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# FRONTIERS IN REGULATING BUILDING EMISSIONS: AN AGENDA FOR CITIES

DANIELLE SPIEGEL-FELD\*

## ABSTRACT

Recent developments in Congress and the Supreme Court have highlighted the folly of relying solely on the federal government to contain global climate change. If the United States is to help rein in the climate crisis, state and local governments will need to accelerate their efforts to reduce greenhouse gas emissions. In many urban areas, where most Americans now live, the most important step that local governments can take to curtail these emissions is to reduce energy use in buildings. Recognizing this, a number of American cities have adopted building performance standards (“BPSs”) in recent years, which limit the annual amount of energy a building can use or emissions it can release. With an eye toward encouraging the proliferation of BPSs, this Article surveys the key decisions that a city must make in designing a BPS and argues that future laws must do more to integrate resilience goals. As the climate crisis accelerates, local lawmakers must develop policies that simultaneously reduce emissions and protect their constituencies from the climate impacts that we can no longer fend off.

## INTRODUCTION

The Supreme Court’s recent decision in *West Virginia v. Environmental Protection Agency* (“EPA”), which cabined the EPA’s authority to regulate greenhouse gas (“GHG”) emissions under the Clean Air Act,<sup>1</sup> has underscored the urgency of pursuing state and local action to combat climate change. In cities, where the majority of Americans now live,<sup>2</sup> the

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<sup>1</sup> See 142 S. Ct. 2587, 2616 (2022).

<sup>2</sup> *Urban Areas Facts*, U.S. CENSUS BUREAU, <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/ua-facts.html> [<https://perma.cc/4KMT-G9LV>] (last visited Nov. 13, 2022).

most important step that local governments can take for the climate is to reduce emissions from energy use in buildings. Energy use in buildings is typically responsible for the majority of local GHG emissions in dense urban areas.<sup>3</sup> Buildings' contribution to local GHGs is especially large in older, urban areas with established mass transit systems because, in these cities, transportation accounts for a relatively smaller share of emissions.<sup>4</sup> Thus, in Boston, Chicago, New York City, Philadelphia, and Washington, D.C., buildings account for around 70% of emissions.<sup>5</sup>

Recognizing the importance of decarbonizing buildings, over the past fifteen years, numerous American cities have stepped in front of the state or federal governments to enact progressively more stringent regulations that seek to curtail building energy use and shift buildings toward less carbon-intensive sources of energy.<sup>6</sup> The cities started off with a fairly light touch approach, encouraging buildings to reduce their energy use and emissions without forcing them to do so.<sup>7</sup> The idea that owners could be incentivized via this gentle approach was informed by a belief that owners themselves would benefit from reducing their energy usage and would therefore seize the opportunity to slash energy use if they were

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<sup>3</sup> Nariman Mostafavi, Mehdi Pourpeikari Heris, Fernanda Gándara & Simi Hoque, *The Relationship Between Urban Density and Building Energy Consumption*, 11 BUILDINGS 455, 456 (2021).

<sup>4</sup> N.Y.C. MAYOR'S OFF. LONG-TERM PLAN. & SUSTAINABILITY, ONE CITY: BUILT TO LAST 22, 24, 27, 32 (2014); CITY OF PHILA., 2019 PHILADELPHIA GREENHOUSE GAS INVENTORY SUMMARY 2 (2022); *Greenhouse Gas Inventories*, DC.GOV, <https://doee.dc.gov/service/greenhouse-gas-inventories> [<https://perma.cc/9H6A-PAVS>] (last visited Nov. 13, 2022).

<sup>5</sup> *Building Emissions Reduction and Disclosure*, CITY OF BOS., <https://www.boston.gov/departments/environment/building-emissions-reduction-and-disclosure> [<https://perma.cc/DD6Y-KKW4>] (last visited Nov. 13, 2022); Press Release, Lori Lightfoot, Mayor, City of Chi., *Mayor Lightfoot Announces a Building Decarbonization Working Group* (June 2, 2021), [https://www.chicago.gov/city/en/depts/mayor/press\\_room/press\\_releases/2021/june/DecarbonizationWorkingGroup.html](https://www.chicago.gov/city/en/depts/mayor/press_room/press_releases/2021/june/DecarbonizationWorkingGroup.html) [<https://perma.cc/RXD8-GEJP>]; *Climate Mobilization Act*, N.Y.C. COUNCIL, <https://council.nyc.gov/data/green/> [<https://perma.cc/GTH7-6DK7>] (last visited Nov. 13, 2022); Helena Rudoff, *Philadelphia's 2019 Greenhouse Gas Inventory Reports 20% Reduction in Emissions Since 2006*, CITY OF PHILA. (Apr. 21, 2022), <https://www.phila.gov/2022-04-21-philadelphias-2019-greenhouse-gas-inventory-reports-20-reduction-in-emissions-since-2006/> [<https://perma.cc/E7PB-42QQ>]; *Greenhouse Gas Inventories*, *supra* note 4.

<sup>6</sup> David Ribeiro, *U.S. Cities Adopt Stricter Building Energy Codes*, ACEEE (Sept. 9, 2019), <https://www.aceee.org/blog/2019/09/us-cities-adopt-stricter-building> [<https://perma.cc/82TD-GWW8>].

<sup>7</sup> Maria Rachel, *Building Performance Standards Push Grows Amid Electrification Incentives, White House Efforts*, UTIL. DIVE (Aug. 9, 2022), <https://www.utilitydive.com/news/building-energy-performance-standards-coalition-electrification-transition-maryland/629121/> [<https://perma.cc/2JHS-TXTC>].

made aware of the potential to do so.<sup>8</sup> Unfortunately, owners have proven more reticent to make changes than lawmakers had hoped.<sup>9</sup> As a result, some cities, including Boston, New York, St. Louis, and Washington, D.C., have recently adopted a stricter approach that obliges large buildings to restrict their total energy use or GHG emissions or else pay a fine.<sup>10</sup> These new laws are typically referred to as “building performance standards,” or BPSs for short.<sup>11</sup>

The move toward mandatory BPSs poses new complications for local policymakers. Among other decisions, regulators must decide how to measure compliance (should they cap energy use or GHG emissions?), what the penalty should be for exceeding the caps, and how to distribute the cost of implementing the law between different sectors (i.e., residential buildings versus office buildings) and geographies (i.e., environmental justice communities versus wealthier communities). Drawing from the authors’ work leading a large-scale study into the projected impacts of New York City’s BPSs, known as Local Law 97,<sup>12</sup> this Article sets out some of the pros and cons of these different design choices. It also highlights an issue that has not yet been addressed in the early BPSs: how to integrate adaptation planning<sup>13</sup> into mitigation oriented BPSs. As the

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<sup>8</sup> *Id.*

<sup>9</sup> Mark Shahinian, *Four Important Market Failures: Why There Is Slow Growth of Energy Efficiency with Commercial Building Owners and Operators*, ENERGY IN DEMAND (July 25, 2020), <https://energyindemand.com/2020/07/25/four-important-market-failures-why-there-is-slow-growth-of-energy-efficiency-with-commercial-building-owners-and-operators/> [<https://perma.cc/HX2Q-KCV2>].

<sup>10</sup> One state—Washington State—has also adopted a BPS. *Clean Buildings Performance Standard*, WASH. STATE DEP’T OF COM., <https://www.commerce.wa.gov/growing-the-economy/energy/buildings/clean-buildings-standards/> [<https://perma.cc/D4KA-VSQ2>] (last visited Nov. 13, 2022).

<sup>11</sup> *Id.*

<sup>12</sup> N.Y.C., N.Y., Local Law No. 97 (May 20, 2019) (codified as amended in scattered sections of N.Y.C., N.Y., N.Y.C. CHARTER, ch. 26 and N.Y.C., N.Y., N.Y.C. ADMIN. CODE, tit. 28, arts. 320–21). Between February 2020 and September 2021, the author of this Article led a team of researchers from across New York University and several private consultancies to study whether New York City could add a carbon trading program to its BPSs, as set forth in Local Law 97 of 2019, and what the predicted impacts of adding a trading program to the law would be. As a precursor to the carbon trading analysis, the team conducted detailed modeling projecting the impacts of Local Law 97 without trading. For the full results of the study, see *Issues*, GUARINI CTR. ON ENV’T, ENERGY & LAND USE L., <https://www.guarinicenter.org/buildings> [<https://perma.cc/Q9HB-3738>] (last visited Nov. 13, 2022).

<sup>13</sup> As used here, “adaptation planning” refers to actions that are taken to better equip the built environment to deal with the impacts of climate change such as rising sea levels and increasingly intense storms. Climate change mitigation, by contrast, refers to actions that are taken to lessen climate change by reducing GHG emissions. *Responding to Climate*

impacts of global climate change intensify and the need to adapt grows increasingly acute, cities would do well to integrate adaptation planning into major mitigation policies, like BPSs. Doing so would promote policy coherence and the efficient deployment of capital.

The remainder of this Article proceeds as follows: Part I provides background information on buildings' contribution to climate change and the first generation of policies that cities adopted to try to rein in emissions from the sector. Part II presents an overview of the existing BPSs that American cities have adopted, highlighting the tradeoffs involved in the design decisions that they have made. Finally, in Section II.B, this Article provides some suggestions for how adaptation might be integrated into the next generation of BPSs.

## I. SOURCES OF BUILDING EMISSIONS & CITIES' EARLY ATTEMPTS TO REDUCE SUCH EMISSIONS

### A. *Sources of Building Emissions*

Buildings' GHG emissions come from two different sources. First, buildings purchase electricity from the electrical grid to power lights, air conditioners, computers, and so on.<sup>14</sup> Second, buildings burn oil and gas on-site to create heat, warm water, and fuel gas-fired stoves.<sup>15</sup> Notably, not every building burns fossil fuels on-site for these purposes—some buildings use electricity for heating, hot water, and cooking—and a number of jurisdictions have passed laws recently that ban fossil fuel infrastructure for new buildings.<sup>16</sup> The move to ban fossil fuel infrastructure for new construction is part of the “electrify everything” movement that seeks to decarbonize the economy by converting the electrical grid to be

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*Change*, NASA (Sept. 1, 2022), <https://climate.nasa.gov/solutions/adaptation-mitigation/> [<https://perma.cc/3C7G-GVKE>].

<sup>14</sup> *Sources of Greenhouse Gas Emissions*, EPA, <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions> [<https://perma.cc/NKN6-L5QX>] (last visited Nov. 13, 2022).

<sup>15</sup> *Id.*

<sup>16</sup> Anne Barnard, *N.Y.C.'s Gas Ban Takes Fight Against Climate Change to the Kitchen*, N.Y. TIMES (Dec. 15, 2021), <https://www.nytimes.com/2021/12/15/nyregion/nyc-gas-stove-heat-ban.html> [<https://perma.cc/BVJ3-GXQ7>]; Emilie Raguso, *Berkeley First City in California To Ban Natural Gas in New Buildings*, BERKELEYSIDE (July 17, 2019), <https://www.berkeleyside.org/2019/07/17/natural-gas-pipes-now-banned-in-new-berkeley-buildings-with-some-exceptions> [<https://perma.cc/74ZA-Q9FW>]. For a discussion of the constraining effect of these bans, see NATHAN MATTISON, BEYOND GAS BANS: ALTERNATIVE PATHWAYS TO REDUCE BUILDING EMISSIONS IN LIGHT OF STATE PREEMPTION LAWS 2 (2022).

powered by renewable sources such as wind and solar and then transition vehicles and appliances from liquid fuels to electricity.<sup>17</sup> At present, however, on-site combustion remains quite common, especially in residential buildings in cold climates.<sup>18</sup>

Just as there are two main sources of emissions from buildings, there are also two different pathways through which buildings can reduce their emissions. The most obvious way that buildings can reduce their emissions is simply by using less energy. For instance, they could raise the thermostat during the summer to use less air conditioning, install high efficiency lighting, and improve the airtightness of the building's façade. The other way that buildings can reduce their GHG emissions is by switching to less emission-intensive sources of fuel. For instance, they could electrify their heating systems and swap their gas stoves for electric ones. The magnitude of the benefit that electrification provides depends on the carbon intensity of the electricity, which varies from place to place depending on the generation mix. In New York City, for instance, the electricity currently purchased from the grid is mainly produced by burning natural gas and is, therefore, fairly carbon intensive.<sup>19</sup> Further upstate in cities like Buffalo and Syracuse, the electricity is mainly produced from zero-emitting sources including hydropower and nuclear energy.<sup>20</sup> As a result, electrification should provide a bigger benefit upstate than in New York City—the difference should be reduced as New York State decarbonizes electricity downstate in accordance with the Climate Leadership and Community Protection Act.<sup>21</sup>

#### B. *American Cities' Regulatory Powers to Control Building Emissions*

Not only do buildings contribute an outsized share of cities' GHG emissions, but, as noted in the Introduction, cities also have more power to address emissions from buildings than they do from other sectors, such as transportation. Cities that seek to develop policies to reduce GHG

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<sup>17</sup> *Electrify Everything*, REGENERATION, <https://regeneration.org/nexus/electrify-everything> [<https://perma.cc/RXR5-6G4G>] (last visited Nov. 13, 2022).

<sup>18</sup> Filippo Padovani, Nelson Sommerfeldt, Francesca Longobardi & Joshua M. Pearce, *Decarbonizing Rural Residential Buildings in Cold Climates: A Techno-Economic Analysis of Heating Electrification*, ENERGY & BLDGS., Nov. 1, 2021, at 1, 1.

<sup>19</sup> James Barron, *Ending a Tale of Two Power Grids*, N.Y. TIMES (Nov. 30, 2021), <https://www.nytimes.com/2021/11/30/nyregion/clean-energy-nyc.html> [<https://perma.cc/7DPP-3XVV>].

<sup>20</sup> *Id.*

<sup>21</sup> *Id.*

emissions must operate within a thicket of preempting federal and state regulations.<sup>22</sup> Transportation accounts for the largest share of U.S. GHG emissions (27%),<sup>23</sup> yet the federal government generally regulates vehicle emissions and has expressly preempted state and local governments from doing so themselves.<sup>24</sup> Electricity generation accounts for the next largest share of U.S. GHG emissions (25%),<sup>25</sup> but the state governments and the federal government regulate aspects of electricity, leaving little room for most local governments to control the carbon intensity of the electricity that is supplied to the grid.<sup>26</sup> What cities can do is regulate the demand side of the economy by encouraging individuals to consume less energy or to choose to consume less carbon-intensive types of energy. Regulating buildings is one important lever that cities can pull to influence how much and what type of energy individuals consume.

### C. *Cities' Early Attempts to Reduce Building Emissions*

The earliest crop of municipal building regulations adopted in the United States were squarely geared toward reducing emissions via the first pathway described above—reducing total energy usage—and they sought to incentivize, rather than mandate, change.<sup>27</sup> These early laws were rooted in a body of scholarship that argued that private actors were failing to capitalize upon cost-effective opportunities to reduce their energy usage.<sup>28</sup> This supposedly irrational behavior was often described as

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<sup>22</sup> Katrina M. Wyman & Danielle Spiegel-Feld, *The Urban Environmental Renaissance*, 108 CALIF. L. REV. 305, 348–50 (2020).

<sup>23</sup> *Sources of Greenhouse Gas Emissions*, *supra* note 14.

<sup>24</sup> Clean Air Act, 42 U.S.C. §§ 7401–7675 (2018); Energy Policy and Conservation Act (EPCA), Pub. L. No. 94-163, 89 Stat. 871 (1975); *Ophir v. City of Boston*, 647 F. Supp. 2d 86, 90 (D. Mass. 2009); *Metro. Taxicab Bd. of Trade v. City of New York*, 615 F.3d 152, 156 (2d Cir. 2010). Under the Clean Air Act, California is allowed to regulate vehicle emissions if it gets a waiver from the federal government. *See* Clean Air Act § 7410. Other states can adopt California's standards and a good number have done so. Jennifer Hijazi, *States Adopt California Car Rules Amid National Standards Debate*, BLOOMBERG L. (Mar. 26, 2021, 6:01 AM), <https://news.bloomberglaw.com/environment-and-energy/states-adopt-california-car-rules-amid-national-standards-debate> [<https://perma.cc/6E35-W9LC>].

<sup>25</sup> *Sources of Greenhouse Gas Emissions*, *supra* note 14.

<sup>26</sup> Note that there are some exceptions to this general rule where cities themselves own their electric utilities, especially in vertically integrated states. For a discussion of this issue, see Shelley Welton, *Public Energy*, 92 N.Y.U. L. REV. 267, 304–05 (2016).

<sup>27</sup> Wyman & Spiegel-Feld, *supra* note 22, at 343.

<sup>28</sup> DANIELLE SPIEGEL-FELD, GUARINI CTR. ON ENV'T, ENERGY & LAND USE L., *BUILDING DEMAND FOR EFFICIENT BUILDINGS: INSIGHTS FROM THE EU'S ENERGY DISCLOSURE REGIME 2* (2016), <https://guarinicenter.org/buildingdemand/> [<https://perma.cc/4KSL-ZUXV>].



the “energy efficiency paradox.”<sup>29</sup> There are various hypotheses for why the energy efficiency paradox exists, but one prominent idea is that it results from the fact that owners simply are not aware of all the cost-effective improvements they could make to their properties.<sup>30</sup> Moreover, even when owners are aware of the problem, their tenants, who often pay for the utilities, are even less likely to understand how efficient a given property is.<sup>31</sup> Without this information, there is no way for renters to factor efficiency into decisions about where to rent space and, therefore, no way to incentivize the owners to improve the property.<sup>32</sup>

America’s largest city, New York City, took a major step toward mitigating the information deficit when it passed a suite of information disclosure regulations for large buildings in 2009.<sup>33</sup> These laws are still in force today.<sup>34</sup> One of these laws, often referred to as the “benchmarking law,” requires that owners of large buildings annually report the amount of energy that they use per square foot to consider how efficient a building is compared to similar properties.<sup>35</sup> Another law requires buildings to conduct an energy audit once every ten years that indicates the cost-effective energy improvements that owners could make to their buildings.<sup>36</sup> In the decade after New York City passed its benchmarking law, at least nineteen other American cities, including major cities such as Atlanta, Boston, and Chicago, followed suit. Many of these cities adopted audit requirements during this time period as well.<sup>37</sup> The animating aim

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<sup>29</sup> Robert de Neufville, *The Energy Efficiency Paradox*, BIG THINK (Oct. 22, 2011), <https://bigthink.com/guest-thinkers/the-energy-efficiency-paradox/> [<https://perma.cc/T63C-KYNJ>].

<sup>30</sup> See Kenneth Gillingham & Karen Palmer, *Bridging the Energy Efficiency Gap: Policy Insights from Economic Theory and Empirical Evidence*, 8 REV. ENV’T ECON. & POL’Y 18, 18–19, 22 (2014).

<sup>31</sup> See *id.*

<sup>32</sup> SPIEGEL-FELD, *supra* note 28, at 1.

<sup>33</sup> *Greener Greater Buildings Plan, 2009*, N.Y.C. MAYOR’S OFF. OF CLIMATE & ENV’T JUST., <https://www1.nyc.gov/site/sustainability/legislation/greener-greater-buildings-plan-2009.page> [<https://perma.cc/QU5Y-YAEW>] (last visited Nov. 13, 2022). Note that the European Union (“EU”) has also required information disclosure since 2002. *Questions and Answers on the Revision of the Energy Performance of Buildings Directive*, EUR. COMM’N (Dec. 15, 2021), [https://ec.europa.eu/commission/presscorner/detail/en/qanda\\_21\\_6686](https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_6686) [<https://perma.cc/X2B8-YUT8>].

<sup>34</sup> See *Greener Greater Buildings Plan, 2009*, *supra* note 33.

<sup>35</sup> *Id.*

<sup>36</sup> N.Y.C., N.Y., Local Law 84 (Dec. 9, 2009) (codified as amended in scattered sections of N.Y.C., N.Y., N.Y.C. ADMIN. CODE, tit. 28, art. 309); N.Y.C., N.Y., Local Law 87 (2009) (codified as amended of N.Y.C., N.Y., N.Y.C. ADMIN. CODE, tit. 28, art. 308.4.1).

<sup>37</sup> By 2017, at least ten American jurisdictions (Atlanta, Austin, Berkeley, Boston, Boulder, Los Angeles, New York City, Orlando, San Francisco, and Seattle) had adopted audit



of both types of law is to incentivize property owners to voluntarily improve their properties by revealing cost-effective opportunities for them to do so.<sup>38</sup>

From a political economy perspective, it makes sense that cities would start their foray into climate-oriented building regulation with a voluntary incentive approach. For many years, prevailing wisdom was that environmental regulation could induce industrial flight away from the regulating jurisdiction, thereby diminishing the local tax base.<sup>39</sup> Indeed, concerns about states' propensity to race to the bottom, adopting more and more lenient regulations to attract industry, helped build support for the federalization of environmental law in the 1970s.<sup>40</sup> In the early 2000s, some cities seem to have perceived an economic benefit to pursuing some types of environmental regulation—namely, those regulations that perceptively improved the quality of the local environment, such as laws aimed at improving local air quality<sup>41</sup>—but it is unclear whether the same economic calculus applied to GHG emissions reductions, which confer global rather than local benefits. By starting out with a low-cost incentive approach to GHG regulation, city governments could test the waters of climate regulation without imposing costly obligations on industry that could provoke backlash. From this perspective, buildings—as opposed to, say, industrial processes—are also a natural candidate for local regulators to start with because they are inherently immobile, which may diminish the concern about intra-jurisdictional flight.<sup>42</sup>

Interestingly, states have been slower to adopt disclosure laws. At the time of this writing, only four states—California, Colorado, New

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requirements. NATALIE MIMS, STEVEN R. SCHILLER, ELIZABETH STUART, LISA SCHWARTZ, CHRIS KRAMER & RICHARD FAESY, EVALUATION OF U.S. BUILDING ENERGY BENCHMARKING AND TRANSPARENCY PROGRAMS: ATTRIBUTES, IMPACTS, AND BEST PRACTICES, at A-10 to A-11 (2017).

<sup>38</sup> *Id.* at 29, 37, 39.

<sup>39</sup> See Adam B. Jaffe, Steven R. Peterson, Paul R. Portney & Robert N. Stavins, *Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?*, 33 J. ECON. LITERATURE 132, 133, 136 (1995); Anthony J. Barbera & Virginia D. McConnell, *The Impact of Environmental Regulations on Industry Productivity: Direct and Indirect Effects*, 18 J. ENV'T ECON. & MGMT. 50, 50, 52 (1990).

<sup>40</sup> Richard B. Stewart, *Pyramids of Sacrifice? Problems of Federalism in Mandating State Implementation of National Environmental Policy*, 86 YALE L.J. 1196, 1199, 1201, 1212, 1214, 1250, 1254 (1977).

<sup>41</sup> See Wyman & Spiegel-Feld, *supra* note 22, at 309, 326, 328, 333–34, 338, 339.

<sup>42</sup> Note that buildings' immobility does not entirely eliminate the concern about intra-jurisdictional flight because landlords may try to pass on the costs of regulation to tenants, who might then choose to move elsewhere. *Id.* at 341.

Jersey, and Washington—have required energy benchmarking,<sup>43</sup> and only Washington State has required periodic energy audits.<sup>44</sup> One might be tempted to assume that cities' leadership on disclosure policy simply reflects the fact that city governments are often more progressive than the states in which they sit. This might be part of the explanation but is unlikely to explain it entirely because many of the cities that adopted disclosure policies early on (e.g., Boston, San Francisco, and Portland, Oregon) sit in states that the Democratic Party firmly controlled at the time that the city laws were enacted.<sup>45</sup> Whatever the explanation, it is clear that cities have led the way on building disclosure policy.

Energy disclosure laws have provided a critical source of data regarding energy use in buildings and opportunities for reducing it.<sup>46</sup> Unfortunately, these laws have been less effective at actually incentivizing owners to reduce their energy use.<sup>47</sup> The most charitable assessment of New York City's benchmarking law found that the law contributed to

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<sup>43</sup> See, e.g., *Building Energy Benchmarking Program*, CAL. ENERGY COMM'N, <https://www.energy.ca.gov/programs-and-topics/programs/building-energy-benchmarking-program> [<https://perma.cc/L5DN-G38P>] (last visited Nov. 13, 2022); *Building Benchmarking*, COLO. ENERGY OFF., <https://energyoffice.colorado.gov/climate-energy/energy-policy/building-benchmarking> [<https://perma.cc/GL8F-XKT6>] (last visited Nov. 13, 2022); 2018 N.J. Laws 17 (codified as amended of N.J. STATUTES tit. 48, ch. 3, sec. 87.8); *Clean Buildings Performance Standard*, *supra* note 10. Note that Colorado only passed its benchmarking law in 2021, and the first reporting deadline was December 1, 2022. *Building Benchmarking*, *supra* note 43.

<sup>44</sup> See WASH. REV. CODE § 19.27A (2009).

<sup>45</sup> BOS., MASS., BUILDING EMISSIONS REDUCTION AND DISCLOSURE ORDINANCE AMENDMENT (BERDO) §§ 7-2.1 to 7-2.2 (2021); *Party Control of Massachusetts State Government*, BALLOTPEDIA, [https://ballotpedia.org/Party\\_control\\_of\\_Massachusetts\\_state\\_government](https://ballotpedia.org/Party_control_of_Massachusetts_state_government) [<https://perma.cc/HG69-L4DW>] (last visited Nov. 13, 2022); Press Release, S.F. Env't Dep't, San Francisco's Benchmarking Ordinance Requiring Commercial Buildings to Disclose Energy Data Shows Major Reduction in Energy Use and an Opportunity to Save Millions in Energy Costs (Oct. 5, 2015), [https://sfenvironment.org/sites/default/files/editor-uploads/outreach/press/sfe\\_ou\\_sfbenchmarkingordinance\\_october5.pdf](https://sfenvironment.org/sites/default/files/editor-uploads/outreach/press/sfe_ou_sfbenchmarkingordinance_october5.pdf) [<https://perma.cc/C6ZW-W93M>]; *Party Control of California State Government*, BALLOTPEDIA, [https://ballotpedia.org/Party\\_control\\_of\\_California\\_state\\_government](https://ballotpedia.org/Party_control_of_California_state_government) [<https://perma.cc/PR26-TLS8>] (last visited Nov. 13, 2022); *Home Energy Score Program*, CITY OF PORTLAND, <https://www.pdxhes.com/program> [<https://perma.cc/9TNQ-YT2A>] (last visited Nov. 13, 2022); *Party Control of Oregon State Government*, BALLOTPEDIA, [https://ballotpedia.org/Party\\_control\\_of\\_Oregon\\_state\\_government](https://ballotpedia.org/Party_control_of_Oregon_state_government) [<https://perma.cc/NG9P-NFGH>] (last visited Nov. 13, 2022).

<sup>46</sup> See, e.g., Ting Meng, David Hsu & Albert Han, *Estimating Energy Savings from Benchmarking Policies in New York City*, 133 ENERGY 415, 416, 422 (2017); SPIEGEL-FELD, *supra* note 28, at 2–3.

<sup>47</sup> See SPIEGEL-FELD, *supra* note 28, at 1, 3.

a 6% reduction in energy use during the first three years in which it was in force and a 14% reduction over the first four years.<sup>48</sup> Another study that examined the effects of benchmarking laws in Austin, New York City, San Francisco, and Seattle found that, on average, the benchmarking laws led to a 3% decline in utility expenditures between 2012 and 2013.<sup>49</sup> As for the auditing requirements, New York City's audit law has been estimated to have reduced energy use by 2.5% in residential buildings and 4.9% in commercial buildings during the first five years in which the law was in effect.<sup>50</sup>

There are a number of possible explanations for the lackluster results. One potential explanation is simply that deep energy retrofits are not as cost-effective as policymakers presumed. Another potential explanation (among others) is that the means of disclosure was ineffective. Recall that there are two different constituencies that disclosure laws can educate: building owners and tenants.<sup>51</sup> The first generation of benchmarking laws generally failed to effectively inform renters about how efficient a given building was because the information was not widely publicized.<sup>52</sup> In New York City's case, the information was technically available to the public but was buried on a government website that few people knew existed.<sup>53</sup> Thus, while they may have been effective in informing owners about their properties' relative efficiency, they probably did not succeed in exerting market pressure on property owners to improve their properties. Responding to this deficiency, New York City and Chicago amended their benchmarking laws in 2018 to require that buildings prominently display energy efficiency ratings on-site where they are visible for all to see.<sup>54</sup> It is possible that the enhanced benchmarking laws will drive more voluntary improvements than the initial laws did.

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<sup>48</sup> Meng et al., *supra* note 46, at 416.

<sup>49</sup> Karen Palmer & Margaret Walls, *Does Information Provision Shrink the Energy Efficiency Gap? A Cross-City Comparison of Commercial Building Benchmarking and Disclosure Laws* 14, 23, 25 (Res. for the Future, Working Paper No. 15-12, 2015).

<sup>50</sup> Constantine E. Kontokosta, Danielle Spiegel-Feld & Sokratis Papadopoulos, *The Impact of Mandatory Energy Audits on Building Energy Use*, 5 NATURE ENERGY 309, 310 (2020).

<sup>51</sup> See SPIEGEL-FELD, *supra* note 28, at 2.

<sup>52</sup> See *id.* at 1–3.

<sup>53</sup> Cf. Wyman & Spiegel-Feld, *supra* note 22, at 342–43 (describing the ineffectiveness of cities sharing benchmark information on “obscure” city websites).

<sup>54</sup> N.Y.C., N.Y., Local Law 33 of 2018 § 3 (Jan. 8, 2018) (codified as amended in scattered sections of N.Y.C., N.Y., N.Y.C. ADMIN. CODE, tit. 28, art. 309); N.Y.C., N.Y., Local Law 95 (May 20, 2019); *2017 Chicago Energy Rating System*, CITY OF CHI. (2017), [https://www.chicago.gov/content/dam/city/progs/env/EnergyBenchmark/2017\\_Chicago\\_Energy\\_Rating\\_System\\_Summary.pdf](https://www.chicago.gov/content/dam/city/progs/env/EnergyBenchmark/2017_Chicago_Energy_Rating_System_Summary.pdf) [<https://perma.cc/DK5E-46KH>].

It is too early to tell.<sup>55</sup> But given the urgency of the issue, and federal government's lack of action, cities can ill afford to wait to see whether the improved benchmarking laws will increase action. A number of cities, including Boston, Chicago, New York City, and St. Louis, among others, have set targets to reduce building emissions by 80% by 2050,<sup>56</sup> and it seems highly unlikely that disclosure laws, which rely on voluntary actions, will get them all the way to where they need to be. Mandatory building performance standards are shaping up to be cities' preferred tool for achieving the required action.<sup>57</sup>

## II. BUILDING PERFORMANCE STANDARDS

At the time of this writing, at least eight U.S. jurisdictions had adopted building performance standards: Boston, Massachusetts; Chula Vista, California; Denver, Colorado; Montgomery County, Maryland; New York City, New York; St. Louis, Missouri; Washington, D.C.; and Washington State.<sup>58</sup> The basic idea behind these laws is fairly straight

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<sup>55</sup> The laws only took effect in 2020, and data from both 2020 and 2021 are certainly anomalous given the ways in which the COVID-19 crisis altered energy usage. For a review of how energy use patterns changed during the COVID-19 crisis, see *How a Global Pandemic Shifted NYC's Energy Use*, URB. GREEN COUNCIL (Apr. 2022), <https://www.urbangreencouncil.org/content/projects/how-global-pandemic-shifted-nyc%E2%80%99s-energy-use> [https://perma.cc/5RQ9-8EMQ].

<sup>56</sup> SAMUEL A. MARKOLF, INÈZ M. K. AZEVEDO, MARK MURO & DAVID G. VICTOR, BROOKINGS, PLEDGES AND PROGRESS: STEPS TOWARD GREENHOUSE GAS EMISSIONS REDUCTIONS IN THE 100 LARGEST CITIES ACROSS THE UNITED STATES 2, 8, 10–11, 20 (2020), [https://www.brookings.edu/wpcontent/uploads/2020/10/FP\\_20201022\\_ghg\\_pledges\\_v4.pdf](https://www.brookings.edu/wpcontent/uploads/2020/10/FP_20201022_ghg_pledges_v4.pdf) [https://perma.cc/KH48-QNPU].

<sup>57</sup> Kontokosta et al., *supra* note 50, at 309–10 (describing the increasing prevalence of mandatory building energy audits).

<sup>58</sup> BOS., MASS., BERDO § 7-2.2 (2021); CHULA VISTA, CAL., ORDINANCE No. 3498 § 15.26.050 (2021); *Energize Denver Benchmarking*, CITY & CNTY. OF DENV., <https://www.denvergov.org/Government/Agencies-Departments-Offices/Agencies-Departments-Offices-Directory/Climate-Action-Sustainability-Resiliency/Goals-and-Policies/Energize-Denver-Benchmarking> [https://perma.cc/V9DV-8LLT] (last visited Nov. 13, 2022); MONTGOMERY CNTY. DEP'T OF ENV'T PROT., MONTGOMERY COUNTY'S BUILDING ENERGY PERFORMANCE STANDARDS (2021), <https://www.montgomerycountymd.gov/green/Resources/Files/energy/beps-one-pager.pdf> [https://perma.cc/5LPN-DNF3]; N.Y.C., N.Y., Local Law No. 97 (May 20, 2019); *Building Energy Performance Standards (BEPS) Ordinance and Draft BEPS Targets*, CITY OF ST. LOUIS, MO (2021) [hereinafter *Building Energy Performance Standards*], <https://www.stlouis-mo.gov/government/departments/public-safety/building/building-energy-improvement-board/documents/beps-ordinance.cfm> [https://perma.cc/GWQ9-3JSJ]; Wash., D.C., Clean Energy DC Omnibus Amendment Act, D.C. Law 22-257 § 301 (2018); H.B. 1257, 66th Leg., Reg. Sess. (Wash. 2019). At the time of this writing, Colorado was

forward: They limit the amount of energy or carbon emissions that buildings can release on a per square foot basis and penalize owners whose properties exceed their limits.<sup>59</sup> Within these broad outlines, there is considerable variation in the laws that the different jurisdictions have adopted, and some of the choices that the early adopters have made have already proven problematic.<sup>60</sup> Moreover, as noted in the Introduction, none of the first generation of BPSs had tried to incorporate adaptation planning into the laws,<sup>61</sup> which is a missed opportunity. The following sections evaluate the different approaches that the existing BPSs take and then provide guidance for how future lawmakers might integrate adaptation into the laws.

#### A. *Key Decisions in Designing a BPS*

Of all the decisions that policymakers must make in designing a building performance standard, three stand out as being particularly consequential. They are: (1) whether to limit total energy use (an “energy efficiency standard”) or to limit GHG emissions attributable to the building’s energy use (a “GHG standard”); (2) what size and types of buildings to cover; and (3) what types of flexibility mechanisms to permit.<sup>62</sup> Below we briefly discuss how the early adopters approached these three questions and what we see as the pros and cons of the choices they made.

##### 1. Energy Efficiency Versus GHG Standards

One of the most important decisions policymakers must make in establishing a BPS is what metric should be used for gauging compliance. There are two main options for metrics: measure the amount of energy used or measure the GHG emissions attributable to the energy used.<sup>63</sup> Boston and New York City both measure GHG emissions.<sup>64</sup> By

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also in the process of developing a BPS as well, but the details are not yet known. See *Building Performance Standards*, COLO. ENERGY OFF., <https://energyoffice.colorado.gov/climate-energy/energy-policy/building-performance-standards> [https://perma.cc/P3F6-QVZ6] (last visited Nov. 13, 2022).

<sup>59</sup> *E.g.*, BERDO, § 7-2.2.

<sup>60</sup> See discussion *infra* Section II.A.

<sup>61</sup> SPIEGEL-FELD, *supra* note 28, at 6.

<sup>62</sup> See discussion *infra* Section II.A.3.

<sup>63</sup> Danielle Spiegel-Feld & Katrina M. Wyman, *Building Better Building Performance Standards*, 52 ENV'T L. REP. 10,268, 10,271–74 (2022).

<sup>64</sup> BERDO, §§ 7-2.1 to 7-2.2; N.Y.C., N.Y., Local Law No. 97 (May 20, 2019).

contrast, Chula Vista, Denver, Montgomery County, St. Louis, Washington, D.C., and Washington State measure energy efficiency.<sup>65</sup>

There are two key drawbacks to choosing a GHG metric. First, many cities, including New York City, do not directly control the GHG intensity of electricity that is purchased from the grid.<sup>66</sup> Thus, assuming that the BPS counts emissions from electricity that is purchased from the grid, when a city adopts a GHG metric it cannot effectively control the stringency of the BPS; if the electrical grid decarbonizes quickly, the city's BPSs will be far less stringent than if it decarbonizes slowly.<sup>67</sup> In New York City's case, a New York State law mandating aggressive electrical grid decarbonization,<sup>68</sup> which was passed two months after Local Law 97, made the local law substantially less stringent (and impactful) than city lawmakers likely anticipated.<sup>69</sup>

The second problem with a GHG metric is that it neglects to recognize that energy efficiency provides distinctive benefits compared to renewable energy. As has been noted elsewhere, "GHG standards do not necessarily incentivize owners to reduce the amount of energy that they use."<sup>70</sup> Under a GHG standard, owners' buildings can use as much renewable energy as they please because it has low or no GHG emissions.<sup>71</sup> This is problematic because reducing energy consumption will reduce the societal need to build out new renewable sources of electricity as renewable sources replace fossil fuel sources of power and transportation and buildings are electrified. In other words, increasing energy efficiency is an important complementary policy to decarbonizing electricity supplies and electrification, and it is a policy that local governments can implement, even though they do not typically control the carbon intensity of the grid. Increasing energy efficiency will not only reduce the cost of decarbonizing

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<sup>65</sup> CHULA VISTA, CAL., ORDINANCE NO. 3498 § 15.26.050 (2021); Zachary Hart, *Denver Passes Building Performance Standard*, INST. FOR MKT. TRANSFORMATION (Nov. 23, 2021), <https://www.imt.org/denver-passes-building-performance-standard> [<https://perma.cc/64HH-7UWF>]; MONTGOMERY CNTY. DEP'T OF ENV'T PROT., *supra* note 58; *Building Energy Performance Standards*, *supra* note 58; Wash., D.C., Clean Energy DC Omnibus Amendment Act, D.C. Law 22-257 § 301 (2018); H.B. 1257, 66th Leg., Reg. Sess. (Wash. 2019).

<sup>66</sup> N.Y.C., N.Y., Climate Leadership and Community Protection Act (CLCPA), N.Y. ENV'T CONSERV. §§ 75.0101–75.0119 (2019).

<sup>67</sup> For more discussion of this critique, see Spiegel-Feld & Wyman, *supra* note 63, at 10,272.

<sup>68</sup> CLCPA, §§ 75.0101–75.0119 (2019).

<sup>69</sup> Spiegel-Feld & Wyman, *supra* note 63, at 10,275–76.

<sup>70</sup> *Id.* at 10,271.

<sup>71</sup> *Id.*



society,<sup>72</sup> it also could reduce consumer energy bills, which could particularly benefit low-income people facing energy poverty.<sup>73</sup>

## 2. Size and Types of Covered Buildings

A second key decision that policymakers must address in adopting a BPS is determining the buildings to which it should apply. There is a sectoral dimension to this question (i.e., whether the law covers buildings used for housing or only those used for commercial and industrial purposes) as well as a physical dimension (i.e., whether it applies to buildings of any size or only those that are larger than some specified threshold). Several of the existing BPSs exempt all or some residential buildings from the performance caps,<sup>74</sup> and none of the laws apply to buildings with less than 10,000 square feet.<sup>75</sup>

In thinking about which buildings to cover, policymakers must be mindful of the tradeoffs involved. To be most environmentally effective, the law should cover as wide a swath of properties as possible. Especially in cities in which buildings burn a substantial amount of fossil fuels on-site for heating and hot water, there may be strong environmental justice arguments for covering a broad swath of properties so as to avoid depriving the most vulnerable populations of potential improvements in local air quality. Yet the decision to impose these mandates on residential properties also generates some important economic and political costs, which could diminish the public's appetite for passing a stringent BPS and potentially raise the price of housing as well. Policymakers will need to evaluate the acceptability of these costs against background economic and political conditions to determine the scope of coverage that best meets their jurisdiction's goals. There is unlikely to be one optimal approach for all cities. Indeed, New York City's own calculus changed within a matter of months.<sup>76</sup>

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<sup>72</sup> *Id.* at 10,275–76.

<sup>73</sup> *See id.* at 10,274.

<sup>74</sup> For example, Montgomery County phases in the performance standards for residential buildings after the standards begin to apply to commercial buildings. MONTGOMERY CNTY. DEP'T OF ENV'T PROT., *supra* note 58.

<sup>75</sup> MIMS ET AL., *supra* note 37, at E-1; N.J. Clean Energy Act, N.J. STATUTES, tit. 34, § 1A-3.1 (May 23, 2018); *id.* at tit. 48, ch. 3, § 87.8; *Clean Buildings Performance Standard*, *supra* note 10; BOS., MASS., BERDO, §§ 7-2.1 to 7-2.2 (2021); *2017 Chicago Energy Rating System*, *supra* note 54; *Building Energy Performance Standards*, *supra* note 58.

<sup>76</sup> Initially, New York City's Local Law 97 exempted *all* residential buildings in which one or more units was rent regulated. After the state passed rent regulation reforms in the

### 3. Flexibility Mechanisms

A third type of issue that policymakers must consider is what types of flexibility mechanism to permit for buildings that would otherwise exceed the allowable amount of emissions or energy attributable to their operations. The existing BPSs exhibit a variety of approaches in this respect.<sup>77</sup> Some permit building owners to purchase GHG offsets or Renewable Energy Credits (“RECs”) (New York City, Boston, and Washington, D.C.),<sup>78</sup> some allow owners of multiple buildings to comply on a portfolio basis (Boston),<sup>79</sup> or to contribute to a fund that can be used for “local building carbon abatement projects . . . that benefit Environmental Justice Populations” (Boston and under consideration in New York City).<sup>80</sup> Note that the last flexibility mechanism (contributing to a fund to finance local building improvements) is essentially a bespoke type of offset in that it enables a property owner to offset his own emissions or energy by reducing them elsewhere.<sup>81</sup>

There are two main reasons to incorporate various flexibility mechanisms. First, each of the flexibility mechanisms can lower the cost of compliance for owners by allowing them to seek out lower cost means of compliance than retrofitting the regulated building.<sup>82</sup> The “local carbon abatement” fund holds another potential benefit as well. To the extent that it is used to subsidize retrofits of affordable housing, it could reduce

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summer of 2019 that made it more difficult for landlords to pass on the costs of energy efficiency improvements to their tenants. New York City amended local law to exempt only those buildings in which 35% or more of the units are rent regulated. N.Y.C., N.Y., Local Law No. 97 (May 20, 2019); N.Y.C., N.Y., Local Law No. 116 of 2020 (Nov. 17, 2020) (codified as amended in scattered sections of N.Y.C., N.Y., N.Y.C. ADMIN. CODE, tit. 28, art. 320); S. 6458, A. 8281, 2019–2020 Reg. Sess. Sen.-Assembly (N.Y. 2019).

<sup>77</sup> *E.g.*, STEVEN NADEL & ADAM HINGE, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., MANDATORY BUILDING PERFORMANCE STANDARDS: A KEY POLICY FOR ACHIEVING CLIMATE GOALS 37, 39, 41 (2020).

<sup>78</sup> Local Law No. 97; BERDO, §§ 7-2.1 to 7-2.2; Clean Energy DC Omnibus Amendment Act, D.C. Law 22-257 § 34-1436 (2018).

<sup>79</sup> BERDO, §§ 7-2.1 to 7-2.2.

<sup>80</sup> *Compare id.* (establishing Boston’s Equitable Emissions Investment Fund), with Celina Damide, *Tale of Two Cities: NYC’s LL97 and Boston’s BERDO*, BRIGHTCORE, <https://www.brightcoreenergy.com/post/nyc-local-law-97-boston-berdo> [<https://perma.cc/CCJ8-BS9R>] (Jan. 21, 2022) (describing New York City’s restrictions on the use of compliance mechanisms).

<sup>81</sup> BERDO, §§ 7-2.1 to 7-2.2.

<sup>82</sup> *See* EPA, BUILDING PERFORMANCE STANDARDS: OVERVIEW FOR STATE AND LOCAL DECISION MAKERS 6–7 (2021), [https://www.epa.gov/sites/default/files/2021-02/documents/benchmarking\\_building\\_performance\\_standards\\_section2.pdf](https://www.epa.gov/sites/default/files/2021-02/documents/benchmarking_building_performance_standards_section2.pdf) [<https://perma.cc/VW4K-QZ8S>] (describing how alternative compliance measures can save building owners costs).

the potential for BPSs to increase housing costs for low-income and moderate-income households.

Each of the flexibility mechanisms also presents environmental tradeoffs that must be carefully considered. For example, permitting owners to meet their obligations via RECs and offsets introduces significant questions about additionality; in New York City's case, it is not immediately clear that the RECs that owners will use to comply with their obligations will actually contribute to the development of new renewable energy resources. Permitting portfolio compliance could potentially also redistribute local pollution concentrations if the buildings with higher abatement costs are concentrated in particular areas. As for the local carbon abatement funds, if the price for contributions is set to be lower than the penalty that owners would otherwise face for excess emissions, it could diminish owners' appetite to make relatively expensive retrofits, such as electrifying heating systems.

### *B. The Next Frontier in BPSs: Integrating Resilience*

For all of the variation between the existing BPSs, they each share at least one deficiency: They fail to integrate resilience goals.<sup>83</sup> The GHG standards that New York City and Boston adopted are arguably most guilty in this respect due to their indifference between renewable energy and energy efficiency;<sup>84</sup> by treating renewable energy and energy efficiency equivalently, they undercut the goals of electricity system resilience.

But even the energy efficiency standards, like those that have been adopted by Washington, D.C., and St. Louis, do not deliberately integrate resilience or broader adaptation goals into their targets.<sup>85</sup> For instance, if ground source heat pumps and air source heat pumps were equally carbon intensive, investing in them would yield the same rewards under the laws even though ground source heat pumps are far more vulnerable to flooding.<sup>86</sup> Similarly, if two windows offer equivalent energy efficiency

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<sup>83</sup> See JESSICA MILLER & BENJAMIN SILVERMAN, INST. FOR MKT. TRANSFORMATION, BUILDING PERFORMANCE STANDARD MODULE: RESILIENCY 6, 11–14 (2022) (providing examples of how BPSs can incorporate resilience goals).

<sup>84</sup> BERDO, §§ 7-2.1 to 7-2.2.; N.Y.C., N.Y., Local Law No. 97 (May 20, 2019).

<sup>85</sup> Wash., D.C., Clean Energy DC Omnibus Amendment Act, D.C. Law 22-257, §§ 301, 303 (2018); Building Energy Performance Standard, Bill No. 219, ST. LOUIS BOARD OF ALDERMEN (Feb. 14, 2020).

<sup>86</sup> See Liam McCabe, *4 Reasons You Might Consider a Heat Pump (Plus a Few Caveats)*, CONSUMERREPS. (July 19, 2022), <https://www.consumerreports.org/heat-pumps/reasons-to-consider-a-heat-pump-for-your-home-a6507162057/> [<https://perma.cc/73JY-WFTB>]; *Air-Source Heat Pumps Versus Ground-Source Heat Pumps*, DANDELION ENERGY (Mar. 13,

benefits but differing levels of protection against hurricane force winds, they would also be treated equally under each of the current laws.<sup>87</sup>

The failure to integrate resilience goals into BPSs risks promoting a suboptimal allocation of the scarce capital that lawmakers can reasonably expect will be invested in upgrading buildings. It could also ultimately hinder the goal of minimizing building-related GHG emissions. The reason for this is that there is a substantial amount of embodied carbon in construction materials.<sup>88</sup> Therefore, if a building is built or retrofitted to meet a GHG reduction goal in a manner that leaves it more vulnerable to storms than need be and must consequently be rebuilt after a short while, then the total emissions attributable to the buildings at that site will likely be higher than if the building had been originally built or retrofitted to last.

Interestingly, at least one American city (Boston) has endeavored to integrate mitigation into its resilience-oriented building regulations.<sup>89</sup> Boston's zoning regulations require that new buildings that are planned to be constructed in highly flood-prone areas undergo a special "resilience review."<sup>90</sup> This resilience review, in turn, requires that projects demonstrate compliance with a number of environmental conditions, including that resilience-oriented upgrades should improve the building's "energy efficiency, [GHG] reduction potential, and passive survivability" wherever feasible.<sup>91</sup> Boston's effort to bootstrap mitigation-oriented improvements onto its resilience policy, tackling multiple objectives at once, is an important precedent. In drafting the next generation of BPSs, other cities should think carefully about how to incorporate this type of holistic thinking into their policies to reduce building energy use or emissions as well. By developing standards that aim to reduce building energy use or emissions *and* make them more resilient to the effects of climate change, lawmakers can encourage a more optimal use of cities' limited resources.

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2019), <https://dandelionenergy.com/air-source-heat-pumps-versus-ground-source-heat-pumps> [<https://perma.cc/E528-FN56>]; *Flood Recovery: Heating and Cooling Systems*, PENN. DEP'T OF ENV'T PROT., <https://www.dep.state.pa.us/dep/deputate/watermgt/GENERAL/FLOODS/fs1957.htm> [<https://perma.cc/RTU3-3HPK>] (last visited Nov. 13, 2022).

<sup>87</sup> See *The Difference Between Hurricane Windows and Impact Windows*, AOA CONSTR. (Mar. 9, 2021), <https://www.aoaconstruction.com/news/content/difference-between-hurricane-and-impact-windows/> [<https://perma.cc/TLP4-YV8E>] (describing the different energy efficiency and impact resistance benefits windows can offer).

<sup>88</sup> *What is Embodied Carbon?*, CARBON CURE (Sept. 22, 2020), <https://www.carboncure.com/concrete-corner/what-is-embodied-carbon/> [<https://perma.cc/P582-XA8Y>].

<sup>89</sup> BOS., MASS., Zoning Code art. 25A-7 (2021).

<sup>90</sup> *Id.*

<sup>91</sup> *Id.*