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Sink or Swim: In Search of a Model for Coastal City Climate Resilience

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Sarah J. Adams-Schoen*

Introduction.....	434
I. Climate Change Resilience from the Ground Up	440
A. Municipal Governments and Mitigation.....	442
B. Municipal Governments and Adaptation	443
II. New York City’s Climate Change Resilience Initiatives ..	449
A. New York City and Climate Change: The “New Normal”	449
B. New York City Takes a Comprehensive Approach to Climate Change	453
1. Long-Term Comprehensive Sustainability Planning That Includes Climate Change Mitigation	454
2. Climate Change Resilience and Coastal Protection Planning.....	455
3. Local-Scale Climate Models and Risk Analysis	458
4. NYC Green Codes Task Force.....	460
5. Zoning Code Amendments	462
III. New York City: A Model for Climate Change Resilience?.....	463
A. PlaNYC: A Persuasive Narrative About a Climate Resilient Future.....	465

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B. The Super Wicked Problem of Waterfront Development	469
C. 80 by 50: Impressive but Probably Insufficient to Stay Within a 2°C Pathway	479
1. Is the City's Target Sufficient to Avoid Dangerous Interference with the Climate System?.....	479
2. Can the City Achieve Deeper Reductions?	486
D. Setting the Standard for Local Data Collection, Analysis and Benchmarking	489
E. Green Building Codes and Benchmarking for a Resilient Future	492
F. Lack of Intergovernmental Integration—A Formidable Obstacle to Coastal Climate Change Resilience	501
1. Municipalities Must Look Elsewhere for a Regional Model that Incorporates a Hub City and Its Extensive Suburbs.....	502
2. The Need for More State and Federal Support of Local Climate Resilience Planning	505
Conclusion	511

INTRODUCTION

Although the threats of global climate change¹ are by no means limited to coastal areas,² coastal cities face extreme and

1. Some definitions of “climate change” focus on changes in climate caused by human activities only, while others include all changes in climate, whether caused by human activity or natural variability in climate. *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 6 (Martin Parry et al. eds., 2007) [hereinafter AR4 WGII], *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg2_report_impacts_adaptation_and_vulnerability.htm [<http://perma.cc/LF39-GG33>] (“IPCC usage refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the Framework Convention on Climate Change, where *climate change* refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.”). A handful of scholars advocate for use of the term “climate disruption,” first coined by John Holdren, rather than “global warming” or “climate change,” arguing that climate disruption is a more accurate, active and instrumental term. *See* David Malakoff, *Let's Call It 'Climate Disruption,' White House Science Adviser Suggests (Again)*, SCIENCE (May 2, 2014, 3:15

unique challenges. Global temperatures are increasing and the rate of increase is accelerating—with corresponding increases in sea levels, acidification of oceans, and losses of flood-mitigating wetlands.³ Storms and other extreme weather events are increasing in frequency and severity.⁴ As a result, coastal communities are already experiencing rising sea levels, eroding shores, more massive storm surges, more severe storms, salt water intrusion, loss of land and changes in marine resources⁵—and all cities can expect increased incidences of, and more extreme, storms, heat waves, droughts, and other extreme weather conditions.⁶

New York City in particular faces grave threats from climate change. With 520 miles of coastline, the City's coastline is longer than the coastlines of Miami, Boston, Los Angeles, and San Francisco combined.⁷ According to the New York City Mayor's Office, more than eight million New Yorkers live in areas vulnerable to flooding, storm surges and other natural disaster-related risks.⁸ Nearly half a million of these residents live on 120 square miles of land that is less than 6 feet above the high tide line.⁹ This extremely vulnerable land is also

PM), available at <http://news.sciencemag.org/climate/2014/05/lets-call-it-climate-disruption-white-house-science-adviser-suggests-again> [<http://perma.cc/9WBC-TC26>].

2. See, e.g., John R. Nolon, *Land Use and Climate Change Bubbles: Resilience, Retreat and Due Diligence*, 39 WM. & MARY ENVTL. L. & POL'Y REV. 321, 337, 343 (2015) (discussing climate change related real estate market collapses in Sidney, a village located along the Susquehanna River in the Catskill Mountains of New York; Spicewood Beach, a lakeside community in Texas; and Elkhart, a small farming town in southwestern Kansas).

3. See *infra* Part II.A.

4. See *id.*

5. See *id.* Of course, the effects of these changes are not limited to coastal cities, nor are the consequences of direct harms to coastal cities limited to those localities. See generally Robin Kundis Craig, *Climate Change, Sustainable Development, and the Fifth Assessment Report*, in Sarah Adams-Schoen et al., *A Response to the IPCC Fifth Assessment*, 45 ENVTL. L. REP. NEWS & ANALYSIS 10027, 10031 (2015) (discussing global interdependencies with respect to the effect of climate change-related harms).

6. See *infra* Part II.A.

7. CITY OF NEW YORK, PLANYC: A STRONGER, MORE RESILIENT NEW YORK 40 (June 2013) [hereinafter STRONGER, MORE RESILIENT], available at <http://www.nyc.gov/html/sirr/html/report/report.shtml> [<http://perma.cc/C58V-B56D>].

8. *Id.* at 207.

9. BEN STRAUSS ET AL., NEW YORK AND THE SURGING SEA: A VULNERABILITY ASSESSMENT WITH PROJECTIONS FOR SEA LEVEL RISE AND COASTAL FLOOD RISK, CLIMATE CENTRAL RESEARCH REPORT 8 (2014), available at <http://sealevel.climatecentral.org/uploads/ssrf/NY-Report.pdf> [<http://perma.cc/3KFX-6LDZ>]. Super Storm

home to property valuing \$101 billion, more than 1,500 miles of road, 1,200 EPA-listed sites, and 100 public schools.¹⁰

Given these vulnerabilities, it may not be surprising that New York City is on a short list of U.S. cities that began proactively planning for future climate-change related risks in the early 2000s.¹¹ Since then, the city has assessed its vulnerabilities, planned for, and, significantly, begun implementing extensive mitigation¹² and adaptation¹³ initiatives.¹⁴ But, notwithstanding New York City's arguably proactive¹⁵ commitment to climate change resilience,¹⁶ on

Sandy's peak flood elevation was nine feet above the high tide line as measured at the Battery in New York City. *Id.*

10. STRAUSS ET AL., *supra* note 9, at 8.

11. The city released *PlaNYC: A Greater, Greener New York*, its first long-term comprehensive sustainability plan, on Earth Day, April 22, 2007. See CITY OF NEW YORK, PLANYC: A GREENER, GREATER NEW YORK (April 2007) [hereinafter GREENER, GREATER], available at <http://www.nyc.gov/html/planyc/html/publications/publications.shtml?process=1&type=Report> [<http://perma.cc/P24G-7VWM>]; see also JoAnn Carmin et al., PROGRESS AND CHALLENGES IN URBAN CLIMATE ADAPTATION PLANNING: RESULTS OF A GLOBAL SURVEY 10 (2012) [hereinafter ICLEI 2011 SURVEY], available at <http://www.icleiusa.org/action-center/learn-from-others/progress-and-challenges-in-urban-climate-adaptation-planning-results-of-a-global-survey> [<http://perma.cc/SR62-4C6A>] (stating that as of 2011, only 13% of U.S. cities surveyed had completed even an assessment of climate-change related vulnerabilities); *infra* notes 59–60 & accompanying text (discussing ICLEI 2011 SURVEY).

12. The IPCC defines “mitigation” as “anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases.” AR4 WGII, *supra* note 1, at 750.

13. The IPCC defines “adaptation” as “the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” *Id.* at 6.

14. See generally *infra* Part II.

15. Although New York City was among a handful of U.S. cities that began comprehensive planning for climate change in the early 2000s, from a global perspective the city was late to the party. See Harriet Bulkey & Heike Schroeder, *Global Cities and the Politics of Climate Change*, in HANDBOOK OF GLOBAL ENVIRONMENTAL POLITICS 249, 250–51 (Peter Dauvergne ed., 2012) (identifying the following five U.S. municipalities that participated in a CO₂ reduction project which began in 1991: Minneapolis-St. Paul, Minnesota; Portland, Oregon; Chula Vista, California; Denver, Colorado; Miami-Dade County, Florida); see also Portland, Or., Resolution No. 35207 (Nov. 10, 1993).

16. The New York City Mayor's Office defines “resiliency” as “our capacity to survive, adapt, and grow in the face of stress and shocks.” CITY OF NEW YORK, ONE CITY, BUILT TO LAST 20 (Revision 1.1 2014), available at <http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf> [<http://perma.cc/GG49-NHDN>]. The United Nations Office for Disaster Risk Reduction defines “resilience” as “[t]he capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of

October 29, 2012, “Super Storm Sandy” struck a massive blow to the Big Apple—which caused the deaths of 44 New Yorkers,¹⁷ left nearly 2 million people without power,¹⁸ and resulted in \$19 billion in damage¹⁹—highlighting the need to weigh climate change and disaster resiliency more heavily on the City’s policy scales.

Describing the effect of Sandy on the relative priority of climate resilience policies, the City observed that “[i]n October 2012, with the arrival of Sandy, the case for increased climate resiliency—even beyond the initiatives [previously] set forth . . . —was forcefully made to all New Yorkers.”²⁰ New York City responded by undertaking a prompt and remarkably thorough analysis of its climate change resilience, and immediately implementing many of the measures identified in that analysis.²¹ This resulted in, among other things, extensive amendments to zoning and building codes to transform New York City into a more disaster-resilient city²² and to continue decreasing New York City’s greenhouse gas (“GHG”) emissions.²³

A change in the City’s administration on January 1, 2014, heralded an even greater commitment to mitigation, additional sustainability initiatives, and continued implementation of the prior administration’s comprehensive sustainability and resilience plans, *A Greener, Greater New York* and *A Stronger, More Resilient New York*, respectively.²⁴ Among other things,

organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.” *Terminology*, U.N. OFFICE FOR DISASTER RISK REDUCTION, <http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm> [<http://perma.cc/C69Q-BHEV>] (last visited May 20, 2015). This article treats the term “resilience” (or “resiliency,” its more popular form in the United States) as encompassing both adaptation and mitigation. *See infra* Part I.

17. STRONGER, MORE RESILIENT, *supra* note 7, at 13–14.

18. *Id.* at 11.

19. *Id.*

20. *Id.* at 40.

21. *Id.* at 3; *see also infra* Part II.B.2 (discussing *Special Initiative for Rebuilding and Resiliency*).

22. *See infra* Part II.B.5 (discussing amendments to New York City’s zoning and building codes).

23. *See infra* Parts II.B.1 and III.C (discussing GHG emissions reductions targets).

24. *See also* CITY OF NEW YORK, PROGRESS REPORT 2014: A GREENER, GREATER NEW YORK, A STRONGER, MORE RESILIENT NEW YORK (2014), *available at* http://www.nyc.gov/html/planyc/downloads/pdf/publications/140422_PlaNYCP-Report_

Mayor de Blasio's Administration increased the City's GHG emissions reduction commitment from 30% by 2030 to 80% by 2050 (from a 2005 baseline), formed the Mayor's Office of Recovery and Resiliency, amended the City's air pollution code, and expressly acknowledged the City's role in conducting and regulating substantial emissions-generating activities.²⁵ In 2014, the City published its sixth annual progress report on the City's mitigation and resilience initiatives²⁶ and its fourth annual benchmarking report on the reduction of GHG emissions from buildings,²⁷ adding to a voluminous collection of data tracking the City's strategies, successes, and challenges.²⁸

Given the robustness of New York City's approach as well as the need for "high adaptation" of coastal cities,²⁹ municipalities across the United States, and coastal cities in particular, can benefit from examining New York City's strategies, successes, and lessons learned.³⁰ As discussed below, many of New York City's climate change measures have put the City in a league of its own, contributing significantly to the City's resilience, decreasing GHG emissions, and providing significant co-

FINAL_Web.pdf [<http://perma.cc/KN9D-XM7J>] [hereinafter PROGRESS REPORT 2014]; see generally *infra* Part II.

25. See generally *infra* Part II; PROGRESS REPORT 2014, *supra* note 24.

26. See PROGRESS REPORT 2014, *supra* note 24.

27. See CITY OF NEW YORK, NEW YORK CITY LOCAL LAW 84 BENCHMARKING REPORT SEPTEMBER 2014 (September 2014), available at http://www.nyc.gov/html/planyc/downloads/pdf/publications/2014_nyc_ll84_benchmarking_report.pdf [<http://perma.cc/QHD5-EV58>] [hereinafter BENCHMARKING REPORT 2014].

28. See generally *PlaNYC Publications*, MAYOR'S OFFICE OF RECOVERY & RESILIENCY, <http://www.nyc.gov/html/planyc/html/publications/publications.shtml?process=1&type=Report> [<http://perma.cc/P24G-7VWM>] (last visited May 20, 2015) (providing downloadable pdfs of 63 City reports related to sustainability).

29. See *infra* notes 39–42 and accompanying text (discussing AR5 WGII conclusion that, based on 2°C and 4°C pathways, sea level related risks like flooding remain medium to high even for highly adapted communities). IPCC, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY: SUMMARY FOR POLICYMAKERS 23 (2014) [hereinafter WGII SUMMARY FOR POLICYMAKERS], available at http://ipcc-wg2.gov/AR5/images/uploads/WG2AR5_SPM_FINAL.pdf [<http://perma.cc/Z3RU-JUDJ>].

30. See generally ICLEI—LOCAL GOVERNMENTS FOR SUSTAINABILITY USA, THE PROCESS BEHIND PLANYC: HOW THE CITY OF NEW YORK DEVELOPED ITS COMPREHENSIVE LONG-TERM SUSTAINABILITY PLAN 5 (2010) [hereinafter ICLEI PLANYC CASE STUDY] (evaluating New York City's sustainability planning process "to share the lessons learned from New York with communities around the world"), available at http://www.nyc.gov/html/planyc/downloads/pdf/publications/iclei_planyc_case_study_201004.pdf [<http://perma.cc/HL5X-7DKE>].

benefits³¹ like improved public health, cleaner air and, according to the City, more affordable housing.³²

But, the City also faces a host of challenges that threaten to “sink” it, including wicked policy binds, ineffective regional structures, a lack of support at the federal level, and other conditions that constrain the City’s ability to remain resilient such as its massive population, coastal geography, and increasingly frequent and intense coastal storms, storm surges, and flooding.³³ As a result, the City’s climate change resilience initiatives may still fall short of what is required to sufficiently “moderate[] harm” from dangerous interference with the climate system.³⁴

Part I of this article examines the role of local governments in climate change adaptation and mitigation. Part II discusses climate change mitigation and adaptation initiatives New York City undertook before and after Super Storm Sandy. Part III assesses the City’s initiatives, evaluating which initiatives provide role models for other municipalities as well as key challenges posed by the City’s approach.

31. AR5 defines “co-benefits” as “positive effects on human health that arise from interventions to reduce emissions of those CAPs [climate-altering pollutants] that warm the planet or vice versa.” See K.R. Smith et al., *Human Health: Impacts, Adaptation, and Co-Benefits*, in IPCC, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY CONTRIBUTION OF WORKING GROUP II TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 715 (C.B. Field et al. eds., 2014), available at https://ipcc-wg2.gov/AR5/images/uploads/WGIAR5-Chap11_FINAL.pdf [<https://perma.cc/TZV9-BMCK>]. For example, increasing “[e]nergy efficiency and reducing reliance on coal for electricity generation not only reduces emissions of greenhouse gases, but also reduces emissions of fine particles that cause many premature deaths worldwide as well as reducing other health impacts from the coal fuel cycle.” *Id.* at 742; see generally *id.* at 737–41 (evaluating data on potential co-benefits from climate adaptation and mitigation measures).

32. See *infra* Parts II and III (discussing City’s initiatives); see, e.g., *infra* Part III.D (discussing the City’s robust and transparent data collection, analysis, and benchmarking initiatives).

33. See, e.g., *infra* Parts III.B and C (discussing “super wicked” problem of waterfront development and critiquing City’s GHG emissions reduction targets).

34. See AR4 WGII, *supra* note 1, at 6 (defining “adaptation” in terms of “moderat[ing] harm or exploit[ing] beneficial opportunities”).

I. CLIMATE CHANGE RESILIENCE FROM THE GROUND UP

Local governments are often referred to as being “on the front line” of climate change adaptation.³⁵ The role of local governments in climate change mitigation, however, has received less attention,³⁶ despite the fact that local governments conduct and regulate activities that contribute a substantial portion of the global inventory of GHG emissions.³⁷ As the following discussion of the municipal role in mitigation and adaptation shows, 2014 heralded a shift in which governmental and nongovernmental bodies at all levels began recognizing the central role of local governments in both climate change adaptation and mitigation.

Discussion of municipalities’ mitigation and adaptation roles, respectively, and indeed the term “adaptation” itself, however, may suggest a false dichotomy that could mislead municipal officials and the public into believing resilience can be achieved through robust adaptation alone. The Intergovernmental Panel on Climate Change’s (“IPCC”) most recent projections suggest that the efficacy of adaptation depends on aggressive mitigation:

Prospects for climate-resilience pathways for sustainable development are related fundamentally to what the world accomplishes with climate change mitigation (*high confidence*). Since mitigation reduces the rate as well as the magnitude of warming, it also increases the time available for adaptation to a particular level of climate change, potentially by several decades.

35. See, e.g., J. Kevin Healy & L. Margaret Barry, *Local Initiatives*, in GLOBAL CLIMATE CHANGE & U.S. LAW 375 (Michael B. Gerrard & Jody Freeman eds., 2d ed. 2014) (referring to local jurisdictions as “the government entities on the front line in protecting the health and welfare of their citizens” and therefore principally responsible for coping with climate change-related harms).

36. See Hossein Estiri, *21 Percent: The Role of Socioeconomics and Housing Characteristics on CO₂ Emissions from the U.S. Residential Sector 2* (Nov. 1, 2012), available at <http://ssrn.com/abstract=2196984> [<http://perma.cc/ABG7-XN7P>] (criticizing climate scientists for initially discounting significance of cities in climate change); Cynthia Rosenzweig et al., *Cities Lead the Way in Climate-Change Action*, 467 NATURE 909, 909 (2010) (“Cities were initially ignored by most climate-change scientists.”).

37. See Nancy B. Grimm et al., *Global Change and the Ecology of Cities*, 319 SCI. 756 (2008) (showing cities contribute substantially to climate change); Sue Grimmond, *Urbanization and Global Environmental Change: Local Effects of Urban Warming*, GEOGRAPHICAL J. 83 (2007) (showing cities contribute substantially to climate change); see also INTERNATIONAL ENERGY AGENCY (IEA), WORLD ENERGY OUTLOOK 2014 (2014).

Delaying mitigation may reduce options for climate-resilient pathways in the future.³⁸

In other words, failure to promptly and aggressively mitigate climate change will likely significantly diminish the ability of coastal communities³⁹ to moderate harms like flooding and foreclose opportunities to do so in the future.⁴⁰ Likewise, although mitigation measures can limit the amount of GHG emissions, they too are only part of the solution because “much of the change in climate over the next 30 to 40 years is already determined by past and present emissions.”⁴¹ Additionally, current and near-future risks from climate change already pose significant enough threats that coastal communities must undertake adaptation initiatives to protect public health, property, and infrastructure.⁴²

Accordingly, this article treats the concept of resilience planning as inclusive of both adaptation and mitigation planning, and concludes that effective regulation at the local level cannot be achieved through adaptation alone no matter how robust. Additionally, this article urges scholars, lawyers, and policy makers to recognize in their communications the need for an integrated approach.⁴³

38. WGII SUMMARY FOR POLICYMAKERS, *supra* note 29, at 28.

39. Reference to “coastal communities” here includes all communities that face flooding, storm surge, and other risks associated with rising seas, and therefore includes estuarine, riverine, and some lakeside communities, among others.

40. See WGII SUMMARY FOR POLICYMAKERS, *supra* note 29, at 23 (showing even highly adapted North American communities will face medium to high risks under scenarios of global mean temperature increases at 2°C and 4°C above preindustrial levels).

41. SCOTTISH EXECUTIVE, CHANGING OUR WAYS: SCOTLAND’S CLIMATE CHANGE PROGRAMME 76 (2006), available at <http://www.gov.scot/Resource/Doc/100896/0024396.pdf> [<http://perma.cc/9PQY-TQD7>]; see also Robin Kundis Craig, “Stationarity Is Dead”—Long Live Transformation: Five Principles for Climate Change Adaptation Law, 34 HARV. ENVTL. L. REV. 9, 9 (2010) (“While there is no question that successful mitigation strategies remain critical in the quest to avoid worst-case climate change scenarios, we have passed the point where mitigation efforts alone can deal with the problems that climate change is creating.”).

42. See STRAUSS ET AL., *supra* note 9, at 11; *infra* note 97 & accompanying text.

43. See *infra* Part III.A.

A. Municipal Governments and Mitigation

With respect to mitigation, 2014 marked a shift in the recognition of the role of cities. In 2014, the IPCC issued its Fifth Assessment Report (“AR5”), which included for the first time in the Mitigation of Climate Change volume of its assessment report a separate chapter on urban areas, referred to in the chapter title as “human settlements.”⁴⁴ According to the IPCC, “[s]ince the publication of the Fourth Assessment Report, there has been a growing recognition of the significant contribution of urban areas to GHG emissions, their potential role in mitigating them, and a multi-fold increase in the corresponding scientific literature.”⁴⁵

Clearly, local regulations and activities have the potential to significantly impact global emissions levels. In addition to wielding regulatory authority over land uses, building design, and transportation, local governments tend to maintain sizeable fleets of motor vehicles; own and lease extensive building stock; own or operate solid waste transfer stations, landfills, sewage treatment plants, and power plants; collectively expend millions of dollars annually in product procurement; and can influence or control the source of power used in the municipality.⁴⁶ Additionally, the impact of local government regulations and conduct is growing as the world population continues to concentrate in cities. As of 2011, more than half the global population was urban, as compared to only 13% in 1900⁴⁷; additionally, urban areas account for approximately 75% of global energy use and the same amount of CO₂ emissions.⁴⁸ By 2050, the global urban population is

44. K.C. SETA ET AL., CH. 12: HUMAN SETTLEMENTS, INFRASTRUCTURE, AND SPATIAL PLANNING, *in* CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (O. Edenhofer et al. eds., 2014) [hereinafter CH. 12: HUMAN SETTLEMENTS].

45. *Id.* at 929.

46. Healy & Barry, *supra* note 35, at 375–76. I use “local government” and “municipality” interchangeably. Municipalities are political subdivisions, including cities, towns, villages, and districts such as school districts and sewer districts. *Municipality*, BLACK’S LAW DICTIONARY (9th ed. 2009), available at <http://thelawdictionary.org/municipality/> [<http://perma.cc/QT5-5B5C>].

47. CH. 12: HUMAN SETTLEMENTS, *supra* note 44, at 929.

48. *Id.*

projected to grow by between 2.5 to 3 billion, corresponding to nearly 70% of the world's population.⁴⁹

Despite the “significant contribution of urban areas to GHG emissions [and] their potential role in mitigating them,”⁵⁰ as well as the laudable efforts of many cities,⁵¹ AR5 also found that “[t]housands of Cities are undertaking climate action plans, but their aggregate impact on urban emissions is uncertain (*robust evidence, high agreement*).”⁵² Although this finding could be construed as support for the normative position that climate change mitigation is not an appropriate pursuit for local governments,⁵³ the uncertain aggregate impact of thousands of cities’ mitigation efforts probably does not indicate that local governments are somehow inherently less able to meaningfully reduce GHG emissions than state, federal or international entities. Rather, the finding instead likely indicates the need for more and different action at the local government level,⁵⁴ more support and coordination between levels of government,⁵⁵ and more transparency and accountability.⁵⁶

B. Municipal Governments and Adaptation

In the United States, municipal governments have made significant contributions to adaptation planning and implementation, at least as compared to the federal and state governments. However, U.S. municipalities lag behind their

49. *Id.* at 942.

50. *Id.* at 929.

51. *See, e.g., supra* note 15 (identifying U.S. municipalities that participated in a CO₂ reduction project that began in 1991).

52. CH. 12: HUMAN SETTLEMENTS, *supra* note 44, at 929.

53. *See, e.g.,* Robert N. Stavins, *State Eyes on the Climate Policy Prize*, 27 ENVTL. F. 16, 16 (July/Aug. 2010) (arguing that state and local climate change mitigation “make[s] no sense”); Jonathan B. Wiener, *Think Globally, Act Globally: The Limits of Local Climate Policies*, 155 U. PA. L. REV. 1961, 1962 (2007). *But see* Jonathan Rosenbloom, *Urban Community Collaborative*, in Adams-Schoen et al., *supra* note 5, at 10039 (posing the question “But if the international community is unable to act and there is a willingness among local governments to act, then why not allow them to do so?”).

54. *See infra* Part III.F (discussing the relatively small number of local governments undertaking climate action planning and the even smaller number of local governments that have moved from planning to implementation).

55. *See infra* Part III.F (discussing the lack of local-state-federal integration).

56. *See infra* Part III.F (discussing the need for increased transparency).

counterparts throughout the world,⁵⁷ and, although many sources laud the extensive work of local governments with respect to adaptation,⁵⁸ little attention has been focused on a troubling gap that exists between climate-related vulnerabilities and local preparedness.

According to a survey administered by ICLEI in 2011, the United States has the lowest percentage of cities pursuing adaptation planning out of all regions surveyed (59%), while Latin American and Canadian cities have the highest (95% and 92% respectively).⁵⁹ Of particular concern, only 13% of the U.S. cities surveyed had even completed an assessment of their vulnerabilities and risks, the lowest percentage of all regions surveyed.⁶⁰

In its most recent assessment report, the IPCC identified a laundry list of potentially catastrophic risks (or “impacts”) consistent with the gap between vulnerability and local preparedness:

Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones, and wildfires, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability (very high confidence). Impacts of such climate-related extremes include alteration of ecosystems, disruption of food production and water supply, damage to infrastructure and settlements, morbidity and mortality, and consequences for mental health and human well-being. For countries at all levels of development, these impacts are consistent with a significant lack of preparedness for current climate variability in some sectors.⁶¹

In response to this vulnerability-preparedness gap, the IPCC highlights the importance of “city and municipal governments acting now to incorporate climate change adaptation into their development plans and policies and infrastructure

57. ICLEI 2011 SURVEY, *supra* note 11.

58. See, e.g., IPCC, CLIMATE CHANGE 2014: SYNTHESIS REPORT 107 (2014), available at http://www.ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_FINAL_full.pdf [<http://perma.cc/A7WN-49YJ>] (“There is a significant increase in the number of planned adaptation responses at the local level in rural and urban communities of developed and developing countries since the AR4.”).

59. ICLEI 2011 SURVEY, *supra* note 11, at 14.

60. *Id.* at 10.

61. WGII SUMMARY FOR POLICYMAKERS, *supra* note 29, at 6.

investments,”⁶² characterizing “[a]ction in urban centers [as] essential to successful global climate change adaptation.”⁶³

This characterization of local government action as essential to disaster preparedness planning makes sense given that “[l]ocal land use authority is the foundation of the planning that determines how communities and natural resources are developed and preserved, and how disaster resilient communities are created.”⁶⁴ As Patricia Salkin explains:

Across the country, local governments maintain day-to-day responsibility and control over the use of the vast majority of lands that abut the nation’s edge and other environmentally sensitive areas. Land use patterns are determined, infrastructure is designed and provided, and many other development issues are decided at the local level, where natural hazards are experienced and losses are suffered most directly.⁶⁵

Indeed, local governments have an array of tools in their toolbox that can help adapt their communities to climate change-related conditions including building codes; land use, zoning, and subdivision regulations; comprehensive, capital improvement, transportation, floodplain management, storm-water management, and open space plans; facilities needs studies; population growth and future development studies; and economic development plans.⁶⁶ Thus, it may not be surprising that a national survey of public and private emergency managers, code specialists, and engineers found

62. Aromar Revi et al., *Urban Areas*, in CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY, CONTRIBUTION OF WORKING GROUP II TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 541 (C.B. Field et al. eds., 2014), available at https://ipcc-wg2.gov/AR5/images/uploads/WGIAR5-Chap8_FINAL.pdf [perma.cc/ULJ9-LN64].

63. *Id.* at 538; see also THE U.S. CONFERENCE OF MAYORS, THE U.S. MAYORS CLIMATE PROTECTION AGREEMENT 2 (2014) (adding new focus on urban resiliency), available at <http://usmayors.org/climateagreement/Final%20USCM%202014%20Mayors%20Climate%20Protection%20Agreement.pdf> [http://perma.cc/CNL4-8AWR].

64. John R. Nolon, *Disaster Mitigation Through Land Use Strategies*, 23 PACE ENVTL. L. REV. 959, 976–77 (2006).

65. Patricia Salkin, *Sustainability at the Edge: The Opportunity and Responsibility of Local Governments to Most Effectively Plan for Natural Disaster Mitigation*, 38 ENVTL. L.R. 10158, 10159 (2008).

66. *Id.* at 10162–69 (discussing sustainability tools in local government toolbox).

that building codes and land use planning ranked as the most effective tool to achieve hazards vulnerability reduction.⁶⁷

Municipal regulation of the form and placement of building stock in particular offers an opportunity to create more resilient infrastructure and patterns of development; whereas, failure to proactively plan for climate change will result in further investment in infrastructure and patterns of development that, at best, fail to adapt to hazards, and, at worst, exacerbate hazards. For example, law and policy makers must take a hard look at waterfront development plans and related regulations⁶⁸ to assess whether development and rebuilding is being allowed or even encouraged in areas that are currently vulnerable or will become vulnerable within the life of the development, and whether the development is increasing the vulnerability of adjacent areas. On a more mundane, but still significant level, structure elevation requirements should be amended to reduce the vulnerability of the structure throughout its entire useful life, not just for the next five, ten or twenty years.⁶⁹ Relatedly, existing local zoning and building codes should be assessed to determine whether they impose requirements on the construction of elevated structures that increase local flood risk by, for example, increasing the impermeable surface area of the lot.⁷⁰ Because

67. *Id.* at 10158.

68. *See infra* Part III.B.

69. Many flood-prone communities rebuilding after a flood or storm surge event are requiring elevation of structures. *See, e.g.*, NEW YORK CITY BUILDING CODE (“NYCBC”), app. G, § 304.1.1 (2014), *available at* http://www.nyc.gov/html/dob/apps/pdf_viewer/viewer.html?file=2014CC_BC_Chapter_1_Administration.pdf§ion=concode_2014 [<http://perma.cc/KCN8-V27C>] (requiring 1–2 family residences be flood-proofed to 2 feet above Base Flood Elevation).

70. For example, addition of lengthy switchback ramps and stairs needed to access an elevated first floor may increase the impermeable area of the structure. *See, e.g., id.* at § 302.1.1 (requiring 30 feet of ramp for a 30 inch rise). Depending on the amount of stairs or ramping required to access the elevated structure, the structure may need to be shifted back from the street, thereby occupying space that had previously been the backyard. *See, e.g.*, CITY OF NEW YORK, COASTAL CLIMATE RESILIENCY: RETROFITTING BUILDINGS FOR FLUID RISK 42–43 (2014). *See also* OREGON DEP’T OF LAND CONSERVATION, WATER QUALITY MODEL CODE AND GUIDE BOOK 4.44 (2000), *available at* <http://www.oregon.gov/LCD/Pages/waterqualitygb.aspx> [<http://perma.cc/65HR-8XVY>] (discussing disruptions caused by building impervious surfaces in floodplains); Christopher P. Konrad, *Effects of Urban Development on Floods*, U.S. GEOLOGICAL SURVEY (Nov. 2003), <http://pubs.usgs.gov/fs/fs07603/pdf/fs07603.pdf> [<http://perma.cc/Q73Q-LFBT>].

we can anticipate the addition of substantial new building stock and infrastructure over the next few decades, local governments that regulate the placement and, in some respects, design aspects of building stock have an opportunity to avoid locking in infrastructure that increases flood and other climate-related risks.⁷¹

Indeed, given the clear role for local governments in adaptation planning and implementation,⁷² some scholars and commentators question whether local governments will soon face liability for failure to plan for and implement climate change adaptation measures.⁷³ Because the consequences of destructive storms are foreseeable and at least in part attributable to failures in the legal system, Maxine Burkett argues that local governments could face tort liability for failure to adapt to climate change.⁷⁴ She posits that although no affirmative duty exists for governments to provide protection from natural hazards, once a local government begins instituting adaptation measures, that action triggers a duty to adapt reasonably under the circumstances and failure to do so can result in liability for negligence.⁷⁵

71. John R. Nolon, *The Land Use Stabilization Wedge Strategy: Shifting Ground to Mitigate Climate Change*, 34 WM. & MARY ENVTL. L. & POL'Y REV. 1, 6 (2009) (reporting that sixty-six percent of the buildings in existence in the United States by the year 2050 are projected to be built between now and then).

72. *Id.*

73. See, e.g., Maxine Burkett, *Duty and Breach in an Era of Uncertainty: Local Government Liability for Failure to Adapt to Climate Change*, 20 GEO. MASON L. REV. 775, 780–81 (2013).

74. *Id.* at 780–81; see also Daniel Farber, *Symposium Introduction: Navigating the Intersection of Environmental Law and Disaster Law*, 2011 B.Y.U. L. REV. 1783, 1786 (2011) (“[E]nvironmental disasters stem from gaps in environmental regulation: weak protection of wetlands, badly planned infrastructure, and, above all, climate change . . .”).

75. Burkett, *supra* note 73, at 780–81; see also Jenna Schweitzer, *Climate Change Legal Remedies: Hurricane Sandy and New York City Coastal Adaptation*, 16 VT. J. ENVTL. L. 243, 246–47 (2014) (applying Maxine Burkett’s tort liability argument to New York City, concluding the City would not face liability for failure to adapt reasonably, and arguing that New York common law signals to local governments that property owners bear the risks of failure to adapt to natural hazards); Christopher Serkin, *Passive Takings: The State’s Affirmative Duty to Protect Property*, 113 MICH. L. REV. 345, 388–406 (2014) (arguing that regulatory failure to protect property in the face of climate change can amount to an unconstitutional taking); *St. Bernard Parish Gov’t v. U.S.*, No. 05-1119L, 2015 WL 2058969, at *1 (Fed. Cl. May 1, 2015) (holding that U.S. Army Corps of Engineers failure to adequately maintain a flood protection system exacerbated flood damage from Hurricane Katrina and several subsequent

So far, in the United States, plaintiffs' claims against local governments have not extended to negligent failure to adapt to climate change. Rather, plaintiffs injured by flooding have brought actions against local governments alleging that the municipalities' negligent design, construction, or operation of flood control structures caused the plaintiffs' injuries,⁷⁶ and, in at least one instance, plaintiffs injured by flooding brought an action against a county government claiming that the county's negligent regulation of development on an adjacent property caused plaintiffs' damages.⁷⁷ With respect to the former actions, liability has tended to hinge on whether the municipality's conduct was statutorily immune,⁷⁸ and, if it was not, whether the plaintiffs proffered sufficient proof of negligence and causation.⁷⁹ With respect to the latter action, the court held that the county owed no duty to homeowners to

storms, and, although temporary, resulted in a taking of private property without just compensation in violation of the Takings Clause).

76. See, e.g., *Vermeff v. City of Boulder City*, 80 P.3d 445, 445 (Nev. 2003), *abrogated by* *ASAP Storage, Inc. v. City of Sparks*, 173 P.3d 734 (Nev. 2007); *Walter Legge Co. v. City of Peekskill*, 619 N.Y.S.2d 771, 771–72 (N.Y. App. Div. 1994).

77. See, e.g., *Cootey v. Sun Inv., Inc.*, 718 P.2d 1086, 1088–89 (Haw. 1986); see also Courtenay Thompson, *Settlement Reached on the Capes*, OREGONIAN, Dec. 24, 1999 (reporting on settlement of lawsuit by homeowners against developers in a case resulting from houses dropping into the ocean and others being condemned as a result of erosion from waves).

78. See, e.g., *Vermeff*, 80 P.3d at 553 (ruling on appeal of summary judgment that city was not entitled to immunity for damages occurring during flood under statute immunizing government entities from liability arising out of emergency management activities where damage was due to pre-emergency installation of the drainage channel), *abrogated by ASAP Storage*, 80 P.3d at 744–45 (ruling that statute immunizing government from liability relating to emergency management activities creates immunity for emergency responses and emergency preparation activities); see also *In re Katrina Canal Breaches Consol. Litig.*, 696 F.3d 436 (5th Cir. 2012) (holding that the government was immunized against claims for flooding damage); *In re Katrina Canal Breaches Consol. Litig.*, 577 F. Supp. 2d 802, 807 (E.D. La. 2008) (ruling that genuine issues of material fact existed as to whether damage from flooding was caused by governmental negligence in design, construction, maintenance, and operation of a navigational channel, including resulting destruction of flood-mitigating wetlands, as opposed to negligence with regard to federal flood control project, which would be subject to statutory governmental immunity).

79. *Walter Legge Co.*, 210 A.D.2d at 317 (affirming order granting judgment as matter of law for city where there was insufficient proof of causation and negligence in action against city for damage to property allegedly caused by flooding when natural waterway used as part of municipal drainage system overflowed).

ensure that development of an adjoining subdivision would not create a risk of flooding the homeowners' property.⁸⁰

II. NEW YORK CITY'S CLIMATE CHANGE RESILIENCE INITIATIVES

A. New York City and Climate Change: The "New Normal"⁸¹

Illustrating the "significant lack of preparedness for current climate variability"⁸² characteristic of the majority of U.S. cities,⁸³ New York was dealt a massive, crippling blow by Super Storm Sandy on October 29, 2012.⁸⁴ A number of idiosyncrasies—namely, timing, size and path—combined to make Sandy the City's most extreme storm on record since 1900 in terms of scale and scope of devastation and, arguably, surge height.⁸⁵ The tidal surge flooded the New York Port Authority Trans-Hudson subway tunnels, the New York subways, and the Brooklyn Battery Tunnel⁸⁶; 44 New Yorkers lost their lives⁸⁷; 6,500 patients were evacuated from hospitals and nursing homes; nearly 90,000 buildings were in the

80. *Cootey*, 718 P.2d at 1086.

81. In the foreword to the PlaNYC 2013 Progress Report, Mayor Bloomberg lamented, "we are sobered by the 'new normal' that climate change is producing in our city, including more frequent and intense summer heat waves and more destructive coastal storms like Hurricane Sandy." CITY OF NEW YORK, PLANYC PROGRESS REPORT 2013: A GREENER, GREATER NEW YORK 4 (2013) [hereinafter PROGRESS REPORT 2013], http://nytelecom.vo.llnwd.net/o15/agencies/planyc2030/pdf/planyc_progress_report_2013.pdf [<http://perma.cc/X4P3-9WAG>].

82. WGII SUMMARY FOR POLICYMAKERS, *supra* note 29, at 6.

83. See e.g., ICLEI 2011 SURVEY, *supra* note 11.

84. STRONGER, MORE RESILIENT, *supra* note 7, at 40.

85. *Id.* at 21. *But see* STRAUSS ET AL., *supra* note 9, at 16 (arguing that Sandy's surge height has been misreported as 14 feet at the Battery and that Sandy's peak storm surge was actually 9 feet). Sandy's surge combined with high tide to produce flood levels of 14 feet above the mean lower low water line ("MLLW") at the Battery, and 8.99 feet above the mean higher high water line ("MHHW") at the Battery. *Id.*; see also *infra* Part III.A (discussing the City's narrative about the toughness of the storm versus the toughness of New Yorkers).

86. *Id.* at 14.

87. *Stronger, More Resilient* reported that the storm caused the death of 43 City residents. STRONGER, MORE RESILIENT, *supra* note 7, at 13. This number was later changed to 44. See ONE CITY, BUILT TO LAST, *supra* note 16, at 19. The vast majority of the deaths were from drowning in areas where waters rose rapidly as a result of the storm surge. Of these deaths, 23 occurred in Staten Island, including 10 in the neighborhood of Midland Beach, and the remainder occurred in Queens, Brooklyn and Manhattan. Victims ranged in age from two years old to 90. STRONGER, MORE RESILIENT, *supra* note 7, at 13–14.

inundation zone⁸⁸; 1.1 million children were unable to attend school for a week⁸⁹; nearly 2 million people were without power⁹⁰; the storm shut down access to New York City by highway, rail and air for almost a week⁹¹; related power outages lasted for weeks in some areas⁹²; and, the storm caused an estimated \$19 billion in damage.⁹³

Severe storms and other climate-related impacts are expected to continue to manifest and increase in intensity as a result of the accumulation of GHGs in the atmosphere.⁹⁴ Cynthia Rosenzweig, co-chairperson of the second New York City Panel on Climate Change (“NPCC2”), identified “compelling areas of linkage between Super Storm Sandy and climate change, including rising sea levels that made storm surges higher.”⁹⁵ Moreover, although scientists debate whether climate change caused Super Storm Sandy, scientists tend to agree that climate change contributed to the severity of the storm⁹⁶ and will result in more extreme storms in the future.⁹⁷ As Strauss et al. of Climate Central observe:

88. “More than 400 New York City Housing Authority buildings containing approximately 35,000 housing units lost power, heat, or hot water during Sandy.” STRONGER, MORE RESILIENT, *supra* note 7, at 14.

89. *Id.* at 11.

90. *Id.*

91. *Id.* at 17.

92. *Id.* at 14.

93. *Id.* at 11.

94. See NEW YORK CITY PANEL ON CLIMATE CHANGE, CLIMATE RISK INFORMATION 2013: OBSERVATIONS, CLIMATE CHANGE PROJECTIONS, AND MAPS 15 (Cynthia Rosenzweig and William Solecki eds., 2013) [hereinafter “NPCC2”], http://www.nyc.gov/html/planyc2030/downloads/pdf/npcc_climate_risk_information_2013_report.pdf [<http://perma.cc/Q2GG-YTQB>].

95. Burkett, *supra* note 73, at 781 (citing Colin Sullivan, *Columbia University Panel Urges Quick Action to Plan ‘Coastal City for the Future,’* CLIMATEWIRE (Nov. 20, 2012), <http://www.eenews.net/climatewire/2012/11/20/archive/5?terms=colin+sullivan> [<http://perma.cc/62B3-KFQM>]).

96. See NPCC2, *supra* note 94, at 7 (“While it is not possible to attribute any single extreme event such as Hurricane Sandy to climate change, sea level rise already occurring in the New York City area, in part related to climate change, increased the extent, and magnitude of coastal flooding during the storm.”).

97. *Id.* at 8 (“Although hurricanes depend on a range of climate variables and it is not clear how all these variables will change, a number of recent studies suggest that the number of the most intense hurricanes may increase globally. It is more likely than not that these hurricanes will also increase in the North Atlantic Basin.”) (internal footnote and citations omitted). See also Cynthia Rosenzweig et al., *Building the Knowledge Base for Climate Resiliency: New York City Panel on Climate Change 2015 Report*, 1336 ANNALS N.Y. ACAD. SCI. 1, 11 (2015) [hereinafter “NPCC 2015”],

[E]very coastal flood today is already wider, deeper and more damaging because of the roughly 8 inches (IPCC 2013) of warming-driven global sea level rise that has taken place since 1900. [Climate Central's 2014] analysis finds that this rise has already increased the annual chance of extreme coastal floods in New York City by 50%. Looking forward under a fast sea level rise scenario, [Climate Central] compute[s] a 3-in-4 chance of historically unprecedented coastal flooding in New York City by 2100—or a 1-in-10 chance under a slow rise scenario.⁹⁸

By the 2080s, NPCC2's projections suggest that sea level changes alone will “lead[] to . . . between a doubling and an approximately 10- to 15-fold increase in the frequency of the current 100-year coastal flood”⁹⁹

As a result of climate-related factors and land subsidence, sea level in New York City has risen 1.1 feet since 1900, approximately 1.2 inches per decade—a rate that is nearly two times the global average.¹⁰⁰ According to NPCC2, an ongoing body established by New York City law to regularly update and report on region-specific climate data and projections, sea level rise is projected to accelerate as the century progresses, rising in New York City 11 to 21 inches by the 2050s, 18 to 39 inches by the 2080s, and as much as 6 feet by 2100 (over average 2000–2005 levels).¹⁰¹

available at <http://onlinelibrary.wiley.com/doi/10.1111/nyas.12591/epdf> [<http://perma.cc/99B2-HZKH>] (concluding that it is more likely than not that the number of intense hurricanes and the intensity of precipitation from these hurricanes will increase in the North Atlantic Basin). NPCC 2015 presents the work of the NPCC from January 2013 to January 2015, which, among other things, documents recently observed climate trends and climate projections for the region up to 2100, compares the NPCC2 methods and projections to those done by AR5, provides new maps for 100- and 500-year coastal flood events in the 2020s, 2050s, 2080s and 2100, incorporates analyses of public health issues, and sets forth a “process for developing a system of indicators and monitoring to track data related to climate change hazards, risks, impacts, and adaptation strategies.” *Id.* at 9.

98. STRAUSS ET AL., *supra* note 9, at 11.

99. NPCC 2015, *supra* note 97, at 11. A “100-year coastal flood” is “a flood with a 1% annual chance of occurrence” and a “500-year coastal flood” is a “flood with a 0.2% annual chance of occurrence.” *Id.* at 9.

100. NPCC2, *supra* note 94, at 8 (finding that approximately 45% of the observed sea level rise of 1.2 inches per decade since 1900 is due to land subsidence, with the remaining sea level rise driven by climate-related factors).

101. NPCC 2015, *supra* note 97, at 11. *See also infra* Part III.D (discussing the City's robust, transparent, and science-based data collection, analysis and benchmarking initiatives).

To put these projections in perspective, consider that, with only a 1.5-foot sea level rise, another storm like Sandy could require New York City to evacuate as many as three million people.¹⁰² With a three-foot rise in sea level, major storms could inundate low-lying shore communities in Brooklyn, Queens, Staten Island, and Long Island, shut down the City's transportation system, flood the highways, and render the tunnels into the City impassable.¹⁰³ An even greater sea level rise, which appears possible by mid- to late-century given the continued pace of GHG emissions, "would place much of the city underwater—and beyond the reach of any protective measures."¹⁰⁴ Obviously, such conditions would cost lives, cause property damage and business losses, harm the environment and threaten public health. In economic terms, former Mayor Bloomberg recently predicted, "while Sandy caused about \$19 billion in losses for [New York City], rising sea levels and ocean temperatures mean that by the 2050s, a storm like Sandy could cause an estimated \$90 billion in losses (in current dollars)."¹⁰⁵

Nor are storms and flooding the only, or even the worst, foreseeable effects of climate change on New York City. NPCC2 predicts that by 2050 the City could have as many days at or above ninety degrees annually as Birmingham, Alabama currently has.¹⁰⁶ Heat waves are also predicted to more than triple in frequency and last on average one and a half times longer than they do today.¹⁰⁷ Compounding this, heat indices are also projected to increase.¹⁰⁸ "The combination of high temperatures and high humidity can produce severe additive

102. The second NPCC report's future flood maps illustrate how projected sea-level rises will expose additional areas of New York City to flooding during extreme storm events. See NPCC2, *supra* note 94, at 25.

103. *Id.*

104. Bruce Stutz, *New York City Girds Itself for Heat and Rising Seas*, YALE ENV'T 360 (Sept. 10, 2009), <http://e360.yale.edu/content/feature.msp?id=2187> [<http://perma.cc/5UTE-5LRE>] (discussing the results of the first NPCC report).

105. Michael R. Bloomberg, *Foreword to CITY OF NEW YORK, PLANYC: A STRONGER, MORE RESILIENT NEW YORK 40* (June 2013), available at <http://www.nyc.gov/html/sirr/html/report/report.shtml> [<http://perma.cc/EF53-EJYN>].

106. See NPCC2, *supra* note 94, at 20. NPCC2 projects mean annual temperatures to increase by 4.1 to 5.7°F by the 2050s and by 5.3 to 8.8°F by the 2080s. NPCC 2015, *supra* note 97, at 10.

107. NPCC2, *supra* note 94, at 19.

108. *Id.* at 22.

effects by restricting the human body's ability to cool itself and thereby induce heat stress."¹⁰⁹ Given that heat waves kill more Americans each year than all other natural disasters combined,¹¹⁰ the need to address the causes of increasing temperatures and heat indices is great.

Ultimately, NPCC2 concludes that "although there remain significant uncertainties regarding long-term climate change, the [most recent projections and analyses in the] NPCC 2015 report support[] the large body of evidence indicating that decision-makers are better served by consideration of the future climate risks rather than reliance on the climate of the past in development of resiliency and rebuilding programs."¹¹¹

B. New York City Takes a Comprehensive Approach to Climate Change

Heeding the sobering data and dire predictions for its massive coastal population,¹¹² New York City is taking a comprehensive approach to climate change mitigation and adaptation. The City is collecting, analyzing and publishing climate change-related data and planning for more massive storm surges, heavy rains and winds, major heat waves and other extreme weather conditions. The City is also taking numerous proactive steps to decrease GHG emissions and otherwise mitigate its contribution to climate change.¹¹³ What follows is a summary of some of the City's key adaptation and mitigation initiatives.¹¹⁴

109. *Id.*

110. STRONGER, MORE RESILIENT, *supra* note 7, at 26.

111. NPCC 2015, *supra* note 97, at 16.

112. *But see generally infra* Part III (discussing whether New York City is taking sufficient resilience measures to protect its coastal population).

113. Indeed, New York City is attacking climate change mitigation and resiliency from so many different angles that simply locating and navigating the different initiatives and challenges is a feat unto itself. Initiatives not addressed in this article include, among others, the City's air quality initiatives and Sustainable Stormwater Management Plan. Reports on these initiatives and many others are available at the City's *Publications* website. See *PlaNYC Publications*, *supra* note 28.

114. The City provides downloadable copies of more than a dozen reports on its sustainability initiatives, including benchmarking reports and reports on climate resilience. See *generally PlaNYC Home*, MAYOR'S OFFICE OF RECOVERY & RESILIENCY, <http://www.nyc.gov/html/planyc/html/home/home.shtml> [<http://perma.cc/B6M4-JD6B>] (last visited June 26, 2015).

1. Long-Term Comprehensive Sustainability Planning That Includes Climate Change Mitigation

In 2007, Mayor Michael Bloomberg launched PlaNYC and the Mayor's Office published a report entitled *PlaNYC: A Greener, Greater New York*, which laid out the City's long-term comprehensive sustainability goals, including the goal of reducing the City's GHG emissions 30% below 2005 levels by 2030 ("30 by 30"), and 126 initiatives to reach this and other goals, including the establishment of the Mayor's Office of Long-Term Planning and Sustainability.¹¹⁵ In 2011, the City updated *A Greener, Greater New York* with new initiatives that placed an even greater emphasis on climate change resilience in response to weather changes that the City observed were already taking place.¹¹⁶ Following Super Storm Sandy, the City published *A Stronger, More Resilient New York*, which contained a comprehensive assessment of the City's climate change vulnerabilities and a detailed adaptation and mitigation plan.¹¹⁷ In September 2014, Mayor de Blasio announced the formation of the new Mayor's Office of Recovery and Resiliency and the City's commitment to increase its GHG emissions-reduction target from 30% below 2005 levels by 2030 ("30 by 30") to 80% below 2005 levels by 2050 ("80 by 50"), in conjunction with publication of *One City, Built to Last*, a detailed plan for achieving two-thirds of the City's additional CO₂ emissions reductions through increases in building efficiency.¹¹⁸

Since the publication of *PlaNYC: A Greener, Greater New York* in 2007, the City has launched, among other things, the country's first municipal brownfields cleanup program and an innovative green infrastructure program; implemented its Greener Greater Buildings Plan, Clean Heat program, climate resilience initiatives, Million Trees program and Green Infrastructure Plan; launched an ambitious suite of policies to reduce energy use in large buildings; passed regulations to

115. See generally ICLEI PLANYC CASE STUDY, *supra* note 30, at 5 (evaluating New York City's comprehensive long-term sustainability planning process).

116. Numerous related New York City publications, including the 2007 and 2011 *Greener, Greater New York* reports and annual progress reports are available at *PlaNYC Publications*, *supra* note 28.

117. See STRONGER, MORE RESILIENT, *supra* note 7.

118. See ONE CITY, BUILT TO LAST, *supra* note 16, at 20.

phase out highly polluting fuel oil; developed updated climate impact projections; and passed the City's Zone Green Zoning Text amendment.¹¹⁹ The City has invested in a fleet of more than 600 plug-in electric vehicles and 153 charging stations, is testing electric taxis, is adding chargers to ten of its public parking lots, and passed a law in 2014 that requires 20% of new off street parking to be built "charger ready."¹²⁰ As a result of these and other measures, the City achieved a 19% reduction in GHG emissions from 2005 levels as of 2014.¹²¹

2. Climate Change Resilience and Coastal Protection Planning

New York City's New Waterfront Revitalization Program ("local WRP" or "LWRP"), administered by the Department of City Planning ("DCP"), is the City's principal coastal zone management tool. In accordance with New York State's WRP and the federal Coastal Zone Management Act ("CZMA"), New York City adopted its first local WRP in 1982.¹²² The current LWRP policies were adopted by the City Council in 1999 in the "New Waterfront Revitalization Program," and became effective upon state and federal approval in 2002.¹²³ The City Council approved amendments to the 2002 LWRP in October 2013, which will become effective upon approval by the New York State Department of State and concurrence by the U.S. Department of Commerce. The LWRP currently in effect sets forth ten policies designed to maximize the benefits derived

119. PROGRESS REPORT 2013, *supra* note 81, at 6.

120. PROGRESS REPORT 2014, *supra* note 24, at 18.

121. *Id.* at 51.

122. NEW YORK CITY DEPARTMENT OF CITY PLANNING, THE NEW WATERFRONT REVITALIZATION PROGRAM 3 (2002) [hereinafter "NYC LWRP"], *available at* http://www.nyc.gov/html/dcp/pdf/wrp/wrp_full.pdf [<http://perma.cc/TEU9-8B8C>]. New York City's local waterfront revitalization plan ("WRP") is authorized by New York State's Waterfront Revitalization of Coastal Areas and Inland Waterways Act, N.Y. Exec. Law §§ 910–923 (2015), which stems from the federal Coastal Zone Management Act, 16 U.S.C. §§ 1451–1464 (2014). The implementing regulations of the New York statute and coastal area policies can be found in the Department of State regulations, N.Y. COMP. CODES R. & REGS. tit. 19, § 600.

123. *See* N.Y.C. DEP'T OF CITY PLANNING, THE NEW YORK CITY WATERFRONT REVITALIZATION PROGRAM: NEW YORK CITY APPROVED REVISIONS PURSUANT TO SECTION 197-A OF THE CITY CHARTER 5 (2013) [hereinafter "NYC REVISED LWRP"], http://www.nyc.gov/html/dcp/pdf/wrp/revisions/nyc_wrp_city_approved.pdf [<http://perma.cc/XT2P-PPNR>] (discussing history of New York City's LWRP and New LWRP).

from economic development, environmental preservation and public use of the waterfront, while minimizing the conflicts among those objectives.¹²⁴ All city, state, and federal discretionary actions in the coastal zone must be reviewed for consistency with these policies.¹²⁵ Notably, the 2002 LWRP's objectives do not include coastal resilience and nowhere in the 2002 LWRP is climate change or sea level rise discussed. However, on October 30, 2013, the City approved a series of revisions to its LWRP in order to advance the goals laid out in *Vision 2020: The New York City Comprehensive Waterfront Plan* ("*Vision 2020*"),¹²⁶ which is organized around eight goals, one of which is climate resilience.¹²⁷ The revised LWRP is awaiting state and federal approval.¹²⁸

As part of PlaNYC, in December 2012, the City convened the Special Initiative for Rebuilding and Resiliency ("SIRR") to address long-term climate change resilience specifically in the wake of Super Storm Sandy.¹²⁹ Six months later, SIRR

124. NYC LWRP, *supra* note 122, at 3. The ten policies address: (1) residential and commercial redevelopment; (2) water-dependent and industrial uses; (3) commercial and recreational boating; (4) coastal ecological systems; (5) water quality; (6) flooding and erosion; (7) solid waste and hazardous substances; (8) public access; (9) scenic resources; and (10) historical and cultural resources. *Id.* at 8.

125. *Id.* at 3; *see also infra* Part III.B (discussing local, state and federal consistency review).

126. NEW YORK CITY DEPARTMENT OF CITY PLANNING, VISION 2020: NEW YORK CITY COMPREHENSIVE WATERFRONT PLAN 5 (March 2011) [hereinafter "VISION 2020"], available at http://www.nyc.gov/html/dcp/pdf/cwp/vision2020_nyc_cwp.pdf [<http://perma.cc/MXZ6-Z96W>].

127. NYC REVISED LWRP, *supra* note 123, at 6. The eight goals are: expand public access, enliven the waterfront, support the working waterfront, improve water quality, restore the natural waterfront, enhance the Blue Network (the waterways themselves), improve governmental oversight, and increase climate resilience. *Id.*

128. The City Council approved the amendments to the revised LWRP on October 30, 2013. The revised LWRP will go into effect upon approval by the New York State Department of State and concurrence by the U.S. Department of Commerce. *See The Waterfront Revitalization Program—Approved by the City Council! 2012 WRP Revisions*, N.Y.C. DEP'T OF CITY PLANNING, http://www.nyc.gov/html/dcp/html/wrp/wrp_revisions.shtml [<http://perma.cc/7G5M-GKHD>] (last visited Apr. 20, 2015) (describing approval process). The public comment period for state approval closed on February 20, 2015. Following approval by the state, the New York State Department of State will request incorporation of the City's LWRP amendment into the State's Coastal Management Program by the federal Office for Coastal Management. *Id.*

129. STRONGER, MORE RESILIENT, *supra* note 7, at 3.

released *A Stronger, More Resilient New York*,¹³⁰ and DCP released *Designing for Flood Risk* and *Urban Waterfront Adaptive Strategies*,¹³¹ each of which is relevant to the City's waterfront management policies.

The coastal protection chapter of *A Stronger, More Resilient New York* sets forth the City's most recent comprehensive coastal protection plan.¹³² This plan reviews and rejects the "silver bullet" of a massive, harbor-wide storm-surge barrier, and instead proposes a broad range of discrete coastal protection measures.¹³³ For example, the plan proposes the use of augmented wetlands, reefs and living shorelines in Jamaica Bay, Tottenville in Staten Island, Bay Ridge Flats, along the Arthur Kill and Kill van Kull, and along Long Island Sound. The plan also recommends the use of hard armoring (i.e., protective infrastructures), including local storm surge barriers in Newtown Creek, Rockaway Inlet and the Gowanus Canal in Brooklyn. These barriers would consist of large, movable in-water gates connected to levees or floodwalls on adjacent shores.¹³⁴ Although the report notes that "ultimately the City will be best served by implementing the entire suite of options," the report claims that implementation of the thirty-seven "Phase I" measures could reduce expected losses in a Sandy-

130. A STRONGER, MORE RESILIENT NEW YORK is a 438-page, 22-chapter report presenting recommendations for rebuilding the communities affected by Sandy and increasing the resilience of infrastructure and buildings citywide. Gathering data from numerous sources, including the NPCC2 report and an economic analysis by the reinsurance company Swiss Re, the 2013 report projected that, absent implementation of the SIRR recommendations, by 2050, a storm similar to Sandy would cost New York City approximately five times as much as Sandy, or \$90 billion. *Id.* at 34.

131. See N.Y.C. DEP'T OF CITY PLANNING, DESIGNING FOR FLOOD RISK (June 2013), available at http://www.nyc.gov/html/dcp/pdf/sustainable_communities/designing_flood_risk.pdf [<http://perma.cc/C5JT-HJTG>]; N.Y.C. DEP'T OF CITY PLANNING, URBAN WATERFRONT ADAPTIVE STRATEGIES (June 2013), available at http://www.nyc.gov/html/dcp/pdf/sustainable_communities/urban_waterfront_print.pdf [<http://perma.cc/DQG8-GZWB>].

132. See STRONGER, MORE RESILIENT, *supra* note 7, at 50.

133. *Id.* at 50–65.

134. *Id.* at 56. The SIRR report also contains six initiatives designed to strengthen the City's ability to understand the impacts of climate change, *id.* at 32, fourteen initiatives to increase the resilience of the City's buildings, *id.* at 79–86, six economic recovery initiatives, *id.* at 89–90, ten initiatives for addressing the needs of the insurance system, *id.* at 101–03, and twenty-three initiatives for increasing the resiliency of utilities, *id.* at 122–29.

like storm in the 2050s by up to twenty-five percent, or more than \$22 billion.¹³⁵

The reports released by DCP in June 2013, *Designing for Flood Risk* and *Urban Waterfront Adaptive Strategies*, are intended to help New York City and other urban waterfront communities improve their resilience to coastal flood risks.¹³⁶ *Designing for Flood Risk* identifies design principles to guide flood-resistant construction, provides an overview of regulatory requirements for construction in flood zones under the National Flood Insurance Program, recommends changes to zoning to “enable more versatile and desirable design solutions for flood-resistant construction,” and “explores the impacts of flood-resistant construction standards on built form and the creation of a vibrant streetscape and public realm.”¹³⁷ *Urban Waterfront Adaptive Strategies* identifies and analyzes potential adaptive strategies, including interventions inland, at the shoreline, and in the water.¹³⁸ Both of these DCP reports informed *A Stronger, More Resilient New York*.¹³⁹ *Designing for Flood Risk* also shaped the DCP’s Flood Resilience Text Amendment.¹⁴⁰

3. Local-Scale Climate Models and Risk Analysis

To help respond to climate change in New York City and accomplish the goals outlined in PlaNYC, the Mayor’s Office convened the first New York City Panel on Climate Change (“NPCC1”) in 2008.¹⁴¹ In doing this, New York City became the first city to scale down the United Nations’ IPCC global climate models to develop climate-related projections specific to a municipality.¹⁴² In 2009, NPCC1 released a set of climate projections specific to New York City. Significantly, but

135. *Id.* at 40.

136. See DESIGNING FOR FLOOD RISK, *supra* note 131, at 10–11; URBAN WATERFRONT ADAPTIVE STRATEGIES, *supra* note 131, at iii.

137. See DESIGNING FOR FLOOD RISK, *supra* note 131, at 32.

138. See URBAN WATERFRONT ADAPTIVE STRATEGIES, *supra* note 131, at 3.

139. See, e.g., STRONGER, MORE RESILIENT, *supra* note 7, at 47, 82.

140. See *infra* Part II.B.5 (summarizing Flood Resilience Text Amendment).

141. Michael R. Bloomberg et al., *Climate Change Adaptation in New York City: Building a Risk Management Response*, 1196 ANNALS N.Y. ACAD. SCI. 1 (2010).

142. IPCC, the international advisory body on climate change, was formed in 1988 by the World Meteorological Organization and the United Nations Environment Programme. See NPCC2, *supra* note 94, at 34.

unsurprisingly, NPCC1 concluded that, despite efforts to reduce GHG emissions, New York City must make substantial preparations for climate-related changes.¹⁴³

In September 2012, the City passed Local Law 42, which established the New York City Panel on Climate Change as an ongoing body.¹⁴⁴ Local Law 42 requires the NPCC to meet at least twice a year to review scientific data on climate change; recommend projections for the 2020s, 2050s, and 2080s within one year of the publication of the IPCC Assessment Reports, or, at a minimum once every three years; recommend a framework for stakeholders to incorporate climate change projections into their planning processes; and advise the City's Office of Long-Term Planning and Sustainability on a communications strategy related to climate science.¹⁴⁵

Local Law 42 also established a New York City climate change adaptation task force, "consisting of city, state and federal agencies and private organizations and entities responsible for developing, maintaining, operating or overseeing the city's public health, natural systems, critical infrastructure, buildings and economy."¹⁴⁶ Like the NPCC, the task force is required to meet at least twice a year, and, within one year of the NPCC's development of recommended climate change projections pursuant to Local Law 42, the task force must create an inventory of potential climate change-related risks.¹⁴⁷

In January 2013, the Mayor's Office convened the second New York City Panel on Climate Change ("NPCC2") to provide scientific information and analyses on climate risks for use in

143. NPCC, CLIMATE RISK INFORMATION 5 (2009), *available at* http://www.nyc.gov/html/om/pdf/2009/NPCC_CRI.pdf [<http://perma.cc/AHN8-MAXA>].

144. N.Y.C. ADMIN. CODE §§ 3-122-3-123.

145. *Id.*

146. *Id.*

147. *Id.* The task force is also responsible for reviewing the NPCC's climate change projections, evaluating potential impacts of climate change on public health, including delivery of public health services to the city's vulnerable populations; evaluating the potential impacts of climate change on the city's natural systems, critical infrastructure and buildings; identifying rules, policies and regulations governing public health, natural systems, critical infrastructure, buildings and economy that may be affected by climate change; and formulating and updating coordinated strategies to address the potential impact of climate change on the city's communities, vulnerable populations, public health, natural systems, critical infrastructure, buildings and economy. *Id.*

the SIRR.¹⁴⁸ Specifically, the goal of NPCC2 was to “present climate uncertainties clearly in order to facilitate risk-based decision-making on the use of policy tools such as incentives, regulations, and insurance” in order to “make New York City more resilient to mean changes in climate and to future extreme events.”¹⁴⁹ NPCC2 published reports in June 2013 and February 2015, which provided new climate change projections and future coastal flood risk maps for New York City.¹⁵⁰

4. NYC Green Codes Task Force

In July 2008, Mayor Bloomberg and City Council Speaker Christine Quinn asked the New York Chapter of the U.S. Green Building Council (“USGBC”) to convene the NYC Green Codes Task Force to review the City’s building and construction codes and make recommendations on how they could be amended to promote more sustainable practices. The task force was asked, among other things, to examine construction, fire, water and sewer and zoning codes; identify impediments to the incorporation of green technologies; identify opportunities to promote energy efficiency and other sustainable practices; and recommend ways to incorporate climate adaptation measures into the codes.¹⁵¹

The task force’s more than 200 volunteers¹⁵² responded with 111 proposed initiatives, consisting primarily of code additions or revisions.¹⁵³ Nine additional recommendations were

148. NPCC2, *supra* note 94, at 7; *see also supra* Part II.B.1.

149. NPCC2, *supra* note 94, at 9.

150. *Id.* at 4; NPCC 2015 *supra* note 97, at 9–10.

151. Letter from Michael Bloomberg, Mayor, and Christine Quinn, Speaker of the Council of the City of New York, to Russell Unger, Executive Director, USGBC New York (July 8, 2008), *in* URBAN GREEN COUNCIL, NYC GREEN CODES TASK FORCE: EXECUTIVE SUMMARY (2010) [hereinafter “NYC GREEN CODES”], *available at* http://www.nyc.gov/html/gbee/downloads/pdf/gctf_executive_summary.pdf [<http://perma.cc/S7HA-FBTF>].

152. The volunteers consisted of “architects; engineers; lighting, landscape architects and interior designers; owners and developers; corporate tenants; contractors; cost estimators; affordable-housing experts; code specialists; attorneys; waste haulers; scientists and public-health experts; and representatives of environmental organizations, building trade unions, city agencies, and industry and professional associations.” NYC GREEN CODES, *supra* note 151, at 3.

153. *See GCTF Enacted Proposals*, PLANYC, <http://www.nyc.gov/html/gbee/html/codes/enacted.shtml> [<http://perma.cc/7F8D-R8SH>] (last visited Mar. 25, 2015) (listing

introduced as bills in the City's 2014 legislative session.¹⁵⁴ Each proposed code amendment or revision includes proposed statutory language, a detailed explanation of the issues, an analysis of costs and savings, precedents from other jurisdictions, a comparison of the proposal to any related Leadership in Energy & Environmental Design ("LEED") credits and information on implementation.¹⁵⁵ The proposals primarily affect new buildings under construction and existing buildings that are being renovated, but, in some cases, the proposals focus on upgrading existing buildings.¹⁵⁶

As of April 2015, 52 of the 111 proposals had been implemented and another 4 had been partially implemented.¹⁵⁷ The enacted codes include new laws or amendments to existing law that: (1) add environmental protection as a fundamental principle of construction codes,¹⁵⁸ (2) streamline approvals for green technologies and projects,¹⁵⁹ (3) increase resiliency of buildings to natural disasters,¹⁶⁰ (4) increase energy efficiency¹⁶¹ and decrease carbon emissions,¹⁶² (5) remove

enacted and partially enacted proposals, corresponding legal language, and links to the proposals).

154. PROGRESS REPORT 2014, *supra* note 24, at 20.

155. *See, e.g.*, URBAN GREEN COUNCIL, NYC GREEN CODES TASK FORCE: FULL PROPOSALS OC1-1-3 (2010) [hereinafter "NYC GREEN CODES PROPOSALS"], *available at* http://www.nyc.gov/html/gbee/downloads/pdf/gctf_all_proposals.pdf [<http://perma.cc/U49A-LBYX>].

156. *See, e.g., id.* at OC3-1 (proposing amendment to building code to require all buildings to comply with improved environmental and health standards); 2009 N.Y.C. Local Law No. 85 (enacting the proposed amendment to require all buildings to comply with improved environmental and health standards).

157. *See NYC Green Codes Proposal Tracker*, URBAN GREEN COUNCIL, <http://urbangreencouncil.org/greencodetracker> [<http://perma.cc/8CX5-NLNN>] (last visited Apr. 20, 2015) (providing status of all 111 proposal and links to applicable legislation, local laws, and the proposal).

158. 2010 N.Y.C. Local Law No. 49.

159. 2010 N.Y.C. Local Law No. 5.

160. *See, e.g.*, NYCBC, app. G; 2013 N.Y.C. Local Law No. 143 (improving safeguards for toxic materials stored in flood zones); 2013 NYC Local Law No. 81 (studying and forecasting non-flood climatic hazards to 2080); 2013 N.Y.C., Local Law 79 (ensuring toilets and sinks can operate during blackouts).

161. *See, e.g.*, 2010 N.Y.C. Local Law No. 52 (improving lighting efficiency in apartment buildings); 2010 N.Y.C. Local Law No. 48 (regarding manual on-automatic off lighting); 2010 N.Y.C. Local Law No. 47 (regarding the reduction of artificial lighting in sunlit lobbies and hallways).

162. *See, e.g.*, 2011 N.Y.C. Local Law No. 21 (reducing summer heat with cool roofs); 2013 N.Y.C. Local Law No. 141 (reducing carbon dioxide emissions from specialized

impediments to alternative energy,¹⁶³ (6) increase indoor health and safety,¹⁶⁴ (7) increase resource conservation,¹⁶⁵ (8) manage stormwater more sustainably,¹⁶⁶ (9) promote sustainable urban ecological practices,¹⁶⁷ and (10) enhance water efficiency.¹⁶⁸

5. Zoning Code Amendments

Building on the work of the Green Codes Task Force, on April 30, 2012, the City Council adopted the Zone Green Text Amendment,¹⁶⁹ which amended the City's Zoning Resolution for the stated purpose of removing impediments to the construction and retrofitting of greener buildings.¹⁷⁰ The Zone Green amendments were one of a series of Zoning Resolution amendments the DCP proposed to promote sustainable communities and climate change resilience. This series of amendments also included a Flood Resilience Text

concrete); 2010 ECCCNY ch. 5 and ASHRAE 90.1 2010 ch. 5 (minimizing air leakage building exteriors); 1 R.C.N.Y. ch. 5000 (ensuring lighting systems function properly).

163. *See, e.g.*, 63 R.C.N.Y. 1 (removing landmarks impediments to alternative energy); 2011 N.Y.C. Local Law No. 20 (allowing large solar rooftop installations); 2012 N.Y.C. Local Law No. 28 (increasing allowable size of solar shades); 2010 N.Y.C. Local Law No. 43 (allowing use of biofuels).

164. *See, e.g.*, 2012 N.Y.C. Local Law No. 2 (limiting harmful emissions from carpets); 2011 N.Y.C. Local Law No. 71 (requiring the filtering of soot from incoming air); 15 R.C.N.Y. ch. 2 (phasing out dirty boiler fuels); 2010 N.Y.C. Local Law No. 43 (phasing out dirty boiler fuels); 2011 N.Y.C. Local Law No. 20 (treating corrosive concrete wastewater); 15 R.C.N.Y. ch. 1 (reducing "red tape" for asbestos removal); 2010 N.Y.C. Local Law No. 55 (increasing availability of drinking fountains). In addition, the Federal Formaldehyde Standards for Composite Wood Products Act enacted in 2010 restricts cancer-causing formaldehyde in building materials. *See* 15 U.S.C. § 2697 (West 2010).

165. *See, e.g.*, 2012 N.Y.C. Local Law No. 60 (providing recycling areas in apartment buildings); 2011 N.Y.C. Local Law No. 71 (requiring use of recycled asphalt).

166. *See, e.g.*, 15 R.C.N.Y. ch. 31 (strengthening stormwater run-off management requirements for new developments).

167. *See, e.g.*, 2013 N.Y.C. Local Law No. 80 (constructing sustainable sidewalks).

168. *See, e.g.*, 2010 N.Y.C. Local Law No. 57 (enhancing water efficiency standards); 2010 N.Y.C. Local Law No. 56 (catching leaks by measuring water use); 2010 N.Y.C. Local Law No. 54 (stopping wasting drinking water for cooling).

169. N.Y.C. DEP'T OF CITY PLAN'G, ZONE GREEN TEXT AMENDMENT (enacted Apr. 30, 2012), *available at* http://www.nyc.gov/html/dcp/pdf/greenbuildings/adopted_text_amendment.pdf [<http://perma.cc/E9S9-DKUP>].

170. N.Y.C. DEP'T OF CITY PLAN'G, ZONE GREEN TEXT AMENDMENT HANDOUT 1, *available at* <http://www.nyc.gov/html/dcp/pdf/greenbuildings/handout.pdf> [<http://perma.cc/KA2P-ULJN>] (last visited June 26, 2015).

Amendment, which the City adopted on October 9, 2013.¹⁷¹ The Flood Resilience amendments removed barriers to constructing and retrofitting for flood resilience based on the latest flood maps issued by the Federal Emergency Management Agency (“FEMA”).¹⁷² The amendments also put in place measures to mitigate the potential negative effects of elevated buildings on ground-floor activity and quality of the streetscape.¹⁷³ The City also adopted numerous sustainability-related amendments to its Zoning Resolution prior to and separate from the Zone Green and Flood Resilience amendments. These include amendments that allow car share vehicles to park in off-street parking garages and lots in certain locations¹⁷⁴; require indoor, secure, long-term bicycle parking in new multi-family residential, community facility, and commercial buildings¹⁷⁵; require street tree planting for all new developments and major enlargements citywide¹⁷⁶; and prevent excessive paving of front yards by encouraging landscaping and planting of yards.¹⁷⁷

III. NEW YORK CITY: A MODEL FOR CLIMATE CHANGE RESILIENCE?

PlaNYC is far from merely aspirational—it contains concrete goals such as the 2050 emissions reduction goal and interim emissions reductions goals, specific implementation strategies, substantial data analyses projects, an aggressive timeline for making changes to relevant local laws, and funding strategies. PlaNYC’s 2013 progress report boasts that “PlaNYC is the world’s standard for municipal sustainability plans and cities

171. N.Y.C. DEP’T OF CITY PLAN’G., FLOOD RESILIENCE TEXT AMENDMENT, *available at* http://www.nyc.gov/html/dcp/pdf/flood_resiliency/final_text.pdf [<http://perma.cc/A7E2-UWYM>] (last visited Mar. 22, 2015).

172. *Id.* at § 12–10.

173. *Id.* at § 64-00(c).

174. N.Y.C. DEP’T OF CITY PLAN’G. ZONING RESOLUTION AMENDMENT (adopted Sept. 29, 2010), *available at* <http://www.nyc.gov/html/dcp/pdf/zone/allarticles.pdf> [<http://perma.cc/B9V3-KH6X>].

175. N.Y.C. DEP’T OF CITY PLAN’G. ZONING RESOLUTION AMENDMENT, N 090191 ZRY, § 11-337 (adopted Apr. 22, 2009).

176. N.Y.C. DEP’T OF CITY PLAN’G. ZONING RESOLUTION AMENDMENT, N 080081 ZRY, § 11-336 (adopted Apr. 30, 2008).

177. *Id.*

throughout the world are emulating our work.”¹⁷⁸ Notwithstanding significant tensions and challenges, this boast appears to hold water, at least with respect to communications and public involvement; data analysis, collection and transparency; vulnerability assessment; building efficiency improvements; and development of action-focused plans with concrete implementation strategies including funding strategies.¹⁷⁹ Despite proactive and laudable policies, the boast does not hold water, however, with respect to emissions reductions commitments and coastal zone policies that fail to fully account for likely near- and medium-term future hazards—key features of mitigation and adaptation, respectively.

Thus, a number of New York City initiatives, as well as their underlying planning processes, provide excellent models for regional, county and sub-county level resilience planning efforts. Other of the initiatives take important steps, some of which are unprecedented in the United States, but nevertheless fall short of what is likely required to sufficiently “moderate[] harm” from dangerous interference with the climate system.¹⁸⁰

178. PROGRESS REPORT 2013, *supra* note 81, at 6.

179. *See generally* ICLEI PLANYC CASE STUDY, *supra* note 30, at 7. In 2010, ICLEI selected PlaNYC as the model for its Sustainability Five Milestone process “because of the comprehensive scope of the plan, the extensive planning process the City undertook to analyze issues, and the broad public outreach performed by the City to more than 70 stakeholder groups.” *Id.* at 9. The Milestones are as follows: conduct a sustainability assessment, establish sustainability goals, develop a local sustainability plan, implement policies and measures, and evaluate progress and report results. *Id.* ICLEI identified the following as factors that contributed to the success of the plan, *inter alia*:

a methodical, transparent, and inclusive planning process[]; c]entral management and coordination[]; a]n external Sustainability Advisory Board . . . []; a] comprehensive public outreach process [that] generated broad public support and helped to educate the general public about climate change and sustainability issues . . . []; t]he plan included an implementation plan with a timeline and a funded budget[]; and s]wift transition from planning to action.

Id. at 6.

180. *See* AR4 WGII, *supra* note 7, at 6 (defining “adaptation”); *see also supra* note 13 (quoting same).

A. PlaNYC: A Persuasive Narrative About a Climate Resilient Future

To the extent “good planning [is] persuasive storytelling about the future,”¹⁸¹ New York City is doing good resilience planning. The post-Sandy report, *Stronger, More Resilient*, tells a persuasive story of toughness and unity. Threaded throughout *A Stronger, More Resilient New York* are messages about the strength, toughness and machismo of New Yorkers:

The underlying goal of this report is resiliency. That is, to adapt our city to the impacts of climate change and to seek to ensure that, when nature overwhelms our defenses from time to time, we are able to recover more quickly.

In short, we have to be tough.

And toughness, as we all know, is one of the defining traits of New Yorkers.

In just the first few years of this century, we have been through the September 11, 2001 terrorist attacks, financial crises and blackouts, and now, Sandy. With each challenge, we have become more united as a city.

We must come together again with an even stronger commitment to slow the progress of climate change while simultaneously preparing for the changes already evident around us—and those yet to come.

If we embrace this plan today, we will be positioned to meet the challenges that climate change may bring tomorrow, and almost certainly will bring in the years and decades ahead. If we take action now, we will make New York City stronger, safer, and more resilient—not only for our own benefit, but for the benefit of future generations of New Yorkers.

181. Estiri, *supra* note 36, at 6 (quoting James A. Throgmorton, *Planning as Persuasive Storytelling About the Future: Negotiating an Electric Power Rate Settlement in Illinois*, 12 J. PLAN. EDUC. & RES. 17 (1992)). See also James A. Throgmorton, *Planning as Persuasive Storytelling in the Context of “the Network Society,”* Presentation at the ACSP-AESOP Third Joint Congress, Leuven, Belgium (July 8–12, 2003), available at http://ir.uiowa.edu/cgi/viewcontent.cgi?article=1005&context=urban_pubs [<http://perma.cc/WH26-CH2U>] (responding to criticism of claim that planning is persuasive storytelling and citing other recent treatments of storytelling in planning).

The time has come to make our city even tougher.¹⁸²

The new administration carries the toughness theme forward with its tag line, “One City, Built to Last,” reminiscent of Ford Truck’s 1990s ad campaigns (“Built to Last” and “Built Ford Tough”).¹⁸³ The underlying message appears to be that “tough guys” care about climate change, and, ultimately, New Yorkers—at least if they get on board with the City’s initiatives—are tougher than climate change. Illustrative of this, *A Stronger, More Resilient New York* includes a definition of “resilient,” which lists as synonyms “New York City” and “TOUGH.”¹⁸⁴

Given systemic climate change denial,¹⁸⁵ paralysis at the federal level,¹⁸⁶ and a troubling lack of preparedness in the

182. STRONGER, MORE RESILIENT, *supra* note 7, at 6. The toughness theme is also reinforced through images. *See, e.g., id.* at 6.

183. *See* ONE CITY, BUILT TO LAST, *supra* note 16; *see also* Tanya Gazdik, *Ford Boosts Ad Spending Behind Jwts’ ‘Built To Last’ Campaign*, ADWEEK (Feb. 9, 1998, 12:00 AM), <http://www.adweek.com/news/advertising/ford-boosts-ad-spending-behind-jwts-built-last-campaign-23668> [<http://perma.cc/7HN8-KUU8>] (discussing introduction of “Built to Last” tagline, to be used in conjunction with “Built Ford Tough” tag line).

184. STRONGER, MORE RESILIENT, *supra* note 7, at 2.

185. *See Global Trends*, IPSOS MORI (2014), <http://www.ipsosglobaltrends.com/environment.html> [<http://perma.cc/V2JP-ZK8E>] (finding in a September/October survey that only 54% of Americans believe “[t]he climate change we are currently seeing is largely the result of human activity”). The American response to this question (54%) was 10 points lower than the second lowest percentage of the 20 countries surveyed. *Id.* Similarly, an Associated Press-GfK poll found only 33% of Americans were “extremely confident” that the average temperature of the world is rising due to the existence of heat-trapping greenhouse gasses in the atmosphere. GfK PUBLIC AFFAIRS & CORPORATE COMMUNICATIONS, *THE AP-GfK POLL 2 (2014)* available at http://ap-gfkipoll.com/main/wp-content/uploads/2014/04/AP-GfK-March-2014-Poll-Topline-Final_SCIENCE.pdf [<http://perma.cc/ME5P-3F7H>]; *see also* Lydia Saad, *In U.S., Global Warming Views Steady Despite Warm Winter* (Mar. 30, 2012), <http://www.gallup.com/poll/153608/global-warming-views-steady-despite-warm-winter.aspx> [<http://perma.cc/4A45-DB4L>] (reporting on Gallup annual environmental poll in which 42% of respondents said reports of climate change are exaggerated); Peter J. Jacques et al., *The Organisation of Denial: Conservative Think Tanks and Environmental Scepticism*, 17 ENVTL. POL. 349, 349 (2008) (linking environmental skepticism fostered by conservative think tanks to a weakening of US commitment to environmental policies). Even more troubling, some states are restricting local government’s ability to pass laws or implement policies on climate change. *See, e.g.*, Tristram Kortzen, *In Florida, Officials Ban Term ‘Climate Change,’* FL. CTR. FOR INVESTIGATIVE REPORTING (Mar. 8, 2015), <http://fcir.org/2015/03/08/in-florida-officials-ban-term-climate-change/> [<http://perma.cc/BA8H-CFK6>] (discussing unwritten Florida

United States,¹⁸⁷ the persuasive power of a municipality's climate change plan should be considered when assessing the plan's effectiveness. Dan Kahan has urged that communication at the local level that is consistent with "the path of least resistance" is not only pragmatic, but is in fact "morally right."¹⁸⁸ He argues that discussions at the local level are sufficiently removed from the divisive language of the national debate "and sufficiently proximate to other meaning-pervaded domains . . . to evoke a host of different associations."¹⁸⁹ Thus, he asserts that, at the local level, citizens are "speaking in idioms—ones relating to their shared historical experience, for instance, as people either battered by violent storms or baked by arid, scorching heat—the familiarity and logic of which predate climate change."¹⁹⁰

Certainly, the City's use of a toughness theme appears to evoke the shared experience of survival and, as a result, the need for action separate from any politicized discussion of climate change. Referencing the "September 11, 2001 terrorist attacks, financial crises and blackouts," the City's resiliency plan draws on these experiences of extreme hardship and survival, asserting that "[w]ith each challenge, we have become more united as a city" and urging New Yorkers to "come together again with an even stronger commitment to slow the progress of climate change while simultaneously preparing for the changes already evident around us—and those yet to come."¹⁹¹ This narrative of toughness may be more than just a public relations device; rather, the narrative, by evoking a shared experience that predates debate on climate change, may increase public acceptance of the City's resilience and

policy prohibiting state officials from using the term "climate change" or "global warming" in official communications, emails, or reports).

186. See *infra* Part III.F.2, discussing the lack of federal congressional support of state and local climate resilience initiatives, noting federal executive actions in this area, and discussing the need for integration across the local, state and federal levels.

187. See *infra* notes 395–08 (discussing ICLEI 2011 Survey showing that percentage of U.S. municipalities to have completed adaptation assessments is lower than any other region surveyed).

188. Dan M. Kahan, *Cognitive Bias and the Constitution*, 88 CHI.-KENT L. REV. 367, 408 (2013).

189. *Id.* at 407.

190. *Id.*

191. STRONGER, MORE RESILIENT, *supra* note 7, at 6. The toughness theme is also reinforced through images. See, e.g., *id.*

mitigation plans, and indeed may be a lynchpin in their success.¹⁹² But, is it “morally right,” as Kahan urges, to take the path of least resistance¹⁹³ when doing so involves a failure to correct public misperception of the scope of the crisis?

Data and projections from the IPCC, NPCC2 and other scientists tell us that climate change itself is tough and getting tougher with each passing day.¹⁹⁴ Thus, although the City is undertaking adaptation and mitigation planning and implementation initiatives, many of which are unprecedented in the United States, the City’s “toughness” message may have the unintended, and potentially significant, harmful consequence of giving New Yorkers a false assurance of preparedness and lack of vulnerability. This may be especially so because the toughness message has been combined with a narrative that paints Super Storm Sandy as an anomaly. By referring to Sandy as “the worst natural disaster ever to hit New York City,”¹⁹⁵ the Mayor’s Office may give the mistaken impression that the storm was both unprecedented and a true worst-case-scenario—when, in fact, a storm of Sandy’s magnitude is not unprecedented in the region, and a different set of circumstances could have made Sandy even more devastating than it was.¹⁹⁶ Since 1900, New York City has experienced storms with higher winds speeds,¹⁹⁷ more rain,¹⁹⁸ and peak surges ten feet or higher above mean low tide,¹⁹⁹ which, if they hit the City today would have even higher peak

192. *See id.* at 408 (“[I]nsistence [that the divisive meanings of the national climate change debate be engrafted onto the local adaptation one] has wrecked attempts to replicate in North Carolina a constructive form of political engagement with climate science now unfolding in states like Florida and Virginia.”).

193. Kahan, *supra* note 188, at 408.

194. *See supra* Part II.A.

195. *See* Bloomberg, *supra* note 105.

196. STRONGER, MORE RESILIENT, *supra* note 7, at 21.

197. *See id.* (“[Sandy’s] 80- mile-per-hour (“mph”) peak wind gusts fell well short of other storms that have hit New York City, including Hurricane Carol in 1954 (up to 125-mph gusts) and Hurricane Belle in 1976 (up to 95-mph gusts).”).

198. *Id.* (“Previous storms also brought much more rain with them. Sandy dropped a scant inch in some parts of New York, far less than the 5 inches of rain dropped on the city during Hurricane Donna in 1960 or the 7.5 inches during the April 2007 nor’easter.”).

199. *See id.* at 21 (discussing 1821 hurricane (13-foot storm surge) and Hurricane Donna in 1960 (10-foot storm surge)).

surges as a result of rising sea levels.²⁰⁰ Moreover, although circumstances combined to increase Sandy's devastation, Sandy itself was not a worst-case scenario. For example, had Sandy struck at high tide in Western Long Island Sound, as opposed to near high tide at the Battery, Swiss Re projects that Sandy's peak surge would have been four feet higher than it was.²⁰¹

Thus, although potentially effective as communication strategies to garner support of a plan, narratives of toughness combined with characterizations of Sandy as an anomalous worst-case-scenario, especially combined with the City's voluminous and numerous reports on climate resilience planning, could lead the public to conclude that their local government has the problem under control. In addition to likely being incorrect,²⁰² this perception could lead residents and business owners to overlook opportunities to contribute to climate change adaptation (by, for example, installing flood mitigation measures on their own property) and mitigation (by, for example, making significant lifestyle changes to reduce personal energy usage), or make choices that increase their own or the City's future vulnerability (by, for example, purchasing property in a flood zone or rebuilding a structure with a 80-year useful life based on 10-year sea level rise projections).²⁰³

B. The Super Wicked Problem of Waterfront Development

Public policy scholars characterize as “wicked problem[s]” policy problems that defy resolution because of “enormous interdependencies, uncertainties, circularities, and conflicting stakeholders implicated by any effort to develop a solution.”²⁰⁴ Climate change generally, and the policy conundrum faced by

200. STRAUSS ET AL., *supra* note 9, at 11 (noting that storms today are intensified in terms of surge height and other variables as a result of higher sea levels).

201. *See* STRONGER, MORE RESILIENT, *supra* note 7, at 21 (describing projected impacts under a western Long Island Sound high tide scenario).

202. *See supra* Part II.A, *infra* Part III.C (discussing sea level rise and related projections and likely insufficient mitigation to stay within a 2°C pathway).

203. *See generally infra* Part III.B (discussing continued waterfront development in highly vulnerable areas; *see also infra* note 207 (discussing specific examples of waterfront development in known risk areas)).

204. *See* Richard Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1159 (2009).

municipalities' regulation of waterfront development in particular, poses a "super wicked problem."²⁰⁵ In addition to obvious economic and political obstacles posed by policies that involve displacement of residents and businesses and devaluation of property, major changes in waterfront development policies also must overcome particularly wicked obstacles related to the complex intergovernmental web of laws, regulations and agencies that regulate waterfront areas.

To highlight the wickedness of the waterfront development problem, consider the repeated dire projections for vulnerable coastal areas²⁰⁶; continued development of these areas, including publicly funded development²⁰⁷; the devastation of these areas during Sandy and other extreme weather events, including loss of lives, displacement of thousands of residents and businesses, and massive property and infrastructure losses²⁰⁸; and political assurances post-Sandy that New Yorkers are "tougher"²⁰⁹ than climate change and, without question, "we'll rebuild it."²¹⁰ Indeed, at the same time as the City was publishing warnings about accelerating sea level rise and increasing risk from floods and storm surge, the City also reported in its Clean Waterfront Plan that "New Yorkers are taking advantage of the waterfront for recreation, housing, and

205. *Id.* at 1159–60 (arguing that climate change is a "super wicked problem").

206. *See, e.g.*, NPCC 2015, *supra* note 97, at 41 (high estimate projection of sea level rise of 6.25 feet over a 2000 to 2004 base period by the century's end); Burkett, *supra* note 73, at 782 n.46 (citing New York and New Jersey master plans and reports predicting the growing dangers from continued development).

207. *See* John Rudolf et al., *Hurricane Sandy Damage Amplified by Breakneck Development of Coast*, HUFF. POST (Nov. 12, 2012, 12:15 PM), http://www.huffingtonpost.com/2012/11/12/hurricane-sandy-damage_n_2114525.html [<http://perma.cc/VCA8-3T54>] ("On Staten Island, developers built more than 2,700 mostly residential structures in coastal areas at extreme risk of storm surge flooding between 1980 and 2008, with the approval of city planning and zoning authorities, according to a review of city building data by scientists at the College of Staten Island. Some of this construction occurred in former marshland along the island's Atlantic-facing south shore.").

208. *See* Sarah Adams-Schoen, *On the Waterfront: New York City's Climate Change Adaptation and Mitigation Challenge, Part I*, 25 ENVTL. L. N.Y. 81, 82–83 (2014).

209. *See supra* Part III.A (discussing PlaNYC's "toughness" narrative).

210. Colleen Curry, *NYC Neighborhood Hit Hard by Superstorm Sandy Would Rather Sell Than Rebuild*, ABC NEWS (Apr. 29, 2013), <http://abcnews.go.com/US/superstorm-sandy-hit-neighborhood-smarter-sell-rebuild/story?id=19066168> [<http://perma.cc/FE4X-3DNF>] (quoting New Jersey Governor Chris Christie as saying there is "no question . . . we'll rebuild it").

new business opportunities in record numbers.”²¹¹ The City also reported in its current coastal management plan that “[n]ew housing on waterfront property has helped the city accommodate the influx of nearly one million new residents. Since 1992, [when the City adopted its first waterfront plan,] more than 20,000 new residential units have been built on waterfront blocks, with nearly 6,000 additional new units in the development pipeline.”²¹²

Although governments “do not ordinarily dictate where people can live, own property, or operate their businesses,” they can “use sound zoning regulations and natural hazards management programs, along with appropriate building codes and practices, to help ensure that people are encouraged to avoid especially hazardous locations.”²¹³ Governments “can also enact even stricter requirements for critical facilities, such as schools and nursing homes, which house particularly vulnerable populations.”²¹⁴

Maxine Burkett urges that devastation in vulnerable coastal areas is a failure of local governments to respond adequately to known risks:

Instead of rezoning at-risk areas to cease development, . . . decision makers in New York and New Jersey allowed continued heavy development of risky coastal areas even though they were increasingly aware of the potential for “massive storm surge in the region.” At least two fatalities in Staten Island occurred in developments completed as recently as the 1990s in coastal areas at extreme risk of storm surge flooding.²¹⁵

211. N.Y.C. LOCAL LAW 55 OF 2011: CLEAN WATERFRONT PLAN 4 (2014), *available at* http://www.nyc.gov/html/planyc/downloads/pdf/publications/2014_nyc_clean_waterfront_plan.pdf [<http://perma.cc/X7N3-86BX>].

212. VISION 2020, *supra* note 126, at 13.

213. ED THOMAS ET AL., NATURAL HAZARD MITIGATION ASS'N, PLANNING AND BUILDING LIVABLE, SAFE & SUSTAINABLE COMMUNITIES: THE PATCHWORK QUILT APPROACH 7 (2013), <http://nhma.info/uploads/publications/Patchwork%20QuiltUPDATED.pdf> [<http://perma.cc/Z6LA-YRH6>].

214. *Id.*; see also Andrea McArdle, *Storm Surges, Disaster Planning, and Vulnerable Populations at the Urban Periphery: Imagining A Resilient New York After Superstorm Sandy*, 50 IDAHO L. REV. 19, 19–41 (2014) (contrasting the harm to vulnerable populations and infrastructure in the City's flood zones following Superstorm Sandy with the City's policy of rebuilding and continued encouragement of waterfront development).

215. Burkett, *supra* note 73, at 782 (citations omitted).

Indeed, more than eight years before Super Storm Sandy, Princeton University reported that the rapid population growth in New Jersey's "coastal counties was setting the scene for monumental environmental damage and property loss."²¹⁶ Ultimately, New Jersey suffered economic losses from Super Storm Sandy estimated at \$9 to \$15 billion.²¹⁷

Although the damage from Sandy was catastrophic, it was not "unthinkable," as described by New Jersey Governor Chris Christie.²¹⁸ Rather, the storm and resulting damages were foreseeable, and future damaging storms of its magnitude and of greater magnitude are also foreseeable.²¹⁹ Thus, New York City officials—and other municipal leaders considering how to reduce the mounting toll of floods and other hazards—would be wise to "keep foremost in [their] minds that the best disaster response and recovery comes from proper planning, land use, and building codes that prevent the disaster from ever happening in the first place."²²⁰

In light of the devastation from Sandy (and before that Hurricanes Irene and Lee) and the projections of more frequent and more intense future storms, coastal community planning must include coordinated multi-jurisdictional efforts "to reduce or eliminate unnecessary damage caused by human occupancy of hazardous areas."²²¹ *A Stronger, More Resilient New York*, the City's post-Sandy catalog of resiliency initiatives, concluded that "[e]fforts by [the multiple] agencies [with regulatory authority in the coastal zones] are not completely aligned. This lack of unified and coordinated regulatory oversight can lead to delayed and unpredictable waterfront activity, complicating the

216. *Id.*

217. *Id.*

218. Cavan Sieczkowski, *Hurricane Sandy Damage Photos: Superstorm's 'Unthinkable' Aftermath Revealed (PICTURES)*, HUFF. POST (Oct. 30, 2012), http://www.huffingtonpost.com/2012/10/30/hurricane-sandy-damage-photos-superstorm-unthinkable-aftermath_n_2044099.html [<http://perma.cc/JF6D-KDZA>] ("Chris Christie said the wreckage is 'beyond anything I thought I'd ever see.' Adding, 'The level of devastation at the Jersey Shore is unthinkable,' according to CNN.").

219. See STRAUSS ET AL., *supra* note 9, at 11 (projecting increased frequency and intensity of coastal storms).

220. THOMAS ET AL., *supra* note 213, at 7.

221. *Id.* at 6 (warning that "[w]e need to reduce or eliminate unnecessary damage caused by human occupancy of hazardous areas").

achievement of important public goals, including coastal resiliency.”²²² Without coordination, “the proliferation of programs and initiatives may lead to confusion, potential diffusion of resources, less than perfect communication within and among government entities, and missed opportunities.”²²³

Indeed, the local, state and federal legal and policy framework governing coastal and estuarine planning and management is a complicated web that includes more than a dozen related federal, county, state and local laws implemented by an even greater number of agencies, departments, commissions and task forces.²²⁴ These include the federal Coastal Zone Management Act (“CZMA”), Submerged Lands Act, and Coastal Barrier Resources Act²²⁵; the New York State Waterfront Revitalization of Coastal Areas and Inland Waterways Act (“NYS CZMA”), Waterfront Revitalization Program (“WRP”), Tidal Wetlands Act (“TWA”), and Coastal Erosion Hazard Area Act (“CEHA”)²²⁶; and the New York City New Waterfront Revitalization Program, comprehensive coastal management plan, the coastal chapter of *Stronger*,

222. See STRONGER, MORE RESILIENT, *supra* note 7, at 40 (discussing coordination challenges).

223. Patricia E. Salkin, *New York Climate Change Report Card: Improvement Needed for More Effective Leadership and Overall Coordination with Local Government*, 80 U. COLO. L. REV. 921, 925 (2009).

224. For example, the CZMA implements the national Coastal Zone Management Program, which is administered federally by the Department of Commerce under the direction of the National Oceanic and Atmospheric Administration (“NOAA”) and at the state level by an agency designated by each state or territory. 16 U.S.C. §§ 1455–1456; see generally N.Y.C. DEPT OF CITY PLAN’G. ZONING RESOLUTION AMENDMENT, *supra* note 176. In New York, the Coastal Zone Management Program is implemented by the Department of State. However, under New York law, a municipality may opt to adopt a Local Waterfront Revitalization Plan, which is administered by an agency or department designated by the municipality. 42 N.Y. EXEC. LAW § 915 (McKinney 2014); N.Y. COMP. CODES R. & REGS. Tit. 19, § 601 (2012) (implementing optional LWRP provisions).

225. Submerged Lands Act of 1953, 43 U.S.C. § 1312 (2006); The Coastal Zone Management Act, 16 U.S.C. § 1454 (2012); Coastal Barrier Resources Act, 16 U.S.C. § 1452(2)(K) (2006).

226. New York State Waterfront Revitalization of Coastal Areas and Inland Waterways Act, N.Y. COMP. CODES R. & REGS. tit. 19, § 600.1(c) (2012); Tidal Wetlands Act (TWA), N.Y. COMP. CODES R. & REGS. tit. 6, § 661.1 (2012); New York Coastal Erosion Hazard Area Act (CEHA), N.Y. ENVTL. CONSERV. LAW § 34-0102(5) (McKinney 2012).

More Resilient, and the City's Zoning Resolution,²²⁷ among others. Municipal policies and projects along the City's waterways may also be subject to the state's common law and statutory public trust doctrine²²⁸ as well as federal takings jurisprudence.²²⁹

New York State enacted the NYS CZMA and adopted a state WRP pursuant to the federal CZMA,²³⁰ which offers financial incentives and management opportunities for participating waterfront municipalities.²³¹ New York City adopted its LWRP pursuant to an optional provision of New York law,²³² and the State and U.S. Secretary of Commerce have approved the LWRP.²³³ As a result, local, state and federal actions that affect a New York City coastal area or inland waterway must be reviewed by the New York City Department of City Planning for consistency with the City's LWRP.²³⁴ For actions

227. NYC LWRP, *supra* note 122; VISION 2020, *supra* note 126; *Zoning Resolution Text*, N.Y.C. DEP'T OF CITY PLAN'G. (Apr. 28, 2015), <http://www.nyc.gov/html/dcp/html/zone/zonetext.shtml> [<http://perma.cc/J9T3-X7QW>].

228. The Underwater Lands Bill, Act of Aug. 7, ch. 791, § 3, 1992 N.Y. Laws 4028, 4029 (codified as amended at N.Y. PUB. LANDS LAW § 75 (McKinney 2014)).

229. *See, e.g.*, *New Creek Bluebelt, Phase 4 v. City of New York*, No. D42904 (N.Y. App. Div. Nov. 19, 2014) (finding reasonable probability that city wetlands designation is a regulatory taking under federal constitution).

230. The CZMA implements the national Coastal Zone Management Program, which is administered federally by the Department of Commerce under the direction of the National Oceanic and Atmospheric Administration and at the state level by an agency designated by each state or territory. 16 U.S.C. §§ 1455–1456-1456; *see generally* PATRICIA SALKIN, *NEW YORK ZONING LAW AND PRACTICE* § 9B:02 (4th ed. 2014).

231. *See generally* SALKIN, *supra* note 230, at § 9B:01. The intention of New York's Legislature in adopting the NYS CZMA was to provide "a balance between economic development and preservation that will permit the beneficial use of coastal . . . waterway resources while preventing the . . . diminution of open space areas or public access to the waterfront, shoreline erosion, . . . or permanent adverse changes to ecological systems." N.Y. COMP. CODES R. & REGS. tit. 19, § 600.1(c).

232. 42 N.Y. EXEC. LAW § 915 (McKinney 2014); *see also* N.Y. COMP. CODES R. & REGS. tit. 19, § 601 (implementing optional LWRP provisions), *available at* http://www.dos.ny.gov/opd/programs/pdfs/Article_42.pdf [<http://perma.cc/3K95-J2RS>].

233. NYC LWRP, *supra* note 122, at Cover Page 2.

234. 16 U.S.C. §§ 1456(c)(1)–(2) & (d) ("Federal agencies shall not approve proposed projects that are inconsistent with the enforceable policies of a coastal state's management program, except upon a finding by the Secretary that such project is consistent with the purposes of this chapter or necessary in the interest of national security."); 42 N.Y. EXEC. LAW § 916 (McKinney 2014) (requiring "state agency program actions be undertaken in a manner which is consistent to the maximum extent practicable with the approved [local] waterfront revitalization program," including reviews conducted under the state environmental quality review act"); 15 C.F.R. pt.

directly or indirectly undertaken by state agencies, including funding assistance and development projects,²³⁵ the state agency with jurisdiction must complete an assessment in which it determines whether the state action is consistent with the NYC LWRP²³⁶ and file the assessment with the N.Y. Department of State (“NY DOS”).²³⁷ When a project involves federal action, such as federal funding or the issuance of a federal permit, the project is subject to a federal consistency review.²³⁸

In order to obtain a finding of consistency, a project must not “substantially hinder the achievement of any of the policies [of the LWRP] and, where practicable, [must] advance one or more of the policies.”²³⁹ Only LWRP policies that are relevant to the

930 (2015) (implementing the federal consistency requirements of the CZMA); N.Y. COMP. CODES R. & REGS. tit. 10, § 97.12(d)(13) (2015) (providing for state environmental impact review based on effects of proposed action on applicable policies of LWRP as opposed to WRP when municipality has an approved LWRP). *See also* NYC LWRP, *supra* note 122, at 4 (“As a result of these approvals, state and federal discretionary actions within the city’s coastal zone must be consistent to the maximum extent practicable with the [L]WRP policies and the city must be given the opportunity to comment on all state and federal projects within its coastal zone.”). *See generally* SALKIN, *supra* note 230, at § 9B:10 (stating that, once approved, “LWRPs become amendments to the state’s coastal management program, and ‘in effect, become the policies and standards of the local government, the State of New York, and the federal government.”) (citing and quoting *Stutchin v. Town of Huntington*, 71 F. Supp. 2d 76, 89 (E.D.N.Y. 1999)).

235. *See* N.Y. COMP. CODES R. & REGS. tit. 19, § 600.3(a) (2015) (making state funding contingent on compliance with article 42 of the Executive Law, which provides requirements for NYS CZMA); 42 N.Y. EXEC. LAW § 916(1)(a) (requiring NYS Secretary of State to examine “programs which involve issuance of permits, licenses, certifications and other forms of approval of land use or development, the provision of grants, loans and other funding assistance which leads to or influences land use or development, [and] directly undertaken land use or development and planning activities” for consistency with approved LWRP).

236. *See State Consistency*, N.Y. DEPT OF STATE, OFFICE OF PLAN’G & DEV., <http://www.dos.ny.gov/opd/programs/consistency/state.html> [<http://perma.cc/UT3D-WHNN>] (last visited May 20, 2015) (describing state consistency review process). A copy of the N.Y. Department of State CAF is attached as Attachment B and is also available at <http://www.dos.ny.gov/opd/programs/pdfs/caf2.pdf> [<http://perma.cc/END3-7A2Q>].

237. 42 N.Y. EXEC. LAW § 916(1)(a) (McKinney 2014). *See also State Consistency*, *supra* note 236 (describing state consistency review process).

238. 16 U.S.C. §§ 1456(c)(1)–(3) & (d) (2012); 15 C.F.R. §§ 930.30–46 (2015) (including consistency for federal agency activities); *id.* at §§ 930.50–66 (including consistency for activities requiring federal license or permit); *id.* at §§ 930.90–101 (including consistency for federal assistance to state or local governments); *see also* 42 N.Y. EXEC. LAW § 912(9) (McKinney 2014) (declaring policy of assuring state and federal consistency with approved LWRPs).

239. NYC LWRP, *supra* note 122, at 6.

specific site, surroundings, or action are used to determine consistency.²⁴⁰ Furthermore, the LWRP designates several Special Natural Waterfront Areas (“SNWAs”) where additional considerations must be given due to the “particular natural habitat features” of those areas.²⁴¹

The City’s current LWRP, which was approved by the City in 1999 and adopted by the state in 2002, focuses on increasing public access to the waterfront and protection of habitat more than flood mitigation, and does not consider sea level rise or climate change at all. The LWRP includes a flood and erosion hazard policy²⁴² and, when a project is located within an SNWA, the primary policy consideration for a consistency determination is to “[p]rotect and restore the quality and function of ecological systems,” which is subject to guidelines in the TWA.²⁴³ An activity or project that “protect[s] or restore[s]” special features in an SNWA is “consistent with waterfront policy for these areas.”²⁴⁴ Additionally, the LWRP recognizes that “enhancement of adjacent areas to provide natural buffers” provides a viable method of protecting tidal wetlands.²⁴⁵

Unlike the City’s current LWRP, the City’s comprehensive coastal management plan *Vision 2020* expressly recognizes a policy of increasing climate resilience.²⁴⁶ *Vision 2020*, released in 2011, provides the policies and goals that the City has set for the revitalization of its waterfront area by the year 2020.²⁴⁷ The City Council approved revisions to its LWRP to incorporate

240. *Id.* at 7.

241. *Id.*

242. Similarly, the WRP provides that one policy of the State in regards to public access is to “[p]rotect, maintain, and increase the levels and types of public access to public water-related recreation resources and facilities so that these resources and facilities may be fully utilized by all the public” with priority provided to public beaches. Waterfront Revitalization of Coastal Areas and Inland Waterways, N.Y. COMP. CODES R. & REGS. tit. 19, § 600.5(g) (Mckinney 2012). The WRP also provides that “[a]ccess to the public foreshore and to lands immediately adjacent to the foreshore or water’s edge that are publicly owned shall be provided . . . Such lands shall be retained in public ownership.” *Id.* § 600.5(e)(2).

243. NYC LWRP, *supra* note 122, at 16.

244. *Id.*

245. *Id.* at 18.

246. VISION 2020, *supra* note 126, at 104–13 (describing “Goal 8: Increase climate resilience”).

247. *Id.* at 6.

the goals in *Vision 2020*, including the climate resilience goal.²⁴⁸ Notably, the revised LWRP will require consideration in the planning and design of all new development projects of “the potential vulnerabilities of the project to the effects of sea level rise, coastal flooding, and storm surge over its usable life and the general consequences to the project of these types of events.”²⁴⁹

Given that waterfront projects that are undertaken by, funded by, or approved by the city, state or federal government must be consistent with the City’s LWRP, and local actions must also be consistent with the City’s other applicable plans including *Vision 2020*, one concrete action the City can take to increase coastal resilience is to revisit its LWRP and *Vision 2020* with an eye toward further strengthening the coastal resilience policies in light of the risks of sea level rise, storm surge and other weather extremes. For example, although the City’s proposed amendments to its LWRP require consideration of climate change and sea level rise in the planning process, the revised LWRP encourages commercial and residential development in “appropriate Coastal Zone areas.”²⁵⁰ The revised LWRP lists eight criteria for determining what constitutes an “appropriate” area for development—none of which are climate change or sea level rise related risks.²⁵¹ Thus, although the revised LWRP provides that “[p]rojects should consider potential risks related to coastal flooding”²⁵² and planning decisions should consider climate change and sea level rise,²⁵³ the LWRP could further emphasize the goal of coastal resilience by expressly recognizing the risks of

248. NYC REVISED LWRP, *supra* note 123, at 5–6.

249. *Id.* at 43.

250. NYC REVISED LWRP, *supra* note 123, at 16–17.

251. *Id.* at 16 (listing the following criteria: “compatibility with the continued functioning of the designated Special Natural Waterfront Areas, the Arthur Kill Ecologically Sensitive Maritime and Industrial Area, or Significant Maritime and Industrial Areas, where applicable; the absence of unique or significant natural features or, if present, the potential for compatible development; the presence of substantial vacant or underused land; proximity to existing residential or commercial uses; the potential for strengthening upland residential or commercial areas and for opening up the waterfront to the public; transportation access; the maritime and industrial jobs potentially displaced or created; and the new opportunities created by redevelopment”).

252. *Id.* at 17.

253. *Id.* at 43–44.

continued waterfront development and including climate change and sea level related risks in the list of criteria for determining if an area is appropriate for waterfront development.

Currently, *Vision 2020* recognizes sea level rise as an issue, but also seeks to support economic development on the waterfront and increase “water recreation, waterborne transportation, and water-related cultural activities and education programs,” with an emphasis on expanding public access to the City’s waterfront and waterways.²⁵⁴ If the City were to amend *Vision 2020* or produce a supplemental coastal management plan that clarified that coastal resilience is a priority over other competing coastal policies, climate resilience could potentially factor more heavily in local planning, zoning and permitting decisions.

Another concrete action the City can take is to review the SNWAs to determine if they need to be expanded to remain consistent with sea level rise projections. Relatedly, the state can support coastal communities’ resilience efforts by reviewing and potentially amending the Tidal Wetlands Act to provide for further protection of areas designated as SNWAs. State and federal legislatures can also support municipal coastal resilience efforts by reviewing and amending state and federal coastal zone management programs to place greater emphasis on reducing risks related to climate change.

In the meantime, the City can stop approving the development of critical facilities like daycare centers and hospitals in areas currently prone to flooding or likely to be prone to flooding within the lifetime of the facility. It can also increase its review of commercial and residential developments in vulnerable areas to require the projects to have a net reduction in the flood resilience of the area, rather than requiring only that the project be neutral in terms of flood impact. Of course, implementation of these measures would have both political and economic costs including, among other things, takings challenges. The goals of these measures could be achieved, potentially, through market mechanisms not subject to takings challenges if readily available information accurately identified current and future flood risk in the City’s

254. VISION 2020, *supra* note 126, at 7.

most vulnerable areas. For example, the City's Green Building Task Force proposed that the City amend its current flood map, which is based on historical data and does not account for future sea level rise, to "reflect projected sea-level rise and increases in coastal flooding through the year 2080," and update this map at least once every ten years.²⁵⁵ With readily available long-term flood projections, persons desiring to build in the most vulnerable areas may themselves opt to choose a different location or may find it difficult to secure necessary funding or insurance.²⁵⁶

C. 80 by 50: Impressive but Probably Insufficient to Stay Within a 2°C Pathway

The City's September 2014 announcement of its "80 by 50" initiative distinguishes the City as a role model city with respect to local GHG emissions reduction commitments, consistent with the City's boast that the revised commitment makes New York "the largest city in the world to commit to this goal."²⁵⁷ However, to avoid dangerous interference with our climate system, New York City and municipalities looking to the City's initiative as a possible model should consider whether they can commit to larger, more accelerated reductions.

1. Is the City's Target Sufficient to Avoid Dangerous Interference with the Climate System?

AR5 warns that to have a better than two-in-three chance of avoiding the dangerous interference with our climate system that would occur with a 2°C increase in average global temperatures over pre-industrial levels,²⁵⁸ global GHG

255. NYC GREEN CODES PROPOSALS, *supra* note 155, at BR1-1 to BR 1-3. As of April 2015, this proposal had not yet been implemented.

256. *See* Nolon, *supra* note 2, at 337, 343 (discussing market mechanisms for shifting patterns of development out of disaster prone areas).

257. ONE CITY, BUILT TO LAST, *supra* note 16, at 3. Note, however, that numerous other cities in the United States and abroad have committed to achieving larger reductions. *See infra* notes 299–301 & accompanying text.

258. The 2009 Copenhagen Accord "recognize[d] the scientific view that the increase in global temperature should be below 2 degrees Celsius," or 3.6°F, to prevent dangerous interference with the climate system, prevention of which was the goal of the United Nations Convention on Climate Change ("UNCCC"). Note that many small island nations called for a goal of 1.5°C because 2°C is projected to result in sea level

emissions must be reduced by at least 40–70% below 1990 levels by 2050, and to zero or below by 2100.²⁵⁹ Others warn that, to avoid the 2°C threshold, we must decrease human-caused GHG emissions to zero by 2050,²⁶⁰ and still others warn that the carbon emissions budget will be exhausted by between 2024 and 2039.²⁶¹

The City makes three claims with respect to its role in reducing emissions sufficient to avoid the “most dangerous impacts of climate change.”²⁶² First, the City claims that its commitment is “in line with the UN target,” which the City characterizes as a 50% reduction below 1990 levels by 2050. Second, the City suggests that its commitment is larger than this UN target and in line with a higher UN target for

rise that would submerge some of these nations. *See generally Climate Change: The ‘Greatest Threat’ to the Peoples of the Pacific*, ISLAND BUS. (July 31, 2014), <http://www.islandsbusiness.com/news/palau/5906/climate-change-the-greatest-threat-to-the-peoples/> [<http://perma.cc/TF5U-PUTL>].

259. *See* John C. Dernbach, *Achieving Dramatic Reductions in GHG Emissions Through Sustainable Development*, in Sarah J. Adams-Schoen et al., *supra* note 5, at 10029–31. In his article, John Dernbach cites and parses apart the following paragraph from IPCC, CLIMATE CHANGE 2013: THE PHYSICAL SCIENCE BASIS 27 (2013) (footnotes omitted), available at http://www.climatechange2013.org/images/report/WG1AR5_SPM_FINAL.pdf [<http://perma.cc/L7KM-TCWH>] [hereinafter WGI SPM]:

Limiting the warming caused by anthropogenic CO₂ emissions alone with a probability of >33%, >50%, and >66% to less than 2°C since the period 1861–1880, will require cumulative CO₂ emissions from all anthropogenic sources to stay between 0 and about 1570 GtC (5760 GtCO₂), 0 and about 1210 GtC (4440 GtCO₂), and 0 and about 1000 GtC (3670 GtCO₂) since that period, respectively. These upper amounts are reduced to about 900 GtC (3300 GtCO₂), 820 GtC (3010 GtCO₂), and 790 GtC (2900 GtCO₂), respectively, when accounting for non-CO₂ forcings as in RCP2.6. An amount of 515 [445 to 585] GtC (1890 [1630 to 2150] GtCO₂) was already emitted by 2011.

Id.

260. *See, e.g., B Team Open Letter Calls for Bold Climate Action at COP21 in Paris*, B TEAM (Feb. 5, 2015), <http://bteam.org/the-b-team/b-team-open-letter-calls-for-bold-climate-action-at-cop21-in-paris/> [<http://perma.cc/BF5N-PFGZ>]; *see also* V. Ramanathan & Y. Feng, *On Avoiding Dangerous Anthropogenic Interference with the Climate System: Formidable Challenges Ahead*, 105 PROC. NAT’L ACAD. SCI. 14245, 14245 (2008) (estimating global warming of 2.4°C even if GHG concentrations held to 2005 levels).

261. Dernbach, *supra* note 259, at 10030 n.16 (citing Malte Meinshausen et al., *Greenhouse-Gas Emission Targets for Limiting Global Warming to 2°C*, 458 NATURE 1158, 1159 (2009), in stating that based on past and projected emissions, “we would exhaust the CO₂ emission budget by 2024, 2027 or 2039, depending on the probability of exceeding 2°C (respectively 20%, 25% or 50%)”).

262. ONE CITY, BUILT TO LAST, *supra* note 16, at 5.

developed nations. Third, the City suggests that it has set this higher target to account for the City's historically disproportionately high contributions of GHG emissions and higher per capita emissions:

In line with the UN target, we will put New York City on a pathway to achieve an 80 percent reduction in GHG emissions from 2005 levels by 2050.

The United Nations Framework Convention on Climate Change ("UNFCCC") projects that by 2050, global GHG emissions must be reduced by 50% below 1990 levels to avoid the most dangerous impacts of climate change. Developed countries must reduce their emissions even more aggressively—by up to 80% by 2050—to account for their greater contribution to global emissions to date and their higher than average per-capita emissions. If we fail, the impacts of climate change will be far-reaching and felt by all, but with the worst consequences for the world's poorest and most vulnerable populations.²⁶³

Although the City's emissions reduction commitment of 80% below 2005 levels by 2050 is amongst the highest municipal GHG emissions reductions commitments, the City's three claims nevertheless warrant scrutiny. First, the City's claim that its commitment is "in line with the UN target" of 50% by 2050 is accurate if the UNFCCC's Bali Action Plan's so-called "50 by 50" proposal is interpreted as a "UN target."²⁶⁴ The 2007 Bali Action Plan called for a long-term objective that included reduction of global emissions 50% below 1990 levels by 2050, and this proposal was endorsed by the Group of Eight Industrialized nations.²⁶⁵ But, to clarify, a 50 by 50 target is not present in any binding or nonbinding international agreement. Additionally, it should be noted that the 50 by 2050 objective was likely based on AR4 projections,²⁶⁶ and AR5

263. ONE CITY, BUILT TO LAST, *supra* note 16, at 5–6; *see also* United Nations General Assembly, *United Nations Framework Convention on Climate Change*, 1771 UNTS 107; S. Treaty Doc No. 102-38; U.N. Doc. A/AC.237/18 (Part II)/Add.1; 31 ILM 849 (1992) [hereinafter "UNFCCC"].

264. Conference of the Parties, *Bali Action Plan*, Decision 1/CP.13, UN Doc. FCCC/CP/2007/6/Add.1 (Mar. 14, 2008).

265. *See* Daniel Bodansky, *The Copenhagen Climate Change Conference: A Postmortem*, 104 AM. J. INT'L L. 230, 235 (2010).

266. THIRD WORLD NETWORK (TWN), SHARED VISION AND BURDEN SHARING IN THE "GLOBAL GOAL" 2 (2008), *available at* <http://unfccc.int/resource/docs/2008/smsn/ngo/064.pdf> [<http://perma.cc/6M6N-EADH>] (suggesting the 50 by 50 target comes from

revised the target upwards to between 40 and 70 by 2050.²⁶⁷ Also, the City's target and the Bali Action Plan proposal are based on different baselines. Nevertheless, even taking into consideration the differences in baseline, the City's commitment to reduce its emissions 80% below 2005 levels by 2050 is in line with both the Bali Action Plan proposal of 50 by 50 and the AR5 global targets of 40–70% below 1990 levels by 2050.²⁶⁸

However, the City's claim that its target is consistent with the UN's 80 by 50 target for developed countries²⁶⁹ is potentially misleading. Unlike the City's 80 by 50 target, which refers to reductions below 2005 levels, the UN's call for 80% reductions by 2050 for developed countries refers to reductions below 1990 levels.²⁷⁰ Using global emissions data from 1990 and 2005, the UN's 80 by 50 target equates to a reduction from 35.0 GtCO₂e to 7.0 GtCO₂e; whereas, the City's target equates to a reduction from 43.16 GtCO₂e to 8.63 GtCO₂e²⁷¹ (based on global data), a difference of 1.6 gigatonnes of CO₂ equivalent. The City's target would have to be increased to 83.78% to achieve the larger UN goal for developed countries.²⁷² To assess the true significance of the difference in baseline, the City's goal should be adjusted to reflect the difference between New York City's 1990 and 2005 GHG

footnote 1 linked to the fourth paragraph of the Bali Action Plan chapeau, which refers to figures in AR4, Working Group III).

267. See Dernbach, *supra* note 259, at 10030; AR5 WGI SPM, *supra* note 258, at 27.

268. The City uses a 2005 baseline and the Bali Action Plan and AR5 use a 1990 baseline. Based on global emissions data, 80% below 2005 emissions (43.16 GtCO₂e * 0.2 = 8.63 GtCO₂e) is a larger reduction than 70% below 1990 emissions (35.0 GtCO₂e * 0.3 = 10.5 GtCO₂e). See also *infra* notes 271–72 & accompanying text (citing source of data and further comparing goals based on different baselines).

269. ONE CITY, BUILT TO LAST, *supra* note 16 (recognizing UN call for “[d]eveloped countries [to] reduce their emissions even more aggressively—by up to 80% by 2050—to account for their greater contribution to global emissions to date and their higher than average per-capita emissions.”). “Developed countries” refers to “Annex I” countries of the Kyoto Protocol.

270. ONE CITY, BUILT TO LAST, *supra* note 16, at 5–6.

271. This back-of-the-envelope conversion is based on global emissions of 35.0 GtCO₂e in 1990 and 43.16 GtCO₂e in 2005, an increase of 23.33%. See *Climate Action Tracker*, CLIMATE ACTION TRACKER, <http://climateactiontracker.org> [<http://perma.cc/7GRM-8JX7>] (last visited June 26, 2015).

272. Eighty percent below 1990 levels (35.0 GtCO₂e) and 83.78% below 2005 levels (43.16 GtCO₂e) is 7.0 GtCO₂e (the UN target). 80% below 2005 levels (43.16 GtCO₂e) and 75% below 1990 levels (35.0 GtCO₂e) is 8.63 GtCO₂e (the City target based on global data).

emissions; however, 1990 emissions levels for the City are not available.²⁷³

Finally, the City's suggestion that it has set a higher target than the so-called UN 50 by 50 target to account for the City's historically disproportionately high contributions of GHG emissions and higher per capita emissions may accurately describe the City's intention in setting its 80 by 50 goal, but may nonetheless give readers a false sense that the "most dangerous impacts of climate change"²⁷⁴ will be avoided as long as developed countries and their cities "reduce their emissions . . . aggressively—by up to 80 percent by 2050 . . ."²⁷⁵ The projections underlying the UN call for developed countries to reduce emissions by 80% assume that countries will meet their commitments, an assumption that has not borne out in practice.

Specifically, assuming developed country emissions are reduced by 80% (from 1990 levels) and other countries meet their reduction pledges, the global average reduction is projected to be sufficient to limit average global emissions to 21 gigatonnes by 2050, an amount projected to keep us within the 2°C pathway.²⁷⁶ However, a significant gap exists between GHG emissions reductions pledges and the 21 gigatonnes by 2050 ceiling.²⁷⁷ The International Energy Agency ("IEA") projects that—even assuming full implementation of existing government measures to curb CO₂ emissions and cautious implementation of policies in the pipeline—GHG emissions will rise 20% by 2040, "putting the world on track for a long-term global temperature increase of 3.6°C."²⁷⁸ And others project

273. URBAN GREEN COUNCIL, 90 BY 50: NYC CAN REDUCE ITS CARBON FOOTPRINT 90% BY 2050 14 (2013), available at http://urbangreencouncil.org/sites/default/files/90_by_50_report.pdf [<http://perma.cc/49N7-NVRE>] (reporting that accurate GHG emissions data for the city date back only to 2005).

274. ONE CITY, BUILT TO LAST, *supra* note 16, at 5.

275. *Id.* See also UNFCCC, *supra* note 263.

276. The UNEP issued a progress report in 2012 on global emissions, which concluded that, among other things, to stay within the 2°C pathway, average global GHG emissions need to be limited to 21 gigatonnes by 2050. UN ENV'T PROGRAMME, THE EMISSION GAP REPORT 2012: A UNEP SYNTHESIS REPORT 3 (2012).

277. See *id.* at 1 (projecting that filed pledges pursuant to the Copenhagen Accord would result in a gap by 2020 of 14 gigatonnes between global emissions and the level needed to stay below 2°C).

278. See IEA, WORLD ENERGY OUTLOOK 2014 FACT SHEET 1–2 (2014), available at http://www.worldenergyoutlook.org/media/weowebiste/2014/141112_WEO_FactSheets.

even bleaker scenarios.²⁷⁹ At the 2013 Conference of Parties (“COP19”) in Warsaw, recognizing this “ambition gap,” the parties agreed that global GHG emissions need to peak this decade, and get to zero net emissions by the second half of this century. Similarly, both the UNEP and IEA have been urging since 2010 that to have a reasonable chance of staying within the 2°C pathway, countries must make vigorous efforts to cut their GHG emissions by the year 2020, with even stronger action thereafter.²⁸⁰ Climate Tracker projects that, to stay within a 2°C pathway, developed country reductions need to be within the range of 25–40% below 1990 levels by 2020, based on projections from the IPCC Fourth Assessment Report (“AR4”).²⁸¹ For New York City’s 2005-baseline target to be roughly consistent with this 2020 goal (which should be increased to account for the more up-to-date projections in AR5), the City’s reductions must be in the range of 39–51% below 2005 levels by 2020.²⁸²

To further illustrate the gap, Scenarios A and B in the table below show two paths toward a global 50 by 50 target.²⁸³ In

pdf [<http://perma.cc/D3XL-BRZY>]. This projection is based on IEA’s “New Policies Scenario,” which “takes into account policies and implementing measures affecting energy markets that had been adopted as of mid-2014, together with relevant policy proposals, even if specific measures needed to put them into effect have yet to be fully developed. It assumes only cautious implementation of such commitments and plans.” IEA, *WORLD ENERGY OUTLOOK 2014* 687 (2014), available at http://www.worldenergyoutlook.org/media/weowebiste/energymodel/policydatabase/WEO2014_AnnexB.pdf [<http://perma.cc/RM5N-GBH4>].

279. See, e.g., Ramanathan & Feng, *supra* note 260, at 14245 (estimating global warming of 2.4°C even if GHG concentrations held to 2005 levels).

280. See IEA, *Executive Summary*, in *WORLD ENERGY OUTLOOK 2010* 45 (2010); UNEP, *Technical Summary*, in *THE EMISSIONS GAP REPORT: ARE THE COPENHAGEN ACCORD PLEDGES SUFFICIENT TO LIMIT GLOBAL WARMING TO 2°C OR 1.5°C? A PRELIMINARY ASSESSMENT 10* (advance copy) (November 2010). UNEP suggested that to have a likely chance of avoiding exceeding the 2°C threshold, global emissions must peak before 2020, with substantial declines in emissions thereafter. “Likely” refers to a greater than 66% probability. *Id.* at 14.

281. See *Climate Action Tracker*, *supra* note 271.

282. As with the above conversions, this conversion is based on global GHG emissions data, and not New York City data, for 1990 and 2005.

283. The data in the table and this analysis is illustrative only. It is based on a compilation of sources that likely do not include the same assumptions. The 1990 data for “developed” countries is from an excel spreadsheet derived from the United Nations Framework Convention on Climate Change. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, SUMMARY OF GHG EMISSIONS FOR ANNEX I 1 (2012), available at https://unfccc.int/files/ghg_data/ghg_data_unfccc/ghg_profiles/application/pdf/ai_ghg_profile.pdf [<https://perma.cc/P8Q2-ARE3>].

Scenario A, developed countries achieve an 80% reduction of their GHG emissions from 1990 levels and in Scenario B developed countries achieve a 100% reduction from 1990 levels. As Scenario A shows, if developed countries reduce their emissions 80% (i.e., from 19 to 3.8 gigatonnes of CO₂ equivalent), developing countries would have to decrease their emissions 33% (i.e., from 20.4 to 13.7 gigatonnes of CO₂ equivalent) in order to achieve a global emissions reduction of 50% (i.e., from 35 to 17.5 gigatonnes of CO₂ equivalent). While a 33% reduction may sound attainable, at least as compared to 80%, note that developing countries would have to achieve this reduction in emissions at the same time as their populations are expected to double,²⁸⁴ which means that Scenario A would require developing countries to decrease their emissions from 5.0 tonnes per capita to 1.7 tonnes per capita—a 66% reduction in per capita emissions. Moreover, they would have to reduce per capita emissions by 66% while at the same time attempting to increase GNP.²⁸⁵ Scenario B also depicts a path toward a global 50 by 50 target, with developed countries achieving 100% reductions in their emissions. In this scenario, to get the rest of the way toward a 50% reduction in global emissions, developing countries would have to reduce emissions to 14% below the 1990 baseline. Given expected population growth, a 14% decrease in developing country emissions represents a 56% reduction in per capita emissions.

Year/ Scenario	Total GHG emissions (gigatonnes of CO ₂ equivalent)	Developed country emissions	Developing country emissions	Pop. of developing countries (billions)	Developing country emissions per capita
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284. The population of developing countries' is expected to double between 1990 and 2050 (from 4.1 billion to 8 billion), while the population of developed countries is expected to remain relatively flat. Press Release, UN Population Division, World Population to Exceed 9 Billion by 2050 (Mar. 11, 2009), *available at* <http://www.un.org/esa/population/publications/wpp2008/pressrelease.pdf> [<https://perma.cc/GF4A-W9UJ>].

285. Developing countries are projected to have continued GNP growth of 6% per year (or 4% GNP growth per capita). U.N. DEP'T ECON. & SOC. AFFAIRS & U.N. CONF. ON TRADE & DEV., WORLD ECONOMIC SITUATION AND PROSPECTS 2013 6 (2013), *available at* http://www.un.org/en/development/desa/policy/wesp/wesp_archive/2013_wesp.pdf [<http://perma.cc/H7EL-P4CH>].

1990	35	19	20.4	4	5.0
2050: Scenario A	17.5 (50%)	3.8 (80%)	13.7 (33%)	8	1.7 (66%)
2050: Scenario B	17.5 (50%)	0 (100%)	17.5 (14%)	8	2.2 (56%)

As a normative question, how much of the onus of staying within a 2°C pathway should be placed on developing versus developed countries is hotly debated. But, as a positive question, the crux of the issue is whether in combination developed and developing countries can achieve the reductions necessary to stay within a 2°C pathway, and, if so, how that can be done. The proposition that developing countries will achieve per capita reductions of between 52 and 61% appears untenable. Although developing countries have fewer infrastructure locked-in problems,²⁸⁶ in light of doubling populations, steady GNP growth, and substantially fewer resources,²⁸⁷ it is difficult to fathom how developing countries could achieve even a 52% per capita cut in emissions.

2. Can the City Achieve Deeper Reductions?

Of course, cities—even cities of the scale of New York City—cannot control all or even most of the factors that contribute to local GHG emissions.²⁸⁸ According to the U.S. Energy Information Agency (“EIA”), the factors that contribute to statewide per-capita GHG emissions include climate, the structure of the state economy, population density, energy sources, building standards, and explicit state policies to reduce emissions.²⁸⁹ Although cities tend to have control over

286. See *supra* note 284 (discussing opportunities in developing countries).

287. WORLD ECONOMIC SITUATION AND PROSPECTS 2013, *supra* note 285, at 67.

288. See *supra* Part I.A. (discussing municipality’s ability to influence factors that contribute to GHG emissions).

289. See generally EIA, EMISSIONS OF GREENHOUSE GASES IN THE UNITED STATES 2008 (2009), available at [http://www.eia.gov/oiaf/1605/ggrpt/pdf/0573\(2008\).pdf](http://www.eia.gov/oiaf/1605/ggrpt/pdf/0573(2008).pdf) [<http://perma.cc/7QZV-KSDW>].

building efficiencies and density,²⁹⁰ most existing cities have little control over the remaining factors.²⁹¹ Cities have little or no control over their baseline climate or whether the city or state economy is largely driven by energy production or non-energy-production activities.²⁹² Further, state public utility commissions and legislatures typically shape energy use in a state. Increasingly, however, cities are exerting influence or control over the energy sources they use for heating and electricity.²⁹³

Indeed, more than 80% of New York City's GHG emissions reductions to-date are attributable to the City's shift from coal and oil energy sources to natural gas and, to a small extent, renewable resources, and other improvements to utility operations.²⁹⁴ The City characterizes these reductions as the low-hanging fruit, observing that improvement in utility operations strategies "cannot be replicated, and future reductions will be much more difficult to achieve."²⁹⁵

PlaNYC's planners and advisory board set the City's target so that it would be both aggressive and achievable, on the

290. See *infra* Part II.B.4 (discussing New York City's building efficiency initiatives).

291. IPCC, SUMMARY FOR POLICYMAKERS, *in* CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE, CONTRIBUTION OF WORKING GROUP III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Edenhofer, O. et al. eds., 2014).

292. See Alexandra B. Klass, *Climate Change and Cities*, *in* Adams-Schoen et al., *supra* note 5, at 10037 (discussing factors, noting that energy-producing economies are tied to the physical location of energy resources, and identifying Pittsburgh, Pennsylvania as an example of a city that has shifted its economy to non-energy production activities).

293. See *id.* at 10038 (discussing Chicago, Illinois' "electric aggregation" program whereby the city decreased its reliance on coal and increased its use of renewable resources by entering into long-term power purchase agreements ("PPAs") with electricity suppliers on behalf of its citizens). See also Herman K. Trabish, *A Utility in the Making: The Municipalization of Boulder, Colorado*, UTILITY DIVE (Aug. 27, 2014), <http://www.utilitydive.com/news/a-utility-in-the-making-the-municipalization-of-boulder-colorado/300268/> [<http://perma.cc/UUD9-3XPM>] (discussing municipalization of electric utilities); Mahesh Bhawe, *Microgrids Create Municipalization Benefits*, RENEWABLE ENERGY WORLD (June 2, 2014), <http://www.renewableenergyworld.com/rea/news/article/2014/06/microgrids-create-municipalization-benefits> [<http://perma.cc/Y7FQ-9ZXU>] (discussing local efforts around distributed generation).

294. ONE CITY, BUILT TO LAST, *supra* note 16, at 7. Changes in utility operations included: decreased wastewater treatment plant methane, improved landfill methane capture, less carbon intensive electricity generation, more efficient steam generation, and a reduction in fugitive SF₆ emissions. *Id.*

295. *Id.* at 6.

theory that an overly ambitious or unrealistic target would not be implemented.²⁹⁶ At least in PlaNYC's initial stages, the Office of Long-Term Planning and Sustainability ("OLTPS") took a more conservative approach in its modeling and based efficiency estimates on current technologies, rather than on future technological improvements.²⁹⁷ In initially developing PlaNYC's emissions reduction target, OLTPS researched best practice plans and programs, including Portland, Oregon's climate action plan, Santa Monica's sustainability plan, London's Better Buildings Partnership Program, and congestion pricing programs in London and Stockholm.²⁹⁸

These cities and others may provide models for New York City to increase and accelerate its GHG emissions reduction commitment. By way of comparison, London, England has set CO₂ emissions reduction targets of 20% by 2015, 40% by 2020, 60% by 2025 and 80% by 2030 (from 1990 levels);²⁹⁹ the Tokyo Metropolitan Government's target is 25% by 2020 (from 2000 levels)³⁰⁰; and, the City of Chicago's target is 25% by 2020 (from 1990 levels).³⁰¹ The Urban Green Council, the New York Chapter of the U.S. Green Building Council, has also identified strategies for the City to achieve more aggressive emissions reduction, ultimately concluding that the City can achieve a 90% reduction from its 2010 GHG emissions levels by 2050.³⁰²

296. ICLEI PLANYC CASE STUDY, *supra* note 30, at 20.

297. *Id.*

298. *Id.* at 29.

299. Mayor of London, *Executive Summary*, in DELIVERING LONDON'S ENERGY FUTURE: THE MAYOR'S CLIMATE CHANGE MITIGATION AND ENERGY STRATEGY viii–ix (2011), available at <http://www.london.gov.uk/sites/default/files/Energy-future-oct11-exec-summ.pdf> [<http://perma.cc/ZC44-VSTN>]. In 2007, Parliament enacted the Greater London Authority Act 2007, which imposes a duty on the London mayor to address climate change as it relates to Greater London, including strategies for minimizing GHG emissions and increasing efficient production and use of energy. Greater London Authority Act 2007, 2007, c. 24, §§ 42–44 (Eng.), available at http://www.legislation.gov.uk/ukpga/2007/24/pdfs/ukpga_20070024_en.pdf [<http://perma.cc/9KAE-Y6Q3>].

300. *Carbonn Climate Report: Tokyo Metropolitan Government*, CARBONN CLIMATE REGISTRY, [http://carbonn.org/data/report/commitments/?tx_dataareport_pi1\[uid\]=102](http://carbonn.org/data/report/commitments/?tx_dataareport_pi1[uid]=102) [<http://perma.cc/5EWQ-9YLC>] (last visited June 13, 2015).

301. *Carbonn Climate Report: City of Chicago*, CARBONN CLIMATE REGISTRY, [http://carbonn.org/data/report/commitments/?tx_dataareport_pi1\[uid\]=327](http://carbonn.org/data/report/commitments/?tx_dataareport_pi1[uid]=327) [<http://perma.cc/R7QG-XAHH>] (last visited June 13, 2015).

302. URBAN GREEN COUNCIL, *supra* note 273, at 1.

However, without additional supportive state and federal policies, municipalities like New York City remain constrained in their ability to achieve maximum GHG emissions reductions. For example, preemption and other hurdles beyond the City's control limit the extent to which the City can impose performance standards on motor vehicles.³⁰³ The result is that although NYC's 80 by 50 initiative probably makes an insufficient contribution to the global effort to remain within a 2°C pathway, the target may be close to the City's maximum achievable target.³⁰⁴ Nevertheless the targets of other cities like London suggest that New York City should reevaluate whether it can achieve an even higher target, including an aggressive 2020 target.

D. Setting the Standard for Local Data Collection, Analysis and Benchmarking

New York City's local data collection, analysis and benchmarking initiatives provide a model of municipal data analysis and transparency. Resiliency, sustainability and energy efficiency data benchmarking like the City's provides relatively easy access to information that has the potential to encourage market transactions that favor sustainable market participants; shape energy-efficient and other sustainable and resilient behaviors; and provide an empirical foundation upon which to assess current initiatives and guide future policies.³⁰⁵

When the Mayor's Office convened NPCC1 in 2008, New York City became the first city to scale down the United Nation's IPCC global climate models to develop climate-related

303. See *infra* Part III.F (discussing state and federal law and policy obstacles to municipal mitigation); but see *Climate Smart Communities Summary for Local Officials*, N.Y. STATE DEPT OF ENVTL CONSERVATION, <http://www.dec.ny.gov/energy/50851.html> [<http://perma.cc/P6BT-WK8F>] (last visited May 21, 2015) (providing resources for local communities to decrease GHG emissions).

304. But see URBAN GREEN COUNCIL, *supra* note 273, at 1 (asserting that the City can achieve a 90% reduction from 2010 GHG emissions levels by 2050).

305. See, e.g., Klass, *supra* note 292, at 10038 (discussing energy efficiency benchmarking and noting that Austin, Texas; Seattle, Washington; Washington, D.C.; and Minneapolis, Minnesota "impose some form of benchmarking requirements on commercial buildings and mandate some information disclosure to local governments or prospective buyers to increase demand for energy efficient buildings").

projections specific to a municipality.³⁰⁶ The City's subsequent codification of Local Law 42—which established NPCC as an ongoing body with regular data analysis and reporting requirements, and established a New York City climate change adaptation task force, also with regular reporting requirements³⁰⁷—and Local Law 84—which requires regular reporting on energy and water use of public and private properties³⁰⁸—distinguishes the City as ahead of the curve with respect to local-scale climate data analysis, risk assessment, and benchmarking.

With respect to the City's emissions reductions and other building sustainability plans, building owners are mandated by law to annually record energy and water use, and this information is publicly disclosed by the City.³⁰⁹ With the release of the City's Local Law 84 benchmarking report in 2013, the City became the first U.S. city to analyze and publicly disclose energy and water use data for multiple years for more than 8,000 private sector properties.³¹⁰ With respect to the 80 by 50 initiative, the City also updates its GHG emissions inventory annually and reports on the progress of its climate change mitigation initiatives in annual reports that are publically available on the City's website.³¹¹

In addition to accountability mechanisms specific to the green building and 80 by 50 initiatives, OLTPS also uses multiple approaches for monitoring and reporting progress on the City's other sustainability initiatives. OLTPS produces annual PlaNYC progress reports, which provide detailed

306. IPCC, the international advisory body on climate change, was formed in 1988 by the World Meteorological Organization and the United Nations Environment Programme. See NPCC2, *supra* note 94.

307. 2012 N.Y.C. Local Law No. 42 (codified at N.Y.C. ADMIN. CODE §§ 3-122–3-123). See also *supra* notes 144–47 & accompanying text (discussing NPCC and task force requirements).

308. 2005 N.Y.C. Local Law No. 86 § 2, available at http://www.nyc.gov/html/dob/downloads/pdf/ll_86of2005.pdf [<http://perma.cc/RM7Y-U5U3>].

309. See *id.*; BENCHMARKING REPORT 2014, *supra* note 27, at 8.

310. PROGRESS REPORT 2014, *supra* note 24, at 19.

311. See PlaNYC, *Ongoing Resiliency Projects*, MAYOR'S OFFICE OF RECOVERY & RESILIENCY, <http://www.nyc.gov/html/planyc/html/progress/progress.shtml> [<http://perma.cc/MS4H-TG63>] (last visited Mar. 8, 2015) (providing links to progress and benchmarking reports); see also, e.g., CITY OF NEW YORK, INVENTORY OF NEW YORK CITY GREENHOUSE GAS EMISSIONS (2014), available at http://www.nyc.gov/html/planyc/downloads/pdf/NYC_GHG_Inventory_2014.pdf [<http://perma.cc/4ME7-486E>].

updates on the implementation progress of the 127 PlaNYC initiatives.³¹² Following the City's publication of its comprehensive analysis of vulnerabilities post-Sandy, *Stronger, More Resilient*, the annual PlaNYC progress report also includes updates on the resiliency initiatives proposed in *Stronger, More Resilient*.³¹³ These reporting requirements are codified in local law, which, among other things requires the City to report on a set of sustainability indicators to measure the progress towards achieving the goals in PlaNYC.³¹⁴ The City's sustainability indicators were released on Earth Day 2009 and have since been incorporated into the City's Citywide Performance Report, which the City updates on a monthly basis and which is available online.³¹⁵

The City is also involved in a number of data initiatives at the national and international scale. For example, the City contributed data to the Building Performance Database, a data-sharing platform in partnership with the U.S. Department of Energy ("DOE").³¹⁶ The City has also joined the Urban Sustainability Directors Network, an international community of municipalities that are engaging in benchmarking and exchanging best practices and lessons-learned.³¹⁷ OLTPS also participated as a Steering Committee member in the development of the STAR Community Index, a national sustainability framework for local governments.³¹⁸

312. See, e.g., PROGRESS REPORT 2014, *supra* note 24, at 34–54.

313. See, e.g., *id.* at 91–106.

314. 2008 N.Y.C. Local Law No. 17.

315. See ICLEI PLANYC CASE STUDY, *supra* note 30, at 45 (describing City's mechanisms for reporting on implementation of its sustainability plan).

316. PROGRESS REPORT 2014, *supra* note 24, at 33.

317. *Carbon Neutral Cities Alliance Press Release—March 2015*, URB. SUSTAINABILITY DIRECTORS NETWORK (Mar. 27, 2015), <http://usdn.org/public/CNCAMarch2015PressRelease.html> [<http://perma.cc/XE7V-MUCS>].

318. See generally *STAR Sustainability Goals and Guiding Principles*, ICLEI, <http://www.icleiusa.org/sustainability/star-community-index/star-goals-and-guiding-principles> [<http://perma.cc/M34Q-3W5A>] (last visited May 21, 2015) (STAR's "81 sustainability goals and 10 guiding principles collectively define community-scale sustainability, and present a vision of how communities can become more healthy, inclusive, and prosperous across eight specific categories").

E. Green Building Codes and Benchmarking for a Resilient Future

In 2013, the City studied opportunities to achieve an 80 by 50 reduction based on current technologies. The study found that nearly two-thirds of the GHG reductions that are needed must come from more efficient buildings.³¹⁹ The City has already achieved a 19% reduction of its GHG emissions from 2005 levels, and *One City, Built to Last* identifies a strategy for achieving an additional 61% reduction in GHG emissions by 2050.³²⁰ To stay on track with this, the plan states that the City must achieve an overall reduction in the energy used to heat, cool, and power buildings of 30% below 2005 levels by 2025.³²¹

One question the City's approach begs is whether the NYC Green Codes Task Force's 111 code amendment proposals are sufficient to achieve the deepest possible cuts in GHG emissions.³²² As of April 2015, 52 of the 111 proposals had been implemented and another 4 had been partially implemented.³²³ These proposals are comprehensive and proactive, putting New York City at the forefront of municipalities using building code reform as a means of climate change adaptation and mitigation. However, a review of model codes, USGBC recommendations, and initiatives of other major cities such as London suggests that, while New York City's approach puts it ahead of many municipalities, the City should continue to examine whether it is responding appropriately to the urgency and scope of the climate change problem. And,

319. ONE CITY, BUILT TO LAST, *supra* note 16, at 7 (noting that nearly three-quarters of the city's GHG emissions come not from vehicles, but rather from the city's more than one million buildings).

320. *See* ONE CITY, BUILT TO LAST, *supra* note 16, at 7–15.

321. *Id.* This target is based on a reduction in the GHG from buildings specifically, which emitted 60% of total citywide 2005 GHG emissions. *Id.* at 11. The City states that a 30% reduction in these emissions will generate \$8.5 billion in total cost savings for New Yorkers. *Id.* *But see supra* Part III.C (discussing need to increase emissions reduction goal); URBAN GREEN COUNCIL, *supra* note 273, at 1 (concluding that 80 by 50 goal is “noble,” but “not enough” and that the City can achieve an even greater reduction).

322. *But see* URBAN GREEN COUNCIL, *supra* note 273, at 17–26 (analyzing numerous strategies for decreasing carbon footprint of City's building sector).

323. *See NYC Green Codes Proposal Tracker*, *supra* note 157 (providing status of all 111 proposals and links to applicable legislation, local laws, and the proposal).

indeed, the NYC Green Codes Task Force proposals call for continued examination of how the codes can be most effectively amended to mitigate and adapt to climate change.³²⁴

Of the 111 proposals included in the Task Force Report, nine proposals specifically targeted building resiliency:

BR1: Develop flood maps that reflect projected sea-level rise and increases in coastal flooding through the year 2080. Currently, flood maps are based on historical data and do not account for projected climate change-related sea-level rise. This proposal would create a New York City Climate Change Flood Map, which would be updated at least once every ten years.³²⁵

BR2: Require toxic materials stored in the 100-year floodplain to be located in flood-proof areas.³²⁶

BR3: Require a multi-agency study of building codes, zoning resolutions and urban design in relation to the 100-year flood map projected out to 2080. Building code revisions to be considered would include: (a) foundation requirements that take into account the effect of rising sea levels on structures and buildings due to buoyancy and water infiltration; (b) freeboard, frame and wash-away structures at first floors; (c) areas of refuge in the event of a citywide power outage; (d) hurricane-resistant buildings; and (e) mold-resistant construction. Zoning revisions to be considered would include: (a) raising “measuring points” within the flood zone; (b) specifying zoning uses to be included within flood zones; and (c) requirements for shelter areas and areas of refuge. The study would also include urban design aspects.³²⁷

BR4: Require the City to undertake a study to determine whether building code and zoning changes are necessary to diminish the impacts of non-flood climatic hazards.³²⁸

BR5: Require the City to undertake a study examining the climate risks posed to buildings through 2080. This study would determine whether impacts will vary across the city or have a

324. See, e.g., NYC GREEN CODES PROPOSALS, *supra* note 155, at BR3-1 (recommending that City undertake study to determine how building codes and zoning resolutions should be strengthened to protect buildings from sea-level rise and flooding).

325. *Id.* at BR1-1 to BR1-3.

326. *Id.* at BR2-1 to BR2-3.

327. *Id.* at BR3-1 to BR3-2.

328. *Id.* at BR4-1.

uniform impact, and then define and map hazard zones in the city based on these risks. This study would analyze risks from the following hazards: rainfall quantity, frequency, intensity and seasonal modifications; heat waves; increased humidity; increased temperatures; probability of other extreme weather events; rise in groundwater table; encroachment of salinity; increased wind velocities; electrical grid disruptions caused by extreme weather events; interaction of increased temperatures with the urban heat island effect; and impact of increased temperature, changes in precipitation and humidity on air quality.³²⁹

BR6: Require the City to undertake a study of passive survivability³³⁰ and dual-mode functionality³³¹ and propose code changes to incorporate these concepts into the City's building codes. This proposal also includes a study on refuge areas in sealed buildings.³³²

BR7: Amend the New York City Plumbing Code to require that toilets and faucets are capable of operating without building power for at least two weeks.³³³

BR8: Amend the New York City Plumbing Code to prohibit the removal of existing water towers and require water towers in all new and renovated buildings.³³⁴

BR9: Endorse the NYC Mayor's Office of Environmental Coordination's effort to provide guidance for analyzing climate change in environmental assessment conducted pursuant to the City Environmental Quality Review ("CEQR"). CEQR is the process by which agencies review the effects of proposed actions on the environment. Under the Mayor's proposal, as endorsed by

329. *Id.* at BR5-1.

330. Task Force member Alex Wilson formulated the concept of "passive survivability," which is the idea that buildings should be designed and built so that they can remain habitable in the absence of an outside power supply. Proposal BR6 notes that, "[i]n the aftermath of Hurricane Katrina, 30,000 residents of New Orleans sought refuge in the Superdome for several days. This rapidly turned into a nightmare because without electricity and air conditioning, temperatures within the building became almost unendurably hot. In contrast, the people who stayed in the French Quarter were relatively comfortable. This is because the older buildings in the Quarter were designed for some degree of passive cooling since they were built before air conditioning was available." *Id.* at BR6-2.

331. "Dual mode functionality" refers to reducing the emergency energy needs of the building by designing it to function in two modes—a "standard mode" and a "low energy" mode. *Id.* at BR6-1.

332. *Id.*

333. *Id.* at BR7-1.

334. *Id.* at BR8-1.

the Task Force, the CEQR guidelines would be updated to include an assessment of the impact of climate change on proposed actions.³³⁵

As of April 2015, six of the nine building resiliency proposals have been implemented: BR 2 (Safeguard Toxic Materials Stored in Flood Zones),³³⁶ BR 3 (Study Adaptive Strategies to Flooding),³³⁷ BR 4 (Study Adaptive Strategies to Non-Flood Climatic Risks),³³⁸ BR 5 (Forecast Non-Flood Climatic Hazards to 2080),³³⁹ BR 6 (Analyze Strategies to Maintain Habitability During Power Outages),³⁴⁰ and BR 7 (Ensure Toilets and Sinks Can Operate During Blackouts).³⁴¹ BR 1, BR 8 and BR 9 have not yet been implemented.

In evaluating the Task Force's proposals, one potentially useful point of comparison is the International Green Construction Code ("IgCC"). USGBC recommends that states and local jurisdictions adopt the International Code Council's ("ICC's") IgCC.³⁴² The IgCC was developed to provide a model sustainability code for the entire construction project and its site; the code establishes minimum green requirements that promote sustainability and energy efficiency.³⁴³ Although the

335. *Id.* at BR9-1.

336. *See GCTF Enacted Proposals*, MAYOR'S OFFICE OF RECOVERY & RESILIENCY, <http://www.nyc.gov/html/gbee/html/codes/enacted.shtml> [<http://perma.cc/7F8D-R8SH>] (last visited Apr. 23, 2015) (citing NYCBC, app. G and 2013 N.Y.C. Local Law 143).

337. *See id.* (citing Special Initiative for Rebuilding and Resiliency and Building Resiliency Task Force).

338. *See id.*

339. *See id.* (citing 2013 N.Y.C. Local Law 81).

340. *See id.* (citing Special Initiative for Rebuilding and Resiliency and Building Resiliency Task Force).

341. *See id.* (citing 2013 N.Y.C. Local Law 79).

342. *Build Better Codes*, U.S. GREEN BUILDING COUNCIL, <http://www.usgbc.org/advocacy/campaigns/build-better-codes> [<http://perma.cc/JB8N-VCTF>] (last visited Mar. 25, 2014). The IgCC includes ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 189.1 as a compliance pathway. ASHRAE has published a guide to its Standard 189.1 and a "FAQ." ASHRAE JOURNAL'S GUIDE TO STANDARD 189.1: BALANCING ENVIRONMENTAL RESPONSIBILITY, RESOURCE EFFICIENCY & OCCUPANT COMFORT (June 2010), https://www.ashrae.org/File%20Library/docLib/Publications/AJSupplement_189-1-1-.pdf [<https://perma.cc/S8L7-HE63>]; FAQ—STANDARD 189.1: STANDARD FOR THE DESIGN OF HIGH PERFORMANCE, GREEN BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS, <https://www.ashrae.org/File%20Library/docLib/Publications/189-1-FAQ-4-26-12.pdf> [<https://perma.cc/PCY6-NY4A>] (last visited Mar. 25, 2014).

343. INT'L CODE COUNCIL, AN OVERVIEW OF THE 2012 INTERNATIONAL GREEN CONSTRUCTION CODE 13–14 (2012), <http://www.iccsafe.org/international-green->

IgCC was not explicitly crafted for the purpose of promoting disaster resilience, the USGBC regards the adoption of model codes like the IgCC as essential to minimizing the negative effects of extreme weather events.³⁴⁴

Unlike LEED³⁴⁵ and other voluntary rating systems, the IgCC is intended to be adopted on a mandatory basis in order to raise the floor for environmental standards.³⁴⁶ Despite this, most local jurisdictions that have adopted the IgCC have made it voluntary.³⁴⁷ For example, Florida adopted the IgCC as an option for the retrofitting and new construction of all state-owned facilities, Boynton Beach, Florida adopted the IgCC as the core of its local voluntary green code, and the cities of Phoenix and Scottsdale, Arizona, and the Kayenta Township (a tribal community in Arizona) adopted the IgCC for voluntary use.³⁴⁸

Although the City did not adopt the IgCC as a mandatory code, it did follow the IgCC model of incorporating sustainability and resilience principles in an enforceable code. In doing so, the task force concluded that “greening” the

construction-code/ (scroll to bottom of page and click “An Overview of the 2012 International Green Construction Code”) [<http://perma.cc/53VH-WJRE>]. The code spans construction projects both spatially (providing standards applicable to the entire project site and all materials related to the project) and temporally (covering site selection and development through pre-occupancy inspection, commissioning and maintenance). *Id.* at 11–17.

344. USGBC, GREENING THE CODES 6 (2011), <http://www.usgbc.org/Docs/Archive/General/Docs7403.pdf> [<http://perma.cc/7XDV-Y9ZL>].

345. LEED refers to the USGBC’s Leadership in Energy and Environmental Design Green Building Rating System. LEED standards are third-party benchmark assessment tools that promote sustainable design and construction principles. *See id. at 1*. *See generally* Sarah Adams-Schoen, *On the Waterfront: New York City’s Climate Change Adaptation and Mitigation Challenge, Part II*, 25 ENVTL. L. N.Y. 101, 102–104 (2014) (analyzing the LEED standards and their use in New York).

346. “Where adopted on a mandatory basis, the IgCC raises the floor of sustainability for all buildings—positioning the IgCC to achieve massive environmental benefits not possible with voluntary rating systems.” INT’L CODE COUNCIL, *supra* note 343.

347. *See* INT’L CODE COUNCIL, ICC FACT SHEET—FIRST INTERNATIONAL GREEN CONSTRUCTION CODE (IGCC) ADOPTIONS 1 [hereinafter “ICC FACT SHEET”], http://www.iccsafe.org/cs/IGCC/Documents/First_IgCC_Adoptions_FactSheet.pdf [<http://perma.cc/6E4W-A9YH>] (last visited Mar. 25, 2015); *see also* INTERNATIONAL CODES-ADOPTION BY STATE, INT’L CODE COUNCIL 1 (Feb. 2015), http://www.iccsafe.org/gr/Documents/state_adoptions.pdf [<http://perma.cc/K67F-HHWY>] (listing the state-by-state adoption of the I-codes).

348. *See* ICC FACT SHEET, *supra* note 347, at 1.

building codes “has significant advantages over mandating LEED for the private sector.”³⁴⁹ Of course, the options for increasing the resilience and decreasing the substantial carbon footprint³⁵⁰ of the City’s buildings are far from binary. Options range from green building ordinances that apply only to municipal construction or renovation projects, to those that apply to private projects that receive public funding, to those that apply to both public and private projects.³⁵¹ Further options exist within each of these schemes, including application of requirements based on project size or type of building. With respect to rating systems, some municipalities use LEED rating systems, others use different third-party rating systems, and still others create their own rating systems. Some municipalities permit developers to meet LEED “equivalents”³⁵² or comply with LEED guidelines without requiring receipt of LEED certification. Even among those that mandate LEED certification (or equivalents), different municipalities require different levels of LEED certification and allow waivers under different scenarios. Some ordinances mandate that developers meet certain standards, while others

349. NYC GREEN CODES, *supra* note 151, at 1; *see also id.* at 1–2 (listing benefits of greening the building codes); Adams-Schoen, *supra* note 345, at 102 (discussing the benefits of greening the building codes).

350. According to the 2013 *New York City Local Law 84 Benchmarking Report*, New York City’s buildings accounted for nearly 75% of the City’s total GHG emissions, 94% of the City’s electrical consumption and 85% of its water usage. BENCHMARKING REPORT 2014, *supra* note 27, at 5.

351. Patricia E. Salkin, *Cooperative Federalism and Climate Change: New Meaning to “Think Globally—Act Locally,”* 40 ENVTL. L. REP. (ENVTL. LAW INST.) 10562, 10567 (2010). Numerous municipalities have mandated LEED certification for new construction and major renovations or otherwise required that city-owned buildings be built according to green building criteria, including Atlanta, Austin, Boston, Boulder, Chicago, Dallas, Los Angeles, Portland, San Diego, San Francisco, San José, and Seattle. *See* 2005 N.Y.C. Local Law 86 § 1, *available at* http://www.nyc.gov/html/dob/downloads/pdf/ll_86of2005.pdf [<http://perma.cc/RM7Y-U5U3>] (listing municipalities that have implemented green building requirements).

352. Ordinances that provide incentives for LEED “equivalents” apply not just to LEED, but also to other rating systems that the jurisdictions deems equivalent. *See, e.g.,* HAW. REV. STAT. §46-19.6 (2015) (requiring counties to give priority application processing for projects that achieve LEED Silver or equivalent); Montreat, N.C., Code of General Ordinances, Chap. J, Art. I, § 4 (“Projects providing proof of equivalent nationally or state recognized certification or rating systems with third-party verification of sustainable building practices may also be eligible for comparable rebates proportionate to level of certification.”).

create incentive schemes.³⁵³ Additionally, many states, including New York, require LEED for state-owned buildings, provide tax credits for buildings that meet certain green building criteria, and require state agencies to reduce energy use and carbon dioxide emissions and utilize green building principles.³⁵⁴

Although not readily apparent from the NYC Green Codes Task Force report, New York City has adopted a scheme for certain public and private sector developments that includes both “greening” its building codes and mandating LEED certifiability. New York City enacted Local Law 84 in 2005, a green building law that requires municipal projects costing more than \$2 million to be designed to meet or exceed certain LEED criteria, although actual certification is not required.³⁵⁵ The LEED requirements also apply to private developments that receive more than 50% City funding or more than \$10 million of City money.³⁵⁶

Additionally, the Task Force proposals include many requirements that are the same or substantially similar to the IgCC. For example, both the Task Force proposals and the IgCC include requirements that alterations made to existing buildings conform to the new green codes,³⁵⁷ air-conditioning systems serving occupied spaces have filters rated at MERV 11 or higher,³⁵⁸ and establish performance standards for building envelopes with respect to heat loss.³⁵⁹

353. See generally 2005 N.Y.C. Local Law No. 86 § 1, available at http://www.nyc.gov/html/dob/downloads/pdf/l1_86of2005.pdf [<http://perma.cc/RM7Y-U5U3>] (summarizing various green building initiatives).

354. *Id.*

355. Buildings classified in occupancy groups G or H-2 must achieve the lowest level of LEED certifiability; all other buildings must achieve a minimum of LEED silver certifiability. 2005 N.Y.C. Local Law No. 86 § 2, available at http://www.nyc.gov/html/dob/downloads/pdf/l1_86of2005.pdf [<http://perma.cc/RM7Y-U5U3>].

356. *Id.*

357. IgCC § 1003.1 (2012), available at http://publicecodes.cyberregs.com/icod/IgCC/2012/icod_IgCC_2012_10_sec003.htm [<http://perma.cc/DU76-2L5P>]; NYC GREEN CODES TASK FORCE: FULL PROPOSALS, at OC3-1 to OC3-2 (Feb. 2010), http://www.nyc.gov/html/gbee/downloads/pdf/gctf_all_proposals.pdf [<http://perma.cc/U49A-LBYX>].

358. IgCC § 803.5 (2012); NYC GREEN CODES PROPOSALS, *supra* note 155, at HT5-1. Note that the Task Force proposal imposes this requirement only on systems providing ventilation of outdoor air with a design capacity greater than or equal to 5,000 cfm. *Id.*

359. Specifically, the Task Force proposal uses ASHRAE 90.1 with additional fixed performance standards. NYC GREEN CODES PROPOSALS, *supra* note 155, at EF3-1.

The Task Force proposals also include numerous recommendations that go above and beyond the IgCC.³⁶⁰ These proposals include: (a) requiring entry mat systems to protect indoor air from street particulates;³⁶¹ (b) requiring improved design parameters, testing, and balancing for exhaust ventilation systems in new residential construction;³⁶² (c) requiring the use of mold-resistant gypsum board and cement board in water-sensitive locations such as bathrooms;³⁶³ (d) prohibiting the issuance of new permits for boilers using #4 and #6 fuel oil and requiring all new burners to use #2 fuel or gas fuel;³⁶⁴ (e) phasing out all existing polychlorinated biphenyl and magnetic ballasts by 2019;³⁶⁵ (f) reducing the level of required emergency lighting, which would reduce battery size;³⁶⁶ (g) requiring wastewater from concrete mixer trucks to be either treated on site or returned to the manufacturing plant for treatment;³⁶⁷ (h) requiring various design features and signage to promote stairway use as a means of promoting fitness and physical activity;³⁶⁸ and (i) increasing the number of required water fountains in commercial buildings to reduce consumers' intake of bottled water and sugary sodas.³⁶⁹ The Task Force also proposed to require all new residential buildings of three stories or less to be constructed pursuant to

The IgCC requires that building envelopes exceed the requirements of the International Energy Conservation Code by no less than 10%. IgCC § 605 (2012).

360. This is not surprising given that the IgCC is not specifically targeted at disaster resiliency and the IgCC was intended to be a set of minimum standards.

361. See NYC GREEN CODES PROPOSALS, *supra* note 155, at HT4-1.

362. *Id.* at HT6-1.

363. *Id.* at HT7-1.

364. *Id.* at HT9-1.

365. *Id.* at HT10-1. The IgCC has no such requirement, but has a verification requirement providing that “prior to issuance of a certificate of occupancy, the field inspector shall confirm the installation of luminaires, type and quantity; lamps, type, wattage and quantity, and ballasts, type and performance for not less than one representative luminaire of each type, for consistency with the *approved* construction documents.” IgCC § 608.10 (2012).

366. See NYC GREEN CODES PROPOSALS, *supra* note 155, at HT12-1. The IgCC provides code enforcement officials with the discretion to waive its lighting efficiency requirements because of emergency lighting considerations. IgCC § 608.9.

367. See NYC GREEN CODES PROPOSALS, *supra* note 155, at HT13-1.

368. *Id.* at HT15-1 to HT18-1; see also *id.* at HT19-1 (the Task Force also recommends including a zoning bonus as an incentive for buildings that make stairs prominent and accessible).

369. *Id.* at HT20-1.

Energy Star standards.³⁷⁰ The IgCC does not apply to residential structures of three stories or less.

One area in need of further evaluation is the inclusion of multiple compliance options or, alternatively, the use of ASHRAE Standard 90.1 (recommended by the Task Force) versus the more rigorous ASHRAE Standard 189.1 (incorporated as a compliance option in the IgCC).³⁷¹ Currently, the New York Energy Conservation Code essentially consists of two separate but comprehensive codes, allowing individual designers to choose as their compliance option either ASHRAE Standard 90.1 or Chapter 8 of the International Energy Conservation Code. The Task Force found that the simultaneous enforcement of two codes is no longer tenable and proposed requiring all commercial buildings to comply with ASHRAE 90.1.³⁷² Similarly, prior to the creation of the IgCC, the ICC's International Energy Conservation Code referenced ASHRAE 90.1, allowing individual designers to choose ASHRAE 90.1 as a compliance path. This essentially created two compliance paths in every participating jurisdiction. The IgCC eliminated this system by including ASHRAE 189.1 as an optional compliance pathway for jurisdictions, not individual designers, to adopt on a mandatory basis.³⁷³

Nevertheless, by incorporating many enforceable standards equivalent to IgCC standards and some that exceed IgCC standards, the task force proposals certainly are progressive. However, the Urban Green Council concluded in its report *90*

370. *Id.* at EF2-1.

371. Standard 90.1, Energy Standard for Buildings except Low-Rise Residential Buildings, provides minimum requirements for the energy-efficient design of new and renovated or retrofitted buildings. ASHRAE, STANDARD 90.1, ENERGY STANDARD FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS (2013). 90.1-2004 has been approved by DOE as the minimum standard for all states. ASHRAE Standard 189.1-2011, Standard for the Design of High-Performance, Green Buildings except Low-Rise Residential Buildings, provides minimum requirements for the siting, design, and construction of high performance, green buildings. ASHRAE, STANDARD 189.1: STANDARD FOR THE DESIGN OF HIGH PERFORMANCE, GREEN BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS FAQ (2014), *available at* www.ashrae.org/greenstandard [<http://perma.cc/9RN9-EUCN>].

372. *See* NYC GREEN CODES PROPOSALS, *supra* note 155, at EF1-1.

373. INT'L CODE COUNCIL, SYNOPSIS—INTERNATIONAL GREEN CONSTRUCTION CODE, PUBLIC VERSION 2.0, NOVEMBER 2010 2 (2010), *available at* http://www.iccsafe.org/cs/IGCC/Documents/PublicVersion/IGCC_PV2_Synopsis.pdf [<http://perma.cc/4QA9-6VG7>].

by 50: NYC Can Reduce Its Carbon Footprint that the City can and must go further: “the extreme emission reductions required to minimize climate change are in fact possible using technologies that are known and in almost all cases currently available, and that the costs are comparable to the lifetime savings.”³⁷⁴ To achieve these deeper reductions, the report recommends, among other things, the use of even greater air sealing and heat recovery systems, photovoltaic panels to produce renewable electricity on site, mini-split heat pumps for most apartments, ground-source heat pumps for commercial and larger residential buildings, and air-source heat pumps for hot water.³⁷⁵ Notably, the report found that “many of the measures introduced to mitigate climate change also increase building resilience For example, greater thermal integrity ensures buildings that will remain more habitable without services such as heat, hot water, or electricity.”³⁷⁶

F. Lack of Intergovernmental Integration—A Formidable Obstacle to Coastal Climate Change Resilience

In its 2015 report NPCC2 concluded that it is “essential” that New York City “facilitate an ongoing and continuous process of stakeholder-scientist interactions” with coordination between the relevant experts and multiple scales of government, including the other municipalities of the New York metropolitan region.³⁷⁷ Implicit in this recommendation are two critiques—one based on the failure of the City’s current initiatives to effectively incorporate the City’s extensive suburbs, and another based on the need for increased integration with relevant state and federal agencies.

374. URBAN GREEN COUNCIL, *supra* note 273, at 1.

375. *Id.* at 4.

376. *Id.*

377. NPCC 2015, *supra* note 97, at 16 (“Collaboration across multiple scales of government will help to ensure that the climate science developed for the New York metropolitan region informs and draws from the best available information, thereby positioning residents and planners to confront expected future changes in the most effective way possible.”).

1. Municipalities Must Look Elsewhere for a Regional Model that Incorporates a Hub City and Its Extensive Suburbs

It probably goes without saying that New York City's suite of initiatives does not provide a comprehensive adaptation and mitigation model for suburban municipalities. However, given New York City's expertise and resources,³⁷⁸ the City is well poised to work with its extensive surrounding suburban communities (beyond the five boroughs) to create a comprehensive regional climate change adaptation and mitigation plan. Moreover, because the impacts of climate change and the strategies to adapt to those impacts do not happen in isolation, municipalities must take care that a particular strategy, which may reduce vulnerability or decrease emissions in one area, does not increase risk and vulnerability in another area.³⁷⁹ Indeed, in its latest report, NPCC2 urged New York City to both strengthen the initiatives in *A Stronger, More Resilient New York* and to expand them "to the entire New York metropolitan region."³⁸⁰

The need for an integrated strategy that prevents, for example, development from moving from low-emissions generating areas to high-emissions generating areas may be particularly acute in and around New York City, where the difference between urban and suburban emissions is greater than in many other areas of the country.³⁸¹ Based on their finding of a strong negative correlation between emissions and the level of land use controls restricting development,³⁸²

378. See ONE CITY, BUILT TO LAST, *supra* note 16, at 3 (commenting on NYC expertise and resources by Mayor de Blasio).

379. Salkin, *supra* note 223, at 925 (finding that integration is a key challenge for local governments facing climate change risks).

380. NPCC 2015, *supra* note 97, at 16.

381. See Edward L. Glaeser & Matthew E. Kahn, *The Greenness of Cities: Carbon Dioxide Emissions and Urban Development*, 67 J. URBAN ECON. 404, 408 (2010) (finding that New York City had the most extreme emissions difference between the central city and suburbs, based on a comparative study of 48 metropolitan areas, and estimating that suburban development around New York City causes more than 300 dollars more damage in carbon dioxide emissions than central city development, based on an assumed social cost figure of 43 dollars per ton of CO₂). Given the 2000 and 2001 vintage of some of the data used for this study, results should be considered illustrative only. See *id.* at 405 (citing sources of data and describing study methodology).

382. *Id.* at 405. Glaeser and Kahn based their comparisons between metropolitan areas (as opposed to within metropolitan areas) on data from 66 major metropolitan areas in the United States. *Id.* at 405.

Edward Glaeser and Matthew Kahn hypothesized that “current land use restrictions may be doing exactly the opposite of what a climate change activist may have hoped. Those restrictions, often implemented for local environmental reasons (such as to preserve open space or reduce neighborhood traffic), seem to push new development towards the least environmentally friendly urban areas.”³⁸³

Moreover, regardless of whether restrictive urban land use regulations cause increased suburban development, the need for climate change adaptation and mitigation regional plans that integrate the extensive suburban communities surrounding hub cities in the United States is nevertheless acute. The majority of the population resides in suburbs, suburbs have a higher per capita carbon footprint than urban areas, and suburbs are less likely to take action on climate change.³⁸⁴ By 2040, the United States is projected to add 93 million new homes to accommodate its rapidly growing population.³⁸⁵ Based on current trends, most of these homes will be single-family homes that are significantly less energy efficient than their multifamily counterparts;³⁸⁶ and, based on current planning practices, the occupants of these single-family homes will continue to commute by car to work, play, and shop.³⁸⁷ Suburban communities need encouragement and

383. *Id.* at 408 (citations omitted).

384. John R. Nolon, *The Land Use Stabilization Wedge Strategy: Shifting Ground to Mitigate Climate Change*, 34 WM. & MARY ENVTL. L. & POL'Y REV. 1, 3–4 (2009); see also Hossein Estiri, *Residential Energy (and Water) Expenditure and the City-Suburb Dichotomy; A Case Study of the Puget Sound Region, WA 1* (Dep't of Urban Design & Plan. Univ. of Wash., Working Paper, 2012), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2246596 [<http://perma.cc/K42Y-L355>] (reporting results from case study of Washington state Puget Sound region showing that, “in general, the likelihood of living in a housing unit with high energy (and water) cost was higher in the suburb and slightly lower in the city,” “suburban renters are more likely to live in housing units with high energy and water costs[, and t]he effect of the number of children in the suburbs was greater on the estimated odds of living in a high-expenditure housing unit than in the city”); but see *id.* at 2 (arguing that research about variations in residential energy consumption within metropolitan areas is inconclusive).

385. Nolon, *supra* note 384, at 3–4 (citing studies).

386. *Id.* (citing studies).

387. See Edward L. Glaeser, *Green Cities, Brown Suburbs: To Save the Planet, Build More Skyscrapers—Especially in California*, 2009 CITY J. 50 (2009) (finding suburban development patterns often facilitate consumption of higher quantities of the bundle of housing services, including bigger and newer homes and more use of cars, and lower density); David Brownstone & Thomas F. Golob, *The Impact Of Residential*

support to assess their climate vulnerabilities, plan and implement adaptation and mitigation strategies, and, in some cases, expand their current efforts beyond building and vehicles initiatives to land use and planning measures.³⁸⁸ As one commentator has noted, “[S]o far, climate action has extended slowly to suburbia. Central cities in smart growth states have taken on climate change, but vast swaths of metropolitan suburbia continue to reproduce a political geography of local free-riding.”³⁸⁹

Thus, effective adaptation planning and implementation, as well as mitigation, will benefit from integrated adaptation and mitigation plans that recognize the distinct needs of suburbs and the interplay between urban hubs and their often-extensive networks of suburbs.³⁹⁰ New York City and other hub cities striving to mitigate climate change and increase local resilience would therefore be wise to pursue an integrated planning strategy that includes surrounding suburban communities. As Touro Law Center Dean Patricia Salkin urges in the context of New York State’s climate change initiatives, “the true potential of [the State’s substantial activity with respect to climate change and energy efficiency issues] will not be fully realized” without “a coordinated, comprehensive, and fully integrated inter-jurisdictional approach to addressing these challenges.”³⁹¹

Density on Vehicle Usage and Energy Consumption, 65 J. URB. ECON. 91, 91–92 (2009) (finding suburban development patterns often facilitate consumption of higher quantities of the bundle of housing services); William A.V. Clark et al., *Residential Mobility and Neighbourhood Outcomes*, 21 HOUSING STUD. 323, 323 (2006) (finding that households often “move up” to higher quality houses and neighborhoods, which are often in suburban locations).

388. Hari M. Osofsky, *Suburban Climate Change Efforts: Possibilities for Small and Nimble Cities Participating in State, Regional, National, and International Networks*, 22 CORNELL J.L. & PUB. POL’Y 395, 440 (2012).

389. Yonn Dierwechter, *Metropolitan Geographies of US Climate Action: Cities, Suburbs, and the Local Divide in Global Responsibilities*, 12 J. ENVTL. POL’Y & PLAN. 59, 79 (2010); Osofsky, *supra* note 388.

390. *See* Osofsky, *supra* note 388 (finding that not only are suburbs distinct from urban cores, different types of suburbs exist, each of which present distinct challenges and opportunities for building community resilience). *See also* WGII SUMMARY FOR POLICYMAKERS, *supra* note 29, at 25 (“Adaptation is place- and context-specific, with no single approach for reducing risks appropriate across all settings (*high confidence*).”).

391. Salkin, *supra* note 223, at 926.

2. The Need for More State and Federal Support of Local Climate Resilience Planning

The inadequate participation rates of U.S. municipalities in climate change adaptation and mitigation planning are often obscured by sources that focus on the work of a few model cities.³⁹² Other sources use phrasing or provide accurate, albeit incomplete, information that suggests optimistic results when in fact the results are anything but. For example, the Center for Climate & Energy Solutions reported in 2006 that “[i]n 1995, only 15 local governments in the United States were engaged in climate protection activities. 11 years later, that number has grown to 200 cities.”³⁹³ Notwithstanding the accuracy of this statement, by failing to alert the reader that 200 cities is less than 1% of U.S. cities,³⁹⁴ the reader may mistakenly interpret the statement as signifying a high U.S. participation rate in climate protection activities—when the opposite is true. According to a survey administered by ICLEI in 2011, the United States had the lowest percentage of cities pursuing adaptation planning³⁹⁵ and the lowest percentage of cities that had completed an assessment of their vulnerabilities and risks.³⁹⁶

This troubling data is one of many indicators that local governments throughout the United States need more federal and state support for their climate resilience planning.³⁹⁷

392. And, indeed, I am guilty of this. See, e.g., Adams-Schoen, *supra* note 208, at 82–90.

393. CTR. FOR CLIMATE & ENERGY SOLUTIONS, *Climate Change 101: Local Action*, in CLIMATE CHANGE 101: UNDERSTANDING AND RESPONDING TO GLOBAL CLIMATE CHANGE 1, 8 (2006).

394. In the United States, there are approximately 36,000 sub-county general-purpose governments and approximately 3,600 urban areas. See *Lists & Structure of Governments—Population of Interest: Municipalities & Townships*, U.S. CENSUS BUREAU, http://www.census.gov/govs/go/municipal_township_govs.html [<http://perma.cc/96J5-LNNN>] (last visited May 21, 2015) (identifying 36,011 sub-county general-purpose governments in 2007).

395. ICLEI 2011 SURVEY, *supra* note 11, at 14.

396. *Id.* at 10.

397. Although Congress continues to remain gridlocked on climate change, the executive branch has taken numerous actions to incentivize climate change adaptation at the state and local levels. See, e.g., FEMA, FP 302-094-2, State Mitigation Plan Review Guide (effective Mar. 6, 2016) (requiring state mitigation plans to consider changing future conditions, including climate conditions), *available at* http://www.fema.gov/media-library-data/1425915308555-aba3a873bc5f1140f7320d1ebbd18c6/State_Mitigation_Plan_Review_Guide_2015.pdf [<http://perma.cc/2YU9-79W4>]; see

Federal and state law delegates much of the authority relevant to climate change adaptation and mitigation to municipal governments, and yet state and federal policy fails to support local governments in this role through adequate funding, technical support, and complimentary laws and policies.³⁹⁸ Nearly all U.S. cities surveyed by ICLEI reported that securing funding for adaptation is a challenge (approximately 90%) and only 6% reported that the federal government fully understood the realities they face with respect to adaptation.³⁹⁹

Consistent with the 2011 ICLEI survey results, the U.S. Government Accountability Office (“GAO”) concluded in a 2013 report that, although the federal government plays a critical role in producing the information needed to facilitate informed local infrastructure adaptation decisions, this information is not easily accessible to local decision makers.⁴⁰⁰ The governors, mayors, and other local leaders on the President’s Task Force on Climate Preparedness and Resilience also concluded in their report to the President in November 2014 that “projects and investments are being advanced without adequate and coordinated consideration of the project design or alternatives relative to climate impacts and greenhouse gas emissions, a direction that generates unacceptable public health, safety, and financial risks for communities.”⁴⁰¹ Similarly, a 2014

also Third Allocation, Waivers, and Alternative Requirements for Grantees Receiving Community Development Block Grant (CDBG) Disaster Recovery Funds in Response to Hurricane Sandy, 79 F.R. 62182, 62186 (Oct. 16, 2014), *available at* <http://www.gpo.gov/fdsys/pkg/FR-2014-10-16/pdf/2014-24662.pdf> [<http://perma.cc/CSE5-7CRA>] (allocating \$335 million in federal funds to New York for the first phase of the “Big U,” a plan for the protection of 10 continuous miles of New York City).

398. See John R. Nolon, *Climate Change and Sustainable Development: The Quest for Green Communities, Part II*, PLAN. & ENVT. L. 3, 5 (2009); *but see* Community Risk and Resiliency Act, 2014 N.Y. Laws 355 (directing state agencies to prepare model municipal laws taking into consideration sea-level rise and other climate-related events and “develop additional guidance on the use of resiliency measures that utilize natural resources and natural processes to reduce risk”).

399. ICLEI 2011 SURVEY, *supra* note 11, at 22–24.

400. GOV’T ACCOUNTABILITY OFFICE, GAO REPORT: FUTURE FEDERAL ADAPTATION EFFORTS COULD BETTER SUPPORT LOCAL INFRASTRUCTURE DECISION MAKERS 80 (Apr. 12, 2013), *available at* <http://www.gao.gov/products/GAO-13-242> [<http://perma.cc/5935-8ZDB>].

401. See THE WHITE HOUSE, PRESIDENT’S STATE, LOCAL, AND TRIBAL LEADERS TASK FORCE ON CLIMATE PREPAREDNESS AND RESILIENCE: RECOMMENDATIONS TO THE PRESIDENT 20 (recommendation 2.7) (Nov. 2014), *available at* https://www.whitehouse.gov/sites/default/files/docs/task_force_report_0.pdf [<https://perma.cc/3P9V-ZXSH>].

Georgetown Climate Center report on how to improve federal programs to support local climate change preparedness found that many local governments “have been looking to the federal government for help and guidance, only to run into challenges tapping into federal programs and resources.”⁴⁰²

Interestingly, the Georgetown report concluded that perception is often worse than reality and a number of relatively small changes could provide local government with at least some of the needed support:

While it is true that there are some limitations, barriers [to leveraging federal programs to promote adaptation] are often more perceived than real.

While additional resources are certainly needed, adaptation does not require expansive new programs or legislation. Entities at all levels of government have plans, tools, and resources that can be amended, repurposed, or deployed to support adaptation.

Where barriers to adaptation do exist, short-term workarounds are often available while working towards long-term fixes.

Funding constraints limit opportunities for sensible investments in adaptation. The way federal agencies currently make investment decisions often appear [sic] to be “penny wise and pound foolish.”⁴⁰³

Assuming plans, tools and resources exist that can be “repurposed, or deployed” to support local governments, and “short-term workarounds” are indeed available, any delay in comprehensive assessment and implementation of federal support for local government adaptation (and mitigation) initiatives seems, at best, misguided, and, at worst, negligent.⁴⁰⁴ With respect to the “penny wise and pound foolish” critique, many sources, including New York City, have completed economic analyses that show that mitigation and adaptation efforts require large upfront investment, but result in long-term cost savings of many times the initial

402. GEORGETOWN CLIMATE CTR, PREPARING OUR COMMUNITIES FOR CLIMATE IMPACTS: RECOMMENDATIONS FOR FEDERAL ACTION 5 (2014), *available at* <http://www.georgetownclimate.org/sites/www.georgetownclimate.org/files/GCC%20-%20Recommendations%20for%20Federal%20Action%20-%20September%202014.pdf> [<http://perma.cc/6JYR-KJMS>].

403. *Id.* at 6.

404. *See generally* Burkett, *supra* note 73 (discussing potential tort liability for failure to mitigate climate-change related hazards).

investment.⁴⁰⁵ Additionally, these initial investments also result in significant nonmonetary benefits like increased public health and wellbeing.⁴⁰⁶

One step that state and federal governments can take to support local adaptation and mitigation initiatives is to remove existing preemption hurdles. Municipalities face preemption hurdles with respect to numerous potential mitigation initiatives.⁴⁰⁷ California's efforts to reduce GHG emissions from cars illustrates "[t]he dynamic and topsy-turvy reception of state climate efforts."⁴⁰⁸ As summarized by Kristen Engel and Marc Miller, California had to

win its effort to obtain a judicial reversal of EPA's denial of a waiver of federal preemption under the federal Clean Air Act[,] . . . survive a legal challenge filed by the automobile industry claiming that the state's standards are preempted by

405. *See, e.g.*, MULTHAZARD MITIGATION COUNCIL, NATURAL HAZARD MITIGATION SAVES: AN INDEPENDENT STUDY TO ASSESS THE FUTURE SAVINGS FROM MITIGATION ACTIVITIES 5 (2005), available at https://www.nibs.org/?page=mmc_projects#nhms [<https://perma.cc/7VJA-4LGK>] (reporting in 2005 that, on average, each dollar spent on hazard mitigation (i.e., adaptation) saves society \$4 in avoided future losses); STRONGER, MORE RESILIENT, *supra* note 7, at 40 (claiming implementation of 37 "Phase I" measures could reduce expected losses in a Sandy-like storm in the 2050s by up to 25%, or more than \$22 billion); MCKINSEY & CO., UNLOCKING ENERGY EFFICIENCY IN THE U.S. ECONOMY iii (July 2009) (estimating \$520 billion invested in non-transportation energy efficiency in the United States by 2020 could generate energy savings over \$1.2 trillion); *see generally* Klass, *supra* note 292, at 10040 (discussing McKinsey & Company report and other cost savings from mitigation initiatives).

406. *See, e.g.*, LUCAS DE MONCUIT, CARBON CITIES CLIMATE REGISTRY: 2013 ANNUAL REPORT 21 (2014) ("[c]urrent data reveal that supporting the green urban economy and improving urban air quality are the most common co-benefits of mitigation actions while improving public health is seen as a co-benefit for 18% of adaptation actions").

407. *See, e.g.*, *Air Conditioning, Heating & Refrigeration Inst. v. City of Albuquerque*, 835 F. Supp. 2d 1133, 1134 (D.N.M. 2010) (holding that code provisions that required HVAC systems and equipment in small retail and office buildings and one- and two-family detached dwellings and townhouses to comply with minimum efficiency standards were preempted by the federal Energy Policy and Conservation Act); *see also* Elliot Schatmeier, *Avoiding Albuquerque: How Incentive-Based Green Infrastructure Codes May Regulate Appliance Efficiency Standards and Avoid Federal Preemption*, COLUM. J. ENVTL. L. (Dec. 19, 2012), <http://www.columbiaenvironmental.org/articles/avoiding-albuquerque-how-incentive-based-green-building-codes-may-regulate-appliance-efficiency-standards-and-avoid-federal-preemption> [<http://perma.cc/6ZKQ-HF5E>].

408. ROBERT L. GLICKSMAN ET AL., ENVIRONMENTAL PROTECTION: LAW AND POLICY 1143 (6th ed. 2011).

federal fuel efficiency laws[, and] . . . counter arguments by the U.S. Department of Transportation that California’s standards [were] preempted by a federal fuel economy law.⁴⁰⁹

New York City’s attempts to limit the GHG emissions from its substantial taxicab fleet have not fared so well.⁴¹⁰ In 2007, the City announced in its long-term comprehensive sustainability plan, *PlaNYC: Greener, Greater New York*, a policy of “doubl[ing] the efficiency of new taxis by 2012” by limiting taxicab emissions.⁴¹¹ The City’s Taxi and Limousine Commission (“TLC”) implemented the policy by passing a rule requiring taxicabs to meet a minimum miles-per-gallon rating.⁴¹² One month later, on May 22, 2007, Mayor Bloomberg announced that the City planned to make the taxicab fleet fully hybrid by 2012.⁴¹³ A year later, a federal district court invalidated the City rule, holding that rule was preempted under the federal Energy Policy and Conservation Act (“EPCA”), which expressly preempts state or local actions “related to fuel economy standards.”⁴¹⁴ The City responded by creating a system of financial incentives and disincentives to encourage taxi owners to switch to hybrid vehicles by reducing the amount they can charge to lease vehicles that do not have a hybrid or clean diesel engine. A federal district court found

409. Kristen H. Engel & Marc L. Miller, *State Governance: Leadership on Climate Change*, Ch. 29, in *AGENDA FOR A SUSTAINABLE AMERICA* 449 (J. Dernbach ed., Env’tl. L. Inst. 2009); *see also* California State Motor Vehicle Pollution Control Standards; Notice of Decision Denying a Waiver of Clean Air Act Preemption for California’s 2009 and Subsequent Model Year Greenhouse Gas Emission Standards for New Motor Vehicles, 73 Fed. Reg. 12,156, 12,156–12,157 (Mar. 6, 2008) (denying California request for waiver of the preemption provision in section 209 of the Clean Air Act); Notice of Decision Granting a Waiver of Clean Air Act Preemption for California’s 2009 and Subsequent Model Year Greenhouse Gas Emission Standards for New Motor Vehicles, 74 Fed. Reg. 32,744, 32,744–32,746 (July 8, 2009) (reversing prior decision and granting waiver); GLICKSMAN & MARKELL, *supra* note 408, at 1143 (quoting Engels and Miller and discussing federal preemption of state and local climate change initiatives, and federal savings clauses).

410. *See* GREENER, GREATER, *supra* note 11, at 122–24 (describing plan to reduce GHG emissions from taxi and car-for-hire fleet of more than 30,000 vehicles); *see also* ICLEI PLANYC CASE STUDY, *supra* note 30, at 41 (“Taxis travel an average of 80,000 miles per year in New York City.”).

411. GREENER, GREATER, *supra* note 11, at 122–24.

412. TLC Rule § 3.03(c)(10)–(11), 35 R.C.N.Y. § 3-03(c)(10)–(11).

413. *Metro. Taxicab Bd. of Trade v. City of New York*, No. 08 Civ. 7837(PAC), 2008 WL 4866021, at *5 (S.D.N.Y. Oct. 31, 2008) [hereinafter “*Metro. Taxicab I*”].

414. *Id.*

that this regulation was a de facto mandate that related to fuel economy standards and emissions regulations, and was therefore preempted under both EPCA and the Clean Air Act.⁴¹⁵ Despite these preemption hurdles, by 2010, the City's advocacy combined with benefits inherent to hybrid vehicles such as reduced fuel costs, resulted in conversion of 25% of the 13,237-vehicle New York City taxi fleet to hybrids.⁴¹⁶ Nevertheless, the circuitous—and as a result costly and delayed—routes to success for both the City and California with respect to these vehicle emissions initiatives illustrate the obstacles preemption challenges pose to certain local climate change mitigation actions.

Another step state and federal governments can take now to support local adaptation and mitigation initiatives is to support the delivery of downscaled climate data and the development of regional and sub-regional projections and mapping.⁴¹⁷ The GAO recommended in its 2013 report that a federal entity designated by the Executive Office of the President work with agencies to: (1) “identify for decision makers the ‘best available’ climate-related information for infrastructure planning,” and (2) “clarify sources of local assistance for incorporating climate-related information and analysis into infrastructure planning”⁴¹⁸ Federal and state support that

415. *Metro. Taxicab Bd. of Trade v. City of New York*, 633 F. Supp. 2d 83, 105–106 (S.D.N.Y. 2009) [hereinafter “*Metro. Taxicab I*”], *aff'd*, 615 F.3d 152 (2d Cir. 2010) (agreeing with preemption conclusion under EPCA and upholding preliminary injunction against city); *see also* *Ophir v. City of Boston*, 647 F. Supp. 2d 86, 94 (D. Mass. 2009) (holding Boston ordinance requiring hybrid taxicabs “related to” fuel economy standards and was thus preempted under EPCA’s preemption provision even though the ordinance did not include a specific miles-per-gallon standard); *but see* *Green Alliance Taxi Cab Ass’n v. King Cnty.*, No. C 08-1048 RAJ, 2010 WL 2643369, at *5 (W.D. Wash. June 29, 2010) (denying motion for summary judgment and distinguishing *Metro. Taxicab I*, *Metro. Taxicab II*, and *Ophir* on basis that King County green taxi incentive program was voluntary and did not “constitute a mandate applicable to the entire taxi industry”).

416. ICLEI PLANYC CASE STUDY, *supra* note 30, at 41.

417. *But see* New York Community Risk and Resiliency Act, Ch. 355, N.Y. Laws of 2014 (directing state agencies to prepare climate projections and model municipal laws taking into consideration sea-level rise and other climate-related events).

418. GAO, *supra* note 400, at 87. The GAO also advised that revision of the White House Counsel on Environmental Quality (“CEQ”) guidelines on National Environmental Policy Act (“NEPA”) reviews of climate change impacts and risks could provide much-needed support to state and local governments. *Id.* CEQ has since issued draft revised NEPA guidelines. CEQ, REVISED DRAFT GUIDANCE (released Dec.

ensures the availability of data and information at a resolution relevant to local decision makers could go a long way in supporting local decision-makers' efforts to incorporate potential climate change impacts in infrastructure planning.

CONCLUSION

New York City, like other major cities around the world, has acknowledged the problem of climate change, undertaken a comprehensive risk assessment, created a suite of adaptation and mitigation planning initiatives, and begun to implement proactive policies to decrease the city's contribution to the problem and to make the city less vulnerable to the effects of climate change. The City's initiatives put it ahead of the pack, especially as compared to other U.S. municipalities—and this is particularly true of its integrated mitigation and adaptation planning, its transparent climate change-related data analysis initiatives including NPCC, and its comprehensive reform of building and other related codes. The City's commitment to reduce GHG emissions 80% by 2050 from 2005 levels and its progress toward that goal, as well as the City's acknowledgement of the disparate impact of climate change and related risks on vulnerable populations and its commitment to prioritize related planning efforts are also laudable. Each of these initiatives provides useful models for other municipalities.

However, the City faces a host of wicked policy binds, ineffective regional structures, a lack of support at the federal level, and numerous conditions that constrain the City's ability to remain resilient—including its massive population and coastal geography, and the likelihood of continued acceleration of warming and rising seas. In light of this, PlaNYC's persuasive "toughness" theme risks undermining the City's robust data analysis and reporting initiatives by instilling in New Yorkers a false sense of security with respect to both the scope of the problem and their local government's ability to protect them from it. The City is in a wicked policy bind when it comes to messaging, to be sure. On the one hand, it must

garner support for plans and justify the costs of implementing them, and, on the other hand, the City must maintain constituent confidence in its ability to govern. But, regardless, messaging that has the effect of encouraging rebuilding and development in vulnerable areas or otherwise leads to unknowing assumption of climate-related risks is unconscionable. Moreover, as a practical matter, such messaging may cause constituents to take actions that undermine the effectiveness of the City's efforts to increase resilience.

The City faces an equally wicked policy bind with respect to waterfront development. Given the foreseeable risks of increasingly intensive and frequent coastal storms, flooding and storm surges, coastal municipalities must carefully evaluate their waterfront development policies to assure consistency with future climate risks and vulnerability and adopt regulations that curtail or eliminate waterfront development in high-risk areas, encourage or require relocation away from the most vulnerable areas, and take maximum advantage of opportunities to develop natural flood-mitigation infrastructure.

Ultimately, the City's climate change resilience initiatives put the city ahead of the pack and include features that provide a model for other coastal communities. But, notwithstanding this, the initiatives may still fall short of what is likely required to sufficiently "moderate[] harm" from dangerous interference with the climate system.⁴¹⁹

419. See AR4 WGII, *supra* note 1, at 6 (defining "adaptation").