Mandatory Building Performance Standards: A Key Policy for Achieving Climate Goals

Steven Nadel and Adam Hinge
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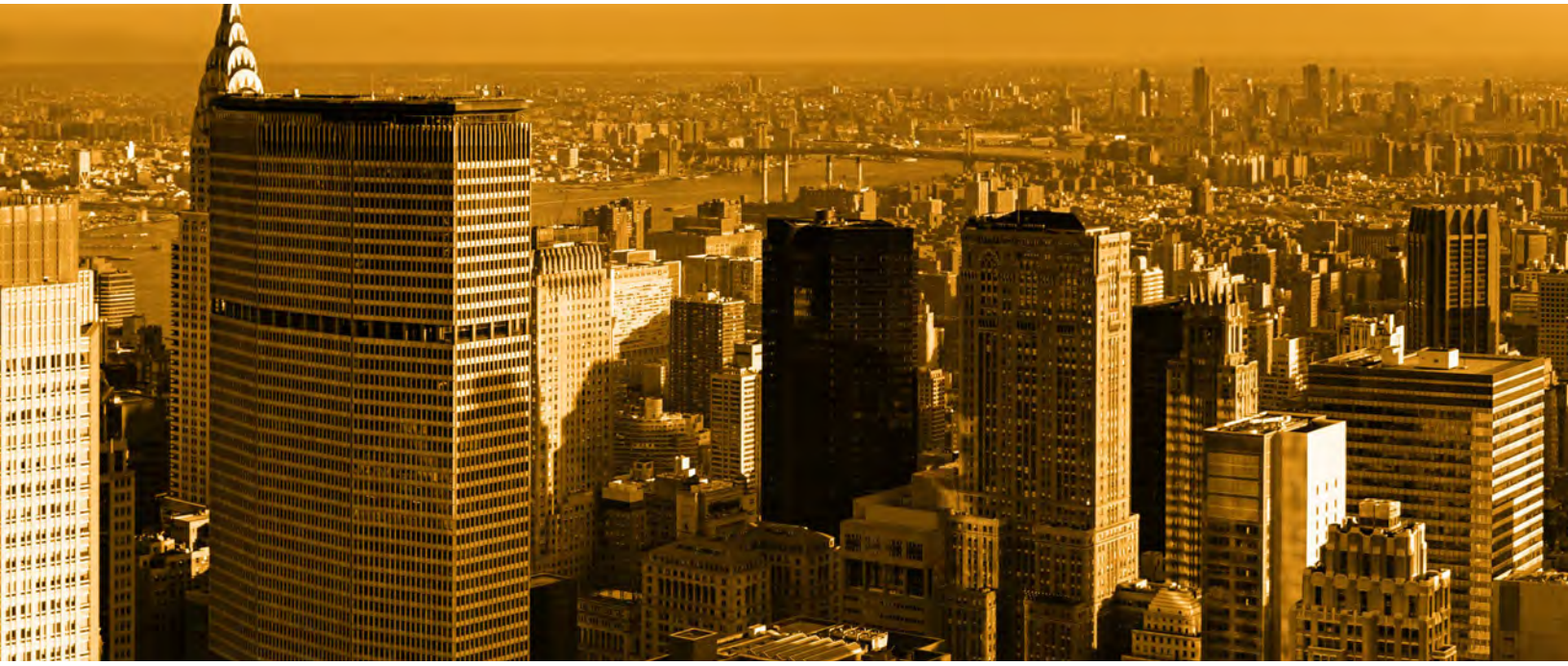
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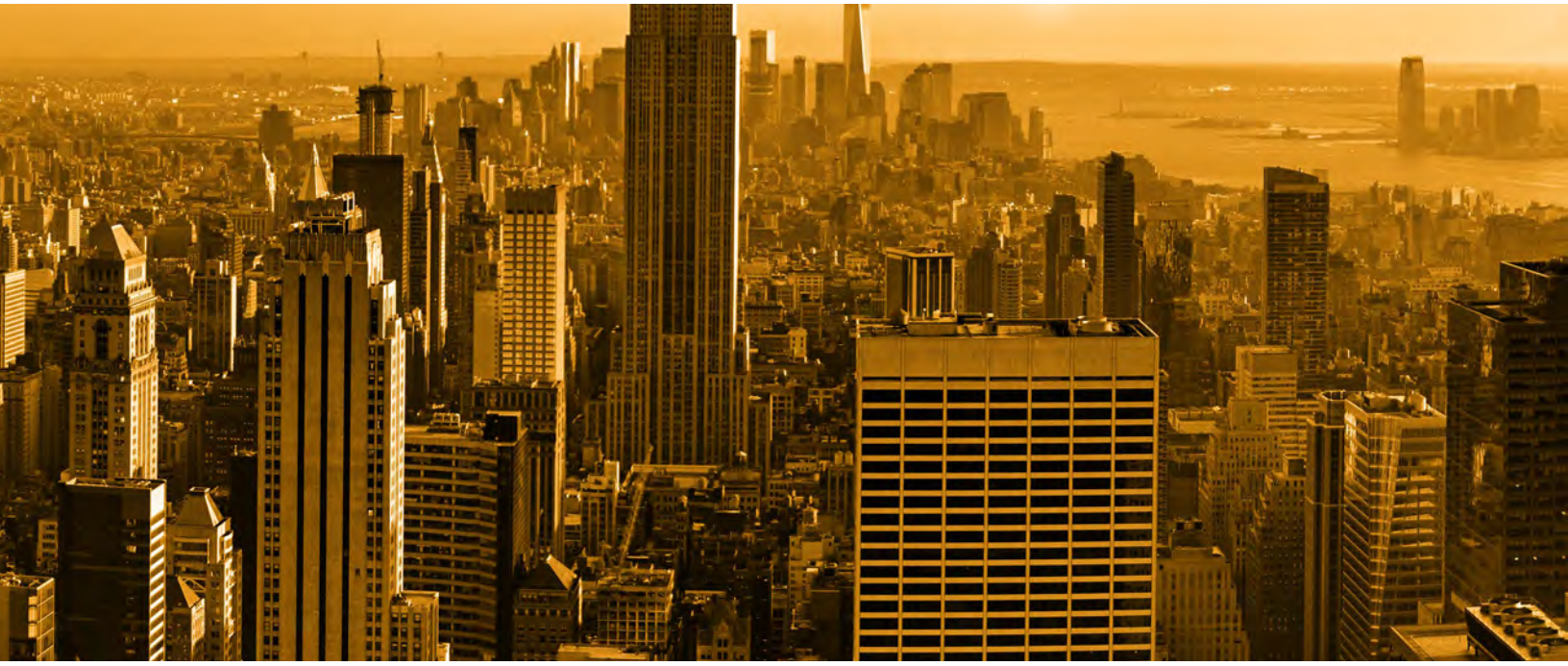
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Abstract

To meet long-term climate goals, substantial energy savings and greenhouse gas emissions reductions must be obtained from existing buildings. Although programs to encourage energy efficiency upgrades to existing buildings have operated for decades, at current rates, it will take approximately 500 years to complete whole-building retrofits on all residences (homes and apartments) and more than 60 years to complete such retrofits on all commercial buildings. New and more aggressive approaches are needed.

Mandatory building performance standards are one such approach. These standards are now being successfully implemented in Boulder, Colorado, and Tokyo. Implementation is just beginning in the United Kingdom, the Netherlands, and Reno, Nevada; and is about to begin in France, Washington State, New York City, St. Louis, and Washington, DC. In addition, another seven jurisdictions are considering adoption. To date, most standards involve commercial buildings and/or rental buildings. In the United States, most of the interest has been in commercial buildings (all but Boulder) and multifamily/rental buildings (all but Washington State). Compared with the United States, Europe and Canada have been more willing to tackle single-family owner-occupied homes (for which mandatory performance standards have already been adopted in France and are being considered in Scotland, Vancouver, and British Columbia). We find that many different approaches are being tested, in part because each jurisdiction is different.

Since implementation is just beginning, it is too early to draw many conclusions. However, we do find that building benchmarking is generally an important precursor for performance standards and that stakeholder consultation is important before standards are proposed. Multiple approaches to performance standards are available, and each jurisdiction must pursue approaches that work for its communities. However, it takes time to build support and work out details. Experience to date also shows that for building performance standards to be successful, attention must be paid to implementation, to adequate staffing, and to complementing standards with other policies and programs. Complementary activities can include building benchmarking, education and technical assistance on ways to reach required performance levels, and financial incentives and financing to help cover costs to building owners. Special attention also must be paid to how performance standards apply in critical markets such as affordable housing. As these policies are implemented, evaluation will be important to improve them and inform future discussions on the best approaches.

In concert with complementary approaches, building performance standards can be an important contributor to efforts to meet energy and climate targets. We are entering an exciting period of experimentation that will likely teach us many lessons on how best to structure and implement such policies to best meet the objective of quality housing and workplaces while obtaining large energy savings and emissions reductions.

Introduction

To meet long-term climate goals, substantial energy savings and greenhouse gas emissions reductions must be obtained from existing buildings. Programs to encourage energy efficiency whole-building retrofits to existing buildings have operated for decades, and even the best programs rarely result in the upgrade of more than 1–2% of eligible buildings annually (York, Nowak, and Molina 2015). New and more-aggressive approaches are needed.

One such approach is mandatory building performance standards—requiring existing buildings to meet some performance benchmark (energy or carbon intensity, performance rating, and so on), with owners having multiple years to bring buildings into compliance. Such policies are in place for high-energy-use commercial and industrial buildings in Tokyo; rental buildings in Boulder, Colorado, and the United Kingdom; and offices in the Netherlands. Commercial building policies have been adopted in Reno, Nevada; New York City; Washington, DC; Washington State; and St. Louis, and details are now being developed (the New York City; Washington, DC; and St. Louis programs include some multifamily buildings). France has a law for residential performance standards, with implementing details still being finalized. Similar policies are being considered in several other jurisdictions.

This paper reviews the rationale for mandatory building performance standards and summarizes work to date in the specified jurisdictions, including key decisions and results where available. We also briefly discuss emerging proposals. Throughout the paper, we focus on whole-building performance standards. We do not focus on energy audit, retrocommissioning, or lighting upgrade requirements but do include a short section beginning on page 30 that briefly discusses these other policies and where they are in place. Many jurisdictions have adopted these other requirements as a step beyond building benchmarking but short of whole-building energy performance standards. In some cases (e.g., New York City), jurisdictions with these other requirements have gone on to adopt whole-building standards. We also note that the line between whole-building performance standards and partial standards is not a bright one. For example, Reno has a whole-building standard, but energy audits or limited upgrades are an alternative compliance path. As long as a jurisdiction nominally requires whole-building performance, we include it in this paper. The various standards differ in their stringency and hence impacts, as we discuss toward the end of this paper.

The Case for Mandatory Building Performance Standards

Need for Large Savings from Existing Buildings

Buildings account for about 39% of U.S. energy use (EIA 2020) and 31% of U.S. greenhouse gas (GHG) emissions (the GHG proportion is lower because nonenergy GHG emissions come disproportionately from other sectors, including agriculture, industry, and transportation) (EPA 2019). To reach long-term goals to slow climate change, we will need large reductions in residential and commercial building energy use. Some of these reductions can come from building more efficient new homes and buildings, actions encouraged by building energy codes that are now in place in most states. However, since about 44% of the commercial building stock and 67% of the housing inventory in 2050 will be in buildings that were built in 2019 or earlier (EIA 2020; Nadel and Ungar 2019), retrofitting the majority of existing buildings must be a key strategy. In ACEEE's 2019 report on how energy efficiency can cut U.S. energy use and GHG emissions in half, improvements to existing homes and buildings accounted for about 23% of the energy savings and 18% of the energy-related GHG emissions reductions (Nadel and Ungar 2019).[1]

Limitations of Current Approaches

While some home and building retrofits now occur each year, it would take centuries to retrofit all existing U.S. buildings (homes, apartments, and commercial buildings) at current rates.

In the case of homes, the leading retrofit programs are Home Performance with ENERGY STAR®, a U.S. Department of Energy (DOE) program that works with state and local program operators, and the low-income Weatherization Assistance Program (WAP), a grant program serving households with low and moderate incomes. In 2018, Home Performance served 86,660 homes (Dunn 2019), and WAP served 33,819 homes (E. Burrin, WAP program manager, DOE, pers. comm., January 31, 2020). Together, these two programs served 0.09% of the 138.5 million housing units (single-family and multifamily) in the United States (Census Bureau 2020). In addition, a variety of other retrofit programs are offered by states, localities, utilities, and other agencies of the federal government, and some owners make retrofits on their own. As a crude estimate, if Home Performance and WAP represent half of U.S. annual retrofits, then it would take more than 500 years to retrofit the current stock of U.S. homes.[2] This estimate includes only whole-home retrofits. Quite a few homes have received much more limited retrofits such as replacing some lightbulbs or upgrading an individual piece of equipment.[3]

[1] These numbers include savings from building retrofits, smart building controls, and half of the savings estimated in the study from appliance and equipment efficiency standards (the remainder of the appliance and equipment standard savings apply to new buildings).
[2] The calculation is 138,537,078 units per Census divided by 120,479 units through Home Performance and WAP times two (to allow for retrofits beyond Home Performance and WAP) = 575 years.
[3] For example, the 2015 Residential Energy Consumption Survey reports that about 5% of housing units have received free or subsidized energy-efficient lightbulbs and about 6% have received a tax credit for a new appliance or equipment (EIA 2018). No time period is provided for when these actions took place.

For the commercial sector, data from the Energy Information Administration's (EIA's) Commercial Building Energy Consumption Survey (CBECS) can help approximate the building renovation rate. In the 2012 survey (the most recent one published), of the buildings at least four years old, 14–39% have had an efficiency-related renovation over the proceeding 18 years, a simple average of 0.8–2.2% per year.[4] If we take the midpoint of this range as a rough estimate, it would take about 67 years to retrofit the current commercial building stock.[5] This estimate is for buildings to receive upgrades to a few building systems. It will likely be longer for most systems in these buildings to be upgraded.

According to these figures, to retrofit 80% of the existing U.S. building stock by 2050, we must increase this annual retrofit rate about 15-fold for residences and about 2-fold for commercial buildings.[6] We must dramatically augment current programs and policies to achieve these large increases. Building performance standards can play an important role in achieving these gains. In some ways, building energy performance standards can be thought of as the existing-building analog to building energy codes for new construction.

Potential Energy Savings and GHG Emissions Reductions in the United States from Mandatory Building Performance Standards

The savings from mandatory building performance standards for existing homes and buildings will depend on the stringency of the standards and the proportion of the building stock to which they apply. As a rough estimate, using data from the Annual Energy Outlook, if mandatory standards apply to two-thirds of the pre-2020 building stock (a more conservative figure than the 80% used in the previous section) and reduce energy use and energy-related carbon dioxide (CO_2) emissions by an average of 30% (the average retrofit savings estimated by Nadel and Ungar 2019), then savings in 2050 will be about 4.55 quads of energy and 170 MMT of CO_2. These results are summarized in table 1. These reductions are 11% of projected 2050 buildings energy use and CO_2 in the EIA 2020 Reference Case.

Table 1. 2050 Potential savings from mandatory building performance standards

Variable	Commercial	Residential	Total
Buildings' energy use in 2050 (quads)	19.93	20.69	40.62
Buildings' energy-related CO_2 in 2050 (MMT)	742	775	1,517
Proportion in 2050 that are pre-2020	44%	67%	
Proportion of pre-2020 stock covered	67%	67%	67%
Average reduction from performance standards	30%	30%	30%
2050 energy savings (quads)	1.76	2.79	4.55
2050 CO_2 savings (MMT)	65.6	104.4	170.0

Figures are for source energy, including upstream power-sector losses. *Sources:* Baseline energy use and CO_2 and existing building share from commercial sector from EIA 2020. Existing building share for residential sector from Nadel and Ungar 2019; this was derived from EIA 2019. Proportion of stock covered and average reduction are rough estimates by the authors.

[4] According to table B1 in the 2012 CBECS (EIA 2016), over the past 18 years, 1.101 million buildings have had a heating, ventilation, and air-conditioning (HVAC) equipment upgrade, which is 14% of the total number of buildings constructed before 2008. If we also include window replacements and lighting and insulation upgrades, and assume no overlap between measures, then 39% of buildings received an energy efficiency upgrade. In all likelihood, some buildings received more than one upgrade, and thus the percentage renovated will be between 14% and 39%. A whole-building retrofit should include multiple systems in a building, and thus the 39% figure is clearly not whole-building retrofits.

[5] The midpoint is 1.5% per year; 1/1.5% = 67 years.

[6] For residences: 80% retrofit/30 years/0.18% retrofit rate = 14.8-fold increase. For commercial buildings: 80% retrofit/30 years/1.5% retrofit rate = 1.8-fold increase.

Current Mandatory Building Performance Standards

We begin this discussion with five standards that are now being implemented: in Tokyo (for very large buildings); Boulder, Colorado (for rental units[7]) and the United Kingdom (also for rental units[7]); the Netherlands (for offices); and Reno, Nevada (commercial and multifamily buildings). We next proceed to five standards where legislation has been enacted but details are still being worked out: France (residences[7]); Washington, DC (commercial and multifamily buildings); New York City (mostly commercial buildings); Washington State (commercial buildings); and St. Louis, Missouri (commercial and multifamily buildings). Within each of these groups, we order our discussion according to the date of adoption.



[7] Including single-family and multifamily units.

Tokyo

Building Performance Standards

In April 2010, the Tokyo Metropolitan Government (TMG) introduced the Tokyo Cap-and-Trade Program (TCTP), which sets mandatory CO2 emissions reduction targets for the largest energy consumers in the city. The program targets facilities consuming over 1,500 kiloliters of annual crude oil equivalent. This includes approximately 1,400 facilities, comprising 1,100 office and mixed-use commercial buildings and about 300 industrial facilities. While there is not a direct correlation between total annual energy consumption and building size, the buildings covered by the TCTP are generally from 20,000 to 30,000 square meters or more (approximately 200,000 to 300,000 square feet and up) (Satoshi Chida, director, Emission Cap and Trade Section, TMG, pers. comm., March 9, 2020). Although these facilities represent only about 0.2% of all commercial and industrial facilities in Tokyo, they account for about 40% of the total CO_2 emissions from those sectors.

A covered facility is required to report its emissions to the TMG every year and must meet an emissions reduction target by implementing emissions reduction measures and/or participating in emissions trading. The facility's baseline emissions from which it must reduce are an average of any three consecutive years between 2002 and 2007. When the TCTP was launched in 2010, the target for emissions reductions from the commercial and industrial sectors was 17% by the year 2020. This 17% reduction by 2020 was also the established target for facilities covered by the TCTP.

Reduction targets were specified for the program's first two five-year compliance periods (2010–14 and 2015–19). Depending on the baseline starting point and some other factors, buildings were required to reduce emissions 8% or 6% in the first compliance period and then 15% or 17% in the second compliance period. In early 2019, the TMG finalized the caps and compliance factors for the third compliance period (2020–24), which will require additional 10% emissions reductions beyond the second compliance period, resulting in 25–27% reductions from the baseline (Chida 2019).

The TMG decided to use five-year compliance periods as a way to balance its long-term investment in energy reduction planning while also retaining the ability to adjust regularly if adequate progress was not being achieved.

A significant element of the TCTP is a tenant mechanism that imposes some obligations on the tenants. Through their "tenants' obligation and participation scheme," tenants in covered buildings must work together with the building owner to implement the energy efficiency plan. Tenants occupying more than 5,000 square meters (approximately 50,000 square feet) or using at least 6 million kilowatt-hours (kWh) per year must submit their own carbon reduction plan.

Companion Programs

The TCTP was preceded by the Tokyo Carbon Reporting Program, which had been introduced in 2002. This earlier mandatory reporting scheme provided detailed (and verified) emissions history so that the baselines for mandatory reductions could be set easily.

The TMG has an array of targeted subsidies and tax credits for various building and business types, funded from a variety of

sources. For example, there are specific subsidy packages to diffuse green lease practices, including covering a portion of retrofit costs for owners once a green lease has been agreed upon with a tenant (C40 and Tokyo 2017).

In addition, owners of buildings larger than 5,000 square meters constructed since 2002 are required to submit a building environmental plan, including a wide range of environmental and energy performance issues.

Beyond companion programs aimed at the biggest emitters covered by the TCTP, many programs are directed toward smaller buildings, including expansion of the Carbon Reduction Reporting Program to small and medium facilities. A benchmarking tool has been developed from the reported data and can enable building owners to understand their energy use and find potential energy management opportunities.

Results

By 2017, the facilities covered by the TCTP had reduced their emissions 27% relative to the baseline year (Tokyo 2019). The majority of the reductions were achieved during the first compliance period, with early reductions driven by electricity supply shortages caused by the Fukushima tsunami and shutdown of much of Japan's nuclear generating capacity. No backsliding from the early deep reductions has been observed, and additional regular reductions are seen most years.

Sources and More Information

- Tokyo Metropolitan Government Cap-and-Trade Program information page: www.kankyo.metro.tokyo.lg.jp/en/climate/cap_and_trade/index.html
- *Urban Efficiency: A Global Survey of Building Energy Efficiency Policies in Cities* (C40 and Tokyo 2015)



Boulder, Colorado

Building Performance Standards

In 2010, the Boulder, Colorado, City Council adopted the SmartRegs program. The program requires all rental housing in the city to demonstrate that it is about as efficient as buildings built to the 1999 Energy Code. The program builds on an existing City of Boulder rental license program that requires a rental property to obtain and renew its license every four years. Renewal entails an inspection for health and safety measures plus additional energy efficiency requirements. The program applies to all long-term licensed rental housing, ranging from single-family homes to large apartment buildings. Compliance can be demonstrated in one of two ways: (1) achieve a score of 120 or better through the Home Energy Rating System (HERS), a nationwide scoring system; or (2) achieve at least 100 points on a prescriptive scoring checklist the City of Boulder developed based on energy and carbon savings for specific measures. Boulder also requires two water efficiency points. For large buildings, a sample of representative apartments can be inspected.

In Boulder, property owners were given two rental license cycles to bring their units into compliance (each license is good for four years). Thus, the requirement began January 2, 2019. Inspections are performed by private inspectors certified by the city. The cost of an inspection is around $120 per rental unit inspected; however, inspectors are third-party private business owners, so the cost can vary.

Companion Programs

Boulder also offers a companion EnergySmart program that provides technical assistance, help with selecting contractors for energy efficiency improvements, and financial incentives beyond those offered by the local utility. EnergySmart is financed mostly by Boulder County, which provides services to all municipalities in the county. In 2010, Boulder County was a recipient of a grant from the DOE under the American Recovery and Reinvestment Act (the program to bring the United States out of the Great Recession). In addition, the city contracted with EnergySmart for specific SmartRegs services, using its Climate Action Plan tax, which is a small city tax on electric service. EnergySmart also leverages available incentives from its local utility.

Results

For the approximately 23,000 licensed rental units, at the end of 2019 (the most recent data available) about 22,500 units in Boulder gained SmartRegs compliance, with just over 200 not yet compliant (Boulder 2020a). Over the course of the eight-year compliance timeline, about half of the rental units were found to be compliant at first inspection, 17% were exempted, and most of the rest required upgrades to reach compliance. Nearly all licensed rental units were inspected using the prescriptive checklist. For those needing upgrades, on average they had to choose two measures to gain an additional 14 points to reach the required 100 points. The most common upgrades were attic, crawlspace, and wall insulation. The average upgrade cost has been $3,022 per unit, of which an average of $579 was paid by rebates. As of the end of 2018, the city estimated the program had saved about 1.9 million kWh of electricity, 460,000 therms of natural gas, $520,000 in energy costs, and 3,900 million metric tonnes of CO_2. The city estimated total investment at just over $8 million, including nearly $1 million in

rebates (Boulder 2019). The Rocky Mountain Institute (Peterson and Lalit 2018) estimated, on the basis of initial results, that once fully implemented, the program will save 4.2 million kWh and 940,000 therms of natural gas annually. If correct, this is an annual savings of about 566 kWh and 123 therms per unit requiring an upgrade.[8]

In our discussions, Boulder officials said they are happy with the program. It has achieved energy savings and GHG emissions reductions and helped to improve the rental housing stock. When asked whether they would increase the stringency of the requirement, they noted that this is not currently in their work plans as higher efficiency requirements would often require new windows, heating and cooling systems, and solar, which can be very expensive (E. Vasatka, sustainability coordinator, City of Boulder, pers. comm., June 28 and July 16, 2019).

For Additional Information

- SmartRegs website: bouldercolorado.gov/plan-develop/smartregs
- A report by the Rocky Mountain Institute on *Better Rentals, Better City* (Petersen and Lalit 2018)
- A report by Lawrence Berkeley National Laboratory (Zimring et al. 2012)
- A paper written by Boulder officials and consultants (Antczak et al. 2016)
- An evaluation of the Boulder DOE grant (Arena and Vijayakumar 2012)



[8] Based on 22,500 total rental units and 33% requiring upgrades as discussed earlier in this paragraph.

United Kingdom

Building Performance Standards

Minimum building energy performance standards have been in effect in the United Kingdom since April 2018, such that it is unlawful to let (lease) properties in England and Wales that do not meet a prescribed minimum level of energy performance. Scotland has a similar policy that is about to begin for just the residential sector. Northern Ireland does not have a program. In the remainder of this section, we discuss the program in England and Wales.

In England and Wales, all rental properties, both residential ("domestic," including multifamily) and commercial ("non-domestic"), that require an Energy Performance Certificate (EPC) in accordance with the European Commission's Energy Performance of Buildings Directive of 2012 are within the scope of this regulation (IPEEC 2017).

The metric for the standard is the building's EPC, which in the United Kingdom is an "A" through "G" rating based on the calculated (or asset) energy performance rating for that building ("A" is the best rating, "G" the worst). The Energy Efficiency (Private Rented Property) (England and Wales) Regulations 2015 (revised in 2017; BEIS 2020a) require that from April 2018 all rented premises within the specified scope are expected to meet a minimum energy standard of an EPC rating of "E." This means that any properties with a rating of "F" or "G" are not allowed to be re-leased from April 2018 without upgrading to a higher level of performance or registering an exemption.

While the regulations initially targeted buildings at the time of a new, renewed, or extended lease beginning in 2018, ultimately all rented buildings must achieve a minimum "E" rating by the established deadlines of April 2020 for domestic and April 2023 for non-domestic buildings.

For domestic buildings, the regulations include a cost cap such that an owner is not required to spend more than £3,500 (about $4,500) per dwelling unit. For non-domestic buildings, the cost threshold is defined to include those investments that pay back within a seven-year period. If the property cannot improve to an EPC "E" rating within the cost thresholds, the owner must make all the improvements that can be made up to that amount and then register an "all improvements made" exemption with the government, which is valid for five years.[9] Other exemptions are described in the references that follow.

In 2019, the UK government began a consultation process to understand potential changes to the non-domestic standards to move more aggressively toward their economy-wide carbon targets. The main proposal from the government (favored option in the consultation) was to set a trajectory for a new standard of EPC "B" in 2030 for the non-domestic sector (BEIS 2019b). The consultation closed January 2020, and the government has not yet responded with its decision.

[9] Nothing is set out explicitly about what happens after five years, but one UK expert said that logic suggests that if the exemption expires, then the regulation would apply, so a landlord would need to comply with the standard or seek another exemption.

Companion Programs

At the time that the building performance regulations were established, the government also introduced a pay-as-you-save finance initiative called Green Deal Finance. Together with subsidies available for domestic energy efficiency from the utility-funded energy efficiency obligation, the initiative was intended to ensure that the standard could be reached at no cost to the landlord. The Green Deal Finance initiative was largely unsuccessful (e.g., see BEIS 2017) and the government has withdrawn its support, so the funding and finance framework has not materialized as expected.

Funding for energy efficiency measures in domestic properties occupied by low-income households is available through the Energy Efficiency Obligation (EEO). For domestic privately rented properties at EPC "F," and "G," the EEO scheme allows selected, higher-cost insulation and renewable heating measures to be subsidized. Other measures are not permitted for "F"- and "G"-rated properties (BEIS 2020b). In addition, some subsidies may be available on a piecemeal basis through individual local authorities.

Results

With the policy just taking effect in April 2018, limited information on results is available at this time. A study published on the domestic building progress in June 2019 found the following:

> *It was clear that enforcement action by local authorities in this area is currently limited. Some local authorities are developing systems and looking to enforce the regulations within the next year. Others are yet to undertake any work at all around enforcing the MEES* [Minimum Energy Efficiency Standards]. *The ineffectiveness of the exemption criteria (prior to April 2019) was a key barrier to enforcement, along with a lack of resourcing for this activity within local authorities…*
>
> *It was widely felt that it will be easier to enforce the MEES after April 2020 when the standards will apply to existing tenants too (as long as the property has an EPC). However, the practical challenges in identifying non-compliant properties, contacting landlords, and resourcing the activity make it difficult for local authorities to enforce the MEES efficiently.* (RSM 2019).

More recent anecdotal information from some UK experts suggests that there has not been a big push to renovate buildings, but some property owners have had their buildings' EPC ratings recalculated to obtain better ratings (and therefore be allowed to re-lease the building). The lack of action is due at least in part to expectations of significant project funding through the UK government's Green Deal finance packages, which did not materialize. In addition, many UK policies have not been implemented as smoothly as might otherwise be expected because of turmoil surrounding Brexit.

Sources and Additional Information

- *Guidance – Domestic Private Rented Property* (BEIS 2020a)
- *Guidance – Non-Domestic Private Rented Property* (DBEIS 2019a)
- *The Domestic Private Rented Property Minimum Standard* (BEIS 2020b)

The Netherlands

Building Performance Standards

In November 2018, the Dutch government amended its Building Decree to require that office buildings have an Energy Efficiency Index of at least 1.3 (equivalent to a "C" EPC rating) as of January 1, 2023. After that date, noncomplying buildings will no longer be permitted to be used as office buildings. The standard is generally enforced by the municipality in which the building is located, but it can also be delegated to another nominated "competent authority." As the minimum standard applies to the use of the office building, the duty to comply can be with either the tenant or the building owner. Failure to comply will be addressed through administrative enforcement measures, such as periodic penalty payments, a fine, or the closure of the office building. The regulations require that measures needed to meet the standard are calculated to pay back within 10 years. An owner or tenant is required to install measures up to this payback threshold but not over, even if a "C" certification is not reached. A 2016 study estimated that average payback time to meet this requirement will be between three and six-and-a-half years, with a cumulative total cost of €860 million by 2023.

The Netherlands has around 96,000 offices, 62,000 of which will need to comply with the standard (the rest are exempted as discussed below). Of these, 56% do not yet have an EPC. Of those that do have an EPC, around three-quarters (20,500) have an "A"–"C" label and one-quarter (7,000) have a label of "D"–"G" and therefore will have to undertake work to comply with the standard. Regarding exemptions, the standard does not apply to buildings in which less than 50% of floor area is used for offices (excluding ancillary functions) or buildings in which only a small floor area (less than 100 square meters) is used for offices. Exemptions also apply for listed historic buildings, buildings that are only temporarily used as offices, buildings that do not use energy to regulate indoor climate, and buildings that are due to be demolished in less than two years.

A tighter target of an "A" label by 2030 was considered but not introduced. However, the "C" requirement by 2023 is expected to be tightened to a higher level in some future year.

A more general requirement for operators of commercial establishments to take up energy efficiency measures has already laid the foundation for the introduction of the minimum standard in this sector. The Dutch Environmental Management Activities Law, Decree on Activities, introduced the "energy savings obligation," which requires the "operator" of 20 different types of commercial establishments (public and private) that use over 50,000 kWh of electricity or over 25,000 cubic meters of natural gas to implement all energy savings measures with a payback of less than five years. A list of recognized energy savings measures with payback in the specified period for each sector is published on InfoMil, a government knowledge center for resources on environmental legislation and policy.[10] A provision allows operators to ask for phased implementation. As of July 1, 2019, all users/tenants must submit an environmental report (Wet Milieubeheer) to the municipality covering all processes in the part of the building they occupy.

[10] www.infomil.nl/onderwerpen/duurzaamheid-energie/energiebesparing/erkende-maatregelen/ (in Dutch).

Offices are required to comply with both the Class "C" regulation and this energy savings obligation.

Companion Programs

The Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland, RVO), offers technical support to building owners to enable them to comply with the standard. It provides an online tool that enables building owners to explore investment costs, annual savings, payback times, and CO_2 savings as routes to meeting the standard. A government-approved register lists energy advisors who can assess and recommend improvements to meet the standard. Building owners can receive a grant for the cost of this advice if they go on to install measures.

The Dutch government also provides tax incentives to partially offset the cost of energy efficiency measures. For example, the Energy Investment Allowance allows companies to deduct 45% of specified energy-saving investment costs from taxable profit. The budget for this allowance is €147 million for 2020.[11] The Environmental Investment Allowance is available for entrepreneurs to make tax deductible investments in a broader range of environmental measures. In addition, installation of solar thermal and heat pumps is incentivized through The Renewable Energy Investment Allowance, which provides a partial subsidy of the costs of the installation. Finally, "green" loans are also available for commercial buildings. These provide preferential interest rates, often coupled with supporting services such as free energy consultations.

Results

While implementation will not come into force until 2023, the program is already having some impact. For example, the number of investors, mortgage banks, owners, and tenants asking for more-detailed information about buildings' energy performance is rising. A significant increase in investment in the renovation and transformation of commercial properties has been observed. A growing number of financial institutions are also adapting their real estate financing measures accordingly. For example, ING, Rabobank, and ABN AMRO, three leading financial institutions in the Netherlands, have indicated they will stop financing office buildings with a "D" label or worse. In addition, ING Real Estate Finance is no longer refinancing clients lacking a plan to get at least a "C" label for their offices (IGBC 2019b).

Sources and Additional Information

- A paper that looks at the potential for minimum performance standards for Europe, including a case study on the Dutch program (Sunderland and Santini 2020) (this section draws heavily from this case study)
- An international compilation that provides information on both the office building and Environmental Management Activities Decree (IGBC 2019b)
- The program website (in Dutch): www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/wetten-en-regels/bestaande-bouw/energielabel-c-kantoren/veelgestelde-vragen

[11] english.rvo.nl/subsidies-programmes/energy-investment-allowance-eia.

Reno, Nevada

Building Performance Standards

In January 2019, the City of Reno enacted the Energy and Water Efficiency Program, which includes both commercial and multifamily building benchmarking and building performance standards for commercial and multifamily buildings 30,000 square feet and larger. This policy was developed by city staff with assistance from the City Energy Project[12] and input from a series of five community workshops. This policy covers 71% of commercial buildings and 90% of multifamily buildings in the city. These buildings must meet both energy and water targets.

For energy targets, a building owner may choose from four options:

- The property received an ENERGY STAR score of 50 or higher.
- The property's energy-use intensity (EUI) was equivalent to or better than the performance of 50% of all covered properties of its type.
- The property achieved an ENERGY STAR score at least 15 points higher than the score it received during its baseline year.
- The property's weather-normalized source EUI was reduced by at least 10% relative to its performance in the baseline year.

For water targets, a building owner may choose from three options:

- The property received an ENERGY STAR water score of 50 or higher.
- The property's water use intensity (WUI) was equivalent to or better than the performance of 50% of all covered properties of its type.
- The property achieved an ENERGY STAR water score at least 15 points higher than the score it received during its baseline year.

Buildings unable to meet the performance criteria have prescriptive options. For example, in lieu of the energy criteria, buildings may comply via one of the following prescriptive routes:

- Completing retuning or an energy and water audit
- Receiving certification under LEED for Existing Buildings
- Participating in and successfully completing a utility-sponsored retuning incentive program within the past seven years
- Performing ongoing commissioning of electrical and mechanical systems
- Receiving a net zero energy certification

For properties without a central cooling system, options include completing three prescriptive measures involving common-area exterior lighting, pipe insulation, a cool roof, a solar water-heating system, or a new water heater; participating in a demand response program; or attending at least three locally offered trainings or professional certification programs in energy conservation or energy code compliance.

[12] www.cityenergyproject.org/about-the-city-energy-project/.

Prescriptive water efficiency measures may be chosen as well. The multiple performance standards and the prescriptive options were added to help address property owners' concerns that a single prescriptive standard (e.g., ENERGY STAR) could be challenging to meet.

Compliance with appropriate performance or prescriptive measures must be demonstrated by 2026 for city-owned properties of 10,000 square feet or more, 2028 for private-sector properties of 100,000 square feet or more, 2029 for private properties of 50,000–99,999 square feet, and 2032 for private properties of 30,000–49,999 square feet. Compliance must be demonstrated again every seven years after these dates. The program does not include any special provisions for affordable housing.

Companion Programs

The city also created the voluntary ReEnergize Reno program to improve building energy and water efficiency 20% by 2025. Participating buildings must track energy and water data through ENERGY STAR Portfolio Manager and disclose results to the City of Reno. The city offers technical support to participating properties. The city also has a Commercial Property Assessed Clean Energy (C-PACE) loan program for commercial buildings and multifamily buildings with five or more units. In addition, the local utility offers energy efficiency programs that include incentives and technical assistance.

Results

Since implementation is just beginning, no results are available yet. However, program staff report that they are getting questions from building owners and, in response to some of these questions, must figure out some specific additional details.

In terms of compliance, buildings at or above the median energy and water scores will pass the performance criteria. For buildings below the median, given the number of prescriptive options and their low cost, we would surmise that use of prescriptive options will be common. Thus, as one observer commented, one could consider Reno's law an audit/retuning law with alternative compliance options including building performance rather than a building performance standard.

Source and Additional Information

- Energy and Water Efficiency Program website: www.reno.gov/community/sustainability/energy-and-water-efficiency
- Energy and Water Efficiency Ordinance (Reno 2019)
- S. Linfante, energy advisor, City of Reno, pers. comm., February 28, 2020

France

Building Performance Standards

In 2015, France adopted the Energy Transition toward Green Growth Act (Ministry of the Environment, Energy and the Sea 2016). This act calls for:

- A 60% reduction in final energy consumption in 2050 compared with 2010 level for commercial-sector buildings
- Renovation of 500,000 homes per year starting in 2017, at least half of which are occupied by low-income households, aiming for a 15% reduction in fuel poverty by 2020
- Energy renovation by 2025 of all private residential buildings whose primary energy consumption exceeds 330 kWh per square meter per year of primary energy

This last provision is a building performance standard. In France, as in the United Kingdom and most other European countries, buildings are rated and labeled on an "A" through "G" scale. The building performance standard in the law means that "F"- and "G"-rated residential buildings (about 15% of the housing stock) must upgrade to at least the "E" level. This includes both rental and owner-occupied residences. The plan is to steadily tighten these requirements to bring the entire housing stock to low energy levels ("Bâtiment Basse Consommation" [BBC] or equivalent) by 2050. This is equivalent to 80 kWh per square meter per year in primary energy for the regulated loads (heating, cooling, lighting, ventilation, and hot water). This long-term goal, which corresponds to a "B" rating, is also part of the 2015 law.

A more-recent energy and climate law, adopted in November 2019, sets the goal to achieve carbon neutrality by 2050 by reducing fossil fuel consumption 40% by 2030—instead of the previous 30% target adopted by France—and by closing coal-based electricity generation by 2022. In addition, the law contains various measures to support the development of renewable energy and to improve the energy efficiency of housing to reduce energy consumption by reducing heat loss. Concerning energy efficiency in the housing sector, the new law calls for retrofitting all "passoires énergétiques" (homes and apartments not in compliance with the standard) within 10 years according to the following chronological targets:

- From 2021, freeze rents of "passoire" units. An owner of a passoire will no longer be able to increase the rents.
- Starting in 2022, each real estate transaction involving a passoire will have to provide an audit on what work is needed to bring it into compliance. Mention of passoire status will be compulsory in the real estate advertisements of the dwellings concerned starting in 2022.
- From 2023, for new rental contracts, the "decency" criteria for dwellings, which specify minimum requirements (e.g., minimum floor area and free of vermin) will be amended to include a maximum threshold of final energy consumption per square meter per year. When a rental falls short of these decency criteria, a tenant can request that the landlord correct the deficiency.

- The law includes an obligation to retrofit the passoires by 2028[13] with the aim of achieving minimum class "E." In the event of noncompliance, sanctions will be defined in 2023 by parliament as part of the five-year energy programming created by the energy–climate bill. This bill may also consider tightening the requirement as of a future year.

Companion Programs

To help support these upgrades, France has a variety of complementary programs, including:

- An Energy Transition Tax Credit provides for a refund of 30% of the total cost of energy renovation work up to a limit of €8,000 for a single person and €16,000 per couple.[14]
- An interest-free Eco-Loan up to €30,000 is available to property owners carrying out energy renovation work. It can be combined with the tax credit above.
- The Habitier Mieux Program (Better Housing) managed by France's National Housing Agency (ANAH) has increased targets for renovating homes. In 2016 the target was 70,000 homes, a 40% increase relative to the previous year.
- Regional Energy Renovation Platforms provide technical and financial support to homeowners carrying out energy renovations. A total of 450 regional "information service units" cover the whole of France.
- Plans are under way to develop an Energy Efficiency Passport to help homeowners and contractors navigate the process to bring each home up to the BBC level
- The energy-saving certificate scheme (certificats d'économies d'énergie, CEE) has energy-saving requirements for energy providers (fuel, electricity, gas, heating oil, and so on) to support energy-saving initiatives. This program targets all households and businesses, with a specific minimum share for low-income households.
- An Energy Renovation Guarantee Fund provides loans to low-income households, with a government repayment guarantee.
- Digital maintenance and repair records are being established to compile and store information on individual homes so present and future owners have ready access to information that will aid in planning home renovations (Ministry of the Environment, Energy and the Sea 2016).

For Additional Information

- An English-language summary of the Energy Transition through Green Growth Act (Ministry of the Environment, Energy and the Sea 2016)
- France section in a report on energy efficiency passports (Fabbri, De Groote, and Rapf 2016)
- The 2019 law (in French): www.ecologique-solidaire.gouv.fr/loi-energie-climat

[13] The 2015 law originally called for 2025, but this was extended by three years to allow time to improve the reliability of the process by which assessments are made and ratings assigned.
[14] Changes to this credit are scheduled to take place soon; see www.economie.gouv.fr/cedef/cite-credit-impot-2020 (in French) and www.ec.europa.eu/info/sites/info/files/economy-finance/2020_dbp_fr_en.pdf.

Washington, DC

Building Performance Standards

In December 2018, the Council of the District of Columbia adopted the Clean Energy DC Omnibus Amendment Act of 2018, which increased the DC renewable portfolio standard, expanded energy efficiency funding and programs, sought to expand use of electric vehicles, and adopted mandatory building energy performance standards for large buildings, including multifamily buildings. The legislation requires buildings with a floor area of 50,000 square feet or more to meet energy performance standards or take other required actions by January 1, 2026, with the standards extending to buildings of 25,000 square feet or more on January 1, 2028, and to buildings of 10,000 square feet or more on January 1, 2031.

The performance standards are part of the district's efforts, as specified in the legislation, to reduce GHG emissions 50% by 2032 and to achieve carbon neutrality by 2050. The standards build on an annual energy benchmarking requirement for commercial and multifamily buildings in the district, which was adopted by the council in the Clean and Affordable Energy Act of 2008. It gradually phases in benchmarking, with DC-owned buildings with over 10,000 square feet of floor area starting in 2009, private buildings with 50,000 square feet floor area starting in 2013, buildings 25,000–49,999 square feet starting in 2022 using 2021 data, and buildings 10,000–24,999 square feet starting in 2025 using 2024 data.[15]

The performance standards have yet to be set, but the District of Columbia Department of Energy and Environment (DOEE) has begun the process to set the specific standards on the basis of criteria in the legislation and input from an advisory task force of about a dozen stakeholders. The legislation specifies that "the building energy performance standard shall be no lower than the District median ENERGY STAR score for buildings of each property type." The legislation also specifies that multiple compliance pathways be established, including a performance pathway under which a building demonstrates at least a "20% decrease in normalized site energy use intensity," a prescriptive pathway containing specific efficiency measures "with savings comparable to the performance pathway," and other compliance pathways established by DOEE. In the case of campuses owned by postsecondary educational institutions and hospitals, campus-wide goals will be established.

The legislation requires that performance targets be revised every five years, and thus the standards for large buildings that are published by January 1, 2021, and must be met by January 1, 2026, will need to be replaced by a new standard published by January 1, 2026 and met by January 1, 2031.[16] The law also requires that DOEE prepare a report to assess whether the standards should be converted from an energy to a GHG metric in the future.

Another provision in the legislation allows DOEE to establish criteria for delaying the effective date for buildings that demonstrate financial distress, have a change of ownership, are vacant, are receiving a major renovation, are pending demolition, or meet other criteria established by DOEE. In addition, the effective date for affordable housing meeting the above criteria may be delayed by DOEE for more than three years.

[15] Buildings with a floor area under 50,000 square feet were added in the Clean DC Energy Act of 2018.
[16] This is the current timetable. Some amendments are being discussed.



Companion Programs

To help support implementation of the building performance standards, the DC council also increased funding support for energy efficiency in the same legislation establishing the standards. This increased support includes additional funding for the DC Sustainable Energy Utility (the main program administrator in the District; its budget is now over $20 million per year), allocating $70 million over six years to the DC Green Bank,[17] allocating $3 million per year for affordable housing compliance with the standards starting in 2022, and allowing gas and electric utilities to again offer energy efficiency and demand-reduction programs. In addition, they are setting up a "High-Performance Building Hub" to provide technical assistance.

Sources and Additional Information

- Building Energy Performance Standards (BEPS) website: doee.dc.gov/service/building-energy-performance-standards
- Legislation (Council of the District of Columbia 2018)
- An overview presentation on the standards (District of Columbia DOEE 2019)
- Frequently asked questions (District of Columbia DOEE 2020)
- A blog on the 2018 Act with links to other information (Majersik and Miller 2018)

[17] www.dcgreenbank.org/.

New York City

Building Performance Standards

In April 2019, the New York City (NYC) City Council passed a package of bills known as the Climate Mobilization Act (CMA). The centerpiece of the CMA is Local Law 97 of 2019, which requires buildings larger than 25,000 square feet to meet strict GHG emissions limits starting in 2024.

The law established GHG intensity limits, expressed in CO_2 equivalent per square foot for 10 building categories (based on Building Code occupancy groups), with the limits taking effect in 2024 (covering each year in the 2024–29 period) affecting the most carbon-intensive 20% of buildings. Some of the buildings affected in this first compliance period will need to reduce their emissions by only 10% or less, but other high-emission buildings in many of the occupancy groups will have to achieve significantly higher reductions.

Significantly more-stringent limits take effect for the second compliance period, 2030–34, and will affect about 75% of covered buildings. Many buildings will need to make substantial reductions to meet the limits, in some cases cutting emissions by as much as 50% or more from their 2018 levels. Yet more-stringent limits are expected to take effect in 2035, and the law establishes the process for setting those out-year limits.

While the law mandates maximum GHG intensity limits, concerns had been raised during development of the law that building owners should not be held responsible for changes in the emissions intensity for electricity. This is forecast to change very significantly during the coming decade or two, both increasing in the near term with the closing of two large nuclear plants and then decreasing with increased renewable sources planned by 2030. As such, emissions intensity conversion factors were specified in the law for both electricity and the district steam system for the 2024–29 period, and a deadline was included in the law for factors to be set for 2030 and beyond. This was considered a critical issue to give building owners capital-planning certainty.

The law allows flexibility through alternative compliance paths, including up to 100% deduction from annual emissions limits for purchase of credits for renewable energy generated in New York City or feeding directly into New York City. Also included is a deduction for up to 10% of the limits through purchase of GHG offsets for the 2024–29 period, with rules to be established that will further define what types of offsets are allowed. In addition, the law allows the possibility for a new trading system (similar to the Tokyo Cap-and-Trade Program), where individual buildings could trade emissions reductions with other buildings, presumably leading to lower costs to achieve the law's emissions reduction goals.

The law established a new Office of Building Energy and Emissions Performance within the New York City Department of Buildings that will develop rules to provide more guidance on the alternative compliance paths, as well as a number of other issues delegated to them through the legislation.

Some building types are excluded from the law's GHG limits. The largest sector excluded is multifamily housing buildings with at least one rent-regulated unit or other low-income or subsidized housing. These buildings can

either meet the emissions limits or follow a prescriptive path that requires a list of relatively low-cost energy savings measures. Concerns were expressed about the impacts of more-stringent requirements on rents. Some special conditions allow flexibility for houses of worship and nonprofit hospitals and health-care facilities.

Companion Programs

The new law builds on the earlier Greener, Greater Buildings package of laws passed in 2009,[18] which included requirements for large buildings (over 50,000 square feet) for mandatory annual energy and water benchmarking with public disclosure,[19] energy audits with retrocommissioning every 10 years, and mandatory lighting system and submetering upgrades by 2025.

A variety of other supporting programs and initiatives have been established:

- The New York City Energy Efficiency Corporation, which is a nonprofit finance company with financing solutions to enable projects that save energy or reduce GHG emissions
- The Building Energy Exchange, which is a resource and trusted expert to the building industry
- The Retrofit Accelerator, which offers targeted outreach and free advisory services to help building owners streamline the process of improving energy and water efficiency

In addition, substantial market support activities are funded by the New York State Energy Research & Development Authority (NYSERDA) (e.g., a flexible technical assistance program for facility owners and work on demonstrating deep low-rise multifamily retrofits), along with significant incentives from the local utilities ConEdison and National Grid.

Sources and Additional Information

- *Legislation (New York City 2019)*
- *New York City Mayor's Office of Sustainability Buildings Page:* www1.nyc.gov/site/sustainability/our-programs/buildings.page
- *Urban Green Council resources:* www.urbangreencouncil.org/content/projects/all-about-nycs-historic-building-emissions-law

[18] More information at www1.nyc.gov/html/gbee/html/plan/training.shtml.
[19] The benchmarking and disclosure law was expanded in 2016 to include buildings over 25,000 square feet.

Washington State

Building Performance Standards

On May 7, 2019, the Clean Buildings Bill was signed into law as part of a package of climate-change bills promoted by the governor and passed by the legislature in 2019. While there was some opposition to the commercial building standards in the bill, it was muted because those with concerns perceived that the bill would pass and directed their energies to some modifications rather than outright opposition. The bill requires the Washington State Department of Commerce to develop and implement an energy performance standard for covered commercial buildings (those with a floor area of 50,000 square feet or more) and to provide incentives for early compliance. Under the law, from 2021 to 2026, the standard will be used to administer a voluntary efficiency incentive program. Beginning in 2026, the standard will be implemented as a mandatory requirement for the largest buildings (floor area of 220,000 square feet or more), with mandatory requirements beginning a year later for buildings 90,000–219,999 square feet and an additional year later for buildings 50,000–89,999 square feet.

By November 1, 2020, the Department of Commerce must establish a state energy performance standard for covered commercial buildings as well as multifamily buildings seeking an incentive (discussed further below). In developing the performance standards, the department is instructed to maximize reductions of GHG emissions from the building sector. The standard must include EUI targets by building type and methods of conditional compliance that include an energy management plan, operations and maintenance program, energy efficiency audits, and investment in energy efficiency measures designed to meet the targets.

The law instructs that American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)/Illuminating Engineering Society (IES) Standard 100-2018, Energy Efficiency in Existing Buildings (ASHRAE 2018), be used as the model standard. The rule-making will modify the standard to meet specific requirements of the law. As part of the rule-making, Commerce will propose EUI targets specific to buildings in the state of Washington and create procedures for reporting conditional compliance and efficiency investment criteria. The law specifies that site EUI targets be no greater than the average EUI for the covered commercial building occupancy type, with adjustments for unique energy-using features. The law allows more-stringent targets for newer buildings. EUI targets must be developed for two or more climate zones and be representative of energy use in a normal weather year. A consultant has been hired to develop intensity targets for consideration. Administrative procedures will be developed as part of the process to develop the targets. The law also calls for revising the initial performance standards by July 1, 2029, and every five years thereafter.

All buildings covered by the program will require energy management plans, including creating energy benchmarking reports. The mandatory standard will require building owners to demonstrate that their building consumes less energy than a specified EUI target or be in the process of reducing the building's EUI. The incentive program will provide early adopters financial support when they demonstrate they have moved a noncompliant building into compliance with the standard.

Companion Programs

As noted, the legislation establishing the law also establishes an incentive program for buildings demonstrating early compliance. The incentive is $0.85 per square foot of conditioned floor area. At this level, incentives are anticipated to cover only a portion of upgrade costs. Total incentives are capped at $75 million. The incentives will be paid by utilities who in turn receive an offsetting credit on their state utility tax. Applications for incentives can be submitted starting July 1, 2021, and if an application is accepted after review, incentive funds will be set aside for use by that building. Buildings will be given a period (e.g., two years) to come into early compliance with the standards and receive their incentive. Incentives will be paid after compliance with the standards is demonstrated; hence, the building owner must front money for compliance. Incentives will be available until available funds are committed. There may be a set-aside (e.g., 20% of funds) for use in rural areas or for buildings serving disadvantaged populations. Large multifamily residential buildings will be eligible for the incentive program but are not covered by the mandatory requirements. Given some of the law's details on how much energy must be saved, larger percentage savings will be needed for building types with low average energy use. Multifamily buildings are a good example, and therefore expectations are that not many multifamily buildings will participate in the incentive program.

In addition to the state incentives, covered buildings may be eligible for other utility energy efficiency incentives. A provision in the law to be reflected in the rules provides that utilities may pay incentives for energy savings to meet the standards, even though the standards are mandatory. This was done to assure utility incentives remained available to help reduce costs to building owners and to contribute to political support for the bill.

In addition, the Department of Commerce has contracted with the Washington State University Energy Program to develop a support program for participants. A joint effort with British Columbia is under way to create a Standard 100 user's manual. Details on the technical assistance will be developed in parallel with the program regulations.

Sources and Additional Information

- Program webpage: www.commerce.wa.gov/buildings
- The law (Washington State Legislature 2019)
- Presentation on the program (Murray 2019)
- A blog on the act and challenges that need to be addressed (Majersik and Miller 2019)
- Chuck Murray, program director, Washington Department of Commerce, pers. comm., February 20, 2020

St. Louis, Missouri

Building Performance Standards

Legislation to establish performance standards for commercial, institutional, multifamily, and municipal buildings with a floor area of 50,000 square feet or more was enacted by the city council in April 2020 and signed by the mayor in May. The legislation builds on energy benchmarking for these same buildings that was adopted in 2017. Under the bill, a Building Energy Improvement Board (BEIB) is appointed by the mayor to develop the specific standards and other details of the standards. The initial standards must be adopted by May 2021 and take effect four years later (six years later for affordable housing). Under the bill, the standards must be updated every four years (six years for affordable housing). The standards can be no lower than the 65th percentile of current buildings of each type, meaning that at least 65% of buildings must upgrade each cycle. The bill allows the BEIB to grant extensions for hardship, allows alternative compliance plans, and allows alternative compliance payments. Another provision in the bill allows buildings undergoing a deep retrofit to be deemed compliant for the next 15 years (St. Louis 2020).

Companion Programs

Several current programs will help with implementation. For example, the Missouri Gateway Chapter of the U.S. Green Building Council has been working with the City of St. Louis on education programs connected with the current building benchmarking program. They anticipate expanding their work together as part of implementation. Missouri also has PACE financing available (commercial and residential), which can help finance building upgrades. The local utilities, Ameren and Spire, offer a variety of energy efficiency programs, including incentives. These will be available to building owners. Their incentives are particularly generous for upgrades to affordable housing. The targets in the bill were set as performance standards, not prescriptive standards, to make it easier for the utility to continue to claim credit for energy savings when it provides incentives (with prescriptive standards, it could be argued that the measures are required and, therefore, there are not incremental savings benefits). In anticipation of this legislation, the city budget for fiscal year 2021 includes funding to establish and staff an Office of High Performance Buildings to work on implementation. In addition, other steps are being considered such as creating a hub to provide technical assistance (E. Andrews, USGBC-Missouri Gateway Chapter executive director, pers. comm., April 23, 2020).

Sources and Additional Information

- The ordinance (St. Louis 2020)
- A blog on the act (Majersik and Miller 2020)

Summary and Comparison

The Boulder and Tokyo standards were adopted in 2010, the France and the UK standards were adopted in 2015, and the other four were adopted in the period from December 2018 to May 2019. To allow easy comparisons of these eight programs, key program criteria for each jurisdiction are summarized in table 2. We discuss many of the other parameters in the section on Key Design Decisions.

Table 2. Key criteria for adopted building performance standards

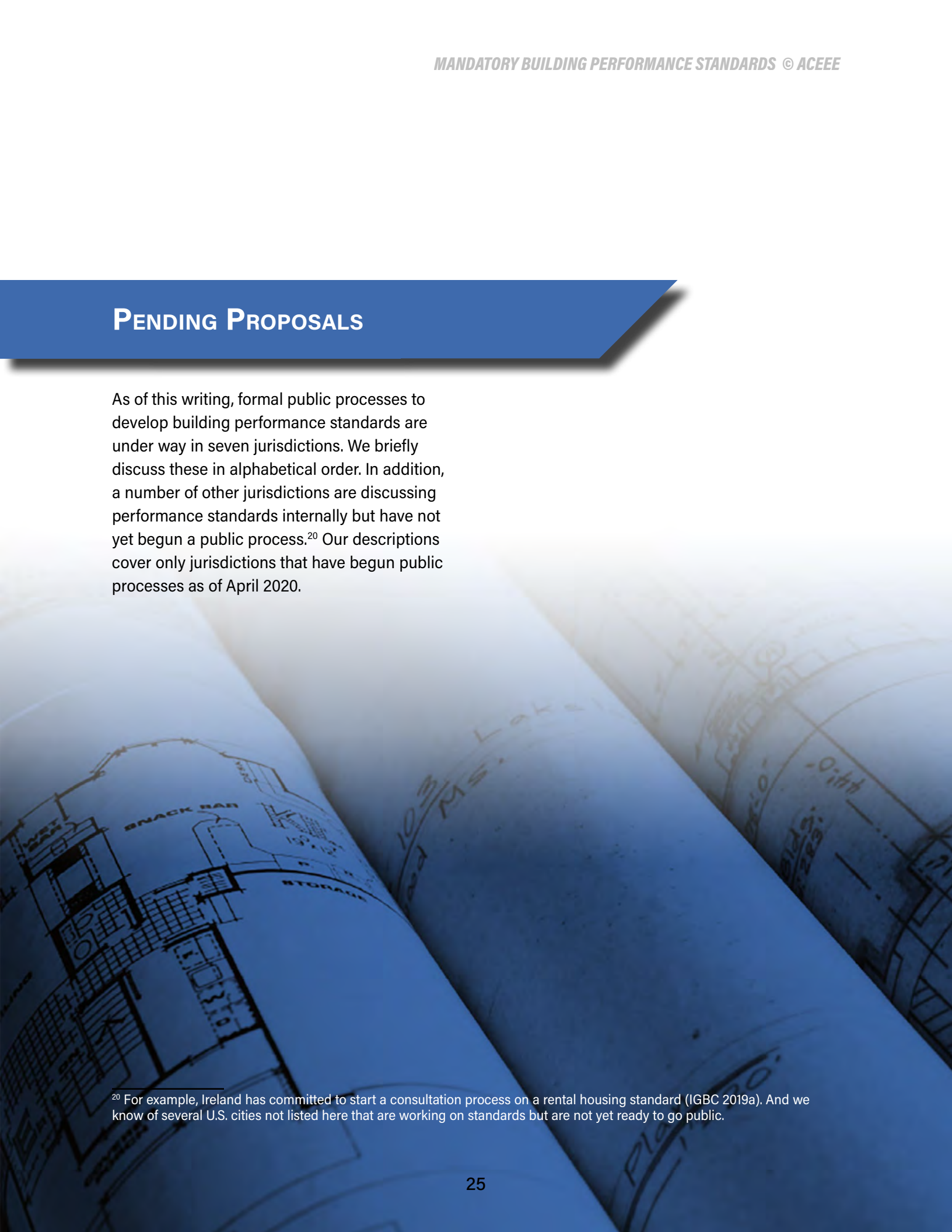
Jurisdiction	Year enacted	Building types included	Minimum building size covered (sq. ft.)	Metric	Initial year of performance requirements	Standard (s)
Tokyo	2010	C, I	1,500 kiloliters of oil equivalent	CO_2 emissions (tonnes CO_2)	2015	17% reduction from baseline by 2020
Boulder	2010	RR	NA	Points (which are based on energy and carbon)	2019	Earn 100 points using prescriptive table or HERS score of 120
United Kingdom	2015	CR	NA	Energy Performance Certificate Rating*	2018	Meet "E" performance under "A"–"G" label
The Netherlands	2018	Offices	~1,000	Energy Performance Certificate Rating*	2023	Meet "C" performance under "A"–"G" label
Reno	2019	C, MF	30,000	ENERGY STAR score (energy and water) or EUI and WUI	2026	Multiple energy and water options—see text
France	2015	Private R	NA	Energy Performance Certificate Rating*	2028	Meet "E" performance under "A"–"G" label
Washington, DC	2019	C, MF	10,000	ENERGY STAR Benchmark Score	2026	Each cycle at least median ENERGY STAR score for that building type or reduce energy use 20%
New York City	2019	C, many MF	25,000	Carbon intensity (tons CO_2 equivalent per square foot)	2024	40% reduction by 2030, 80% by 2050
Washington State	2019	C	50,000	Site energy intensity (kBtus per square foot)	2026	TBD but must be no more than median for that building type
St. Louis	2020	C, MF	50,000	Site energy intensity (kBtus per square foot)	2025	TBD but must be based on the 65th percentile (currently met by 35% of buildings at most)

*Energy performance certificate ratings generally based on "delivered" (essentially the same as site) energy use per square meter.

Building types: C = commercial; CR = commercial rental; I = industrial; MF = multifamily; R = residences; RR = rental residences. "Initial year" refers to the first year that requirements apply to at least some buildings. Many cities phase this over time, and thus the date listed often applies to only some covered buildings.

Pending Proposals

As of this writing, formal public processes to develop building performance standards are under way in seven jurisdictions. We briefly discuss these in alphabetical order. In addition, a number of other jurisdictions are discussing performance standards internally but have not yet begun a public process.[20] Our descriptions cover only jurisdictions that have begun public processes as of April 2020.



[20] For example, Ireland has committed to start a consultation process on a rental housing standard (IGBC 2019a). And we know of several U.S. cities not listed here that are working on standards but are not yet ready to go public.

Boston, Massachusetts

Boston revised its *Climate Action Plan* in fall 2019. The revised plan includes a building emissions performance standard. The city plans to conduct technical analysis and a public process in 2020, leading to a proposed amendment to its current Building Energy Reporting and Disclosure Ordinance (BERDO). It anticipates mandatory carbon emissions targets by building type that decrease over time. As part of the process, it plans to develop pathways for affordable housing, historic properties, and other building types to achieve performance targets, evaluate lowering the size threshold for buildings covered by BERDO (currently 35,000 square feet), evaluate an alternative compliance fund that can be used to support affordable housing retrofits or community energy projects, and consider expanded financing mechanisms for retrofits, including exploring the creation of a local climate bank. In addition, over the longer term, Boston plans to study mechanisms to improve the efficiency of existing buildings not covered by the standard, including rental and time-of-sale scorecards and rental energy efficiency requirements (Boston 2019). Stakeholder consultations have begun, and a technical advisory committee was formed and began meeting in March 2020 (A. Brizius, director of climate and environmental planning, City of Boston, pers. comm., March 6, 2020).

British Columbia

The Canadian province of British Columbia, as part of its CleanBC Plan published in late 2018, pledged to develop an energy code for alterations to existing buildings by 2024 (British Columbia 2019). It is now developing a multipronged strategy for alterations to existing buildings, both residential and commercial, and plans to publish this strategy in early 2021. Somewhat similar to Washington State, British Columbia is planning for the strategy to be informed by the ASHRAE standard for existing buildings. It has developed energy benchmarks (energy use per square meter of floor area) for 15 building types (RDH Building Science 2019) and intends to develop GHG metrics. Current plans are to incorporate standards into the provincial building code that applies at the time of building alteration. Other complementary strategies are being analyzed (K. Sandham, policy analyst and A. Pape-Salmon, executive director, Building and Safety Standards Branch, Office of Housing and Construction Standards, pers. comm., February 28, 2020).

Cambridge, Massachusetts

Cambridge enacted a Building Energy Use Disclosure Ordinance (BEUDO) in 2014. It establishes a building energy-use reporting and disclosure requirement for commercial buildings of 25,000 square feet or more and multifamily buildings with 50 units or more. These buildings account for about 70% of the city's GHG emissions. The ordinance includes a provision directing staff to look into possible building performance standards. A study found that building performance was improving about 1% per year, much too slowly to meet the city's goal of being carbon neutral by 2050. As a result, the city conducted extensive stakeholder engagement to explore possible building performance standard options. On the basis of these consultations, recommended building performance standard amendments to BEUDO will be based on GHG standards where each building must steadily reduce its emissions relative to a 2019–20 baseline. Tentatively, each building must reduce emissions by 20% every five years, getting to an 80% reduction by 2040, with the final 20% reduction (to zero emissions) reached by 2050. Some offsite use of renewable energy will be permitted; the city and stakeholders



are discussing what parameters around such offsite use should be included. Laboratory buildings may have a different schedule. For university campuses, the entire campus could be managed as a unit. GHG standards were chosen because reducing GHG is the ultimate goal and because GHG standards allow each building to determine an appropriate mix of energy efficiency, electrification, and clean energy. Drafting of the ordinance has begun, and additional stakeholder consultations are planned on the ordinance and on additional details, such as a possible program to allow covered buildings to offset some emissions by helping to improve other Cambridge buildings (Federspiel 2019; S. Federspiel, net zero energy planner, City of Cambridge, pers. comm., March 5, 2020).

The city has also worked with the local utility, Eversource, to set up a "concierge service" to help covered buildings improve their energy efficiency. Eversource staffs the program and provides technical assistance and financial incentives, all covered by its energy efficiency budget (Shemkus 2019).[21]

Colorado

A bill pending in the Colorado legislature would establish energy benchmarking and performance standards statewide. The bill applies to state-owned buildings with a floor area of 5,000 square feet or more and nonstate buildings with a floor area of 50,000 square feet or more. The bill calls for the Colorado Air Quality Control Commission to develop building performance standards by

[21] The program website is here: www.cambridgema.gov/Services/buildingretrofitprogram .

April 1, 2024, that achieve a 20% reduction in projected GHG emissions by 2030 across all covered buildings in the aggregate. The initial standards apply in 2029, with compliance reported in 2030. The bill calls for the standards to be revised every five years so that by 2050, the standards are consistent with the state's 2050 overall goal of a 90% reduction in GHG emissions relative to 2005 levels. As part of these revisions, the commission may reduce the size threshold for covered buildings. The building performance standards will be developed by rule and will vary by building type. They will include ENERGY STAR score improvements, ENERGY STAR score targets, energy-use intensity improvements, and energy-use intensity targets. In other words, there will be at least four compliance pathways. The bill also includes a Climate Change Mitigation and Adaptation Fund, funded with fines for violations of air pollution regulations (Colorado 2020). As of this writing, the legislature is on recess due to the COVID-19 pandemic; as a result, consideration of this legislation will likely be delayed until 2021.

Montgomery County, Maryland

Montgomery County, which borders the District of Columbia, has required benchmarking of commercial buildings with a floor area of 50,000 square feet or more since 2015. The county is now considering expanding the benchmarking requirement to include multifamily buildings and lower the size threshold to 25,000 square feet. In addition, it has convened a stakeholder group (e.g., real estate firms, energy specialists, and so on) to consider building performance standards. The group is considering the Washington, DC, approach as well as several alternatives. Members are discussing what buildings to cover, metrics, compliance pathways, reporting, extensions, enforcement, technical and financial assistance, and equity in implementation. Original plans were to have a proposal by approximately May 2020 (Montgomery County DEP 2020), but this has been delayed due to the COVID-19 pandemic.

Scotland

As noted earlier, Scotland has approved regulations very similar to the abovementioned rental housing standards in England and Wales. The Scottish regulations differ from the English and Welsh in that they apply only to domestic privately rented properties and they include a tightening of the minimum standard from "E" to "D" at change of tenancy from 2022 and for all privately rented homes from 2025. In addition, Scotland has begun a formal consultation process to consider a mandatory building performance standard for owner-occupied homes in Scotland. Under the proposal, the mandatory standard would begin in 2024 and would require a performance of "C" on the United Kingdom's "A"–"G" scale. If achieving a "C" is not technically feasible, then a home would need to get as close to "C" as is possible and cost effective, with details still to be developed. The mandatory standard would apply at time of property sale and potentially also to homes undergoing major renovations (with *major renovations* still to be defined). Scotland already has a grant program for households in or at risk of fuel poverty, several energy efficiency loan programs, and a technical assistance and advice program, all of which would help households comply with the proposed standards (Scottish Government 2019).

Vancouver, British Columbia

The Vancouver City Council has declared a climate emergency and is now developing a variety of new policies to address it. The plan includes policies for existing buildings,

which will be subject to carbon pollution limits. This means setting a maximum amount of fossil fuels, such as natural gas, that a building can use in its operations, including space and water heating. Electricity is a minor consideration as currently more than 90% of the power in British Columbia comes from hydropower and other carbon-free sources. Current plans are to start with modest limits for the largest commercial buildings, beginning in about 2025 for offices and progressing to other building types by 2030. The limits will be set by building type and will be designed to encourage owners and managers to create a carbon pollution reduction plan that is coordinated with routine building maintenance, equipment replacement, and other planned upgrades. Every five years the limits will decrease (Vancouver 2020).

For homes and many other building types, a key strategy will be encouraging the use of heat pumps for space and water heating when existing equipment needs replacement. Vancouver is considering a requirement that all new and replacement heating and hot-water systems be zero emissions by 2025 (Vancouver 2020). For single-family homes, Vancouver is considering an absolute target of a specified number of tons of carbon emissions per year, effectively requiring more reductions on average from large homes than from small homes. However, before specific targets are developed, the city is planning a variety of foundation-setting steps such as developing a decision-support tool for homeowners and developing the supply chain for heat pumps. Multifamily and rental units will be some of the last building types regulated. Plans are to develop recommendations for council consideration in fall 2020, at least for the largest buildings (M. Lang, senior green building planner, City of Vancouver, pers. comm., March 16, 2020).



Policies Short of Whole-Building Performance Standards

While this paper discusses whole-building performance standards, a number of cities have adopted prescriptive building standards covering such items as lighting upgrades and other retrofit requirements, building tune-up and recommissioning/ retrocommissioning requirements (recommissioning HVAC and other major systems in an existing building), and energy audit requirements. As noted in the Introduction, these policies are usually a step beyond building benchmarking but fall short of whole-building standards. Some cities (e.g., New York City) have used these policies as a stepping-stone to whole-building standards. In this section, we briefly summarize these policies.



Retrofit Requirements

Austin:

Since 2011, the city has required multifamily properties to reduce energy use by 20% if the property's EUI exceeds 150% of the average.[22] These properties must also provide a High Energy Use report to current and prospective residents (Austin 2019b).

Boulder:

The Boulder Building Performance Program, adopted in 2015, requires lighting upgrades. Upgrades must be completed over the 2021–25 period, depending on building size (Boulder 2020b).

New York City:

NYC Local Law 88 of 2009—and its subsequent expansions with Local Law 132 and 134, both of 2016—requires common areas in residential buildings greater than 25,000 square feet and all areas in nonresidential buildings greater than 25,000 square feet to upgrade lighting to meet current New York City Energy Conservation Code standards by 2025 (NYC 2020).

San Francisco:

San Francisco's Residential Energy Conservation Ordinance requires a minimum set of water and energy efficiency retrofits at time of sale. Water conservation devices may include low-flow showerheads, efficient toilets, and so on. Energy efficiency measures may include attic insulation, weather stripping, appliances, and so on. It applies to residential properties built before 1978. The ordinance was adopted in 1982 and was amended in 1991 (San Francisco 2020b).

Tune-up and Audit Requirements

Atlanta:

The Commercial Buildings Energy Efficiency Ordinance requires building owners who benchmark and report energy and water data to conduct energy and water audits once every 10 years unless the property meets certain efficiency requirements. First audits must be completed during the 2016–25 period and every 10 years thereafter (Atlanta 2020).

Austin:

Beginning in 2011, Austin's Energy Conservation Audit and Disclosure Ordinance required all homes and multifamily buildings (five or more units) that are 10 years and older to have an energy audit performed (Austin 2019b). In addition, home sellers must disclose results to prospective buyers at the time of sale, and owners of multifamily buildings must disclose the energy guide (a label reporting audit results) to prospective renters (Austin 2019a).

Berkeley:

Since 2015, the Building Energy Saving Ordinance has required building owners to undergo an energy assessment if a building's ENERGY STAR score is below 80 (Berkeley 2020).

Boston:

The city's BERDO includes an Energy Action and Assessment requirement. Large residential and commercial buildings have three main compliance pathways: reduce their emissions or energy usage by 15% or more, be certified as highly efficient buildings through ENERGY STAR, or perform an energy audit. Exemptions exist for high-efficiency buildings. The Energy

[22] While this requirement applies to the whole building, we do not discuss this in the main body of the report because it applies only to a minority of multifamily buildings—only those using substantially more energy than the average.

Action and Assessment requirement must be completed over the 2019–22 period and every five years thereafter (Boston 2020).

Boulder:

The Boulder Building Performance Program, adopted in 2015, requires energy audits and retrocommissioning every 10 years on buildings of 20,000 square feet or more. Cost-effective retrocommissioning measures must be implemented within two years of the retrocommissioning study. The audits must be completed over the 2019–23 period while the retrocommissioning must be complete in the 2021–25 period (Boulder 2020b).

Denver:

Since 2018, the city has required developments over 25,000 square feet to choose one energy action from a menu of options in accordance with the Green Buildings Ordinance (Denver 2020).

Los Angeles:

The Existing Buildings Energy and Water Efficiency Program mandates energy auditing and retrocommissioning requirements for commercial and multifamily buildings. First compliance dates must be completed over the 2020–24 period and every five years thereafter (Los Angeles 2020).

Minneapolis:

The city's 2019 expansion to the Commercial Building Energy Benchmarking and Transparency Ordinance requires an ASHRAE Level 1 evaluation or an accepted tune-up/recommissioning within the past five years for the lowest-performing buildings. This requirement is enforced only if an option is available at no cost to the owner (Minneapolis 2019a). In addition, a time-of-sale residential energy disclosure requirement means building owners must undergo an energy assessment and provide this information to potential home purchasers (Minneapolis 2019b).

New York City:

Local law 87 of 2009, among other provisions, requires that all covered buildings (over 50,000 square feet) perform an ASHRAE Level 2 energy audit every 10 years and undergo a retrocommissioning process, including implementation of identified "retrocommissioning measures," also once every 10 years (New York City 2009).

Orlando:

Starting in May 2020, in accordance with the Building Energy and Water Efficiency Strategy, owners of buildings larger than 50,000 square feet that score under the national ENERGY STAR score of 50 must perform either an energy audit or a retrocommission every five years (Orlando 2020).

Philadelphia:

The Building Tune-Up Policy requires owners of large, nonresidential buildings to affirm high performance of their buildings or conduct "tune-ups" of their energy and water systems. First tune-ups are required during the 2021–24 period, with subsequent tune-ups required every five years (Philadelphia 2019).

Portland:

Beginning in 2018, per the Home Energy Score Policy, home sellers must complete an energy assessment of their homes before listing their properties for sale. (Portland 2020).

San Francisco:

Adopted in 2011, Chapter 20 of the San Francisco Environment Code, the city's benchmarking ordinance, requires commercial building owners to conduct an energy audit or retrocommissioning every five years (San Francisco 2020a).

Salt Lake City:

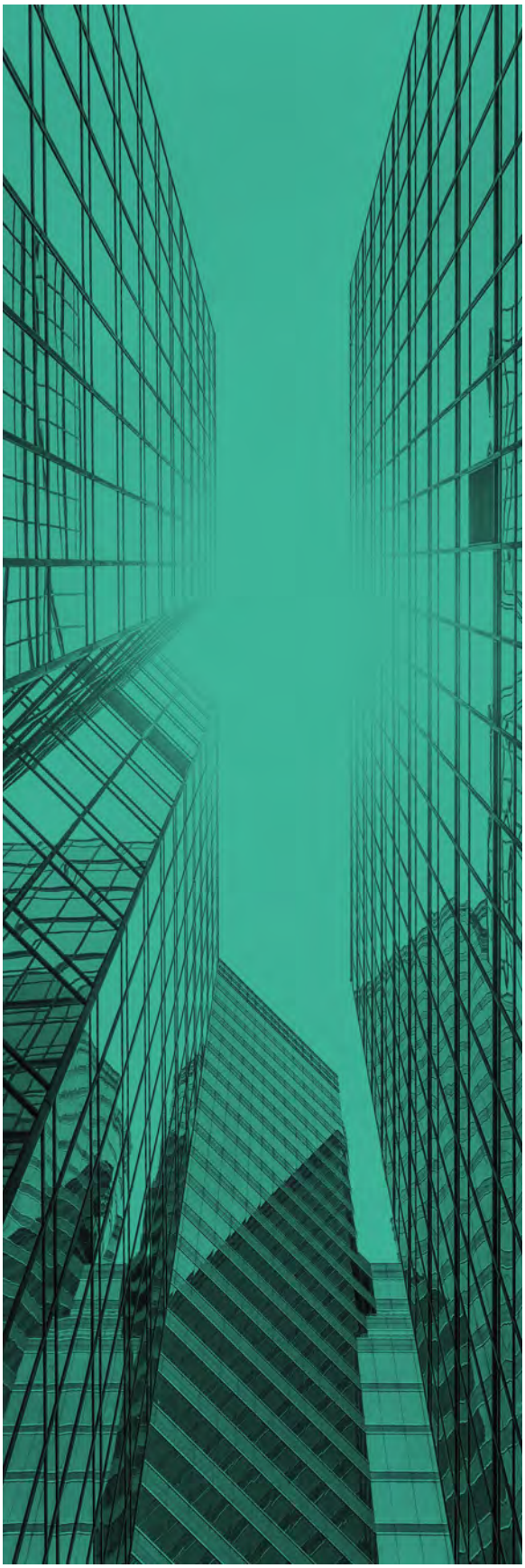
The city's Energy Benchmarking & Transparency Ordinance requires residential and commercial buildings that score 49 or below in ENERGY STAR to undergo energy audits. The first audits must be performed during the 2021–26 period and every five years thereafter. (Salt Lake City 2017).

San Jose:

The Energy and Water Building Performance Ordinance requires owners of low-performing buildings greater than 20,000 square feet to conduct an energy audit or perform retrofitting or retrocommissioning of the building. These requirements must be completed over the 2021–22 period and every five years thereafter (San Jose 2020).

Seattle:

The Seattle Building Tune-Ups Policy (Seattle Municipal Code 22.930) requires the owners of nonresidential buildings over 50,000 square feet to perform energy assessments and building tune-ups to optimize energy- and water-system performance once every five years. First tune-ups must be completed over the 2018–22 period and every five years thereafter (Seattle 2016).



Mandatory Building Energy Labeling

Australia:

Since 2010, the Commercial Building Disclosure program has required that energy efficiency information be provided when commercial office space of 1,000 square meters (approximately 10,000 square feet) or more is offered for sale or lease. The program requires that a Building Energy Efficiency Certificate, based on the National Australian Built Environment Rating System rating, be developed, along with a tenancy lighting assessment of the relevant area of the building. The rating must be prominently displayed as part of all lease marketing (Australia 2020).

Chicago:

The Chicago Benchmarking Energy Ordinance created the Chicago Energy Rating System. Since 2019, the system has assigned all buildings over 50,000 square feet an energy performance rating, which will be required to be posted in a prominent location and shared at the time of listing the property for sale or lease (Chicago 2017).

European Union:

Since the initial European Energy Performance of Buildings Directive (EPBD) in 2002, EU Member States have had to implement Energy Performance Certificates (EPCs), and the recast of the EPBD in 2010 mandated that an EPC be issued for "buildings or building units which are constructed, sold or rented out to a new tenant" (EU 2010).

New York City:

Since 2018, Local Law 33 of 2018 requires building owners subject to the city's benchmarking ordinance to display an "energy efficiency grade" at each public entrance of the building (New York City 2018).

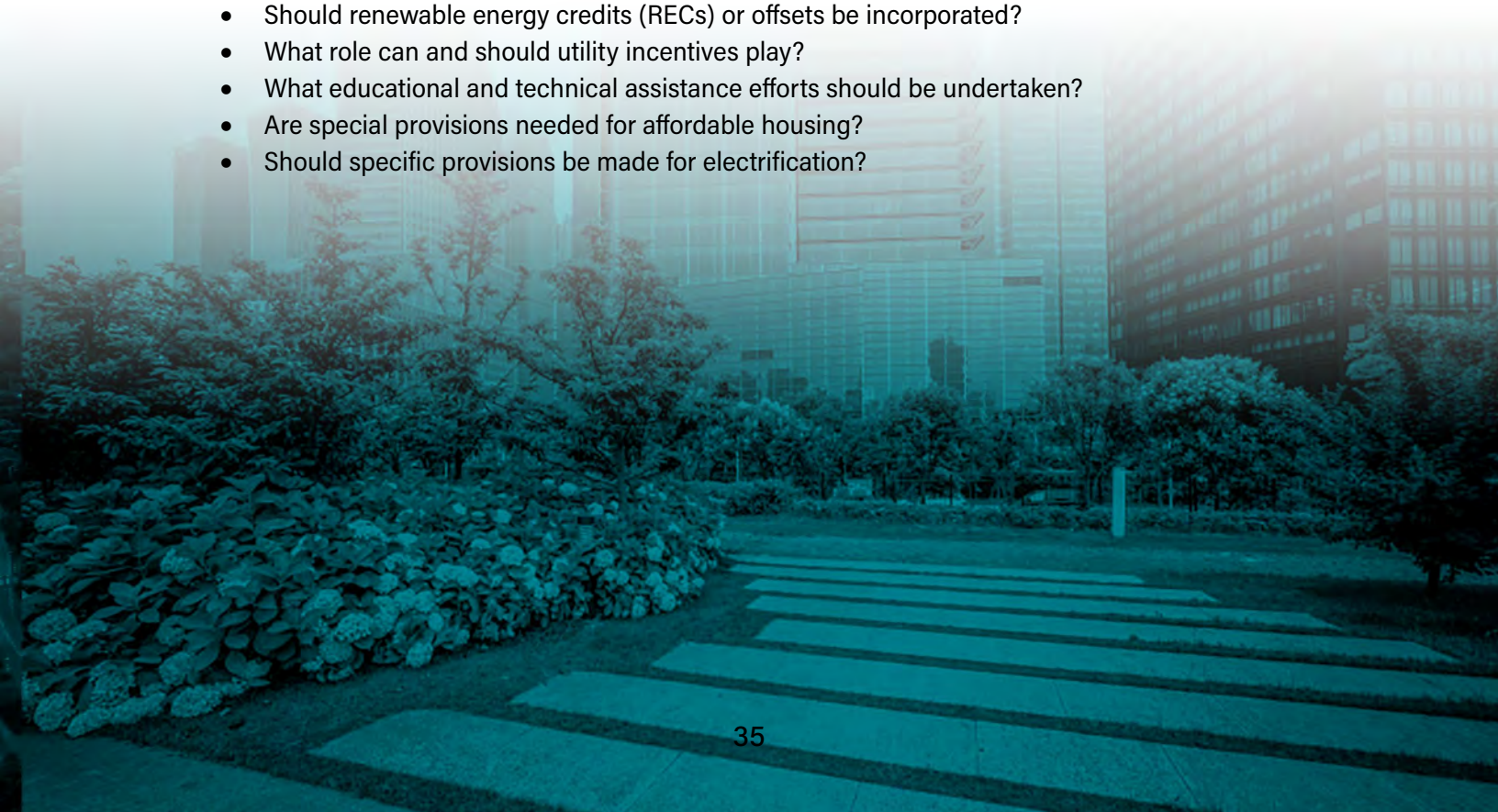


Key Policy and Design Decisions

In developing building performance standards, policymakers have a variety of design decisions to make. In this section, we discuss several of these decisions and how jurisdictions have addressed them to date. This section reports on the range of decisions jurisdictions are making but does not make recommendations. We do provide some recommendations in subsequent sections. In general, however, each jurisdiction is different, and we are still early on the learning curve, so the ability to make reasoned recommendations is limited.

In this section, we address the following questions:

- Which building types and sizes should be covered?
- Which metrics should be used for performance standards?
- How and when should the standards apply?
- How stringent should the standards be?
- How much lead time should be provided?
- Should trading be included?
- Is energy-use benchmarking a key foundation for performance standards?
- What exemptions should be considered?
- Should jurisdictions allocate funding for building upgrades?
- Should incentives be provided for early compliance?
- Should renewable energy credits (RECs) or offsets be incorporated?
- What role can and should utility incentives play?
- What educational and technical assistance efforts should be undertaken?
- Are special provisions needed for affordable housing?
- Should specific provisions be made for electrification?



Which Building Types and Sizes Should be Covered?

One of the initial decisions is which building types to cover—commercial, multifamily, and/or single-family. Of the 10 jurisdictions with building performance standards, 7 cover commercial buildings and 6 include multifamily (2 cover just rentals; the others also include owner-occupied multifamily). Three cover single-family; two cover just rentals and only one (France) includes single-family owner-occupied. These data are shown in table 2.

The seven standards that apply to commercial buildings (including three that also include multifamily) all have a minimum size threshold for coverage. This size threshold ranges from 10,000 square feet (Washington, DC) to 50,000 square feet (Washington State). The Tokyo standard applies to high energy users, defined as at least 1,500 kiloliters of oil equivalent annually. Specific data are shown in table 2. For many of the programs, the standards apply first to the largest buildings, with the size thresholds declining over time. For example, Reno's standards phase in for four different size and ownership classes over a six-year period.

Which Metrics Should be Used for Performance Standards?

Most of the performance standards to date use an energy metric, typically some variation on energy-use per unit of floor area. Several programs use some type of energy rating system that normalizes for a variety of occupancy issues and other drivers of energy intensity between different buildings. In the United States, this is usually the ENERGY STAR Portfolio Manager score. Portfolio Manager starts with the energy use per unit floor area for specific building types and geographies but is then adjusted for weather and several occupancy-related and other factors. Portfolio Manager scores are based on "source" energy use, meaning that electricity is valued according to the amount of energy (British thermal units, Btus) needed to generate, transmit, and distribute a kWh of electricity. In Europe, all member states were required through the European Energy Performance of Buildings Directive to provide EPCs for all buildings, most often as an "A" through "G" rating, somewhat mirroring the equipment and appliance labeling system in place throughout Europe. These ratings are generally based on building "delivered" (essentially site) energy use per square meter of building floor area.

An underlying issue is whether ratings should be based on actual measured building energy use, often called operational ratings (like ENERGY STAR), or calculated on the basis of building characteristics, often called asset ratings (such as the European rating scheme as well as Home Energy Scores in the United States). Operational ratings are based on actual performance and hence are much less dependent on assumptions. However, operational ratings are very much affected by the behavior of current tenants, and the performance for future tenants could well be very different. The advantages and disadvantages of these two approaches are discussed by the International Partnership for Energy Efficiency Cooperation (IPEEC 2014). In general, the trend in the United States and Canada is to use operational ratings for commercial buildings (including large multifamily buildings) but asset ratings for single-family homes. We discuss this issue further in the Lessons Learned section.

One city (Boulder) uses a point-based energy metric (a type of asset rating), but with some adjustments for the carbon intensity of specific fuels. One standard (New York City) uses carbon intensity (based on operational data),

and one other city (Washington, DC) plans to investigate carbon intensity for future use. Tokyo uses carbon as the metric but assigned a specific baseline "allocation" for each building based on historic emissions. Specifics by jurisdiction are shown in table 2.

Of the pending standards, Montgomery County is leaning toward using Portfolio Manager. Washington State, British Columbia, and Vancouver are planning to use a metric of EUI. In all three of these cases, the standard will be based on ASHRAE Standard 100, a process for upgrading existing buildings. The ASHRAE standard uses operational (metered) energy consumption. Boston, Cambridge, and Colorado are all planning to use operational CO_2 emissions while Scotland will use the European "A"–"G" scale.

Since the two main approaches thus far are based on EUI and CO_2 emissions, table 3 provides a summary of the pros and cons of these two approaches.

Given that many larger building owners have properties in multiple jurisdictions, using established models such as ENERGY STAR makes acceptance of the policies simpler and compliance potentially easier compared with very different approaches that have been established in some jurisdictions.

More details on the advantages of these and other metrics are provided by Carbon Neutral Cities Alliance (CNCA 2020).

How and When Should the Standards Apply?

Some of the standards apply to rentals or sales after a specific date. For example, the Boulder standard applies to rental certificates issued starting January 1, 2019. The UK standard applies to any property leased after April 2018. And the French standard applies to rentals and sales after January 1, 2028.

Other standards affect all covered buildings as of a specific date or dates. For example, the Tokyo standard applies to covered buildings

Table 3. Pros and cons of the two major performance standard approaches

Approach	Pros	Cons
EUI	Can use established programs such as ENERGY STAR and the European Energy Performance Certificate to address important normalizations; many users are familiar with these metrics and tools Emphasizes energy efficiency	Largely ignores what happens on the grid, even though the source of power is very important for emissions Since only addresses energy use, harder to develop long-term targets that get to emissions reductions of 80% or more
GHG emissions	Gets at the ultimate goal for most jurisdictions—reducing GHG emissions Provides additional flexibility for building owners if offsets and trading are allowed Easier to set long-term goals, e.g., out to 2050	Emissions from the grid included but are beyond the control of building owners; these emissions factors will change over time depending on what happens on the grid[23] Could deemphasize energy efficiency if offsets widely available; with less efficiency, supplying power on peak and calm/cloudy days can be more challenging

[23] Issue of changing emissions factors can be addressed by specifying conversion factors as part of the Standard, as in the NYC law.

in 2020, the New York City standard in 2024. Reno; Washington, DC; and Washington State have several effective dates, starting with the largest buildings and proceeding in stages to smaller buildings. Phasing in standards starting with the largest buildings first can avert a compliance pileup by having a smaller number of buildings affected in the earliest years.

Many of the standards are subject to periodic adjustments. The Tokyo standard is revised every five years and is just entering its third compliance period. The New York City standard has different standards for 2024 and 2030 and provisions for additional levels to be developed for each five-year period through the legislated 2050 intensity limit. The Washington, DC, and Washington State standards are strengthened every five years, and the Reno standard is reset every seven years. Cambridge and Colorado are also planning higher standards every five years while St. Louis is planning updates every four years for most buildings and every six years for multifamily affordable housing. France and Boston plan to tighten their standards over time. As discussed earlier, the United Kingdom has begun consultations on revisions. By contrast, Boulder has no plans for revisions.

How Stringent Should the Standards Be?

U.S. standards are commonly set around the median current performance of covered buildings. While standards have yet to be finalized, the median current performance is mentioned in the legislation enacted in Reno and Washington, DC; the Washington State legislation refers to the average. Reno notes the median in its legislation but also offers a variety of other optional performance and prescriptive standards to provide flexibility to building owners, perhaps meaning an effective standard well below the median. In St. Louis, the standard is based on the 65th percentile, meaning that 65% of covered buildings must upgrade.

In New York City, the initial standard calls for a 40% reduction in aggregate CO_2 emissions of covered buildings by 2030 (following initial requirements affecting the worst-performing 25% of buildings that take effect in 2024) and an 80% reduction by 2050. Cambridge is planning a similar approach, with (tentatively) a 20% reduction by 2025 ramping up to an 80% reduction in 2040 and a 100% reduction in 2050. Boston is considering a similar model. Tokyo requires CO_2 reductions, with 17% reduction achieved thus far and 25–27% planned for 2025 (including the current 17%). In Boulder, the standard is based on equivalent performance to a new home meeting the 1999 version of the International Energy Conservation Code.

In Europe, the performance standards thus far are based on their "A"–"G" label, with both the United Kingdom and France requiring an "E." This standard thus affects homes and apartments with performance substantially below the median. The Netherlands requires a "C" for offices, and Scotland is considering a "C" requirement but only if such a level is feasible and cost effective.

Thus, standards to date tend to fall into five categories:

- Upgrade buildings that are significantly below average (United Kingdom and France) (however, France has long-term plans, not yet codified, to move to the highest levels of energy performance)
- Move buildings to about the median or average level of performance (Washington, DC; Washington State; and Boulder)

- Move buildings to somewhat above the median or average (Netherlands, St. Louis, and Scotland)
- Set long-term targets with deep reductions (New York City, Boston, Cambridge)
- Set targets that are feasible politically (Reno and Tokyo)

How Much Lead time Should be Provided?

Most of the standards provide five years or more for building owners to make investments to meet standards. In St Louis, it is four years for most buildings, six years for affordable housing. In France, 10 years was provided. New York City provided 5 years for their initial standard and 10 years for their more demanding targets. The lead time is summarized in table 4. Of the pending standards, many of the cities are considering a five-year lead time.

Should Trading be Included?

Trading is a key component of the Tokyo program. New York City is likely to add trading, but details are not yet developed. The other jurisdictions do not have trading.

Trading is popular in Tokyo and New York City because many building owners own multiple buildings and trading gives them the option to exceed the standards on some of their buildings to compensate for other buildings where meeting the standards would be more expensive. Trading programs tend to encourage the lowest-cost ways to reach collective targets, as buildings with low-cost savings or emissions reductions can trade excess credits to buildings with higher compliance costs. Trading has worked well in Tokyo, helping them to reduce energy consumption and emissions significantly when compared with other buildings' performance standards. The Tokyo policy has been emulated elsewhere, with a new national trading system in Korea covering large buildings (or companies) emitting over a certain level taking effect in 2018 (ICAP 2020). Urban Green (2018) has additional information on trading.

Is Energy-Use Benchmarking a Key Foundation for Performance Standards?

In 8 of the 10 cases, energy-use benchmarking preceded the building performance standards.[24] In Reno; Washington, DC; Washington State; the United Kingdom; the Netherlands; France; and St. Louis, the standards specifically use the benchmarking results, either the ENERGY STAR Portfolio Manager Score or the European "A"–"G" label (known in Europe as building rating or certification, not benchmarking). In Tokyo and New York City, the benchmarking results provide the baseline for energy savings and carbon reduction goals, respectively. The pending standards for the most part fall into one of these models, although Colorado's pending law would adopt both benchmarking and performance standards in the same legislation.

Of the programs now being implemented, only Boulder is not currently benchmarking buildings covered by their performance standard.[25] In Boulder, the standard is based on the building code instead of benchmarking. British Columbia and Vancouver are also planning a standard that uses building code authority and without benchmarking.

[24] However, the requirement in Washington State applies only at the time of building sale or lease.
[25] As noted, Boulder does benchmark large commercial buildings, but these are not covered by the building performance standard for rental housing.

What Exemptions Should be Considered?

The performance standards generally include some exemptions. For example, in Boulder, exemptions include buildings built after 2001 (they were built to the 1999 code upon which the program was based), accessory dwelling units, mobile homes, and units that have already received free weatherization through the low-income weatherization program. In Washington, DC, the effective date can be delayed for buildings that demonstrate financial distress, have a change of ownership, are vacant, are receiving a major renovation, are pending demolition, or meet other criteria established by the DC Department of Energy and Environment. In Reno, the legislation lists 13 specific exemptions such as new buildings built under the current building code, unoccupied buildings, buildings undergoing financial distress (specifically defined), buildings with less than 60% occupancy, and buildings with a demolition permit. The New York City legislation has less-stringent, differentiated requirements for multifamily buildings that include at least one rent-regulated unit and for houses of worship.

The United Kingdom has a maximum expenditure, and once the cap is reached, the apartment is deemed exempt, even if it is not yet at the "E" level. The Netherlands and UK have a maximum simple payback period for required improvements. Scotland is considering an exemption as well for homes where meeting the target is not feasible or economically viable. Boulder considered a cost cap but ultimately decided against it, electing instead to provide more time (eight years) to bring buildings into compliance.

For many of the jurisdictions, details, including exemptions, are still being decided.

Should Jurisdictions Allocate Funding for Building Upgrades?

In many of the jurisdictions, funding was allocated to help building owners pay for upgrades needed to meet the standards. In Boulder, funds and programs are provided by a small carbon fee on electric service. In Washington, DC, specific funds were allocated to the DC Green Bank and for improvements to affordable housing. In Washington State, $75 million was allocated to the Early Adopter Incentive Program. In France, tax incentives, loans, and allocations from the government budget are used. New York City has a variety of funding programs, as discussed earlier.

Reno has a C-PACE loan program and some energy efficiency incentives from the local utility, but unlike the other jurisdictions, it did not make substantial funding available. In the United Kingdom, some funding is available, but the major funding expected from its Green Deal did not work out.

Should Incentives be Provided for Early Compliance?

Some policies (Washington State) include provisions that give incentives for early compliance with the standard. In some trading systems, it is also possible to set up incentives for early compliance with emissions reductions banking: if a building reaches its targets in advance of the deadline, it may be able to "bank" those energy or emissions reductions to monetize the value for potential sale to others or reduce the need for investment in a different building. Some advocates have pointed out that a trading system is a motivator for both earlier compliance and investments in buildings that might be excluded from the standards' provisions.

Should RECs or Offsets be Incorporated?

Some jurisdictions, particularly New York City in its adopted Local Law 97, allow buildings to use renewable RECs and/or GHG offsets as an alternative to reducing the energy use to meet the standard. This was a somewhat controversial portion in the New York City law, with many arguing that many other policies are driving renewable energy development, and any building performance standard should focus on just actual building energy (or environmental) performance improvement. Cambridge is also planning to allow use of offsets and renewable energy credits and is considering what types of constraints to put on use of these credits. The city is also looking into ways to encourage offsets/credits within the city limits.

If energy consumption is the chosen metric for the standard, RECs should not be an issue. But for a standard using CO_2 as the metric, use of RECs is a critical policy decision and can take away much of the potential driver of energy performance improvement. For both energy and CO_2 standards, offsets within the covered jurisdiction should not be an issue. But if offsets extend beyond a jurisdiction's borders, they can dilute actions within the jurisdiction.

What Role Can and Should Utility Incentives Play?

One important question is whether utility energy efficiency incentives will be available to help fund energy retrofits even though retrofits will now be mandated. In Washington State, the legislation makes clear that utilities will fund the Early Adopter incentives (with offsetting reductions in taxes they pay), and state staff are planning to make clear that even after the standards take effect, utilities may still offer incentives and claim energy savings. St. Louis has worked with its utilities in drafting its bill to assure that the bill will not hinder utility efficiency programs. In these jurisdictions, proponents of building performance standards are arguing that the standards would not have been adopted but for the expectation of future utility incentives, and thus continued utility incentives are important for making sure the standards are successful and not either ignored or repealed. These discussions are also beginning in Boston, Cambridge, and New York City. So far, no final decisions have been made, although Washington State is planning on continued utility incentives. At this point, New York City owners are also expecting that utility and state (NYSERDA) incentives will be available for retrofits and improvements to meet the standards. And in Massachusetts, Eversource is planning to continue providing incentives after the standards but must discuss the details with regulators.

What Educational and Technical Assistance Efforts Should be Undertaken?

All of the jurisdictions set up programs to provide education and technical assistance. Boulder has its EnergySmart program; Washington, DC, has its High Performance Building Hub; France has its Regional Energy Renovation Platforms; the Netherlands its RVO program; and Washington State has its Early Adopter program (incentives, but it is also planning some technical assistance). Washington State, British Columbia, and Vancouver are also planning extensive efforts around the ASHRAE 100 building retrofit standard. New York City has a variety of programs as discussed. Programs are more limited in the United Kingdom and Reno.

The Institute for Market Transformation (IMT 2020a) discusses a variety of issues involved

with providing local market support with a high-performance building hub.

Are Special Provisions Needed for Affordable Housing?

As noted, 7 of the 10 jurisdictions that have adopted programs include at least some housing in their programs. Of these, most make special allowances for affordable multifamily housing. For example, in Washington, DC, extra funding is provided for affordable housing, and extra time is provided before performance standards must be met. A variety of other provisions for affordable multifamily housing have been suggested by the National Housing Trust to the DC government as part of the process to develop rules for the DC standards (NHT 2019). France also allocated special funding for public housing renovation and for its Energy Renovation Guarantee Fund that helps underwrite loans to low-income households. In both France and the United Kingdom, utility energy efficiency certificates have set-asides for households with fuel poverty. In St. Louis, utility incentives are especially generous for affordable housing. In New York City, the standards are significantly weaker for buildings with rent-regulated apartments due to concerns that performance standards would lead to higher rents. In Boulder, rental units that have participated in the federal low-income Weatherization Assistance Program are exempt from further upgrades. And in Reno, compliance is delayed for three to six years for low-income multifamily housing buildings with Enterprise Green Communities certification.

Should Specific Provisions be Made for Electrification?

One consideration for some jurisdictions is to encourage not only energy efficiency improvements but also a shift in home and commercial building energy use from fossil fuels (e.g., fuel oil, propane, and natural gas) to electricity. Such a shift could reduce GHG emissions as long as the electric grid is moderately clean, a situation that applies in many but not all states now and will become more common in the coming years (Nadel 2018, 2016). Building performance standards can encourage electrification in several ways. First, switching to high-efficiency heat pumps and heat pump water heaters will generally save energy relative to traditional fossil fuel systems, and thus electrification is one way to help meet energy-saving goals (Nadel 2018, 2016). Second, as discussed earlier, some jurisdictions are adopting standards using CO_2 emissions as a metric, which directly reflect the savings in CO_2 emissions from electrification. These savings will be higher in areas with a clean grid and less in areas with a dirtier grid. Third, depending on the specific metrics chosen (separate electric and fuel metrics or a combined energy use per square foot metric), electrification can be further encouraged. This issue is discussed by IMT (2020b).

Summary of Building Performance Standard Implementation

As a complement to the information in table 2, additional information on many of the supporting aspects of the various building performance standards is summarized in table 4.

Table 4. Additional summary information on building performance standard implementation

Jurisdiction	Years of benchmarking	Lead time to first standard	Trading	Funding assistance	Education and technical assistance	Housing affordability provisions
Boulder	0	8	No	Extensive	Extensive	Limited
Tokyo	8	5	Yes	Significant	Significant	NA
United Kingdom	8	3	No	Limited	Extensive	Significant
The Netherlands	10	4	No	Extensive	Extensive	NA
Reno	0	7	No	Limited	Significant	No
Washington, DC	5	8	No	Extensive	Extensive	Extensive
New York City	8	5	Likely	Extensive	Extensive	Significant
Washington State	9[26]	7	No	Extensive	Significant	NA
France	10	10	No	Extensive	Extensive	Extensive
St. Louis	3	5	No	Significant	Significant*	Significant

"Years of benchmarking" is the number of years of required benchmarking at the time when performance standards were adopted. "Lead time to first standard" is from the date of law enactment. Commonly detailed implementing regulations are developed in the first year or so.

*Currently significant but will be extensive if St. Louis establishes a technical assistance hub.

[26] However, as noted previously, benchmarking is limited in Washington State, applying only to sales and new leases. Furthermore, there is no state enforcement; compliance is up to current owners and prospective buyers and tenants.

Lessons Learned Thus Far

With 10 performance standards now in place and more pending, a number of lessons have been learned regarding adoption of building performance standards.



Building benchmarking is generally an important precursor for performance standards.

Most of the performance standards in place rely on prior building benchmarking. Such benchmarking provides data that can be used to help set performance standards, and often the performance standards use the metrics established with benchmarking. However, there are a few exceptions such as Boulder, Washington State, British Columbia, and Vancouver, where standards are set on the basis of building code or ASHRAE Standard 100 procedures complemented with studies needed to translate these codes and procedures into appropriate standards.

Stakeholder consultation is important before standards are proposed.

Consultation helps to identify concerns and allow proponents to identify ways to address these concerns. For example, Reno added a number of alternative compliance mechanisms to address concerns about bringing some buildings to a median ENERGY STAR score. Cambridge moved toward CO_2 metrics and added special paths for university campuses and laboratories to address concerns. Each jurisdiction is different, and these are only examples. In Washington, DC, affordable housing is a significant issue that required/requires substantial attention.

There is no one size fits all.

There are multiple approaches to performance standards, and each jurisdiction must pursue approaches that work for its communities and stakeholders.

It takes time to build support and work out details.

In many of our interviews, staff pointed out how they hoped for adoption within one year, but it ultimately took two years or longer as there are many details to work out and many stakeholders to consult.

Most standards to date involve commercial buildings and/or rental buildings.

In the United States, most of the interest has been in commercial buildings (all but Boulder) and multifamily/rental buildings (all but Washington State). Some limited and old programs are for single-family owner-occupied homes (Suozzo, Wang, and Thorne 1997), but nothing recent. Europe has been more willing to tackle single-family owner-occupied homes, as is British Columbia/Vancouver.

Early experience suggests that an operational rating metric (such as the ENERGY STAR Portfolio Manager Score) is well suited to commercial buildings, while an asset-based metric is appropriate for small residential ones.

With the wide variety of commercial building uses, and even different occupancies among office buildings, finding a valid asset-based rating that can serve as the metric for larger nonresidential buildings is challenging. If the desire is to reduce actual energy use (or resulting emissions), the better metric is measured performance. In homes and small residential buildings, having replicable asset ratings based on easily observable appliances, equipment, and building envelopes is more reasonable. In addition, operational ratings in homes are very susceptible to resident behavior, and an operational rating could be misleading to a prospective purchaser. Due to these two considerations, the asset rating is likely a better metric for homes. It is not yet clear what is most appropriate for larger multifamily buildings.

Only four standards are now being implemented, but initial experience indicates high compliance rates in Tokyo and Boulder and limited compliance so far in the United Kingdom.

In Boulder, the program was added to an existing rental certificate program, and substantial resources were devoted to implementation. Tokyo compliance was aided by extensive stakeholder engagement and earlier voluntary initiatives. The United Kingdom, by contrast, did not add to an existing regulatory program and thus far has not devoted many resources to compliance. Implementation is just beginning in the Netherlands and Reno, and it has yet to begin elsewhere.

Significant resources are required to effectively implement building performance standards.

As shown by the successful program in Boulder and the less successful (thus far) program in the United Kingdom, significant resources are needed to implement building performance standards. This includes staff and other resources for education and enforcement, as well as resources for technical assistance, incentives, and financing.



Next Steps

For jurisdictions with building performance standards, the key next step is to do a good job with implementation, devoting the resources that are needed to education, technical assistance, financing and incentives (which sometimes can be leveraged from other sources such as utilities), and effective enforcement. Evaluation will be important to understand what aspects are working well and what aspects may need rethinking. Several jurisdictions have adopted overarching legislation and are now working out implementation details.

For jurisdictions considering building performance standards, a key next step is to do your homework, review experience elsewhere, consult with stakeholders, and figure out an appropriate approach for your community. As part of this process, consider key implementation details, as availability of future technical and financial support will be important in building support for a proposal.



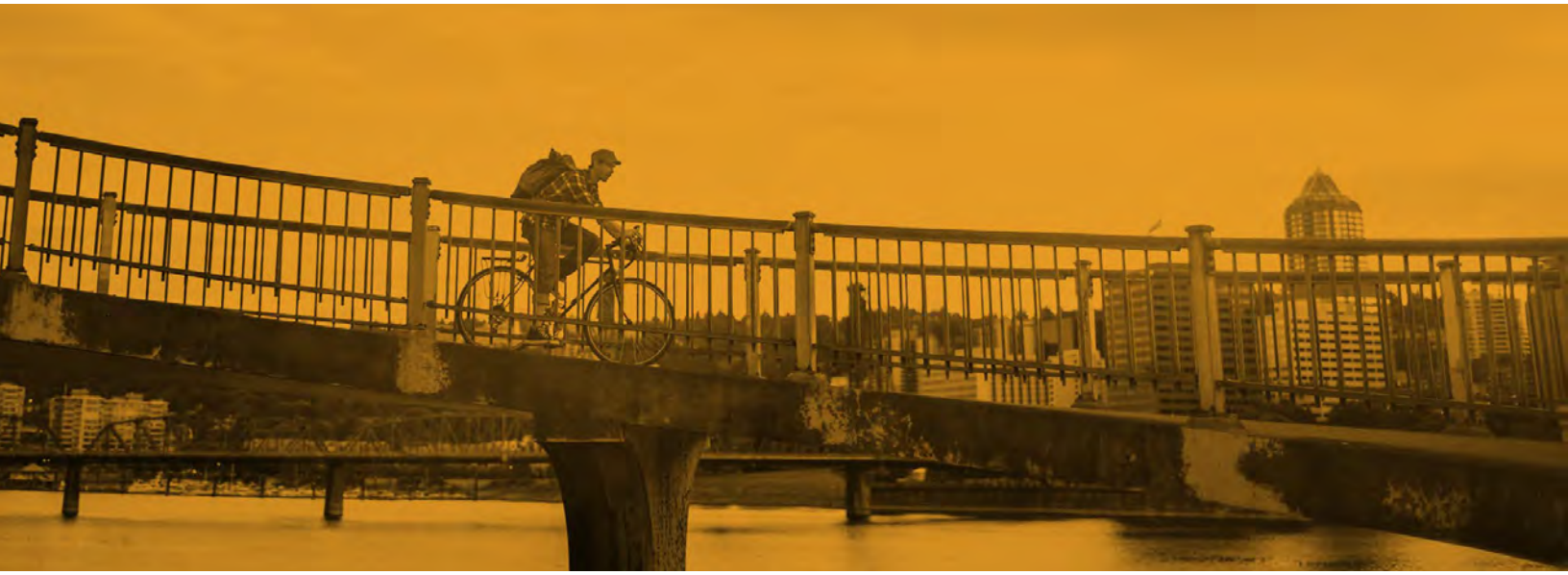
Conclusions

To meet long-term climate goals, substantial energy savings and GHG emissions reductions must be obtained from existing buildings. Programs to encourage energy efficiency upgrades to existing buildings have operated for decades, and at current retrofit rates, it will take about 500 years to retrofit all residences and more than 60 years to retrofit all commercial buildings. New and more-aggressive approaches are needed.

Mandatory building performance standards are one such approach. Such standards are now being successfully implemented in Boulder and Tokyo. We document eight other jurisdictions that have adopted and are preparing to implement such standards, and another seven jurisdictions considering adoption. We find that many approaches are being tried, in part because each jurisdiction is different.

As these policies are implemented, evaluation will be important to improve these policies and inform future discussions on the best approaches. However, at this point, we do know that to be successful, building performance standards must be complemented with other policies and programs, such as building benchmarking, education and technical assistance on ways to reach required performance, both financial incentives and financing to help cover costs to building owners, and special attention to how the performance standards apply in critical markets such as affordable housing.

In concert with complementary approaches, building performance standards can be an important contributor to efforts to meet energy and climate targets. We are entering an exciting period of experimentation that will likely teach us many lessons on how best to structure and implement such policies to best meet the objective of quality housing and workplaces while obtaining large energy savings and emissions reductions.



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