTENTIAL BENEFITS OF DISTRIBUTED GENERATION AND THE RATE-RELATED ISSUES THAT MAY IMPEDE ITS EXPANSION (2007), available at <http://www.ferc.gov/legal/fed-sta/exp-study.pdf> (summarizing the results of the study).

¹⁶⁷ See Tony Dutzik et al., Nat’l Ass’n of State PIRGs, *Toward a Consumer-Oriented Electric System*, in NAT’L COMM’N ON ENERGY POLICY, NCEP TECHNICAL APPENDIX CH. 5: STRENGTHENING ENERGY SUPPLY INFRASTRUCTURE

generation” resources are co-located with the power user, they increase efficiency by reducing the loss of electricity through transmission from a distant power source.¹⁶⁸ Efficient use of electricity will help in reducing the need for additional generation resources to address climate change.

Programs that encourage installation of distributed generation resources are already in place through NYSEERDA, but development can be further encouraged through the New York City Construction Codes,¹⁶⁹ or, on the state level, through the Public Health Law.¹⁷⁰ A particularly positive development in New York has been the amendment of “net metering” regulations by the PSC in February 2009,¹⁷¹ which further expand and clarify the circumstances in which an IOU customer can be given credit for electricity generated by a distributed generation resource against electricity charges otherwise due to the utility. This encourages the installation of on-site electricity generation sources.

With recent improvements in technology, distributed *renewable* resources are particularly valuable for modest electricity needs. For example, New York City now powers many of its parking meters with batteries recharged by solar photovoltaic arrays on the meter itself.¹⁷² New technology for very small distributed wind turbines has been deployed in various settings, such as parking lots or on buildings to generate power for the lot lighting or other building systems.¹⁷³ Dispersed sources of

55 (2004).

¹⁶⁸ *Id.*

¹⁶⁹ See generally N.Y. CITY CONSTR. CODE, available at http://www.nyc.gov/html/dob/html/model/construction_code.shtml.

¹⁷⁰ Pursuant to N.Y. PUB. HEALTH § 2803 (McKinney 2002), the New York Department of Health has promulgated regulations requiring emergency electric power availability in hospitals. N.Y. COMP. CODES R. & REGS. tit. 10, § 713-2.24 (2008).

¹⁷¹ See generally N.Y. STATE PUB. SERV. COMM’N, NEW YORK STATE STANDARDIZED INTERCONNECTION REQUIREMENTS AND APPLICATION PROCESS FOR NEW DISTRIBUTED GENERATORS 2 MW OR LESS CONNECTED IN PARALLEL WITH UTILITY DISTRIBUTION SYSTEMS (2009), http://www.dps.state.ny.us/Final_SIR_02-12-09_Clean.pdf.

¹⁷² For a description of these solar-powered meters, see Celine Ruben-Salama, *Seen in New York: Solar Powered Parking Meters*, TREEHUGGER, Nov. 20, 2006, http://www.treehugger.com/files/2006/11/seen_in_new_yor_1.php.

¹⁷³ For a review of the options available to local governments to create a meaningful review process for wind facilities, see KATHERINE DANIELS, N.Y. STATE ENERGY RES. AND DEV. AUTH., *THE ROLE OF GOVERNMENT AGENCIES IN THE APPROVAL PROCESS 4* (2005), available at <http://www.powernaturally.org>

electrical power can be highly adaptive and solar electricity generation is in large part congruent with times of peak demand.

Another alternative to building new generation is to reduce overall electric demand notwithstanding increasing temperatures and more frequent heat waves. The NYISO conducts a number of programs that enable power consumers to be compensated for agreeing in advance to curtail power use under certain circumstances.¹⁷⁴ On August 2, 2006, when record peak usage was reached in New York, demand response programs enabled reduction of peak load by 1,000 MW (2.9 percent).¹⁷⁵ The PSC currently has an open docket for consideration of various energy efficiency programs¹⁷⁶ and has increased the system benefits charge to ratepayers to permit incentives for installation of time-of-use thermostats and other equipment in return for a consumer's agreement to participate in the NYISO demand curtailment programs. New York City has participated extensively in development of these energy efficiency programs and should continue to advocate for programs which are directed to programs that maximize energy efficiency, such as those that target multi-family buildings or densely populated areas.

Energy efficiency resulting in decreased load can also be

/Programs/Wind/toolkit/16_rolegovernmentagencies.pdf. The National Renewable Energy Laboratory produced state-by-state Small Wind Electric Systems Consumer's Guides to help homeowners, ranchers, and small businesses decide if wind energy will work for them. See U.S. Dep't of Energy, Wind Powering America: Small Wind for Homeowners, Ranchers, and Small Businesses, http://www.eere.energy.gov/windandhydro/windpoweringamerica/small_wind.asp (last visited Nov. 19, 2009).

¹⁷⁴ See N.Y. Indep. Sys. Operator, Demand Response Programs, http://www.nyiso.com/public/markets_operations/market_data/demand_response/index.jsp (last visited Jan. 27, 2010), for a discussion of these programs, which include payments under the Emergency Demand Response Program and the Special Case Resources ICAP program which entitle the NYISO to cut power usage to a customer. Another example, the Day-Ahead Demand Response Program, allows energy users to bid their electric usage load into the Day-Ahead energy market administered by the NYISO in return for the market price of electricity paid to suppliers for that day.

¹⁷⁵ Mark S. Lynch, President & CEO, N.Y. Indep. Sys. Operator, The Future is Now: Energy Efficiency, Demand Response and Advanced Metering, Opening Remarks and Presentation, NYISO Symposium 8 (June 27, 2007) (transcript available at www.nyiso.com/public/webdocs/products/demand_response/general_info/nyiso_symposium06272007_final.pdf).

¹⁷⁶ See generally N.Y. State Dep't of Pub. Serv. Comm'n, Order Establishing Energy Efficiency Portfolio Standard And Approving Programs, Case 07-M-0548 (June 23, 2008).

advanced through local regulations requiring green building standards. As many of New York City's high-rise buildings were built prior to the use of modern energy-saving technology, New York City-mandated efficiency upgrades upon transfer or renovation of real estate could be effective in reducing peak demand. This approach has been utilized in several communities including San Francisco, Berkeley, and Vermont.¹⁷⁷ Mandatory upgrades for energy and water efficiency include toilet and showerhead flow restrictions, specified required insulation levels, and weather stripping.

Requiring an energy audit and disclosure of the results upon a sale of property may be a kinder and gentler way to persuade people to implement recommended efficiency upgrades. For example, Kansas has implemented a measure requiring homebuilders or realtors to disclose information about the energy efficiency of new homes to potential homebuyers prior to purchase.¹⁷⁸ The European Union issued such a directive in 2002 that applies not only to new construction but also to the sale or rental of existing buildings.¹⁷⁹

Recent legislation introduced in the City Council employs these tools and would require energy audits and cost-effective energy-efficiency retrofits every ten years on buildings of 50,000 gross square feet or more as well as reporting energy and water usage ("benchmarking") annually to the City for public dissemination.¹⁸⁰

¹⁷⁷ See, e.g., S.F., CAL., HOUSING CODE § 1210 (2007); BERKELEY, CAL., MUNICIPAL CODE § 19.72.030 (2007). For a summary of the San Francisco ordinance, see S.F. DEP'T OF BLDG. INSPECTION, WHAT YOU SHOULD KNOW ABOUT THE RESIDENTIAL ENERGY CONSERVATION ORDINANCE (2007), available at http://www.recaonline.com/docs/arc/arc2008/PointofSale_SanFranCA.pdf. For a summary of the Berkeley provisions, see C40 Large Cities Climate Summit, Berkeley's Building Standards Mandate Increases Efficiency and Pays Back Householders in Two Years, http://www.nycclimatesummit.com/casestudies/building/bldg_berkeley.html (last visited Jan. 16, 2010). For a summary of Vermont provisions, see VT. DEP'T OF PUB. SERV., VERMONT RESIDENTIAL BUILDING ENERGY CODE HANDBOOK (2004).

¹⁷⁸ KAN. STAT. ANN. § 66-1228 (2007).

¹⁷⁹ Council Directive 2002/91, art. 4-7, 2003 O.J. (L 1) 65, 67-68 (EC).

¹⁸⁰ N.Y. City Council, 2009 Int. No. 967 (April 22, 2009). For a copy of proposed legislation and bill analyses, see N.Y. City Council, Legislative Research Ctr., <http://legistar.council.nyc.gov/Legislation.aspx> (enter "2009 Int. No. 967" into "Search" box; select "All Years"; then select "Search Legislation"). With the economic downturn it appears that the retrofit requirement will be deferred for later consideration by the Council. See Mireya

C. *Upgrade the Transmission/Distribution System to be a “Smart Grid”*

For the purposes of addressing adaptation concerns, the grid should be upgraded to include technology and equipment that can be monitored for potential outage problems, such as voltage fluctuation, and can point instantly to damaged equipment. Such a system would also allow “peak shaving”¹⁸¹ (reducing the need for incremental reliability resources by decreasing volatility of demand for electricity), because it will more precisely indicate power flows and load requirements. NERC and NYSRC reliability standards require certain grid upgrades¹⁸² and the Public Service Law permits rate-based recovery to IOUs making the upgrades.¹⁸³ New York City should advocate for consideration of adaptation concerns with PSC, FERC, and NYSRC to encourage smart grid upgrades and any enabling laws and regulations that may be necessary.

D. *Upgrade Regional Transmission to Allow More Distant Generation Imports*

Electric reliability could be increased by having alternative resources available outside of New York City. Specifically, with transmission grid upgrades, electricity could be accessed from the north (Westchester County above Yonkers) or from the south (through Hudson River underwater cables).¹⁸⁴ This power may be cheaper, easier to site, and less vulnerable to climate change issues than resources in New York City.¹⁸⁵ New York City should consider advocating for these upgrades as a backup to in-city generation.

Navarro, *Bloomberg Drops an Effort to Cut Building Energy Use*, N.Y. TIMES, Dec. 4, 2009, at A1.

¹⁸¹ Lynch, *supra* note 175, at 13.

¹⁸² See N.Y. STATE RELIABILITY COUNCIL, *supra* note 148, at 11; *see, e.g.*, NORTH AMERICAN ELEC. RELIABILITY CORP., *supra* note 144, at TPL-001-0.

¹⁸³ N.Y. PUB. SERV. LAW § 66 (McKinney 2000).

¹⁸⁴ N.Y. CITY ECON. DEV. CORP., MASTER ELECTRICAL TRANSMISSION PLAN FOR NEW YORK CITY 12 (2009), *available at* <http://www.nycedc.com/NewsPublications/Studies/MasterElectricTransmissionPlanforNYC/Documents/MasterElectricTransmissionPlanforNYC.pdf>.

¹⁸⁵ *Id.* at 29. Note, however, that the Master Electrical Transmission Plan could not conclude that new transmission would be economically beneficial to New York City ratepayers relative to siting new generation resources. *Id.* at 92.

E. *Require Assessment of Underground Infrastructure to Determine Vulnerability to Flooding or Rising Sea Levels*

New York City is an archipelago, generally situated at a low elevation above sea level.¹⁸⁶ In addition, much of New York City's critical infrastructure (including electric distribution lines, the Con Edison steam system, and natural gas pipelines) is buried below ground. Burying these assets decreases their vulnerability to high wind conditions which may increase as a result of climate change,¹⁸⁷ but buried resources are also more vulnerable to flooding and sea level rise. It is important that New York City consider creating an inventory of these assets so that it can assess the risks of flooding due to storms and sea level rise and prepare proper mitigation plans. This inventory should include natural gas pipelines, underground electrical transmission and distribution lines, and meters and building interconnection points (often located in basements).¹⁸⁸

Sufficient regulation exists at the federal and local levels to require upgrades as necessary to address vulnerabilities.¹⁸⁹ An inventory of vulnerable coastal generation and appropriate embankments or other barriers, and a new assessment of stormwater discharge and drainage, could also further adaptation planning. Adequate state and local regulatory authority exists to require these upgrades.¹⁹⁰ Cost recovery for these upgrades should

¹⁸⁶ SHAGUN MEHROTRA ET AL., *FRAMEWORK FOR CITY CLIMATE RISK ASSESSMENT* 32 (2009), available at <http://www.urs2009.net/docs/papers/Rosenzweig.pdf>.

¹⁸⁷ EDISON ELEC. INST., *UNDERGROUND VS. OVERHEAD DISTRIBUTION WIRES—ISSUES TO CONSIDER* 1 (n.d.), available at <http://www.eei.org/ourissues/electricitydistribution/Documents/UnderVSOVer.pdf>.

¹⁸⁸ New York City also has an extensive underground steam heating system which is owned and maintained by Consolidated Edison (an IOU), which should also be assessed.

¹⁸⁹ See generally, e.g., 49 U.S.C. §§ 60101–60137 (2008) (DOT pipeline safety); 16 U.S.C. §§ 824–824w (FERC transmission reliability authority); N.Y. CITY CONSTR. CODE (2008).

¹⁹⁰ See N.Y. ENVTL. CONSERV. LAW § 17–0808 (McKinney 2006) (DEC's statutory authority to require permits for stormwater discharge); N.Y. ENVTL. CONSERV. LAW §§ 34–0101 to –0113 (McKinney 2008) (providing additional DEC authority to prevent coastal erosion). Certain local New York City soil erosion control functions have been delegated pursuant by the State to the City Soil and Water Conservation District. N.Y. SOIL & WATER CONSERV. DIST. LAW § 5 (McKinney 1949).

be provided—either directly to the IOUs and then rebated to the generation owners or indirectly through market pricing which reflects additional operating costs for all generation resources in New York City (“Zone J”).¹⁹¹ Similar upgrades to prevent equipment corrosion due to higher salinity could be required and paid for. The City has already initiated efforts to address the rising sea level threat to publicly-owned assets. For example, the New York City Department of Environmental Protection recently announced plans to address rising water levels at its Rockaway Wastewater Treatment Plant, where electrical equipment, such as pump motors, circuit breakers, and controls are being raised to higher elevations.¹⁹²

IV. BUILDING INFRASTRUCTURE

New York City has approximately 950,000 buildings and 5.2 billion square feet of floor space.¹⁹³ Much of this building infrastructure and its productive use is at risk from climate change impacts.¹⁹⁴ Flooding due to rising sea levels may permanently swamp buildings. Flooding and wind occasioned by severe storm events, as we have seen in Hurricane Katrina and other severe storms, can not only pose grave threats to human health and safety but also cause massive economic losses by destroying or damaging building infrastructure. Higher temperatures creating energy demands beyond system capability can make New York City’s many high rise buildings dysfunctional. As elevators stop running or air conditioners go off, buildings are transformed into indoor hot houses that imperil health. According to PlaNYC, the city’s peak electricity demand, if unchecked, even without accounting for

¹⁹¹ Note that a certain market-based recovery for these costs may be difficult to implement in an “energy-only” market such as NYISO’s, as only a portion of New York City’s merchant generators receive energy payments on any given day.

¹⁹² Press Release, New York City Mayor Michael Bloomberg, Mayor Bloomberg Releases N.Y. City Panel on Climate Change Report that Predicts Higher Temperatures and Rising Sea Levels for New York City (Feb. 17, 2009), available at http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2009a%2Fpr079-09.html&cc=unused1978&rc=1194&ndi=1.

¹⁹³ PLANYC, *supra* note 15, at 135.

¹⁹⁴ See *id.* See generally Cullen Howe, *Preparing for the Inevitable: What New York City Should Do to Adapt to the Impending Effects of Climate Change*, 19 ENVTL. LAW IN N.Y. 163 (2008).

climate change impacts, is projected to grow by 29 percent by 2030 with the growth in population of one million people,¹⁹⁵ making energy reliability a critical concern. The twin possibilities of droughts that threaten the city's access to water and flooding that creates sewer overflows and polluted water jeopardize the health and welfare of New York City residents.

Buildings offer significant and unique opportunities for capturing measures which have the co-benefits of reducing GHGs, diminishing demands on energy and water resources, and providing an opportunity for wise siting.¹⁹⁶ Legal requirements and incentives to foster green building development are increasingly being enacted in New York City, New York State, and throughout the country.¹⁹⁷ Green buildings, as they are commonly known, are high-performance buildings that: (1) increase the efficiency with which buildings use energy, water, and materials; and (2) reduce building impacts on human health and the environment through better siting, design, construction, operation, maintenance, and removal. Greening buildings can minimize the strain on energy and water resources projected to result from climate change impacts and diminish the likelihood or magnitude of system overloads, brown-outs/black-outs, and flooding.¹⁹⁸ The benefits of improving building performance can be achieved with actual cost savings or in some cases at minimal additional cost, even on a first-cost basis and certainly on a lifecycle basis.¹⁹⁹ Green buildings are a crucial sector to address in

¹⁹⁵ PLANYC, *supra* note 15, at 3, 103.

¹⁹⁶ PLANYC, *supra* note 15, at 134–36; *see also* Edna Sussman, *Reshaping Municipal and County Laws to Foster Green Building, Energy Efficiency, and Renewable Energy*, 16 NYU ENVTL. L.J. 1, 8–11; 3–16 MARK BENNETT, CULLEN HOWE & JAMES NEWMAN, ENVIRONMENTAL LAW PRACTICE GUIDE § 17D.01 (2009).

¹⁹⁷ *See* BENNETT, HOWE & NEWMAN, *supra* note 196, §§ 17D.05–07; *see also* PLANYC, *supra* note 15, at 134–36.

¹⁹⁸ *See* Edna Sussman, *Building Stock Offers Opportunities to Foster Sustainability and Provides Tools for Climate Change Mitigation and Adaption*, SUSTAINABLE DEV. L. & POL'Y, Spring 2007, at 17–18 (2007); BENNETT, HOWE & NEWMAN, *supra* note 196, §§ 17D.05–07; PLANYC, *supra* note 15, at 134–36.

¹⁹⁹ LISA FAY MATTHIESSEN & PETER MORRIS, COSTING GREEN: A COMPREHENSIVE COST DATABASE AND BUDGETING METHODOLOGY 3 (2004), *available at* <http://www.davislangdon.com/upload/images/publications/USA/2004%20Costing%20Green%20Comprehensive%20Cost%20Database.pdf>; STEVEN WINTER ASSOCIATES, GSA LEED COST STUDY 8 (2004), *available at* <http://www.fypower.org/pdf/gsaleed.pdf>; GREG KATS, THE COSTS AND FINANCIAL BENEFITS OF GREEN BUILDINGS at v (2003), *available at*

fostering adaptation measures, since they are designed to be more energy efficient, thus relieving stress on the electricity systems that would be occasioned by climate change's increased temperatures. They can also be designed to conserve water, thus reducing the impacts of a drought, and to retain more water on site thus reducing the flooding consequences of climate change.²⁰⁰ In New York City the Building Code is the basic governing regulation, but other provisions may be applicable as well—including the New York State Energy Conservation Construction Code, the Multiple Dwelling Law and Housing Maintenance Code, and New York City Fire Department requirements.²⁰¹

A. *Amend the Energy, Building, and Sewer Codes*

The most direct and comprehensive way to drive greener building is by amending energy, building, and sewer codes or other mandatory measures. These codes can serve to promote or impede green building development.²⁰² Some cities like Boston, Washington, D.C., San Francisco, and Los Angeles have begun to mandate green building for projects in the public and private sectors.²⁰³ Several, including Washington, D.C. and Los Angeles,

<http://www.calrecycle.ca.gov/greenbuilding/Design/CostBenefit/Report.pdf>.

²⁰⁰ See BENNETT, HOWE & NEWMAN, *supra* note 196, § 17D.01. The need for New York City to take steps to require and incentivize green building and energy-efficiency best practices is particularly compelling. In the most recent GHG emissions inventory prepared by the City, existing buildings account for approximately 75 percent of the City's GHGs. CITY OF N.Y., INVENTORY OF N.Y. CITY GREENHOUSE GAS EMISSIONS 6 (2009), *available at* http://www.nyc.gov/html/planyc2030/downloads/pdf/greenhousegas_2009.pdf.

²⁰¹ For a review of the various codes that govern building construction in New York City, see CITY UNIV. OF N.Y. BLDG. PERFORMANCE LAB., DECODING THE CODE: HOW CAN NYC'S 2007 BUILDING CODE HELP MEET PLANYC 2030 ENERGY/CARBON REDUCTION GOALS? 34 (2008).

²⁰² See generally DAVID EISENBERG ET AL., DEV. CTR. FOR APPROPRIATE TECH., BREAKING DOWN THE BARRIERS: CHALLENGES AND SOLUTIONS TO CODE APPROVAL OF GREEN BUILDING (2002), *available at* http://www.dcat.net/about_dcat/current/Breaking_Down_Barriers.pdf (providing an overview of how building codes impede green development).

²⁰³ Many cities provide for expedited permitting if buildings meet certain green building criteria. See, e.g., D.C. CODE §§ 6-1451.01-.11 (2007); S.F., CAL., BLDG. CODE § 1304 (2007); City of Chicago Dep't of Bldgs., Green Permit Program, <http://www.cityofchicago.org/city/webportal/portalEntityHomeAction.do?entityName=Green+Buildings&entityNameEnumValue=194> (last visited Nov. 26, 2009) (allowing projects accepted into the program to receive permits between 15–30 business days). This has not been found to be a useful tool in New York City, because the city has many triggers for expedited permitting

have bound themselves to conforming new construction or major renovations to LEED²⁰⁴ green building standards. New York City has for some time required green construction for public buildings.²⁰⁵ Legislation is currently pending in the New York City Council with respect to private construction which would require energy audits on buildings of 50,000 gross square feet or more, and would require reporting of energy and water usage (benchmarking) annually to the City for public dissemination.²⁰⁶

The development and enforcement of energy codes is a shared responsibility of state and local government. In 2002, New York State adopted a new Energy Conservation Construction Code as required by the U.S. Department of Energy (DOE).²⁰⁷ The DOE required all states to adopt commercial energy codes at least as stringent as a specified American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)/Illuminating Engineering Society (IES) standard by 2004, and most states have complied.²⁰⁸ As new technologies are always emerging, frequent code upgrades are necessary and the DOE continues to work on developing more stringent model codes.²⁰⁹ Federal legislation strengthening the development of and adherence to a national energy code was considered in the 110th Congress as part of the energy agenda.²¹⁰ The American Clean Energy and Security Act of 2009 passed by the House of Representatives provides for the

across a range of social programs and transforming this special permit into one of many expedited permitting processes could defeat its impact.

²⁰⁴ See, e.g., D.C. CODE § 6-1451.02 (2007) (covering non-residential government-owned buildings). LEED, which stands for Leadership in Energy and Environmental Design, is a green building certification program. See U.S. Green Building Council, <http://www.usgbc.org> (last visited Nov. 26, 2009) (providing more information about LEED).

²⁰⁵ See N.Y. CITY, N.Y., LOCAL LAW NO. 86 § 2 (2005) available at http://www.nyc.gov/html/dob/downloads/pdf/ll_86of2005.pdf.

²⁰⁶ N.Y. City Council, 2009 Int. No. 967 (April 22, 2009); N.Y. City Council, 2009 Int. No. 973 (April 22, 2009).

²⁰⁷ Information about the N.Y. State Energy Conservation Construction Code, which was updated in 2007, is available at <http://www.dos.state.ny.us/code/energycode/nyenergycode.htm> (last visited Nov. 26, 2009).

²⁰⁸ See U.S. Dep't of Energy, Building Energy Codes Program, Status of State Codes, http://www.energycodes.gov/implement/state_codes/state_status_full.php (last visited Nov. 20, 2009).

²⁰⁹ See U.S. Dep't of Energy, Building Energy Codes Program, About the Program, <http://www.energycodes.gov/whatwedo/> (last visited Nov. 20, 2009).

²¹⁰ Renewable Energy and Energy Conservation Tax Act, H.R. 3221, 110th Cong. (2007).

development of a national energy building efficiency building code with a provision for the use of state and local codes which meet or exceed those standards.²¹¹

In July 2007, New York City went beyond the State Energy Code and adopted the International Building and related Codes developed by the International Code Council.²¹² An important aspect of that enactment was a requirement that the building code be updated every three years.²¹³ At the request of the City, the New York City Chapter of the U.S. Green Building Council convened a Green Codes Task Force to make recommendations for amending the building and energy codes to meet today's needs. It is anticipated that these recommendations will serve to significantly address climate change challenges through provisions for design and construction both improving stormwater management and for reducing energy demand. The periodic review of construction codes and regulations offers the opportunity to require designs that will withstand the impacts of climate change.

B. *Specific Design Requirements*

As building technologies develop, many specific cost effective design elements will present opportunities for additional targeted mandates. Such requirements have been enacted in jurisdictions both in the United States and around the world.²¹⁴

An example of one such planning tool is a vegetation requirement. Since 2007, Seattle has required the achievement of a specified Green Factor, landscaping requirements designed to increase the quantity and quality of planted areas. Green landscaping elements include green roofs, vegetated walls, and drought-tolerant plantings, all of which can be utilized to satisfy

²¹¹ H.R. 2454, 111th Cong. § 201 (as passed by the House of Representatives, June 26, 2009).

²¹² Press Release, Int'l Code Council, New York City Adopts International Codes to Save Lives and Protect Property (July 12, 2007), *available at* <http://www.iccsafe.org/newsroom/News%20Releases/0712NYC.pdf>.

²¹³ See PlanNYC, New York City Building Code, <http://www.plannyc.org/taxonomy/term/787> (last visited Nov. 27, 2009) (“Using the International Building Council’s format the City Council will revise the new model codes every 3 years to accommodate technology and policy changes in the construction field.”).

²¹⁴ For a more comprehensive discussion, see Sussman, *supra* note 198, at 14–17.

the requirement.²¹⁵ Green roofs have been required in Germany and parts of Switzerland for years and have not only reduced the electrical load but also afforded the side benefit of significant on-site stormwater retention.²¹⁶ A second and perhaps easier way to address the heat island effect is to require light-colored reflective roofs, often white or metallic, which are effective in reducing heat absorption.²¹⁷ For example, Chicago amended its energy code to require roofs on low sloped air-conditioned buildings to meet a specified initial solar reflectance.²¹⁸ New York has offered tax abatements for green roofs.²¹⁹

In more suburban-style settings, energy-smart landscaping can reduce energy demand and costs by as much as 25 percent.²²⁰ Projects with a landscaping component can be required to incorporate green landscaping measures.²²¹ For instance, municipalities have enacted tree-shading ordinances that require a certain percentage of parking lots' surfaces to be shaded.²²²

Another tool with tremendous potential is the installation of solar hot water heaters,²²³ now required in Hawaii for residential construction.²²⁴ Heating hot water can constitute 14–25 percent of the energy use in a home.²²⁵

A recent bill introduced in the New York City Council is a good example of such a specific design mandate. As lighting in

²¹⁵ SEATTLE, WASH., MUN. CODE § 23.47A-016 (2006).

²¹⁶ Dusty Gedge, *Life at the Top*, OUR PLANET, Vol. 16, No. 1, at 8–29 (2005), available at http://www.ourplanet.com/imgversn/161/images/Our_Planet_16.1_english.pdf.

²¹⁷ EPA, Heat Island Effect—Cool Roofs, <http://www.epa.gov/heatisland/mitigation/coolroofs.htm> (last visited Nov. 21, 2009).

²¹⁸ CHI., ILL., MUN. CODE § 18-13-101.5.4.1 (2009).

²¹⁹ N.Y. REAL PROP. TAX LAW § 499aaa-ggg (McKinney 2009).

²²⁰ U.S. DEP'T OF ENERGY, NATIONAL RENEWABLE ENERGY LABORATORY, LANDSCAPING FOR ENERGY EFFICIENCY 1 (1995), available at <http://www.mass.gov/Eoeea/docs/door/publications/landscapeee.pdf>.

²²¹ UNION CITY, CAL., MUN. CODE ch. 15.76 (2006).

²²² EPA, Heat Island Effect—Trees and Vegetation, <http://yosemite.epa.gov/gw/statepolicyactions.nsf/HIRIMitigation?OpenView&count=500&type=Trees%20and%20Vegetation> (last visited Nov. 21, 2009).

²²³ U.S. Dep't of Energy, Energy Savers: Solar Water Heaters, http://www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=12850 (last visited Nov. 21, 2009).

²²⁴ HAW. REV. STAT. § 196-6.5 (2008).

²²⁵ U.S. Dep't of Energy, Energy Savers: Water Heating, http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12760 (last visited Nov. 21, 2009).

New York City accounts for approximately 20 percent of energy use in buildings, the bill would require buildings of over 50,000 square feet to upgrade their lighting to meet new energy code standards whenever there is a renovation, and to upgrade the entire building's lighting by 2022.²²⁶

The New York City codes should be reviewed on a periodic basis as the scientific predictions as to climate change become more certain to ensure that adaptation considerations are adequately included. Measures that can be taken now that would serve to minimize water usage and stormwater runoff, or reduce energy demand, should be permissible design features, even if not currently required. At the very least, the building code should not stand as an obstacle to such improvements.

V. WATER²²⁷

Adaptation to climate change is an important challenge for water supply quality, quantity, and wastewater treatment programs. Impacts on these water systems can result from rising sea levels, rising groundwater levels near coasts, disruptions of natural flow regimes, more intense precipitation and increased stormwater runoff, loss of natural wetlands, seawater and freshwater flooding, and possible water scarcity due to rising temperatures.²²⁸ For New York City, impacts may include damage and destruction of infrastructure (corrosion and destruction of pipes, underground transportation systems, transmission lines); an overload of sewer systems; intrusion of seawater into freshwater sources; increased polluted stormwater runoff discharged untreated into water bodies; a potential increase in water-borne diseases; damage and destruction of ecosystems; coastal erosion, flooding, and destruction; and decreased efficiency of power plants.²²⁹ Treatment costs could increase for drinking water and wastewater

²²⁶ N.Y. City Council, 2009 Int. No. 973 (April 22, 2009).

²²⁷ This section was written by Kathy Robb, a partner in the New York office of Hunton & Williams, and founder and director of the firm's Water Policy Institute. For more information, visit <http://www.waterpolicyinstitute.com>.

²²⁸ See generally INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE AND WATER (2008), available at http://www.ipcc.ch/publications_and_data/publications_and_data_technical_papers_climate_change_and_water.htm.

²²⁹ NYPCC, *supra* note 1, at 58–59; GLOBAL CHANGE REPORT, *supra* note 2, at 41–52.

utilities due to heavier runoff carrying sediment, nutrients, and other pollutants.²³⁰

A principal regulatory statute of the water sector is the federal Clean Water Act (CWA).²³¹ The CWA adopts a “cooperative federalism” approach with states and localities toward the regulation of water quality. The CWA focuses on point source pollutants through permitting programs for discharges to navigable waters.²³² As originally contemplated under the CWA, these programs have now been transferred to forty-six of the fifty states for implementation.²³³ There are many other statutes at the federal level that regulate water directly or indirectly: the Coastal Zone Management Act (CZMA),²³⁴ the Endangered Species Act (ESA),²³⁵ the Marine Mammal Protection Act,²³⁶ the Safe Drinking Water Act,²³⁷ the Surface Mining Control and Reclamation Act,²³⁸ the Oil Pollution Act,²³⁹ NEPA,²⁴⁰ Comprehensive Environmental Response, Compensation, and Liability Act,²⁴¹ EPA’s Phase I and Phase II Stormwater Regulations,²⁴² and others. Added to these are New York State statutory counterparts to the federal statutes;²⁴³ state and local regulations of land use, zoning, and other activities that impact water;²⁴⁴ and regional collaborations to address water issues across political boundaries, like the Delaware River Basin Commission and other interstate compacts governing aspects of

²³⁰ NYPCC, *supra* note 1, at 59.

²³¹ 33 U.S.C. §§ 1251–1387 (2006).

²³² 33 U.S.C. §§ 1251(a)(1), 1342(a).

²³³ *See* 33 U.S.C. § 1342(b) (2006); EPA, NPDES State Program Status, <http://cfpub.epa.gov/NPDES/statestats.cfm> (last visited Nov. 21, 2009).

²³⁴ 16 U.S.C. §§ 1451–1466 (2006).

²³⁵ 16 U.S.C. §§ 1531–1544 (2006).

²³⁶ 16 U.S.C. §§ 1361–1423 (2006).

²³⁷ 42 U.S.C. §§ 300f–300j (2006).

²³⁸ 30 U.S.C. §§ 1201–1328 (2006).

²³⁹ 33 U.S.C. §§ 2701–2762 (2006).

²⁴⁰ 42 U.S.C. §§ 4321–4370f (2006).

²⁴¹ 42 U.S.C. §§ 9601–9675 (2006).

²⁴² 40 C.F.R. §§ 122–24 (1990) (Phase I); 40 C.F.R. §§ 122–24 (1999) (Phase II).

²⁴³ *See, e.g.*, N.Y. ENVTL. CONSERV. LAW § 17–0801 to –0831 (McKinney 2009) (establishing the New York State Pollutant Discharge Elimination System). For a comprehensive list of N.Y. State Water laws, see David N. Cassuto & Nicholas A. Robinson, *New York, in* WATERS & WATER RIGHTS (Matthew Bender Supp. 2008).

²⁴⁴ *See* discussion *supra* Section I.

waters shared by New York and other states.²⁴⁵ As a result, there are numerous laws governing water in New York City.

In the context of water systems, adaptation offers tangible and cost-effective means for dealing with climate change. The New York City Department of Environmental Protection has made significant strides in this regard, as reported in its 2008 Assessment and Action Plan which lays out a comprehensive plan for the agency.²⁴⁶ But in the legal context it will require more than a mere tweaking of existing law and regulation to accomplish the necessary changes. Truly effective adaptation will require further legal efforts to address issues (1) across political boundaries comprehensively on a watershed and basin-wide level; (2) across industries, including taking into account at every turn the inextricable link between energy and water; and (3) through financial partnerships that include the public and private sector. Efforts should include addressing agricultural runoff upstate, water efficiency and conservation across industry and political boundaries, and the development of a system for the wide reuse of water. New partnerships are needed to engage these legal efforts and to fund them. Such changes, which could be encouraged through revised laws and regulations, require a perspective beyond New York City's borders.

A. *Stormwater Management*

The PlaNYC Sustainable Stormwater Plan provides a comprehensive review and analysis of the many initiatives that can be undertaken to manage stormwater.²⁴⁷ Buildings and developed lots represent 45 percent of the land area in the city, displacing significant land forms from their prior natural stormwater infiltration function.²⁴⁸ Management measures considered include detention, which temporarily stores water; retention, which removes water from the sewer system; and biofiltration/bioretenion, which uses vegetated source control

²⁴⁵ See U.S. Fish & Wildlife Serv., Interstate Compacts, <http://www.fws.gov/laws/lawsdigest/compact.html> (last visited Nov. 26, 2009) (listing interstate water compacts).

²⁴⁶ N.Y. CITY DEPT. OF ENV'T PROTECTION, ASSESSMENT AND ACTION PLAN (2008), available at http://www.nyc.gov/html/dep/pdf/climate/climate_complete.pdf.

²⁴⁷ See PLANYC STORMWATER MANAGEMENT *supra*, note 49.

²⁴⁸ See *id.* at 31.

techniques.²⁴⁹ Such measures can not only reduce the likelihood of flooding but would also reduce nonpoint source pollution. Revisions to sewer regulations and other relevant codes, as reviewed in the preceding sections, and the establishment of incentives will also be an essential part of the implementation of the measures identified as best suited to New York City.²⁵⁰

B. *Water Conservation*

Adaptation approaches for water must address water conservation and reuse, both to reduce water flow through the City's sewers and to reduce energy consumption and the impacts of drought. In New York City, water conservation has been effective in recent years. Legal requirements could emphasize conservation, requiring or encouraging additional low-flow fixtures, sprinkler systems, and lawn watering restrictions. Analysis and legal encouragement of on-site water reuse through regulation and incentives would also further adaptation, although there are public health and environmental issues regarding reuse that need to be investigated further.²⁵¹ The overall effort at water conservation must be widely supported and the price needs to be properly calculated to be both accepted and effective.

C. *Water Supply Infrastructure and Wastewater Infrastructure*

Water infrastructure risks from flooding can be severe. Wastewater treatment plants are generally located on shores and are susceptible to sea level rise and flooding.²⁵² Potable water supply pipelines and sewer lines may be damaged by flooding conditions, infiltration of sewer lines may increase, and repairs may be more difficult. To protect this vulnerable infrastructure, engineering codes and standards could be reviewed and amended

²⁴⁹ *Id.* at 35–37.

²⁵⁰ See discussion *supra* Section I.

²⁵¹ For an example of one such proposed investigation, see MICHAEL HERRING & MAX ZARATE-BERMEDEZ, RESPONSE TO CLIMATE CHANGE INDUCED DROUGHT: ASSESSING PUBLIC HEALTH IMPACTS OF DECENTRALIZED WATER REUSE AS A NONPOTABLE WATER SUPPLY 1 (2009), available at http://www.soil.ncsu.edu/lockers/Hoover_M/html/docs/CDC_Water_Reuse_Research_Proposal_public.pdf.

²⁵² See NEW YORK CITY DEP'T OF ENVTL. PROTECTION, CLIMATE CHANGE PROGRAM, ASSESSMENT AND ACTION PLAN: REPORT 41 (2008), available at http://www.nyc.gov/html/dep/pdf/climate/climate_complete.pdf (analyzing impacts of projected sea level rise on wastewater treatment facilities).

with climate change risks in mind and incorporated into the applicable laws and regulations.

VI. TRANSPORTATION

New York City is fortunate to have a well developed transportation system. While improvements and expansions are needed to meet the needs of a growing population and new areas of development, New York City's transportation system includes extensive subway, bus network, and roadways systems throughout its five boroughs, multiple train lines to its several suburbs, and commuter transit facilities on its waterways, ports, and airports.²⁵³ These systems are at risk as climate change may lead to flooding of the subways, roadways, and other facilities; water damage to equipment; strain and damage to materials in bridges, tunnels, roads, subways, and other infrastructure from higher temperatures and flooding; increased electricity demand from heavier pump usage; increased operational delays from power outages or brownouts; overheating of subway platforms and underground infrastructure; damage from saltwater to waterfront infrastructure; and sediment requiring more dredging.²⁵⁴ An effective transportation system in the face of climate change is also critical to emergency preparedness, as critical infrastructure that provides evacuation routes or egress points may itself be threatened by climate change.²⁵⁵

Responsibility for transportation infrastructure is decentralized, shared not only by various levels of government but also with the private sector.²⁵⁶ Planning and investment decisions for publicly owned land transportation infrastructure are made within the framework and requirements defined by the planning provisions contained in the federal transportation bill last amended in August 2005.²⁵⁷ State departments of transportation and metropolitan planning organizations (MPOs), working in coordination with local governments, have lead responsibilities for

²⁵³ PLAN NYC, *supra* note 15, at 75–97.

²⁵⁴ GLOBAL CHANGE REPORT, *supra* note 2, at 61–70; NPYCC, *supra* note 1, at 25–29.

²⁵⁵ GLOBAL CHANGE REPORT, *supra* note 2, at 65, 68–69.

²⁵⁶ TRANSP. RESEARCH BD., POTENTIAL IMPACTS OF CLIMATE CHANGE ON U.S. TRANSPORTATION 124–26 (2008), available at <http://onlinepubs.trb.org/onlinepubs/sr/sr290.pdf>.

²⁵⁷ Pub. L. 109–59, 119 Stat. 1144 (2005).

planning transportation.²⁵⁸ New York City's MPO is the New York Metropolitan Transportation Council (NYMTC), which includes the New York City Transportation Coordinating Committees (TCC), the Mid-Hudson South TCC, and Nassau/Suffolk TCC. The Metropolitan Transit Authority (MTA) and the New York State Department of Transportation are also voting members.²⁵⁹ NYMTC's area includes the five boroughs as well as Nassau, Suffolk, Westchester Rockland and Putnam Counties. Privately owned transportation is governed by relevant zoning provisions and governing codes and regulations.

A. *Coordinated Planning*

With this diffuse responsibility for transportation, legal mandates can prove useful to motivate the necessary cooperation among the various parties responsible for meeting climate adaptation challenges. In its comprehensive 2008 report,²⁶⁰ the Transportation Research Board recommended that federal planning regulations require climate change to be included as a factor in the development of public-sector long-range transportation plans; eliminate any perception that such plans should be limited to 20–30 years;²⁶¹ and require collaboration with agencies responsible for land use, environmental protection, and natural resource management to foster more integrated transportation-land use decision making during plan development.²⁶² Legislative direction at the federal level could go far towards fostering adaptation solutions oriented for transportation. Decisions made now with respect to location and design will have far-reaching consequences as many transportation infrastructure projects have a useful life of many decades.

B. *Smart Growth*

Transit-oriented development, also known as smart growth, is a concept that has been gaining wider and wider acceptance. Smart growth is an urban planning and transportation theory that

²⁵⁸ TRANSP. RESEARCH BD., *supra* note 256, at 128.

²⁵⁹ See New York Metro. Transit Council, <http://www.nymtc.org/> (click "About NYMTC" hyperlink) (last visited Nov. 26, 2009).

²⁶⁰ See generally TRANSP. RESEARCH BD., *supra* note 256.

²⁶¹ *Id.* at 17.

²⁶² *Id.*

concentrates growth in the developed center of the community to avoid urban sprawl and advocates compact, transit-oriented, walkable, bicycle-friendly land use, including neighborhood schools and mixed-use development with a range of housing choices.²⁶³ Encouragement of smart growth is an important element in reducing GHG gases as suburban sprawl, a dominant development model in the United States, has led to tremendous increases in vehicle miles traveled.²⁶⁴ Coupled with the benefits of smart growth from quality-of-life perspectives, the interest in minimizing GHG emissions from automobiles has drawn wide support for smart growth.²⁶⁵

While New York City itself could be said to be a model of smart growth with a geographically concentrated population and residents generally living near mass transit, many suburbs of New York City are also turning to address the question of smart growth in their planning efforts. Such efforts are important not only for mitigation but also for adaptation. Ignoring smart growth in the suburbs will negatively affect both New York City's infrastructure and environment, as New York City's water comes from watersheds in the north and west of the city.²⁶⁶ Smart growth promotes not only mitigation but adaptation as well, as it reduces the development of greenfields and serves to increase water infiltration and reduce polluted runoff into New York City's water supply that would result from climate change related impacts such as flooding and severe storm events. Smart growth also reduces air pollution for the entire metropolitan area and reduces additional stress on the city's roadways by preventing additional vehicular traffic. Smart growth should be encouraged in New York. California recently enacted SB 375, commonly referred to as the "California's Sustainable Communities and Climate Protection

²⁶³ See Smart Growth Network, About Smart Growth, <http://www.smartgrowth.org/about/default.asp> (last visited Nov. 26, 2009). The American Planning Association has developed model codes to promote smart growth. See <http://www.planning.org/research/smartgrowth/> (last visited Nov. 26, 2009).

²⁶⁴ See REID EWING ET AL., URBAN LAND INSTITUTE, GROWING COOLER, THE EVIDENCE ON URBAN DEVELOPMENT AND CLIMATE CHANGE 2-8 (2008).

²⁶⁵ See *id.*; U.S. EPA, Environmental Benefits of Smart Growth, <http://www.epa.gov/dced/topics/eb.htm> (last visited Nov. 26, 2009).

²⁶⁶ N.Y. CITY DEP'T OF ENVTL. PROTECTION, 2008 DRINKWATER SUPPLY AND QUALITY REPORT 2 (2008), available at <http://nyc.gov/html/dep/pdf/wsstate08.pdf>.

Act.”²⁶⁷ SB 375 creates a new regional planning document called a “sustainable communities strategy,” or “SCS.”²⁶⁸ An SCS is a blueprint for regional transportation infrastructure and development that is designed to reduce GHG emissions from cars and light trucks to target levels.²⁶⁹ Each of the various metropolitan planning organizations must prepare an SCS and include it in that region’s regional transportation plan.²⁷⁰ The SCS, in turn, influences transportation, housing, and land use planning. Transportation projects consistent with the SCS may receive state funding.²⁷¹ On the land use front, certain residential and mixed-use projects that are consistent with the SCS may be eligible for relief from CEQA, California’s statewide version of NEPA.²⁷² This legislation could be reviewed to determine if any elements could usefully be added to New York City’s initiatives.²⁷³

C. *Specific Design Requirements*

Various federal and state statutes govern transportation infrastructure design, many of which incorporate or are based on standards issued by the American Association of State Highway and Transportation Officials (AASHTO), a national nonprofit, nonpartisan association which represents all five transportation modes: air, highways, public transportation, rail, and water.²⁷⁴ Those standards can be amended to meet the challenges of climate change. For example, standards for flood protection of transportation infrastructure could be updated to reflect projected increases in flood risks. As an assessment of the likelihood of material failure is developed, use of alternate materials that will

²⁶⁷ TOM ADAMS, AMANDA EAKEN AND ANN NOTTHOFF, COMMUNITIES TACKLE GLOBAL WARMING: A GUIDE TO CALIFORNIA’S SB 375 at 5 (2009), available at <http://www.climateplanca.org/sb375summary.pdf> (analyzing SB 375).

²⁶⁸ *Id.* at 14–19.

²⁶⁹ *Id.*

²⁷⁰ CAL. GOV’T CODE § 65080(b)(2) (2008).

²⁷¹ CAL. PUB. RES. CODE §§ 75120–75130 (2008).

²⁷² CAL. PUB. RES. CODE § 21155.1 (2008).

²⁷³ The Blue Ribbon Commission on Sustainability and the MTA have recommended that New York adopt legislation similar to California’s SB 375. MTA, GREENING MASS TRANSIT & METRO REGIONS (2009), available at <http://www.mta.info/sustainability/pdf/SustRptFinal.pdf>.

²⁷⁴ For information about AASHTO and its objectives, see <http://www.transportation.org/?siteid=37&pageid=310> (last visited Nov. 26, 2009).

better withstand the impacts of climate change can be designated.²⁷⁵ Inspection protocols required by law can be amended to assure safety in the wake of projected climate change impacts.²⁷⁶

The transportation system also affords significant opportunities for stormwater management. Roads and sidewalks comprise approximately 27 percent of the city's land area and approximately 34 percent of its impervious surfaces.²⁷⁷ The 2008 PlaNYC Sustainable Stormwater Management Plan highlights some of the steps that can be taken to reduce stormwater runoff through incorporating source control into roadway and sidewalk reconstruction projects, green-streets (conversion of paved, vacant traffic islands and medians into green spaces filled with shade trees, flowering trees, shrubs, and groundcover), highway swales (land depressions that create greater water infiltration), and greener parking lots.²⁷⁸ These can be incorporated into the zoning and building codes.

As transportation projects are often long-term in nature but also very capital intensive, care must be taken not to require over-engineering of projects beyond the actual demands of climate change as the scientific data develops.

VII. AIR²⁷⁹

Air emissions figure prominently in our understanding of human-induced climate change and are at the crux of the discussion about mitigation. Air emissions from fossil fuel combustion and other human activities are understood to be a primary source of increased concentrations of GHGs in the Earth's atmosphere, giving rise to past and anticipated increases in global

²⁷⁵ See Rae Zimmerman, *Global Climate Change and Transportation Infrastructure, Lessons from the New York Area*, in THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON TRANSPORTATION: WORKSHOP SUMMARY AND PROCEEDINGS 1, 4–5 (2003), available at <http://climate.dot.gov/documents/workshop1002/zimmermanrch.pdf>.

²⁷⁶ *Id.*

²⁷⁷ PLAN NYC STORMWATER MANAGEMENT, *supra* note 49, at 31.

²⁷⁸ *Id.* at 53–56.

²⁷⁹ This chapter was written by Adeeb Fadil, who is senior counsel and a member of the environmental practice group at Simpson Thacher & Bartlett LLP, and Mark de Figueiredo, who at the time was an associate at Simpson Thacher.

average temperatures, sea level rise, and extreme storm events.²⁸⁰ GHGs have recently been recognized by the EPA, in its proposed endangerment finding under Section 202(a) of the Clean Air Act, to threaten the public health and welfare of current and future generations.²⁸¹ Accordingly, regulation of GHG emissions in some form or another—such as a cap-and-trade system, a carbon tax, or new permitting requirements for new and modified sources—is expected to play a central role in any mitigation strategy regarding climate change. Air emissions regulation may also, however, play an important role in New York City’s adaptation strategies.

Anticipated effects of climate change, especially higher temperatures, on ground level ozone formation help to illustrate this connection. Ground level ozone forms when precursor chemicals—nitrogen oxides and volatile organic compounds—in the atmosphere are exposed to sunlight and warmer temperatures.²⁸² As global warming continues, higher temperatures for longer periods may lead to more frequent periods of elevated concentrations of ground-level ozone, as well as elevated ozone concentrations.²⁸³ In turn, such conditions may affect human health (especially respiratory illnesses and conditions),²⁸⁴ and environmental quality (such as degradation of

²⁸⁰ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 37–46 (2007), available at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

²⁸¹ Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 66,496 (Dec. 15, 2009). The EPA’s endangerment findings—made in response to the U.S. Supreme Court’s ruling, in *Massachusetts v. EPA*, 549 U.S. 497 (2007), regarding the agency’s obligations with respect to greenhouse gases under Section 202(a) of the Clean Air Act—focus on current and projected levels of six GHGs: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. See Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act, 74 Fed. Reg. 18,886, 18,894–18,905 (Apr. 24, 2009).

²⁸² E.g., N.Y. DEC, About Ozone, <http://www.dec.ny.gov/chemical/8400.html> (last visited Nov. 22, 2009).

²⁸³ INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, THE REGIONAL IMPACTS OF CLIMATE CHANGE: AN ASSESSMENT OF VULNERABILITY § 8.3.9.2 (1997), available at <http://www.ipcc.ch/ipccreports/sres/regional/231.htm>.

²⁸⁴ E.g., Thomas H. Maugh II, *Low-Level Ozone Exposure Found To Be Lethal Over Time*, L.A. TIMES, Mar. 12, 2009, at A17, available at <http://articles.latimes.com/2009/mar/12/science/sci-ozone12>; EPA, Health Effects of Ozone in the General Population, <http://www.epa.gov/03healthtraining/population.html> (last visited Nov. 22, 2009).

susceptible vegetation).²⁸⁵ Elevated ozone levels may also have significant regulatory consequences under the Clean Air Act; areas the EPA designates under the Clean Air Act as “nonattainment” for ozone are subject to, among other things, restrictive permitting conditions for new sources of pollution that contribute to ground level ozone formation,²⁸⁶ and these conditions become more onerous as an area’s classification for nonattainment worsens.²⁸⁷

Currently designated under the Clean Air Act as a nonattainment area for ozone, New York City already labors under the burden of ground-level ozone issues. With no change in current law, New York City eventually would be compelled to address an ozone nonattainment problem exacerbated by climate change. It may be prudent, though, to include in New York City’s planning for adaptation to climate change a way to address earlier the emission of ozone precursors. Doing so could help to blunt the health, environmental, and regulatory impacts that may otherwise be anticipated. Planning efforts to address ozone precursors would be the functional equivalent of building a sea wall to address a potentially rising tide of ground-level ozone.

Research is underway to identify how climate change may affect various aspects of local and regional air quality. Regulatory agencies appear to be relatively early in the process of researching and understanding the linkages between climate change and air quality. For example, in 2002, the EPA began the Climate Impact on Regional Air Quality project.²⁸⁸ The first phase of this project, which is now complete, examined the effect of climate change on air quality without accounting for changes in emissions of ozone and particulate matter precursors; in the next phase of the project, the EPA is examining the effect of both climate change and emission changes on air quality.²⁸⁹ The NASA Goddard Institute

²⁸⁵ *E.g.*, EPA, Ground-Level Ozone: Health and Environment, <http://www.epa.gov/air/ozonepollution/health.html> (last visited Nov. 22, 2009).

²⁸⁶ 42 U.S.C. § 7511a (2006).

²⁸⁷ *Id.* An area’s nonattainment classification can be any of five categories ranging from “marginal” to “extreme.”

²⁸⁸ EPA, Atmospheric Modeling & Analysis Div., Climate Impact on Regional Air Quality (CIRAQ), <http://www.epa.gov/asmdnerl/Climate/ciraq.html> (last visited Sept. 17, 2009); EPA, Atmospheric Modeling & Analysis Division, Linkages Between Climate and Air Quality, <http://www.epa.gov/asmdnerl/Climate/index.html> (last visited Sept. 17, 2009).

²⁸⁹ EPA, Atmospheric Modeling & Analysis Div., Linkages Between Climate and Air Quality, <http://www.epa.gov/asmdnerl/Climate/index.html> (last visited

for Space Studies, based in New York City, has also been researching linkages between climate change and air quality.²⁹⁰ Its work has focused on the science underlying policies to reduce air emissions that would affect climate change as well as air quality. The researchers have found reductions in emissions from surface transportation in North America would have benefits both in terms of near-term climate change mitigation as well as improvements in air quality.²⁹¹ Although this work is relevant to climate change mitigation, it is useful for adaptation strategies as well.

New York City may be able to leverage such work from the EPA, NASA Goddard Institute for Space Studies, and other institutions in developing adaptation strategies involving air emissions regulations. As such climate change-air quality linkages become better understood, a process for identifying them and addressing their implications early across a broad spectrum of planning areas could significantly improve the City's ability to adapt to the consequences of climate change.

VIII. COMMUNICATIONS

Reliable telecommunications are central to the conduct of business in New York City. Telecommunication infrastructure in New York City could be damaged from increased coastal and inland flooding and severe weather caused by climate change. Such events could lead to corrosion damage from salt water, leaching from brownfields, and damage caused by severe winds.²⁹² Climate change could also lead to strain on heating and cooling systems, which could cause more frequent power outages and fluctuations in voltage.

The New York Public Service Commission (PSC) has substantial authority under the Public Service Law to regulate network reliability as part of its statutory obligation to ensure "adequate" service.²⁹³ Best practices designed to ensure reliability of specific elements of the network are published by the Federal Communication Commission's Network Reliability and

Sept. 17, 2009).

²⁹⁰ Drew Shindell, *Science to Support a Unified Policy on Climate Change and Air Quality*, GODDARD INST. FOR SPACE STUD., Dec. 2008, http://www.giss.nasa.gov/research/briefs/shindell_11.

²⁹¹ *Id.*

²⁹² NYPCC, *supra* note 1, at 58–59.

²⁹³ See N.Y. PUB. SERV. LAW § 91 (McKinney 2000).

Interoperability Council. The PSC can issue performance thresholds pursuant to its authority and require reporting of compliance with such performance requirements.²⁹⁴

A comprehensive analysis of network reliability was conducted by the PSC in the wake of 9/11.²⁹⁵ Recommendations made in this 2002 report, many of which have been implemented, can serve as well to address the vulnerabilities created by climate change and would serve as adaptation measures. For example, such steps as requiring more switching equipment, a critical element in a telecommunication system, to be distributed in multiple locations, eliminating single points of potential failure in likely flood areas, improving information on equipment locations, and reviewing material specifications could be explored to safeguard telecommunication systems. In addition, requiring certification for compliance with the Network Reliability and Interoperability Council's standards²⁹⁶ and other stricter standards developed with an eye towards climate change could be considered. Continuing analysis of steps to meet climate change challenges will undoubtedly lead to further solutions.

IX. HAZARDOUS WASTE MANAGEMENT²⁹⁷

Contaminant leaching at brownfield sites in New York City has been identified as one of the risks of rising sea levels resulting from climate change.²⁹⁸ Leaching of sites containing hazardous materials has the potential to contaminate the surrounding environment and increase the risk of exposing populations to those materials. With respect to hazardous waste sites, brownfields, and hazardous waste management, the law is already largely in place to adapt New York City to the eventuality of rising sea levels. The goal is to achieve greater vigilance, better management, and appropriate remedies with respect to those sites at greatest risk, using technical tools already at our disposal.

²⁹⁴ N.Y. STATE DEP'T OF PUB. SERV. OFFICE OF COMM'NS, NETWORK RELIABILITY AFTER 9/11 at 5–6 (2002), *available at* <http://www.dps.state.ny.us/DPS-NetworkReliabilityRpt.pdf>.

²⁹⁵ *See generally id.*

²⁹⁶ *Id.* at 7–8.

²⁹⁷ This chapter was written by Roberta G. Gordon, Counsel in the Environmental Practice Group of Bryan Cave LLP. She was assisted by L. Margaret Barry, an associate at Bryan Cave LLP.

²⁹⁸ NYPCC, *supra* note 1, at 1.

A. Hazardous Waste Sites

The Comprehensive Environmental Response, Compensation and Liability Act, also known as Superfund, establishes a federal regulatory framework for governmental parties to perform cleanups of seriously contaminated sites or to require private parties to do so.²⁹⁹ In addition, New York has a state Superfund program for the cleanup of severely contaminated inactive hazardous waste disposal sites.³⁰⁰

Thus, the statutes and regulations to needed address the potential problems that rising sea levels may cause with respect to hazardous waste sites³⁰¹ are already largely in place. For instance, regulators currently have the authority to conduct new kinds of surveys and mapping.³⁰² These maps could identify hazardous waste sites at the shoreline and low-elevation areas otherwise vulnerable to rises in sea level, as well as identify waste sites likely to be at greatest risk for leaching as a result of sea level changes. Current regulations likely allow existing Site Management Plans and permits to be updated or new Site Management Plans and permits drafted to account for rising sea levels at sites where leaching is likely to occur.³⁰³ Regulators could also use existing regulations to require that more hazardous material be removed during cleanups of the most hazardous sites in susceptible areas. For cleanups that are already complete, regulators may reopen cleanups and revise remedies based on changed conditions.³⁰⁴ As loss of site cap presents a pathway for potential exposure,

²⁹⁹ 42 U.S.C. §§ 9601–9675 (2006).

³⁰⁰ N.Y. ENVTL. CONSERV. LAW §§ 27–1301 to –1323 (McKinney 2007).

³⁰¹ This subsection focuses on inactive hazardous waste sites governed by Superfund, but also is applicable at least in part to certain treatment, storage and disposal (“TSD”) facilities regulated under the federal Resource Conservation and Recovery Act. *See* 42 U.S.C. § 6925 (2006).

³⁰² *See* N.Y. ENVTL. CONSERV. LAW § 3–0301(2)(f) (McKinney 2007) (authorizing DEC to “[u]ndertake any studies, inquiries, surveys or analyses it may deem relevant . . . for the accomplishment of the purposes of the department”).

³⁰³ *See, e.g.,* N.Y. COMP. CODES R. & REGS. tit. 6 § 375–1.6(d)(3) (2009) (permitting DEC to request modification of reports, including site management plans, if DEC provides written reasons for such modifications).

³⁰⁴ New York, for instance, has re-evaluated sites where remedial decisions were already made after it recognized soil vapor as a media of concern. *See* DEP’T OF ENVIRONMENTAL CONSERVATION, DER–13, STRATEGY FOR EVALUATING SOIL VAPOR INTRUSION AT REMEDIAL SITES IN NEW YORK 1 (2006), available at http://www.dec.ny.gov/docs/remediation_hudson_pdf/der13.pdf.

regulators could use existing authority to require more stable site caps for sites at lower elevations, using more impermeable materials, such as composites,³⁰⁵ instead of merely soils. However, laws may need to be modified should it be determined that it is appropriate to increase the use of financial assurance in the form of insurance, bonds, escrows, and other devices for the highest risk sites.

B. *Brownfield Programs*

Federal, state, and local programs establish parameters and provide incentives and assistance for the voluntary cleanup and redevelopment of contaminated sites. The federal brownfield program provides various types of grants to encourage remediation and redevelopment of contaminated sites.³⁰⁶ Under New York State's Brownfield Cleanup Program, the DEC admits certain redevelopment sites into the program and oversees the remediation of those sites by the applicants.³⁰⁷ In many cases, tax credits are available to the parties performing the cleanup.³⁰⁸ In addition, New York City now houses a brownfield cleanup program within the Mayor's Office, which will establish city-specific remediation guidelines and provide oversight for cleanups of sites not enrolled in other brownfield programs.³⁰⁹

Legislation already exists to address brownfield and urban fill sites, which generally have less serious contamination than their hazardous waste counterparts. In addressing legal issues pertaining to brownfields, the remedial actions involved are voluntary and are performed in conjunction with redevelopment. Worthy projects with marginal funding, such as low income housing, might not proceed if the financial barriers are too steep. As with hazardous waste sites, regulations already exist to allow

³⁰⁵ Such composites might consist of a geomembrane composed of high-density plastic overlaying compacted soil.

³⁰⁶ Small Business Liability Relief and Brownfields Revitalization Act, Pub. L. No. 107-118, 115 Stat. 2356 (2002).

³⁰⁷ N.Y. ENVTL. CONSERV. LAW §§ 27-1401 to -1433 (McKinney 2007).

³⁰⁸ See N.Y. TAX LAW § 22 (McKinney 2007).

³⁰⁹ On May 11, 2009, New York City Mayor Michael Bloomberg signed a bill (passed unanimously by the City Council) establishing the local brownfield cleanup program. N.Y. CITY, N.Y., LOCAL LAW No. 27 (2009). See also N.Y. City Office of Environmental Remediation, Local Brownfield Clean-Up Program, http://www.nyc.gov/html/oer/html/developer/local_brownfield.shtml (last visited Nov. 23, 2009).

for mapping of sites, adjustments to management plans, and requirements for impermeable caps at the appropriate sites.³¹⁰ At most, only minimal changes in regulation or guidance would be required because regulators are already accustomed to coping with sites where high water exists. The key will be to apply those concepts to a new set of sites now subject to flood potential. It is possible that the risks of leaching of urban, historic fill sites may not be substantially increased as a result of rising sea levels, and that the laws in place are sufficient to deal with such sites. In New York City, water levels are already high and the land is low, and many such sites have been leaching for 100 years or more and likely do not pose a present risk. Existing regulations relating to erosion control, generic management in place, and monitoring will continue to be applicable to such sites.

C. *Hazardous Waste Storage and Handling*³¹¹

Active facilities where hazardous waste is generated and stored must also be addressed. The federal Resource Conservation and Recovery Act (RCRA) regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. It establishes a cradle-to-grave approach to hazardous waste management.³¹² New York State's hazardous waste management program is based on the federal RCRA and focuses on the criteria to determine which wastes are hazardous and the requirements for hazardous waste handlers.³¹³ It also provides means for addressing past environmental releases of contaminants through investigation and corrective action activities.³¹⁴

While the statutes are already in place, regulations and

³¹⁰ See, e.g., N.Y. COMP. CODES R. & REGS. tit. 6 § 375-1.1 (2009) (providing that general remedial program requirements apply to brownfield sites as well as inactive hazardous waste sites); N.Y. COMP. CODES R. & REGS. tit. 6 § 375-1.8(h) (providing that remedy, including engineering controls, shall include an evaluation of long-term reliability and viability).

³¹¹ Rising sea levels could affect management of non-hazardous solid waste. The issues are similar to those pertaining to hazardous waste and would involve regulation on the federal, state, and local levels.

³¹² Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901-6992k (2006).

³¹³ N.Y. ENVTL. CONSERV. LAW §§ 27-0900 to -0926 (McKinney 2007).

³¹⁴ *Id.* §§ 27-0915 (allowing DEC investigations of individuals who possess hazardous waste), 27-0923 (imposing special assessments on individuals who generate hazardous waste).

guidance might be modified to limit storage of hazardous waste in areas subject to inundation. For permitted facilities, regulatory modifications implemented in response to climate change might be incorporated in facility permits during permit renewal or earlier, if necessary. Regulators of permitted treatment, storage, and disposal facilities can write permits to impose requirements as necessary to protect the environment. Existing regulations already allow restrictions on the siting of certain new facilities handling high volumes of hazardous waste near the shoreline or within the expected floodplain, which can be used to require measures to protect against flood damage. Zoning laws also could be amended to control future development of facilities storing large quantities of hazardous waste along the waterfront.³¹⁵ Importantly, storage of high volume/high hazard products, including, for instance, petroleum, occurs at a variety of facilities, and such hazardous materials exist in greater volumes than hazardous waste. Laws to address such storage also can be reviewed in relation to expected rises in sea levels.

X. FINANCIAL ASSURANCE³¹⁶

The question of whether to require financial assurance can arise in many contexts as the City moves forward to evaluate climate change options. It is a likely requirement for any adaptive measure that may be necessary or desirable but the implementation of which also raises concerns about adverse environmental impacts. The most difficult risks to address are uncertain but feared long-term impacts, and regulators often look to financial assurance to address responsibility for such occurrences.³¹⁷ Depending on the scope of the financial assurance requirement, however, it can also inhibit the implementation of certain technologies or processes, especially those that are considered experimental.

Some environmental statutes require the government to ensure that entities liable under those statutes for adverse environmental

³¹⁵ See *infra* Section I for a discussion of zoning and adaptation.

³¹⁶ This chapter was written by Rachel E. Deming, partner at Scarola Ellis LLP and a member of EPA's Environmental Financial Advisory Board.

³¹⁷ See, e.g., Federal Requirements under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 73 Fed. Reg. 43,492, 43,520 (July 25, 2008) (to be codified at 40 C.F.R. pts. 144, 146).

impacts bear the cost of addressing those liabilities.³¹⁸ Financial assurance was developed as the mechanism used by federal and state regulators to implement those statutory mandates.³¹⁹ Financial assurance regulations require liable entities (often called “responsible parties”) to estimate the potential costs of addressing the environmental impacts associated with a current activity or an identified contaminated property and to demonstrate that the responsible party can pay those costs through the use of certain selected financial mechanisms.³²⁰ The purpose of these requirements is to ensure that the responsible party incorporates those costs into its financial planning. While these regulations focus primarily on the cleanup obligations, there is also a small component that seeks to address third-party claims for injury and damage to property.³²¹ Statutes and regulations relating to the operation of nuclear power plants and surface mining operations also include financial assurance provisions, as do proposed regulations for energy-related activities like geological sequestration.³²² The EPA has recently proposed financial assurance regulations governing mining operations under the federal Superfund law.³²³

³¹⁸ See, e.g., Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9608(b) (2006); Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6924(a)(6) (2006); see also GOV'T ACCOUNTABILITY OFFICE, ENVIRONMENTAL LIABILITIES: EPA SHOULD DO MORE TO ENSURE THAT LIABLE PARTIES MEET THEIR CLEANUP OBLIGATIONS 3–6 (2005) (discussing bankruptcy statistics for liable parties and the role of the EPA in ensuring that financially distressed liable parties are held accountable).

³¹⁹ See, e.g., Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities [hereinafter “TSDF Regulations”], 46 Fed. Reg. 2,802, 2,821–23 (1981) (codified at 40 C.F.R. pt. 264).

³²⁰ 40 C.F.R. §§ 264.145–147.

³²¹ See TSDF Regulations, 46 Fed. Reg. at 2821–22; 40 C.F.R. § 264.147 (2008).

³²² 42 U.S.C. § 2210 (2006) (authorizing financial assurance requirements for nuclear plant licensees); 30 U.S.C. § 1259 (2006) (requiring “performance bonds” for coal mining permit applicants); NRC Financial Protection Requirements and Indemnity Agreements, 10 C.F.R. § 140 (2008); Bond and insurance requirements for surface coal mining and reclamation operations under regulatory programs, 30 C.F.R. § 800 (2008); Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 73 Fed. Reg. 43,492, 43,522 (proposed July 25, 2008) (to be codified at 40 C.F.R. pts. 144, 146).

³²³ Identification of Priority Classes of Facilities for Development of CERCLA Section 108(b) Financial Responsibility Requirements, 74 Fed. Reg. 37,213, 37,213 (July 28, 2009).

It is important to note that current financial assurance requirements do not set aside a pot of money for the responsible party to use to address its obligations, which would then become available to regulators if the responsible party does not meet its obligations. To require a responsible party to fund these long-term obligations up front would cause too much of an adverse impact on the entity's current operating income.³²⁴ This is especially true when the long-term impacts are uncertain, making cost estimations speculative. Therefore, the current system of financial assurance provides for the use of a few alternative mechanisms. They include third-party instruments such as letters of credit, surety bonds, insurance policies, and trust funds, as well as financial testing to determine if an entity's financial information meets certain criteria.³²⁵ These mechanisms are obtained in addition to the actual expenses for a cleanup paid by a responsible party on a current basis.

A. *Utilizing Financial Assurance Requirements*

There are several benefits to current financial assurance processes that can provide important safeguards for the future. The primary benefit is that they force an entity to consider long-term as well as short-term impacts of whatever process or activity it plans to pursue, and to put together cost estimates to consider those long-term impacts.³²⁶ These long-term costs should be built into current operations so that the required long-term protection measures are accounted for and can be provided by the responsible entity when it becomes necessary.

The difficulty is finding financial mechanisms that work since

³²⁴ TSDF Regulations, 46 Fed. Reg. at 2,822; Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities; Financial Requirements, 47 Fed. Reg. 15,032, 15,034–38 (Apr. 7, 1982) (to be codified at 40 C.F.R. pts. 264, 265).

³²⁵ See Bruce J. Gruenewald, *Current Recession to Test Financial Assurance Program*, NAT. RESOURCES & ENV'T, Summer 2009, at 41, 41; Lindene E. Patton & James L. Joyce, *Hazardous Waste Financial Assurance: A Comparison of Third-Party Management Mechanisms—Suggestions for Reform*, ENVTL. DUE DILIGENCE GUIDE (BNA) No. 196, § 231.2001 (June 2008).

³²⁶ EPA, Financial Assurance for Hazardous Waste Treatment, Storage and Disposal Facilities (TSDFs), <http://www.epa.gov/epawaste/hazard/tsd/td/ldu/financial/index.htm> (last visited Sept. 23, 2009); EPA, Financial Assurance for Municipal Solid Waste Landfills, <http://www.epa.gov/waste/nonhaz/municipal/landfill/financial/famsw.htm> (last visited Nov. 24, 2009).

the short-term nature of most financial instruments does not coincide with the long-term obligations being funded. When responsible parties are required to post assurance for cleanups that take several years, they can end up paying twice for the same obligation—they have to pay the actual expenses of the cleanup as they are incurred in addition to posting financial assurance for the remaining work to be done, which often is never utilized. If companies are forced to incur costs today for long-term liabilities, especially speculative ones, they may opt out of engaging in the development and implementation of novel technologies.³²⁷

A possible answer is to tie the provision of financial assurance to estimated expenditures over a shorter time period which is extended on a rolling basis. This would tie the provision of financial assurance to the term of existing financial instruments, with the obligation to routinely update the amount of financial assurance being provided, rather than establishing an obligation upfront that is paid down over time. It could also have the benefit of regularly revisiting and updating cost estimates and would be less likely to include speculative expenses, which can drive up the cost with no benefit.

B. *Alternatives to Financial Assurance*

Substituting collective or industry-wide pooled funds or government responsibility instead of individual owner/operator liability for uncertainties such as long-term stewardship or unknown impacts of new technologies may be desirable, or even necessary, to facilitate short-term or interim relief measures. While this can most clearly be seen for mitigation actions like geological sequestration of carbon-dioxide emissions from coal-fired power plants, it may also be applicable to foster the development of some adaptive measures—experimental engineering techniques or materials used in seawalls, or facilitating new or different use of brownfields.³²⁸

³²⁷ See Letter from Mathew Scirè, Director, Financial Markets and Community Investment, to Senator John D. Rockefeller IV and Rep. Henry A. Waxman, on the Feasibility of Requiring Financial Assurances for the Recall or Destruction of Unsafe Consumer Products (Apr. 22, 2009), *available at* <http://www.gao.gov/new.items/d09512r.pdf> (referencing concerns that requiring financial assurances for potential consumer product recalls could “potentially limit . . . growth and innovation”).

³²⁸ This concept has already been applied to nuclear facilities. 42 U.S.C. §

XI. EMERGENCY PREPAREDNESS³²⁹

New York City is governed by a mixture of state and local laws and regulations concerning emergency preparedness. However, these existing laws and regulations merely describe a process for how the State and City are to carry out their respective duties when and if certain emergencies occur. As such, they do not mention climate change explicitly, nor do they take into account adaptation measures to plan for emergencies that may be caused by localized climate change-related impacts, such as more extreme flooding caused by higher sea levels or more severe and lengthier heat waves caused by higher summertime temperatures. This is a serious omission that could be addressed in future regulatory revisions, as emergency responses can be expected to be initiated more frequently in the future because of climate change impacts. Even in the absence of such regulatory requirements, New York City is attempting to account for climate change impacts through OEM emergency planning.

Article 2B of the State Executive Law sets out the procedure for coordination between the State and municipalities regarding emergency preparedness.³³⁰ Pursuant to this statutory section, local government and emergency service organizations are the first line of defense in times of disaster, with the State providing appropriate supportive services. Local chief executives (including mayors) are directed to take an active role in the development and implementation of emergency and disaster preparedness programs, and should coordinate local programs with State programs. In addition, Article 2B states that these State and local plans “be the most effective that current circumstances and existing resources allow.”³³¹ With respect to declaring states of emergency, mayors have the authority to do so “in the event of a disaster . . . or similar public emergency” and to issue local emergency orders “to bring the emergency situation under control,” including establishing a curfew, controlling pedestrian and vehicle traffic, and designating specific zones, among other things.³³² A mayor may request that

2210(b)(1) (2006).

³²⁹ This chapter was written by Cullen Howe, who is an environmental law specialist at Arnold & Porter LLP.

³³⁰ N.Y. EXEC. LAW §§ 20–29 (McKinney 2002).

³³¹ *Id.* § 20.

³³² *Id.* § 24(1).

the Governor provide assistance if he or she “determines that the disaster is beyond the capacity of local government to meet adequately and state assistance is necessary to supplement local efforts to save lives and protect property, public health and safety, or to avert or lessen the threat of disaster.”³³³

With respect to City laws governing emergency preparedness, Chapter 19-A of the New York City Charter creates the City Office of Emergency Management (OEM), which is tasked with being the lead agency for coordinating and facilitating resources in incidents involving “public safety and health.”³³⁴ Pursuant to the New York City Administrative Code, the Mayor can “declare that a state of emergency exists within the City” if he or she determines that there exists a clear and present danger of “general public disorder” or “substantial injury to persons or to property, all of which constitutes a threat to public peace or order and to the general welfare of the City.”³³⁵ New York City has implemented the Citywide Incident Management System (CIMS), which was adopted via Executive Order in April 2005.³³⁶ CIMS outlines the emergency response core competencies of city agencies (as well as some federal and state agencies) and lays out the agencies in charge for any given emergency. For example, in the case of a “natural disaster/weather emergency,” the primary agencies are OEM, the New York City Police Department, the New York City Fire Department, the New York City Department of Transportation, and the New York City Department of Sanitation.³³⁷ CIMS is compliant with the National Incident Management System (NIMS).

A. *FEMA Requirements*

In 2008, OEM released a New York City Draft Natural Hazard Mitigation Plan, which it was required to prepare to receive non-emergency natural hazard mitigation funding from the Federal Emergency Management Agency (FEMA) pursuant to the

³³³ *Id.* § 24(7).

³³⁴ N.Y. CITY CHARTER §§ 495, 497 (2004).

³³⁵ N.Y. CITY ADMIN. CODE § 3-104 (1996).

³³⁶ New York City Exec. Order No. 61 (Apr. 11, 2005).

³³⁷ N.Y. City Office of Emergency Mgmt., CIMS: Primary Agency Matrix, http://www.nyc.gov/html/oem/html/about/cims_matrix.shtml (last visited Nov. 24, 2009).

Disaster Mitigation Act of 2000.³³⁸ Pursuant to the Act, states and municipalities must have an approved mitigation plan to be eligible to apply for and receive hazard mitigation funds. The Plan assesses natural hazard vulnerabilities in the city and identifies mitigation opportunities. The Plan has been approved by FEMA. However, as FEMA does not require or provide guidance on incorporating climate change adaptation into these plans, the Natural Hazard Mitigation Plan does not contain a comprehensive examination of climate change and does not explicitly analyze any potential hazard through the lens of expected localized climate change-related impacts.³³⁹ Pursuant to federal regulations, this plan must be updated every five years.

B. *Preparing for Climate Change*

As stated, New York City's existing laws and regulations concerning emergency preparedness describe a *process* for responding to emergencies in general. While climate change is not yet explicitly incorporated into emergency preparedness, at least the types of climate change-related emergencies that may arise in the future—such as storm surges, inland flooding, and heat waves during summer months—appear to be adequately addressed by these existing procedural laws and regulations, which provide a basis for dealing with climate change. However, there are no regulations or guidance documents that take into account the specific emergencies that are likely to arise as a result of climate change and what should be done to plan for and lessen their impact. It would be useful if NOAA and FEMA provided updated maps accounting for anticipated climate impacts. For example, the current FEMA maps to determine the 100-year floodplain are based on historical data and do not take into account rising sea levels as a result of climate change.³⁴⁰ Thus the 100-year floodplain is likely a poor guide to flood areas in the future.

³³⁸ CITY OF N.Y., NATIONAL HAZARD MITIGATION PLAN (2009), *available at* http://www.nyc.gov/html/oem/html/about/planning_hazard_mitigation.shtml; *see also* FED. EMERGENCY MGMT. AGENCY, HAZARD MITIGATION ASSISTANCE UNIFIED GUIDANCE 12, 16–17 (2009), *available at* <http://www.fema.gov/library/viewRecord.do?id=3649> (last visited Nov. 24, 2009).

³³⁹ *See generally id.*

³⁴⁰ CITY OF N.Y., NATIONAL HAZARD MITIGATION PLAN, NATURAL HAZARD RISK ASSESSMENT 131–53, *available at* http://www.nyc.gov/html/oem/downloads/pdf/hazard_mitigation/section_3_natural_hazard_risk_assessment.pdf.

Updated maps would enable the city to prepare a Natural Hazard Mitigation Plan consistent with FEMA requirements that better fits anticipated climate change realities.

New York City is well on its way with such planning. In response to extreme weather events in recent years, New York City appointed a Flood Mitigation Taskforce.³⁴¹ The goals of the Taskforce were to first develop a citywide emergency flood response plan to coordinate agency responses to predicted and in-progress heavy rain events; second, develop community education and outreach materials for empowering residents to protect themselves and their property;³⁴² and third, identify and examine Stormwater Mitigation Study Areas (SMSAs) for strategies that will improve stormwater management in the most affected areas in the short term.³⁴³ The Task Force released an Emergency Flood Response Plan³⁴⁴ in April of 2008 as well as a Ready New York Flooding guide³⁴⁵ which included recommendations like backwater valve installations and ejector pump systems which have been or can be included in the building code.³⁴⁶

XII. CONSTITUTIONAL LIMITATIONS³⁴⁷

The laws and regulations that may be crafted by New York City in its adaptation to the risks of climate change are subject to limitations arising out of both the United States and the New York

³⁴¹ See Press Release, N.Y. City Mayor's Office, Mayor Bloomberg Announces Results of the Work of the Flood Mitigation Taskforce at the Beginning of Flood Season (April 28, 2008), available at http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2008a%2Fpr155-08.html&cc=unused1978&rc=1194&ndi=1.

³⁴² See *id.*

³⁴³ N.Y. CITY MAYOR'S FLOOD MITIGATION TASK FORCE, SUMMARY OF RESULTS 5–10 (2008), available at http://www.nyc.gov/html/ops/downloads/pdf/agency_services/flood_mitigation_taskforce_summary_of_results.pdf.

³⁴⁴ See N.Y. City Mayor's Office, *supra* note 341.

³⁴⁵ N.Y. CITY OFFICE OF EMERGENCY MGMT. AND DEP'T OF ENVTL. PROTECTION, READY NEW YORK FLOODING GUIDE (2009), available at http://www.nyc.gov/html/oem/html/ready/flooding_guide.shtml.

³⁴⁶ See N.Y. City Mayor's Office, *supra* note 341.

³⁴⁷ This chapter was written by Adeeb Fadil, who is senior counsel and a member of the environmental practice group at Simpson Thacher & Bartlett LLP, and Noreen Lavan, who is a staff attorney at Simpson Thacher.

State Constitutions. The Supremacy Clause of the United States Constitution provides that the laws of the United States are “the supreme law of the land,” the “laws of any State to the contrary notwithstanding.”³⁴⁸ Any state or local law that conflicts with, or attempts to regulate an area reserved to, federal law will be preempted. Any attempt at regulation must also not run afoul of the Fifth Amendment, which prohibits the taking of private property for public use without just compensation.³⁴⁹ At the state level, the primary question becomes whether proposed legislation falls within the home rule powers of New York City under Article IX of the state constitution³⁵⁰ and the Municipal Home Rule Law,³⁵¹ or is otherwise preempted by state law.

A. Federal Preemption

The Supremacy Clause of the United States Constitution³⁵² is the source of federal preemption law. The Supreme Court has recognized two broad categories of preemption: (i) express preemption, where federal law clearly and expressly preempts state or local law; and (ii) implied preemption, where Congress intends to supersede state or local law by occupying the legislative field, or where state or local requirements conflict with a congressional enactment.³⁵³ Congress has legislated extensively in the environmental arena. While many federal environmental laws contemplate a partnering of federal and state government regulation, and other federal statutes contain “savings clauses” under which state and local governments can promulgate regulations that are more restrictive than federal laws, federal preemption is still a significant hurdle,³⁵⁴ and any New York City

³⁴⁸ U.S. CONST. art. VI, § 2.

³⁴⁹ U.S. CONST. amend. V.

³⁵⁰ N.Y. CONST. art. IX, § 2.

³⁵¹ N.Y. MUN. HOME RULE LAW § 10 (Consol. 2009).

³⁵² U.S. CONST. art. VI, § 2.

³⁵³ See generally *Lorillard Tobacco Co. v. Reilly*, 533 U.S. 525, 541 (2001) (discussing express, conflict, and field preemption); *English v. Gen. Elec. Co.*, 496 U.S. 72, 78–79 (1990) (same); *Hillsborough County v. Automated Med. Labs.*, 471 U.S. 707, 712–13 (1985) (same); *Pacific Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm’n*, 461 U.S. 190, 203–04 (1983) (same).

³⁵⁴ For additional discussion of this subject, see James B. Slaughter & James M. Auslander, *Preemption Litigation Strategies Under Environmental Law*, NAT. RES. AND ENV’T, Spring 2008, at 18, 19.

laws aimed at climate change adaptation may be tested against it.

1. *Express Preemption*

While express preemption appears on its face to require little analysis, disputes still arise regarding the scope of the preemption. This is illustrated by three recent cases, one involving the Clean Air Act and two involving the Energy Policy and Conservation Act (EPCA). The first involved a challenge by the Engine Manufacturers Association to fleet rules of California's South Coast Air Quality Management District.³⁵⁵ The fleet rules prescribed the types of vehicles that fleet operators were required to purchase when adding or replacing fleet vehicles, in some cases mandating the purchase of alternative-fuel vehicles or vehicles meeting certain emissions specifications. The Engine Manufacturers Association challenged the rules as expressly preempted by Section 209(a) of the Clean Air Act.³⁵⁶ The Supreme Court concluded that Congress clearly contemplated the enforcement of emissions standards through purchase requirements, and as a result found that at least certain aspects of the fleet rules were likely preempted.³⁵⁷ The case was remanded for further proceedings.³⁵⁸

Express preemption was also the basis for a challenge to a green building code adopted by the city of Albuquerque, New Mexico in 2008. The code applied to new buildings and additions to and alterations of existing buildings and, among other provisions, imposed minimum energy efficiency standards. Opponents of the new standards, including local and regional distributors of heating, ventilation, and air conditioning (HVAC) systems, sought to enjoin implementation of these standards in

³⁵⁵ *Engine Mfrs. Ass'n v. S. Coast Air Quality Mgmt. Dist.*, 541 U.S. 246, 248–49 (2004).

³⁵⁶ Section 209(a) of the Clean Air Act prohibits state and local governments from “adopt[ing] or attempt[ing] to enforce any standard relating to the control of emissions from any new motor vehicle or new motor vehicle engine . . .” 42 U.S.C. § 7543(a) (2006).

³⁵⁷ *Engine Mfrs.*, 541 U.S. at 258.

³⁵⁸ Upon remand, the district court again dismissed the suit based on alternate theories, and the district court's decision was again vacated in part and remanded by the Ninth Circuit. *Engine Mfrs. Ass'n v. S. Coast Air Quality Mgmt. Dist.*, 498 F.3d 1031, 1050 (9th Cir. 2007). The parties eventually negotiated a settlement under which the fleet rules would apply only to state and local government purchases. For additional discussion of this case, see Slaughter & Auslander, *supra* note 354, at 19.

federal district court, arguing that they were expressly preempted by provisions of the EPCA prohibiting state regulation “concerning the energy efficiency, energy use, or water use” of products covered by the EPCA.³⁵⁹ The district court granted the preliminary injunction, finding that the plaintiffs had shown a likelihood of success on the merits regarding their express preemption claim.³⁶⁰

A third express preemption case involved an attempt by the City of New York’s Taxi & Limousine Commission (TLC) to impose new rules requiring all new taxicabs in the city to meet certain minimum mile-per-gallon standards.³⁶¹ The Metropolitan Taxicab Board of Trade sought an injunction against enforcement of the new standard. The Southern District granted the preliminary injunction, finding that the taxicab owners were likely to succeed on the merits of their claim that the TLC’s standards violate the express preemption clause of the EPCA.³⁶²

2. *Implied Preemption*

The Supreme Court has recognized two bases for implied preemption: (i) “field preemption,” where Congress has “evidence[d] an intent to occupy a given field;” and (ii) “conflict preemption,” where “it is impossible to comply with both state and federal law, or where the state law stands as an obstacle to the accomplishment of the full purposes and objectives of Congress.”³⁶³

Courts have sought to understand whether Congress intended to occupy a given field by looking at a number of factors, including whether “the scheme of federal regulation is so

³⁵⁹ 42 U.S.C. § 6297(c) (2006). The city’s Green Building Manager acknowledged that he was unaware of the federal statute when he drafted the city’s proposed regulations. *Air Conditioning, Heating and Refrigeration Inst. v. City of Albuquerque*, No. 08–633 MV/RLP, 2008 WL 5586316, at *3 (D.N.M. Oct. 3, 2008).

³⁶⁰ *Air Conditioning, Heating and Refrigeration Inst.*, 2008 WL 5586316 at *23.

³⁶¹ *Metro. Taxicab Bd. of Trade v. City of New York*, No. 08 Civ. 7837 (PAC), 2008 WL 4866021 at *1 (S.D.N.Y. Oct. 31, 2008).

³⁶² 49 U.S.C. § 32919(a) (2006) (“[A] State or a political subdivision of a State may not adopt or enforce a law or regulation related to fuel economy standards or average fuel economy standards for automobiles covered by an average fuel economy standard under this chapter.”).

³⁶³ *Silkwood v. Kerr-McGee Corp.*, 464 U.S. 238, 248 (1984).

pervasive as to make reasonable the inference that Congress left no room for the State to supplement it;”³⁶⁴ whether the area of regulation is one in which the federal interest is so dominant that it precludes state regulation;³⁶⁵ whether the state law interferes with “clear and substantial federal interests;”³⁶⁶ or whether the state has a traditional role in regulating a certain area.³⁶⁷ However, even in areas where federal regulation appears pervasive, the Supreme Court appears to be reluctant to find state law preempted.³⁶⁸ The Second Circuit exhibited the same reluctance in a case involving New York City’s regulation of asbestos abatement contractors, finding two discrete regulations aimed solely at protecting worker health and safety expressly preempted by the federal government’s OSHA regulations, but upholding the district court’s dismissal of implied preemption claims, finding that the rest of the regulatory scheme, including worker training requirements, had a “legitimate and substantial purpose to promote public safety and health.”³⁶⁹

Conflict preemption involves matters where compliance with both federal and state regulations is a physical impossibility,³⁷⁰ or where the state law stands “as an obstacle to the accomplishment and execution of the full purposes and objectives of Congress.”³⁷¹ Courts have held that state or local “ordinances that amount to an explicit or *de facto* ban on an activity that is otherwise encouraged” by federal law “will ordinarily be preempted.”³⁷² For instance, suits involving wastewater discharges from a neighboring

³⁶⁴ *Rice v. Santa Fe Elevator Corp.*, 331 U.S. 218, 230 (1947).

³⁶⁵ *Pac. Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm’n*, 461 U.S. 190, 204 (1983).

³⁶⁶ *Hisquierdo v. Hisquierdo*, 439 U.S. 572, 581 (1979) (citing *United States v. Yazell*, 382 U.S. 341, 352 (1966)).

³⁶⁷ *Florida Lime & Avocado, Inc. v. Paul*, 373 U.S. 132, 144–46 (1963).

³⁶⁸ *See, e.g., Silkwood*, 464 U.S. at 249–56 (state common law tort remedies are not preempted by federal regulation of nuclear energy safety); *Pac. Gas & Elec. Co.*, 461 U.S. at 216 (state regulations regarding spent fuel capacity requirements were not preempted by federal nuclear safety regulations as state persuaded Court that state’s regulations were economic, not safety standards).

³⁶⁹ *Envtl. Encapsulating Corp. v. City of New York*, 855 F.2d 48, 57 (2d Cir. 1988) (OSHA regulations were not so comprehensive as to occupy the field of worker education in asbestos abatement.).

³⁷⁰ *Silkwood*, 464 U.S. at 248.

³⁷¹ *Bates v. Dow Agrosiences LLC*, 544 U.S. 431, 458 (2005) (quoting *Hines v. Davidowitz*, 312 U.S. 52, 67 (1941)).

³⁷² *Blue Circle Cement, Inc. v. Bd. of County Comm’rs*, 27 F.3d 1499, 1508 (10th Cir. 1994) (burning of hazardous waste as fuel at a cement kiln was barred by a local ordinance).

state that invoke state or local law (including common law) of the affected state against the out-of-state source interfere with implementation of the federal permitting scheme under the Clean Water Act, including provisions that preserve a State's authority to regulate discharges within its boundaries.³⁷³

3. *Executive Policy*

President Obama recently signed a presidential memorandum reversing the Bush administration's policy regarding federal preemption.³⁷⁴ According to an Office of Management and Budget official, the memorandum was issued because "stakeholders and courts made it clear that the prior administration was putting preemption language into preambles to rules when the rule itself didn't provide for preemption, effectively circumventing the rulemaking process."³⁷⁵ The announced purpose of the memorandum is "to state the general policy of [the Obama] administration that preemption of State law by executive departments and agencies should be undertaken only with full consideration of the legitimate prerogatives of the States and with a sufficient legal basis for preemption."³⁷⁶ The memorandum directs executive departments and agencies to include preemption provisions in regulatory preambles or regulations only when there is a sufficient legal basis for so doing; and to examine regulations issued within the past ten years to determine whether existing preemption language is justified.

B. *New York State Preemption*

While New York State is a "home rule" state, the home rule powers that may be exercised by local governments are subject to certain limitations. Article IX of the New York State Constitution empowers local governments to adopt or amend local laws "not inconsistent with this constitution or any general law relating to": (i) its property, affairs or government; and (ii) ten enumerated

³⁷³ *Int'l Paper Co. v. Ouellette*, 479 U.S. 481, 494 (1987). However, suits invoking nuisance laws of the state where the discharge was taking place were held not to be preempted. *Id.* at 498–99.

³⁷⁴ Presidential Memorandum on Preemption for the Heads of Executive Departments and Agencies, 74 Fed. Reg. 24,693 (May 22, 2009).

³⁷⁵ *Obama Reverses Bush Administration Policy on Federal Preemption of State Regulations*, 98 DAILY ENV'T REP. (BNA), May 26, 2009, at A7.

³⁷⁶ Presidential Memorandum, *supra* note 374.

subjects, subject to the power of the state legislature to restrict the adoption of such local laws.³⁷⁷ The state's Municipal Home Rule Law provides that local governments cannot adopt local laws that supersede state statutes relating to the subject of the laws.³⁷⁸ In addition, local governments may not regulate "matters of state concern" unless within powers enumerated in the constitutional grant or expressly authorized by legislature. Included among the powers generally granted to local governments under the Municipal Home Rule Law are the powers to enact local laws for the "protection and enhancement of its physical . . . environment," and for the "government, protection, order, conduct, safety, health and well-being of persons or property therein."³⁷⁹

Local laws that conflict with state statutes are expressly not authorized under the home rule powers of local government. Further, local laws that are authorized under the home rule powers may nevertheless be preempted if the state legislature chooses to occupy that particular field of regulation.³⁸⁰ An example is New York State's adoption of the Uniform Building Code and Fire Prevention Act,³⁸¹ which preempts local building and fire codes in all jurisdictions other than New York City.³⁸² New York State has also adopted a Uniform Energy Conservation Construction Code Act, which applies in all jurisdictions including New York City; however, the state legislature chose not to occupy the field, and

³⁷⁷ N.Y. CONST. art. IX, § 2. The ten enumerated subjects include matters such as the powers, duties and terms of local government officials and employees, the composition of the local legislature, the transaction of the business of local government, the management of local roads, and "the government, protection, order, conduct, safety, health and well-being of persons or property therein." *Id.* § 2(c)(9).

³⁷⁸ N.Y. MUN. HOME RULE LAW § 10(1) (Consol. 2009).

³⁷⁹ *Id.* § 10(1)(ii)(a)(11–12). For an extended discussion of the lawmaking authority of local governments in New York State, see JAMES A. COON, N.Y. DEPT. OF STATE, ADOPTING LOCAL LAWS IN N.Y. STATE (1998) (reprinted 2008), available at <http://www.dos.state.ny.us/lgss/pdfs/locallaw.pdf>.

³⁸⁰ *DJL Rest. Corp. v. City of New York*, 749 N.E.2d 186, 189–90 (N.Y. 2001); *Kamhi v. Town of Yorktown*, 547 N.E.2d 346, 349 (N.Y. 1989); *Consol. Edison Co. v. Town of Red Hook*, 456 N.E.2d 487, 490 (N.Y. 1983).

³⁸¹ N.Y. EXEC. LAW § 377 (McKinney 2005).

³⁸² Local governments may petition to impose higher or more restrictive standards if they can demonstrate that such standards are reasonably necessary because of special conditions prevailing within the local jurisdiction. N.Y. EXEC. LAW, § 379 (McKinney 2005). See also Legal Memorandum, Office of Gen. Counsel, N.Y. Dept. of State, LG07, The Uniform Code and Local Authority (July 2007), available at <http://www.dos.state.ny.us/cnsl/lg07.htm>.

local governments are expressly permitted to adopt local codes that are consistent with, or more stringent than, the state code.³⁸³

C. Regulatory Taking

The Fifth Amendment of the United States Constitution prohibits the taking of private property without just compensation.³⁸⁴ The Supreme Court has identified certain *per se* regulatory takings, including regulatory actions that result in a permanent physical invasion of private property,³⁸⁵ and actions that result in total economic deprivation to the property owner.³⁸⁶

Regulatory actions that are not *per se* takings are evaluated under a test articulated in *Penn Central Transportation Co. v. New York City*: a balancing of (i) the economic impact of the regulatory action; (ii) its effect on reasonable investment-backed expectations; and (iii) the character of the government action.³⁸⁷ The focus of the inquiry must be on the nature and degree of the burden on private property, and not whether the action “substantially advances” a state interest—application of a “functional equivalence” principle.³⁸⁸ However, if the regulatory action affects a use that was not part of the property owner’s “title to begin with,” the action is not a taking.³⁸⁹ For example, if preexisting background principles of nuisance and property law prohibit the use at issue, a regulatory taking would not occur.³⁹⁰

In *Severance v. Patterson*, the Fifth Circuit recently addressed a regulatory takings claim in the context of rolling easements along the Galveston, Texas coastline. The owner of several beachfront houses challenged an order issued by the Commissioner of the Texas General Land Office that she remove her houses from

³⁸³ N.Y. ENERGY LAW § 11-109 (Consol. 2009).

³⁸⁴ U.S. CONST. amend. V.

³⁸⁵ *See, e.g.,* *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 419–420 (1982) (state law requiring owners of apartment building to permit equipment installation by cable television operators a regulatory taking).

³⁸⁶ *See* *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1014–19 (1992) (regulations that deprive a landowner of “all economically beneficial use” of property are a regulatory taking).

³⁸⁷ *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978).

³⁸⁸ *Lingle v. Chevron U.S.A., Inc.*, 544 U.S. 528, 542–44 (2005).

³⁸⁹ *Lucas*, 505 U.S. at 1027.

³⁹⁰ F. Patrick Hubbard, *The Impact of Lucas on Coastal Development: Background Principles, The Public Trust Doctrine, and Global Warming*, 16 SOUTHEASTERN ENVTL. L.J. 65, 66–67 (2007).

property that, in the aftermath of erosion caused in 2005 by Hurricane Rita, was then located within the beach boundary. The property owner sought declaratory and injunctive relief from the order. The district court dismissed the action, finding, *inter alia*, that Texas law recognizing a rolling beachfront easement predated the owner's acquisition of the property.³⁹¹ The Fifth Circuit majority concurred with the district court's dismissal of the takings claim, but on ripeness grounds rather than on the merits.³⁹² The Fifth Circuit majority then reinstated a Fourth Amendment seizure claim that had been dismissed by the district court, rejecting the district court's conclusion that the Fourth Amendment claim was subsumed by the Fifth Amendment claim, and certified certain state law questions to the Texas Supreme Court in order for it to resolve the Fourth Amendment claim.³⁹³ While the majority on the Court of Appeals panel in *Severance* sidestepped any analysis of whether the rolling easements at issue constituted a regulatory taking under the Fifth Amendment, it did inject another potential constitutional claim, based on unreasonable seizure prohibited under the Fourth Amendment, into the mix.³⁹⁴

Notwithstanding the majority's sidestepping the Fifth Amendment takings claim in *Severance*, government efforts to manage the land-water interface as climate-induced sea level changes, hurricanes and similar events become more pronounced, seem destined to evoke ongoing litigation based on the Fifth Amendment Takings Clause. The Florida Supreme Court, in *Walton County v. Stop the Beach Renourishment, Inc.*,³⁹⁵ recently wrestled with whether certain aspects of a state statute designed to protect Florida's beaches from erosion unconstitutionally deprived

³⁹¹ *Severance v. Patterson*, 485 F. Supp. 2d 793 (S.D. Tex. 2007).

³⁹² *Severance v. Patterson*, 566 F.3d 490, 496–500 (5th Cir. 2009) (holding that property owner had not sought compensation for the taking in Texas state court).

³⁹³ *Id.* at 500–03.

³⁹⁴ Just where such Fourth Amendment jurisprudence may lead is difficult to predict. The dissenting judge in *Severance* rejected the majority's analysis as novel and inapplicable. See 566 F.3d at 511–13 (Wiener, J., dissenting). Even the *Severance* majority suggested that few regulatory takings would implicate Fourth Amendment claims because they “may not involve sufficient interference with possessory interests to constitute a seizure.” *Id.* at 502 (distinguishing the order at issue in *Severance*, which required the plaintiff homeowner to remove the house she owned from the land now within the beach boundary).

³⁹⁵ *Walton County v. Stop the Beach Renourishment, Inc.*, 998 So.2d 1102 (Fla. 2008).

coastal landowners of property rights without just compensation. At issue was a permit granted by the state's Department of Environmental Protection authorizing certain steps to stabilize beaches in two counties that had been critically eroded by four hurricanes and tropical storms in less than ten years.³⁹⁶ The Court concluded that there was no unlawful taking without just compensation.³⁹⁷ Two justices sharply dissented, however,³⁹⁸ and the U.S. Supreme Court has granted a petition for certiorari.³⁹⁹

Any New York City laws and regulations intended to address adaptation to climate change will need to be carefully drafted to survive constitutional challenges, both on the state and the federal levels. But there is latitude in the constitutional framework to allow local action.

XIII. FUNDING MECHANISMS FOR CLIMATE CHANGE ADAPTATION MEASURES⁴⁰⁰

While municipal governments are uniquely situated to implement adaptation measures, they are not necessarily the ideal source of funding for them. The following discussion provides an overview of funding mechanisms and sources available to the City of New York in its adaptation efforts. The examples described below are not exhaustive, but are intended to give a sense of the funding opportunities available at the municipal,⁴⁰¹ state, and federal levels, and of initiatives undertaken elsewhere that can inform New York City's efforts and may be useful for other communities.

³⁹⁶ *Id.* at 1106.

³⁹⁷ *Id.* at 1121.

³⁹⁸ *Id.* at 1121–28 (Wells and Lewis, JJ., dissenting).

³⁹⁹ *Stop the Beach Renourishment, Inc. v. Fla. Dep't of Env'tl. Prot.*, 129 S. Ct. 2792 (June 15, 2009) (No. 08–1151).

⁴⁰⁰ This chapter was written by Jeffrey A. Smith, who is a partner and head of the environmental practice group of Cravath, Swaine & Moore LLP, and Matthew Morreale, who is a senior associate at Cravath. Upton Au and Olivia Katz, paralegals at Cravath, contributed significant research and comparative analysis to this chapter. The chapter also benefited from comments by Steven Engler, who is a paralegal at Cravath.

⁴⁰¹ It is important to note at the outset the potential for municipal policies to be preempted by existing or future legislation at the state and federal levels. *See, e.g., Metro. Taxicab Bd. of Trade v. City of New York*, No. 08 Civ. 7837 (PAC), 2008 WL 4866021, at *1 (S.D.N.Y. Oct. 31, 2008).

A. *Proceeds from Auction and Sale of Emissions Allowances*

At the federal level, the U.S. House of Representatives passed the American Clean Energy and Security Act of 2009⁴⁰² in June 2009, the first time the House has approved federal climate change legislation. The bill establishes a cap-and-trade system for GHG emissions; sets a renewable electricity standard for states; and strengthens energy efficiency standards for industrial equipment, electric motors, and electric appliances and lighting. The bill mandates that a percentage of emissions allowances be allocated to wildlife and natural resources, and to domestic adaptation efforts.⁴⁰³ A portion of these allowances will be auctioned and the proceeds placed in the Climate Change Health Protection and Promotion Fund⁴⁰⁴ (available to local governments)⁴⁰⁵ and the Natural Resources Climate Change Adaptation Fund⁴⁰⁶ (available to states and federal agencies).⁴⁰⁷ The remainder of these allowances will be allocated for free to the states, which will use the proceeds from their sale to fund adaptive programs and activities.⁴⁰⁸

The Senate Environment and Public Works Committee recently reported its own climate legislation, modeled largely on the House bill.⁴⁰⁹ A number of Senators are currently negotiating amendments to that bill prior to full Senate consideration, which could occur as early as 2010. If any cap-and-trade bill becomes law, in addition to any allowances allocated to adaptive purposes, a portion of the proceeds from allowances set aside for clean energy and energy efficiency can be directed to adaptation measures.

At the state level, New York is one of ten states participating in the Regional Greenhouse Gas Initiative (RGGI),⁴¹⁰ a cooperative effort to reduce GHG emissions from power plants.

⁴⁰² H.R. 2454, 111th Cong. (2009) (as passed by the House of Representatives, June 26, 2009).

⁴⁰³ *Id.* § 321.

⁴⁰⁴ *Id.*

⁴⁰⁵ *Id.* § 467(c)(2).

⁴⁰⁶ *Id.* § 321.

⁴⁰⁷ *Id.* § 480(a), (c).

⁴⁰⁸ *See id.* §§ 453(c)–(g), 480(a).

⁴⁰⁹ S. 1733, 111th Cong. (2009) (as reported by the S. Comm. on Env't and Public Affairs, Nov. 5, 2009).

⁴¹⁰ *See* Regional Greenhouse Gas Initiative, <http://www.rggi.org> (last visited Sept. 30, 2009).

The New York State Energy Research and Development Authority (NYSERDA) is administering the CO₂ Allowance Auction Program⁴¹¹ and has developed an Operating Plan⁴¹² describing fourteen initiatives to be funded with auction proceeds, including grants and incentives to eligible individuals, businesses and governments.⁴¹³ Although the Plan focuses on reducing GHG emissions,⁴¹⁴ some of its programs aid adaptation by encouraging so-called “green building.”⁴¹⁵

B. Tax Revenue

Tax revenue could be an important funding source for climate change adaptation measures. Among federal carbon tax proposals, neither Representative John B. Larson’s America’s Energy Security Trust Fund Act of 2009⁴¹⁶ nor Representatives Fortney Stark and Jim McDermott’s Save Our Climate Act of 2009⁴¹⁷ specifically mentions climate change adaptation. However, both

⁴¹¹ N.Y. COMP. CODES R. & REGS. tit. 21, § 507 (2009).

⁴¹² N.Y. STATE ENERGY RESEARCH & DEV. AUTH., OPERATING PLAN FOR INVESTMENTS IN NEW YORK UNDER THE CO₂ BUDGET TRADING PROGRAM AND THE CO₂ ALLOWANCE AUCTION PROGRAM (2009), *available at* <http://www.nyserda.org/RGGI/Files/Final%202009-2011%20RGGI%20Operating%20Plan.pdf>.

⁴¹³ The legislation signed by Governor Paterson on December 4, 2009, diverting \$90 million of proceeds from New York’s RGGI auctions to close the state’s budget deficit demonstrates evidence that designating funding for climate change mitigation and adaptation efforts does not guarantee that the funds will be used for those purposes. *See* Simon Lomax and Michael Quint, *New York Uses Carbon Auction Funds to Plug Budget Deficit*, BLOOMBERG NEWS, Dec. 2, 2009, *available at* http://www.bloomberg.com/apps/news?pid=20602085&sid=a12axzO_w.YA.

⁴¹⁴ OPERATING PLAN, *supra* note 412, at 5.

⁴¹⁵ *Id.* at 12. Energy-efficient structures and increased on-site production of renewable energy lessen the burden on the power grid, reducing brownouts and blackouts. Building with reflective materials and planting vegetation instead of laying pavement counteract the “heat island” effect caused by absorptive non-natural surfaces. CYNTHIA ROSENZWEIG ET AL., MITIGATING NEW YORK CITY’S HEAT ISLAND WITH URBAN FORESTRY, LIVING ROOFS, AND LIGHT SURFACES 7–11 (2006), *available at* <http://www.nyserda.org/programs/Environment/EMEP/finalreports.asp>; *see also* EPA, Heat Island Effect, www.epa.gov/heatland/about/index.htm (last visited Sept. 29, 2009). Green roofs have the potential to mitigate flooding by reducing stormwater flowing into city sewers. N.Y. CITY DEP’T OF ENVTL. PROTECTION, CLIMATE CHANGE PROGRAM, ASSESSMENT AND ACTION PLAN: REPORT 1, at 54 (2008), *available at* http://www.nyc.gov/html/dep/pdf/climate/climate_complete.pdf.

⁴¹⁶ H.R. 1337, 111th Cong. (2009).

⁴¹⁷ H.R. 594, 111th Cong. (2009).

proposals designate a portion of carbon tax revenues for research, development, or investment in creating a low-carbon economy.⁴¹⁸ Investment in green and energy-efficient technologies and infrastructure plays a role in adaptation. If the federal government does not implement a national carbon tax, tax mechanisms nevertheless could be adopted at the state and municipal levels to generate revenue for adaptive purposes.⁴¹⁹

At the municipal level, Boulder, Colorado has used two tax schemes to fund the GHG emissions reduction program in its Climate Action Plan (CAP)⁴²⁰ and to fulfill the City Council's Kyoto Resolution.⁴²¹ In 2004, Boulder instituted a two-year increase⁴²² of its trash tax⁴²³ and used the extra revenue as short-term funding for its GHG reduction programs. The tax is based on the amount of trash collected within city limits and is passed on to customers. In 2006, Boulder's Climate Action Plan Excise Tax⁴²⁴ (commonly referred to as Boulder's Carbon Tax) succeeded the trash tax increase as a long-term funding source for CAP. The CAP taxes electricity use by residents and businesses. On July 7, 2009, Boulder's city council approved⁴²⁵ an ordinance⁴²⁶ that

⁴¹⁸ See H.R. 1337 § 2; H.R. 594 § 2.

⁴¹⁹ Targeted tax measures can coexist in a hybrid scheme with cap-and-trade. Revenues from both systems could be designated for adaptation measures. It should also be noted that any comprehensive statewide taxation system that substantially raises the price of carbon emissions, and thus of energy, risks disadvantaging the economy of the state and would have to be offset by other tax measures to result in a system that is tax neutral overall.

⁴²⁰ CITY OF BOULDER, CLIMATE ACTION PLAN 13–15 (2006), available at http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/cap_final_25sept06.pdf. The CAP Guide was updated in October 2009 to reflect revisions to the CAP strategy detailed in City Council Agenda Item, City of Boulder (June 04, 2009), available at <http://www.bouldercolorado.gov/files/Clerk/Agendas/2009/06-04-09/2a.pdf>. The updated version, the Community Guide to Boulder's Climate Action Plan, is available at http://www.bouldercolorado.gov/files/CAP_Guide.pdf.

⁴²¹ City of Boulder, Colo., Res. No. 906 (2002), available at http://www.bouldercolorado.gov/files/City%20Council/City_Bldr_Resolution_906.pdf.

⁴²² See CAROLYN BROUILLARD & SARAH VAN PELT, A COMMUNITY TAKES CHARGE: BOULDER'S CARBON TAX 3–4 (2007), available at http://www.bouldercolorado.gov/files/Environmental%20Affairs/climate%20and%20energy/boulders_carbon_tax.pdf.

⁴²³ BOULDER REV. CODE, tit. 3, § 10 (1988).

⁴²⁴ BOULDER REV. CODE, tit. 3, § 12 (2007).

⁴²⁵ See Boulder City Council, Committee Meeting Minutes (July 6, 2009), available at http://www.bouldercolorado.gov/files/City%20Council/cac_

increased the CAP Tax to the maximum rate approved by voters in 2006. Many of the programs identified in the CAP, including green building, weatherization, energy efficiency, renewable energy, building code stringency, and transportation system sustainability programs, pertain to climate change adaptation. The excise tax is effectively a “system benefits charge” (SBC)⁴²⁷ implemented at the municipal level. The City of New York could enact similar tax structures.⁴²⁸

C. Grant and Loan Programs

1. Federal Programs

Several federal grant programs could provide the City of New York with funding for climate change adaptation measures. The Energy Efficiency and Conservation Block Grant (EECBG) Program⁴²⁹ provides direct formula grants to cities and counties of a certain size for projects that improve energy efficiency and reduce GHG emissions and total energy use. The American Recovery and Reinvestment Act (ARRA)⁴³⁰ allocated approximately \$81 million in EECBG grant money to the City of

summaries/2009/sum07-06.pdf; *see also* Boulder City Council, Meeting Minutes (July 7, 2009), *available at* http://www.bouldercolorado.gov/files/City%20Council/Minutes/2009_minutes/07_07_09min.pdf.

⁴²⁶ Boulder City Council Agenda Item, Attachment A: Ordinance 7657 (July 9, 2009), *available at* <http://www.bouldercolorado.gov/files/Clerk/Agendas/2009/07-07-09/3h.pdf>.

⁴²⁷ System benefits charges are fees added to electricity bills enacted by over twenty states and the District of Columbia. They support renewable energy, energy efficiency, low-income customer programs, energy research and development, and other initiatives the competitive market is unlikely to provide. States administer these funds in different ways. *See generally* MARTIN KUSHLER & PATTI WHITE, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., A REVISED 50-STATE STATUS REPORT ON ELECTRIC RESTRUCTURING AND PUBLIC BENEFITS (2001).

⁴²⁸ In 2004, Denver voters approved a 0.4 percent sales tax increase to help finance the FasTracks program, which will expand and improve Denver’s transit system. *See* RTD FasTracks, Financing FasTracks, http://www.rtd-fastracks.com/main_33 (last visited Nov. 26, 2009). The City of New York could use revenue from a sales tax increase to make the City’s public transport system more resistant to inland flooding caused by climate change.

⁴²⁹ *See* U.S. Dep’t of Energy, Energy Efficiency and Renewable Energy (EERE), <http://www.eecbg.energy.gov> (last visited Nov. 22, 2009).

⁴³⁰ American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

New York⁴³¹ for, among other activities, weatherization, creation of financial incentive programs for energy-efficient retrofits, the modification of building codes and land use guidelines, and projects to increase the security and reliability of energy infrastructure. The City is awaiting approval for two EECBG grants: the Grant to Reduce Energy Consumption and Greenhouse Gas Emissions of Municipal Buildings and Operations and the Greener, Greater Buildings Loan Fund Grant.⁴³² Approximately another \$453 million in competitive grants eventually will be awarded under the EECBG Program.⁴³³

In some cases, municipal governments must apply to the state for federally capitalized grants. The Federal Emergency Management Agency (FEMA) administers three such grant programs relevant to climate change adaptation. The Pre-Disaster Mitigation Grant Program⁴³⁴ provides funding for hazard mitigation planning and the implementation of mitigation projects before a disaster. Similarly, FEMA's Flood Mitigation Assistance Program⁴³⁵ provides funding to communities in the form of planning and project grants for measures that reduce or eliminate the long-term risk of flood damage to any structure insurable under the National Flood Insurance Program.⁴³⁶ Lastly, FEMA's fiscal year 2009 Interoperable Emergency Communications Grant

⁴³¹ See EERE, Energy Efficiency and Conservation Block Grants Program: Grant Allocation, <http://www.eecbg.energy.gov/grantalloc.html> (last visited Nov. 26, 2009); see also U.S. Dep't of Energy, Recovery Act—Energy Efficiency and Conservation Block Grants Program, Formula Grants, Funding Opportunity Number: DE-FOA-0000013, Jul. 17, 2009, available at www.fedconnect.net/Fedconnect/PublicPages/PublicSearch/Public_Opportunities.aspx (search under public opportunities) (last visited Sept. 30, 2009).

⁴³² See N.Y. City, Status of Applied for Grants, http://www.nyc.gov/html/ops/nycstim/downloads/pdf/grant_status_tracker.pdf (last visited Sept. 30, 2009).

⁴³³ See U.S. Dep't of Energy, Energy Efficiency and Conservation Block Grants Program, <http://www.eecbg.energy.gov/about/default.html> (last visited Sept. 30, 2009).

⁴³⁴ The Pre-Disaster Mitigation Grant Program is subject to anticipated reauthorization beyond September 30, 2009. See FED. EMERGENCY MGMT. AGENCY (2009), *supra* note 338, at 2.

⁴³⁵ See Fed. Emergency Mgmt. Agency, Flood Mitigation Assistance Program, <http://www.fema.gov/government/grant/fma/index.shtml>, (last visited Jan. 16, 2010).

⁴³⁶ See Fed. Emergency Mgmt. Agency, The National Flood Insurance Program, <http://www.fema.gov/about/programs/nfip/index.shtml> (last visited Nov. 26, 2009).

Program (IECGP)⁴³⁷ provides funding to improve the communications systems used during natural disasters, acts of terrorism, and other man-made disasters. To obtain funding under IECGP, applicants must show that a disaster is an “imminent threat.” Such a showing is usually made with historical data.⁴³⁸

Two federally-funded state revolving loan programs—the Clean Water State Revolving Fund⁴³⁹ and the Drinking Water State Revolving Fund⁴⁴⁰—provide low-interest financing to municipalities and communities for water quality and public water system infrastructure projects. The loans are available for wastewater treatment, pollution control, non-point source pollution control, and watershed and estuary management. These projects can lessen the impact of climate change-related flooding, rises in sea level, and weather variability on the city’s public water systems.⁴⁴¹ The ARRA allocated approximately \$433 million and \$87 million in capitalization grants to these funds for the State of New York, respectively.⁴⁴²

Other federal grant programs provide funding directly to municipal agencies. For example, Title XII of the ARRA mandates that \$100 million in discretionary grants be distributed to public transit agencies for reducing energy consumption and GHG emissions.⁴⁴³

2. *State Programs*

State grants represent another funding mechanism for climate change adaptation measures in the City of New York. In October 2008, the New York State Department of Environmental Conservation (DEC) announced that \$3 million in grant funds⁴⁴⁴

⁴³⁷ See Fed. Emergency Mgmt. Agency, FY 2009 Interoperable Emergency Communications Grant Program, <http://www.fema.gov/government/grant/iecgp/index.shtml> (last visited Sept. 18, 2009).

⁴³⁸ Interview with Lynn Bagorazzi, Program Manager, U.S. Department of Homeland Security, Apr. 2, 2009 (notes on file with author).

⁴³⁹ EPA, Clean Water State Revolving Fund, <http://www.epa.gov/owm/cwfinance/cwsrf> (last visited Sept. 29, 2009).

⁴⁴⁰ *Id.*

⁴⁴¹ N.Y. CITY DEP’T OF ENVTL. PROTECTION, *supra* note 415, at 51, 57.

⁴⁴² See EPA, SRF ALLOTMENTS BASED ON FINAL ECONOMIC RECOVERY APPROPRIATIONS (2009) *available at* http://www.epa.gov/water/eparecovery/docs/Final_SRF_eco_recovery_allotments.pdf.

⁴⁴³ 12 Pub. L. No. 111–5, 123 Stat. 210 (2009).

⁴⁴⁴ Notice of Availability of State and Federal Funds, 30 N.Y. Reg. 96 (Oct.

would be made available under the New York City Watershed Protection Program⁴⁴⁵ for projects that protect and enhance the source waters of the city's water supply system. Eligible projects that would mitigate the effects on the city's source waters of weather fluctuations related to climate change⁴⁴⁶ include stormwater management and treatment; nonpoint source abatement and control; and assessment, planning, and research.

Other state grant programs, such as NYSERDA's New Construction Program,⁴⁴⁷ provide financial and technical assistance to design teams and building owners, including municipalities, who incorporate energy-efficient measures into the design, construction, and operation of new and substantially renovated buildings. NYSERDA administers similarly structured programs that provide funding for municipal water and wastewater system improvements,⁴⁴⁸ energy efficiency technical assistance services,⁴⁴⁹ and climate change impact and adaptation research.⁴⁵⁰ These programs are part of NYSERDA's New York Smart Energy Program and are funded by New York State's SBC Program.

22, 2008).

⁴⁴⁵ N.Y. State Dept. of Environmental Conservation, N.Y. City Watershed Program, <http://www.dec.ny.gov/lands/25599.html> (last visited Nov. 26, 2009).

⁴⁴⁶ N.Y. CITY DEP'T OF ENVTL. PROTECTION, *supra* note 415, at 51.

⁴⁴⁷ See NYSERDA, New Construction Program, http://www.nyserda.org/programs/New_Construction/default.asp (last visited Sept. 30, 2009).

⁴⁴⁸ See NYSERDA, Focus on Municipal Water and Wastewater, <http://www.nyserda.org/Programs/Environment/muniwaterwwt.asp> (last visited Nov. 24, 2009) (providing funding to municipalities for planning and installing energy-efficient equipment in water and wastewater treatment facilities).

⁴⁴⁹ See NYSERDA, Technical Assistance, Technical Assistance Program, http://www.nyserda.org/Programs/Technical_Assistance/default.asp (last visited Nov. 26, 2009) (providing cost-sharing of up to \$500,000 over five years to municipalities for energy efficiency feasibility studies, energy retro-commissioning and the development of long-term energy management strategies).

⁴⁵⁰ See NYSERDA Environmental Monitoring, Evaluation, and Protection Program, http://www.nyserda.org/programs/environment/emep/climate_change.asp (last visited Nov. 26, 2009) (providing funding for research on the effects of climate change and adaptation measures on energy systems). EMEP funded the New York City Regional Heat Island Initiative. http://www.nyserda.org/programs/environment/emep/project/6681_25/6681_25_pwp.asp (last visited Nov. 26, 2009).

3. *Municipal Programs*

Berkeley, California's Berkeley FIRST program⁴⁵¹ is an example of municipal funding that helps foster a private market related to climate change adaptation. It allows residential and commercial property owners to borrow money from the city's Sustainable Energy Financing District for the installation of solar photovoltaic electric systems, and to repay the cost over 20 years through an annual special tax on their property tax bills. The city will provide financing up to \$37,500 per installation. If the property is transferred or sold, the new owner pays the remaining tax obligation. The city finances this program by issuing bonds and paying bond holders with revenue from the special taxes.

D. *Incentive Programs*

1. *Federal Programs*

Homeowners, home builders, and owners or designers of new or existing commercial buildings may receive federal tax credits. New and existing homes are eligible for tax credits of 30 percent of the cost, without limit through 2016, for geothermal heat pumps, solar panels, solar water heaters, small wind energy systems, and fuel cells.⁴⁵² Existing homes are eligible for tax credits of 30 percent of the cost, up to \$1,500, for certain windows, doors, insulation, roofs, HVACs, water heaters, and biomass stoves.⁴⁵³ Builders are eligible for tax credits of \$1,000 to \$2,000 for homes that achieve certain levels of energy savings.⁴⁵⁴

Businesses are eligible for investment tax credits, without limit through 2016, of 30 percent of the cost for solar panels, fuel cells, and small wind turbines, and of 10 percent of the cost for geothermal systems, microturbines, and combined heat and power

⁴⁵¹ City of Berkeley, Cal., Office of Energy and Sustainable Development, Financing Initiative for Renewable and Solar Technology (FIRST), <http://www.berkeleyfirst.renewfund.com> (last visited Sept. 23, 2009).

⁴⁵² Residential Energy Efficient Property Credit, I.R.C. § 25D (2006). See also IRS Notice No. 2009-41, Credit for Residential Energy Efficient Property (2009), available at <http://www.irs.gov/pub/irs-drop/n-09-41.pdf>.

⁴⁵³ IRS, Energy Incentives for Individuals in the American Recovery and Reinvestment Act, <http://www.irs.gov/newsroom/article/0,,id=206875,00.html> (last visited Sept. 29, 2009).

⁴⁵⁴ See I.R.C. § 45L (2006)

(CHP) systems.⁴⁵⁵ The Internal Revenue Code allows bonus and accelerated five-year depreciation for these systems. In addition, a tax deduction of up to \$1.80 per square foot is available to owners or designers of commercial buildings that achieve certain levels of energy savings.⁴⁵⁶ Finally, the ARRA allows taxpayers who are eligible for either the business energy investment tax credit or the renewable electricity production tax credit to receive instead a grant from the U.S. Treasury Department for 10–30 percent of the cost of the eligible renewable energy component of the property.⁴⁵⁷

The Clean Energy Deployment Administration (CEDA)⁴⁵⁸ would be established as a “green bank” that promotes access to affordable financing for energy efficiency and clean energy projects through direct loans, letters of credit, loan guarantees, insurance products, and other credit enhancements or debt instruments.⁴⁵⁹ ARRA appropriations for renewable energy and energy efficiency projects and additional congressional appropriations are being considered as ways to fund CEDA. State, local, and private sector entities would be eligible for this financing opportunity.

2. State Programs

At the state level, NYSERDA administers a variety of incentive programs encouraging renewable energy and energy efficiency projects. Its Smart Loan Program⁴⁶⁰ offers a reduction

⁴⁵⁵ See I.R.C. § 48 (2006).

⁴⁵⁶ See I.R.C. § 179D (2006); see also Amplification of Notice 2006-52; Deduction for Energy Efficient Commercial Buildings, I.R.S. Notice 2008-40, available at http://www.irs.gov/irb/2008-14_IRB/ar12.html.

⁴⁵⁷ See U.S. TREASURY DEP’T, OFFICE OF THE FISCAL ASSISTANT SECRETARY, PAYMENTS FOR SPECIFIED ENERGY PROPERTY IN LIEU OF TAX CREDITS 5–6 (2009), available at <http://www.treas.gov/recovery/docs/guidance.pdf>.

⁴⁵⁸ The establishment of CEDA is proposed in both the American Clean Energy and Security Act, H.R. 2454, 111th Cong. §§ 186–191 (2009), and the American Clean Energy Leadership Act, S. 1462, 111th Cong. §§ 105–108 (2009). See also PHYSICIANS FOR SOCIAL RESPONSIBILITY, COMPARISON OF HOUSE AND SENATE CLEAN ENERGY DEPLOYMENT ADMINISTRATION (CEDA) PROVISIONS 1 (2009), available at <http://www.psr.org/assets/pdfs/ceda-provisions.pdf>. The American Clean Energy Leadership Act requires that the Federal Credit Authority functions of the Secretary of Energy be transferred to CEDA within 18 months of the enactment of the bill. S. 1462 § 107.

⁴⁵⁹ Kate Naseef, *House, Senate Bills Include ‘Green Bank’ to Finance Renewable Energy Projects*, 131 DAILY ENVTL. REP. (BNA), July 13, 2009, at A3.

⁴⁶⁰ NYSERDA, N.Y. Energy Smart Loan Fund Program,

of a participating lender's interest rate for up to ten years on loans for certain energy efficiency improvements and renewable technologies.⁴⁶¹ Residential and governmental buildings are eligible for an interest rate reduction of up to 4 percent, or up to 6.5 percent for Con Edison customers.⁴⁶² Qualifying projects include heating and air conditioning systems, solar and wind systems, and energy management systems.

The Solar Electric Incentive Program⁴⁶³ has been allocated nearly \$14 million for providing a typical residential or commercial solar panel system with cash coverage of approximately 40–45 percent of the installed cost.⁴⁶⁴

The Existing Facilities Program⁴⁶⁵ provides incentives for purchasing and installing more energy-efficient equipment, such as lighting, motors, natural gas equipment, and commercial kitchen equipment; and performance-based incentives, intended for large-scale energy efficiency projects, which require an engineering analysis to be submitted to NYSERDA. These incentives are provided for verifiable savings in electricity and gas use, clean and efficient CHP systems, and projects that reduce waste and increase productivity of industrial processes. Programs which facilitate renewables development through public financing have been adopted in other jurisdictions.⁴⁶⁶

<http://www.nyserda.org/loanfund> (last visited July 31, 2009). As of February 9, 2009, NYSERDA is no longer accepting applications to its Commercial Loan Fund and has not announced plans to reopen the fund.

⁴⁶¹ Another example of providing low-interest loans as an incentive is Oregon's recently passed Energy Efficiency and Sustainable Technology Act of 2009, which focuses on weatherization and renewable energy. H.B. 2626–A 75th Assem., Reg. Sess. (Or. 2009), available at <http://www.leg.state.or.us/09reg/measpdf/hb2600.dir/hb2626.en.pdf>. The loan program is financed through state bonds, federal stimulus funds, and private loans. The State of New York can consider these sources of funding in expanding or supplementing existing programs.

⁴⁶² NYSERDA, Home Owner Financing, <http://www.getenergysmart.org/SingleFamilyHomes/ExistingBuilding/HomeOwner/Financing.aspx#> (click on “New York Energy Smart Loan Fund” for more information) (last visited Dec. 21, 2009).

⁴⁶³ See NYSERDA, PV Incentives, <http://www.powernaturally.org/programs/solar/incentives.asp> (last visited Nov. 22, 2009).

⁴⁶⁴ *Id.*

⁴⁶⁵ NYSERDA, Existing Facilities Program, http://www.nyserda.org/programs/Existing_facilities/default.html (last visited Sept. 23, 2009).

⁴⁶⁶ See, e.g., Colo. S.B. 07-051, available at http://www.leg.state.co.us/Clics/Clics2007A/csl.nsf/fsbillcont3/8EFE2CB5022F6CF687257251007C22D3?Open&file=051_enr.pdf (expanding incentive programs for

3. *Municipal Programs*

At the municipal level, the City of New York administers the Industrial and Commercial Abatement Program (ICAP),⁴⁶⁷ which provides real estate tax abatements for up to twenty-five years on a wide variety of industrial and commercial building and renovation. Eligible projects include those with adaptive purposes, such as energy efficiency technologies, on-site generation equipment, and reinstalling critical systems in less flood-prone locations. Companies eligible for ICAP are also eligible for the Energy Cost Savings Program (ECSP),⁴⁶⁸ which provides businesses with city-funded discounts on the regulated transmission and delivery portions of electricity and natural gas bills. Benefits last for eight years, followed by a four-year phase-out. The City provides a four-year property tax credit of up to 8.75 percent of the cost, after NYSERDA rebates, of buying and installing residential and commercial solar systems.⁴⁶⁹ The maximum credit per project is \$62,000. In January 2011, the credit will be reduced from 8.75 percent to 5 percent per year.

Additionally, the New York Independent System Operator (NYISO), a not-for-profit corporation which operates the state's power grid, administers the Emergency Demand Response Program.⁴⁷⁰ Customers with on-site or emergency generators receive incentive payments if they use their own power to reduce demand on the New York grid during declared peak times.⁴⁷¹

renewable energy projects). Governor Bill Ritter of Colorado signed this bill into law in April 2009. Press Release, Governor Bill Ritter, Gov. Ritter Signs Renewable Energy Finance Act (Apr. 22, 2009), *available at* <http://www.colorado.gov/cs/Satellite/GovRitter/GOVR/1240404111414>.

⁴⁶⁷ See N.Y. City Dep't of Finance, Industrial and Commercial Abatement Program, http://www.nyc.gov/html/dof/html/property/property_tax_reduc_incentive.shtml (last visited Nov. 26, 2009).

⁴⁶⁸ See N.Y. City, Energy Cost Savings Program (ECSP), <http://www.nyc.gov/html/sbs/nycbiz/html/incentives/ecsp.shtml> (last visited Nov. 22, 2009).

⁴⁶⁹ N.Y. REAL PROP. TAX LAW §§ 499–aaaa to –gggg (McKinney 2008).

⁴⁷⁰ See N.Y. INDEPEN. SYS. OPERATOR, EMERGENCY DEMAND RESPONSE PROGRAM MANUAL (2008), *available at* http://www.nyiso.com/public/webdocs/products/demand_response/emergency_demand_response/edr_p_mnl.pdf.

⁴⁷¹ See *id.* §§ 2.1, 2.4, 4.2, 5.

E. *Municipal and Tax Credit Bonds*

Municipal bonds are time-tested methods for funding infrastructure.⁴⁷² General obligation bonds are secured by the pledge of the government's taxing power, and revenue bonds are secured by the pledge of project revenues. In 2001, San Francisco voters approved the sale of \$100 million in revenue bonds to pay for solar panels, energy-efficiency technologies, and wind turbines for public facilities.⁴⁷³ Money which would have purchased electricity was used to pay obligations on the bonds.⁴⁷⁴ These bonds bundled projects with shorter payback periods, such as energy-efficiency technologies and wind turbines, with more costly solar projects. By evaluating the costs on a whole-project basis, some of which will be recovered in a few years, the city effectively lowered the cost of solar projects.⁴⁷⁵

Federal initiatives have provided eligible governments and power companies an attractive means of financing certain projects through "tax credit bonds." Bond holders receive a federal tax credit in lieu of interest, enabling the bond issuer to borrow money at a zero percent interest rate. The Energy Policy Act of 2005⁴⁷⁶ created "clean renewable energy bonds" (CREBs) and authorized governments and municipal and cooperating power companies to issue \$800 million of the bonds to finance renewable energy projects.⁴⁷⁷ The Energy Improvement and Extension Act of 2008 (EIEA)⁴⁷⁸ extended the deadline⁴⁷⁹ for issuing bonds to December 31, 2009 and created another CREB program of \$800 million, one-third of which is allocated to governmental bodies.⁴⁸⁰ The ARRA authorizes the further issuance of \$1.6 billion in CREBs.⁴⁸¹ In April 2009, the Internal Revenue Service (IRS) announced that it

⁴⁷² Mayraj Fahim, *Municipal Bonds Have Been Issued by U.S. Local Government Since 1812*, CITY MAYORS FIN., Oct. 22, 2009, <http://www.citymayors.com/finance/bonds.html>.

⁴⁷³ See Sussman, *supra* note 196, at 41 (describing San Francisco's renewable energy bond initiative).

⁴⁷⁴ *Id.*

⁴⁷⁵ *Id.*

⁴⁷⁶ Energy Policy Act of 2005, Pub. L. No. 109-58, 119 Stat. 594 (2005).

⁴⁷⁷ *See id.* § 1303.

⁴⁷⁸ Energy Improvement and Extension Act of 2008, Pub. L. No. 110-343, Div. B, 122 Stat. 3765 (2008).

⁴⁷⁹ *See id.* § 107(c).

⁴⁸⁰ *See id.* § 107(a).

⁴⁸¹ Pub. L. No. 111-5 § 1111.

would accept applications for the new allocations made in 2008 and 2009 until August 4, 2009.⁴⁸²

The EIEA created “qualified energy conservation bonds” (QECBs) in the amount of \$800 million to be issued by state and municipal governments.⁴⁸³ The Secretary of the Treasury will allocate bonds to each state based on population, and to “large local governments” within a state according to its share of the state’s population.⁴⁸⁴ The ARRA authorizes an additional \$2.4 billion in QECBs.⁴⁸⁵ In April 2009, the IRS issued official guidance for prospective applicants.⁴⁸⁶

The City of New York can finance any type of adaptation measure by issuing revenue bonds. The municipality can also apply for allocations to issue CREBs, or issue QECBs with its population-based allocation, to finance a more limited set of adaptation measures. CREB revenues can be used for projects generating electricity from biomass, solar energy, landfill gas, trash combustion, incremental hydropower, and wave energy.⁴⁸⁷ QECB revenues can be used for reducing energy consumption in publicly-owned buildings and mass commuting facilities, implementing green community programs, and for demonstration programs for green building technology.⁴⁸⁸

F. *Feed-in Tariffs*

The City of New York can supplement existing output from the power grid by encouraging on-site production of renewable energy. This would reduce the incidence of brownouts and blackouts due to the spikes in energy demand⁴⁸⁹ that accompany

⁴⁸² See New Clean Renewable Energy Bonds Application Solicitation and Requirements, IRS Notice 2009–33, *available at* <http://www.irs.gov/pub/irs-n-09-33.pdf>.

⁴⁸³ Energy Improvement and Extension Act of 2008, Pub. L. No. 110–343, Div. B, § 301(a).

⁴⁸⁴ *Id.*

⁴⁸⁵ Pub. L. No. 111–5 § 1112(a).

⁴⁸⁶ See Rev. Proc. 2009–3, 2009–29 I.R.B. 150.

⁴⁸⁷ Energy Policy Act of 2005, Pub. L. No. 109–58 § 1303(a).

⁴⁸⁸ Pub. L. No. 110–343, Div. B, § 301(a).

⁴⁸⁹ Peak energy demand has been estimated to increase between 11–17 percent in the next 75 years. COLUMBIA EARTH INST., CLIMATE CHANGE AND A GLOBAL CITY: METRO EAST COAST at xiii (2001), *available at* http://ccsr.columbia.edu/cig/mec/0.2_Executive_Summary.pdf.

increasingly frequent heat waves.⁴⁹⁰ Feed-in tariffs, which place a legal obligation on utility companies to purchase electricity from renewable energy producers at an above-market price, usually over a long, guaranteed period,⁴⁹¹ are a way for the city to promote such renewable energy production.⁴⁹² Families and businesses receive a steady revenue return to defray the cost of renewable energy installations such as solar panels or wind turbines, shifting the subsidization of renewable energy from taxpayers to electricity ratepayers, who share a utility's cost of purchasing the relatively expensive renewable energy.⁴⁹³

Policymakers at various levels of government have made progress in implementing feed-in tariffs. In January, Washington State legislators introduced a bill⁴⁹⁴ modeled on Germany's Renewable Energy Sources Act.⁴⁹⁵ In February, the California

⁴⁹⁰ See Howe, *supra* note 194, at 209.

⁴⁹¹ WORLD FUTURE COUNCIL, FEED-IN TARIFFS—BOOSTING ENERGY FOR OUR FUTURE 6 (2007), available at http://www.hermannscheer.de/en/images/stories/pdf/WFC_Feed-in_Tariffs_jun07.pdf.

⁴⁹² In March 2009, Gainesville, Florida became the first city in the United States to introduce higher payments for solar power. Kate Galbraith, *Europe's Way of Encouraging Solar Power Arrives in the U.S.*, N.Y. TIMES, Mar. 13, 2009, at B1. See also Gainesville, Fla., Ordinance 080566, available at <http://gainesville.legistar.com/View.ashx?M=F&ID=610853&GUID=B6001CA9-8ADD-481F-9CDE-4703CB77BD74>. Unlike Gainesville, the City of New York regulates but does not own the utility, Con Edison, which provides much of its power. This complicates, but does not necessarily preclude, efforts to enact a similar policy.

⁴⁹³ See Galbraith, *supra* note 492, at B1. Feed-in tariffs have been widely used in Europe since the early 1990s to encourage renewable energy. PAUL GIPE, RENEWABLE ENERGY POLICY MECHANISMS 1 (2006), available at <http://www.wind-works.org/FeedLaws/RenewableEnergyPolicyMechanismsbyPaulGipe.pdf>. In Germany, the funding mechanism has led to a significant increase in the number of installed solar panels—five times as many as the United States has in a country about the size of Montana. Anne C. Mulkern, *Renewable Energy: Some See Daylight at Last for U.S. Feed-in Tariffs*, GREENWIRE, Mar. 24, 2009.

Notably, feed-in tariffs kick-started Germany's domestic renewable energy market without requiring large government subsidies. Ratepayers' monthly electricity bills increased by approximately €1.50, or roughly \$2, per household. WORLD FUTURE COUNCIL, *supra* note 491, at 9.

⁴⁹⁴ H.B. 1086, 61st Leg., 2009 Reg. Sess. (Wash. 2009).

⁴⁹⁵ The Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety in Germany provides legally non-binding translations of the 2000 and 2004 Renewable Energy Sources Acts at <http://www.erneuerbare-energien.de/inhalt/3242/> (2000 Act) (last visited Nov. 26, 2009) and <http://www.erneuerbare-energien.de/inhalt/6465/> (2004 Act) (last visited Nov. 26, 2006).

Public Utilities Commission approved long-term prices for state utilities to purchase renewable energy from customers.⁴⁹⁶ In July, Oregon passed a bill which directs its Public Utility Commission to create a feed-in tariff pilot program.⁴⁹⁷ Other states contemplating feed-in tariff legislation include California, Minnesota, Michigan, and Indiana.⁴⁹⁸ At the federal level, Congress is considering such a program under a national renewable portfolio standard.⁴⁹⁹

G. *Other Potential Sources of Funding*

1. *Federal Sources*

The “Climate Change Adaptation Act” (S. 2355) amends the National Climate Program to “enhance the ability of the United States to develop and implement climate change adaptation programs and policies.”⁵⁰⁰ The bill requires the President to present to Congress a five-year national strategic plan for addressing the impacts of climate change, identifying implementation and funding strategies for short-term and long-term actions at the federal, regional, state, and municipal levels. The bill authorizes annual appropriations of \$45 million for the fiscal years 2009–2013, \$25 million of which will be available to coastal states for developing and implementing coastal and ocean adaptation programs.⁵⁰¹ If this or a comparable bill were to become law, the City of New York could have access to adaptation-specific funding.

⁴⁹⁶ Press Release, California Public Utilities Commission, CPUC Approves Feed-in Tariffs to Support Development of Onsite Renewable Generation (Feb. 14, 2008), *available at* http://docs.cpuc.ca.gov/PUBLISHED/NEWS_RELEASE/78824.htm.

⁴⁹⁷ Press Release, Office of the Governor of Oregon, Governor Kulongoski Signs Climate Change Regulation into Law (July 22, 2009), *available at* http://governor.oregon.gov/Gov/P2009/press_072209.shtml. *See also* H.B. 3039, 75th Leg. Assem. (Or. 2009), *available at* <http://www.leg.state.or.us/09reg/measpdf/hb3000.dir/hb3039.en.pdf>.

⁴⁹⁸ Katherine Ling, *Energy Panel Examines Policy Barriers to Small-Scale Renewable Production*, ENV'T & ENERGY DAILY, May 4, 2009.

⁴⁹⁹ Colin Sullivan, *California Likely to Limit Feed-in Tariff to 10 MW*, GREENWIRE, May 27, 2009.

⁵⁰⁰ Climate Change Adaptation Act, S. 2355, 110th Cong. (as introduced on Nov. 14, 2007).

⁵⁰¹ *See id.* §§ 6–7.

2. *State Programs*

Title IV of the ARRA⁵⁰² provides discretionary funding through the Army Corps of Engineers for water-related environmental infrastructure—approximately \$2 billion each for construction and operations/maintenance, and \$25 million for studies. The Corps' finalized list of Civil Works projects includes two streambank protection projects and one salt marsh restoration project within city limits,⁵⁰³ with a total planned allocation of approximately \$6 million.⁵⁰⁴ The City of New York's adaptation efforts may benefit from these and other projects that affect the city's water supply.

3. *ESCOs*

Some energy-efficiency projects require a large initial capital investment to be repaid over a relatively long period. Instead of financing these initiatives through direct appropriations, state and municipal policymakers may work with energy service companies (ESCOs) which develop, design, and finance energy-efficiency projects; install and maintain the equipment involved; measure, monitor, and verify the project's energy savings; and assume the risk that the project will not save the amount of energy guaranteed.⁵⁰⁵ ESCOs often enter into performance-based contracts under which they are compensated based on the amount of energy saved.⁵⁰⁶

The City of New York is authorized under the state's enabling legislation⁵⁰⁷ to develop and implement ESCO projects through a

⁵⁰² American Recovery and Reinvestment Act, Pub. L. No. 111-5, tit. IV, 123 Stat. 115, 134-35 (2009).

⁵⁰³ U.S. Army Corps of Engineers, Civil Works Project Lists, <http://www.usace.army.mil/recovery/Pages/Projects.aspx> (last visited Nov. 26, 2009).

⁵⁰⁴ See Army Corps of Engineers—Civil Works Expenditure Plan: Construction, http://www.usace.army.mil/recovery/Documents/ARRA_Construction.pdf (last visited Nov. 26, 2009).

⁵⁰⁵ Nat'l Ass'n of Energy Serv. Cos., What Is an ESCO?, <http://www.naesco.org/resources/esco.htm> (last visited Nov. 24, 2009).

⁵⁰⁶ For more information on performance-based and other types of contract agreements used by ESCOs and their clients, see JULIE OSBORN ET AL., ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB., ASSESSING U.S. ESCO INDUSTRY: RESULTS FROM THE NAESCO DATABASE PROJECT, ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY (2002), available at <http://eetd.lbl.gov/EA/EMP/reports/50304.pdf>.

⁵⁰⁷ N.Y. ENERGY LAW §§ 9-101 to -103 (McKinney 2004).

“request for proposal” (RFP) process. The maximum contract term of thirty-five years⁵⁰⁸ is consistent across institutional markets (e.g., state facilities, universities, municipal government, and school district facilities), which avoids high transaction costs from procurement and contracting.⁵⁰⁹ A longer contract term⁵¹⁰ also gives more flexibility to finance projects that are comprehensive⁵¹¹ or have longer payback periods, such as renewable energy infrastructure.⁵¹² The enabling legislation encourages consultation with NYSERDA,⁵¹³ which provides advice and assistance.

4. *Partnerships*

Municipalities can partner with federal agencies and local utilities to utilize funding streams to which they otherwise would not have access. Cities can partner with the National Oceanic and Atmospheric Administration (NOAA)’s federally-funded National Weather Service,⁵¹⁴ for example, to implement a customized system⁵¹⁵ designed to issue accurate and timely heat advisories to the public.

The Community Energy Partnership (CEP) is a collaboration among ten Southern Californian cities and two utilities (The Gas Company and Southern California Edison) that provides energy-efficiency retrofits for homes, small businesses, and municipal facilities; workforce energy-efficiency training and education; and other activities in line with California’s Long-Term Energy

⁵⁰⁸ See *id.* § 9-103.

⁵⁰⁹ RANJIT BHARVIRKAR ET AL., ERNEST ORLANDO LAWRENCE BERKELEY NAT’L LAB., PERFORMANCE CONTRACTING AND ENERGY EFFICIENCY IN THE STATE GOVERNMENT MARKET 23 (2008), available at http://www.naesco.org/resources/industry/documents/lbnreportESCOSStateGovt_112008.pdf.

⁵¹⁰ The majority of states authorize twenty year contracting terms. See *id.* at 25.

⁵¹¹ *Id.* (citing DONAHUE AND ASSOCIATES, A REVIEW OF MARYLAND’S ENERGY PERFORMANCE CONTRACTING PROGRAM (2006)).

⁵¹² *Id.* at 24–25.

⁵¹³ N.Y. ENERGY LAW § 9-103(4) (McKinney 2004).

⁵¹⁴ See Nat’l Weather Serv., About NOAA’s National Weather Service, <http://www.nws.noaa.gov/admin.php> (last visited Sept. 23, 2009).

⁵¹⁵ Press Release, Nat’l Oceanic and Atmospheric Admin., NOAA’s National Weather Service Debuts Heat/Health Watch Warning System in Parts of San Francisco Bay Area (June 21, 2007), available at <http://www.publicaffairs.noaa.gov/releases2007/jun07/noaa07-r214.html>.

Efficiency Strategic Plan.⁵¹⁶ The program is funded by utility ratepayers and had a proposed budget of \$2.3 million for the 2006–2008 funding cycle.⁵¹⁷ The City of New York could implement a similar program in partnership with Con Edison.

5. *Renewable Energy Mitigation Program*

In 2000, Aspen, Colorado adopted a Renewable Energy Mitigation Program (REMP), which requires homeowners and builders to pay a fee if their new or renovated home exceeds a specified level of energy consumption.⁵¹⁸ The fees are directed to energy-efficiency and renewable energy projects in the area. Funds from comparable programs could be used for adaptive purposes.

CONCLUSION

Following years of leadership on climate change at the state and local levels, federal law is now being developed to address not only climate change mitigation but also adaptation. There is a growing acceptance of pursuing climate change solutions as the scientific certainty grows and the co-benefits—including energy security, energy reliability, and a cleaner environment—become more apparent. At the federal level, the U.S. House of Representatives passed the American Clean Energy and Security Act of 2009⁵¹⁹ in June 2009, the first time the House has approved cap-and-trade legislation to, among other objectives, address global warming. It devotes significant attention to adaptation measures, which are now an integral part of the discourse on national climate change policy.⁵²⁰ While the activity at the federal level is necessary, it is crucial that parallel activity on climate change continue at the state and local levels as well.

⁵¹⁶ Community Energy Partnership, <http://www.communityenergypartnership.org> (last visited Nov. 24, 2009).

⁵¹⁷ S. CAL. EDISON, COMMUNITY ENERGY PARTNERSHIP (RESOURCE) 1 (n.d.), available at <http://www.sce.com/NR/rdonlyres/DA8FAE53-B482-4AEE-B3AA-04F4ED554941/0/SCE2524COMMUNITYENERGYPARTNERSHIPPROGRAMRESOURCE.pdf>.

⁵¹⁸ ASPEN, COLO., UNIF. BLDG. CODE ch. 8.20.020 § 311 (2002); see Cmty. Office of Resource Efficiency, The Renewable Energy Mitigation Program, <http://www.aspencore.org/file/REMP.html> (last visited Nov. 24, 2009).

⁵¹⁹ H.R. 2454, 111th Cong. § 201 (as passed by the House of Representatives, June 26, 2009).

⁵²⁰ *Id.* §§ 451–495.

New York City has been among the most active and successful local governments in facing up to the challenges not only of mitigation but also of adaptation to climate change. The City is actively working through planning, zoning, and code changes to require a host of measures to foster, and to remove impediments to, adaptation through law and regulation. Beyond the legal framework, a series of guidance manuals are being prepared by New York City for both public and private development that will increase robustness and resilience to climate change. To maximize the efficacy of its efforts, New York City should continue to engage in intergovernmental and regional efforts to develop optimal plans for the future to foster adaptation. A continuation of the City's public outreach campaign is necessary to elicit support from the general population, to inspire individual action, and to gain support for governmental initiatives.

There will be many policy decisions to be made as these initiatives are developed. Short-term goals may conflict in some instances with the long-term goals. For example, the desire to close more polluting electricity generation facilities now may conflict with long-term needs for adequate generation to meet increased demand. Adaptation measures may in some instances conflict with mitigation measures. For example, siting a new facility above a future floodplain may require users today to travel long distances in GHG-emitting transit modes.⁵²¹ The engagement of a broad range of stakeholders, both governmental and private, will be necessary to make optimal decisions.

New York City's progress on adaptation and the updating of adaptation planning can be advanced by requiring periodic reassessments. Following the issuance of PlaNYC,⁵²² Local Law No. 17 created the Mayor's Office of Long Term Planning and Sustainability and required an annual assessment and report on the city's performance with respect to identified sustainability indicators and the development of an updated long term sustainability plan every four years.⁵²³ A parallel requirement for comprehensive adaptation planning and annual assessments could be enacted to assure continued progress on adaptation measures.

⁵²¹ Elisabeth M. Hamin & Nicole Gurran, *Urban Form and Climate Change: Balancing Adaptation and Mitigation in the U.S. and Australia*, 33 HABITAT INT'L 238, 242 (2009).

⁵²² PLANYC, *supra* note 15.

⁵²³ N.Y. CITY, N.Y., LOCAL LAW No. 17 § 2 (2008).

As planning for adaptation must be guided by periodically updated scientific information and predictions, the legislative establishment of a local scientific and technical advisory body would be of great assistance to New York City in its planning efforts.

In the end the choice is ours. Will we follow a path of reactive adaptation and respond only as conditions on the ground actually change, or are we going to embark on proactive adaptation to prepare now and minimize future damage?⁵²⁴ Law and regulation can and does play an important role in setting New York City on the path towards proactive adaptation.

⁵²⁴ See generally Ira Feldman and Joshua H. Kahan, *Preparing for the Day After Tomorrow: Frameworks for Climate Change Adaptation*, SUSTAINABLE DEV. L. & POL'Y., Fall 2007, at 61 (outlining international and domestic efforts addressing climate change adaptation policy).