

Tracking City Progress Toward International Emissions Targets for the Buildings Sector

Alexander Jarrah, American Council for an Energy-Efficient Economy

ABSTRACT

Several cities in the United States have set citywide greenhouse gas (GHG) emissions-reduction goals to guide climate action policy and program planning at the local level. Several studies have indicated that many cities are either not on track to achieve their goals or are not tracking their progress. Further, it is unclear whether the progress made toward citywide goals is sufficient to achieve the reductions needed on the global level.

The Intergovernmental Panel on Climate Change (IPCC) has noted that to achieve global warming scenarios of limited or no overshoot past 1.5°C, buildings sector GHG emissions must decrease by 80–90% by 2050. This paper profiles six U.S. cities and analyzes their emissions reductions in the buildings sector to benchmark them against the IPCC international emissions targets for the years 2050. This paper projects future emissions assuming a linear rate of change consistent with change in past years to determine whether cities are likely to achieve international goals. For context, it also considers factors such as the energy efficiency policy landscape for existing buildings, overall trends in city-level energy use, GHG emissions-reduction goals for the buildings sector set by the city, and demographic trends.

Introduction

Decarbonizing urban areas is necessary to avoid global warming scenarios of 1.5°C or greater. The Intergovernmental Panel on Climate Change (IPCC) has noted that buildings in urban areas will need to reduce emissions by 80–90% by 2050 to achieve global warming scenarios of 1.5° with no or limited overshoot (IPCC 2018). Urban areas account for 70% of GHG emissions, and the buildings sector accounts for one of the largest shares of urban area emissions (IEA 2021). Therefore, GHG emissions reductions in buildings in urban areas hold significant, consequential potential.

Samarripas et al. (2021) note in their *City Clean Energy Scorecard*, which assesses the extent to which 100 U.S. cities are making the buildings and transportation sectors more efficient, that many cities are not tracking GHG emissions data. However, of the 38 of those cities that are tracking GHG emissions data extensively, 19 are on track to achieve their community-wide GHG emissions-reduction goals.¹ However, while the goals cities set for themselves are a good indicator of a city's ambition and intent to mitigate climate change, these goals do not necessarily indicate whether cities in the United States are achieving the reductions needed to keep warming below 1.5°C. Moreover, less is known on whether U.S. cities are achieving sector-specific goals as they relate to GHG emissions. This paper analyzes whether six U.S. cities—Boston, Minneapolis, New York, San Francisco, Seattle, and Washington, DC—are

¹ Community-wide GHG emissions are those that apply to the city as a whole. Community-wide GHG emissions typically include GHG emissions stemming from the buildings, transportation, waste, local government operations, and manufacturing and industrial sectors.

on track to achieve the GHG emissions-reduction targets of 80–90% by 2050 as identified by the IPCC.

Methodology

The report analyzes Boston, Minneapolis, New York City, San Francisco, Seattle, and Washington, DC because they placed among the top five in ACEEE's 2021 *City Clean Energy Scorecard* (Samarripas et al. 2021).² Past Scope 1 and Scope 2 GHG emissions data were collected for the buildings sector from city GHG emissions inventories for the cities included in this analysis. The availability and specificity of GHG emissions data varied from city to city, with some cities publishing data annually and others publishing data at irregular intervals. Likewise, some cities provided a single GHG emissions value representing the total GHG emissions stemming from the buildings sector in a given year, while others published detailed datasets that provided the GHG emissions for each building type (e.g., residential, commercial). Further, the building types included in cities' accountings of building GHG emissions varied depending on the GHG emissions inventory methodology. For example, some cities included manufacturing and industrial sector in the buildings sector GHG emissions accounting, while others limited buildings sector GHG emissions to only residential, commercial, and institutional buildings. Thus, when collecting buildings GHG emissions, the city's definition of what constitutes sector GHG emissions was used.³

To analyze whether cities were on track to reduce buildings sector GHG emissions by 80–90% by 2050, the average annual per capita GHG emissions reductions required to meet targets of both 80% and 90%, relative to a city's per capita GHG emissions in the year closest to the year the city adopted its community-wide GHG emissions-reduction goal were calculated.⁴ Per capita targets were used to control for changes in city population. Each city's per capita target was determined by dividing the target year's anticipated GHG emissions (relative to a goal's baseline GHG emissions) by a forecast target year population. Target year populations were provided by city staff or regional planning commissions or were forecast on the basis of city population growth rates from 2011 to 2019, using a straight linear regression function. Except for forecasts provided by a city or regional planning commission, all population numbers used are from the American Community Survey one-year population estimates (Census Bureau 2019).

Next, the average annual change in per capita buildings sector GHG emissions was calculated from the year the city adopted its own GHG emissions-reduction goal to the most recent year for which data is available, using all the interim data available. This was also calculated using a straight linear regression function. A linear model was used due to the limited availability of GHG emissions data. Using other approaches would have required several

² Boston and New York tied for fifth place in the *City Scorecard*.

³ If a city included GHG emissions stemming from the manufacturing and industrial subsectors in the broader buildings sector GHG emissions, then those GHG emissions were included in the analysis. However, if the city recorded manufacturing and industrial GHG emissions as separate from buildings sector GHG emissions, then they were excluded.

⁴ As the forecasting model requires a start year for beginning the projection, the year the city adopted its own community-wide GHG emissions-reduction goal (or the year with data nearest to the adoption year) was used to avoid arbitrary start years.

additional assumptions, so use a linear model was chosen as it provides a *general* direction for a city’s GHG emissions reductions.

Then, the average annual rate of change was calculated by dividing average annual changes in per capita buildings sector emissions by per capita emissions in the year the city adopted its GHG emissions-reduction goal (or closest year with available data). A city’s future progress to both the 80% and 90% reduction targets was then projected by assuming this rate of change remained constant in future years.

Data Limitations

One significant data limitation is that city GHG emissions datasets cover only a few years. As the linear projection relies on GHG emissions data after the adoption of a community-wide goal, the pool of useable data further constricts to GHG emissions data in the year of adoption and after. This results in a small pool of data to project about three decades into the future.

Further, as the forecasting model relies on past GHG emissions data, it does not account for very recent changes (e.g., in the past year) or planned policies, programs, or initiatives that may influence a city’s progress toward reducing buildings sector GHG emissions. As such, due to the natural time lag that occurs while new policies and actions take effect and evaluators conduct GHG emissions inventory, very recent changes are unlikely to be accounted for. Impacts of the COVID-19 pandemic on GHG emissions also may not be included.

Additionally, the analysis includes only GHG emissions from existing buildings. This is relevant because the IPCC noted that to achieve GHG emissions reductions of 80–90% in the buildings sectors by 2050, all new buildings will need to be built fossil-fuel free and near-zero energy by 2020 (IPCC 2018). As of June 2022, no city included in the analysis has adopted mandatory net- or near-zero energy use codes, although San Francisco has adopted an ordinance banning natural gas connections in new buildings.

Results

Table 1 below summarizes the findings of the analysis, along with citywide trends. Of the six cities included, four are on track to reduce buildings sector GHG emissions by at least 80% according to the linear model used; these cities are also on track to reduce buildings sector GHG emissions by at least 90%, exceeding the target set by the IPCC. New York is not on track, with projections indicating that will actually increase per capita buildings sector GHG emissions. Boston is projected to decrease buildings sector GHG emissions significantly but still fall short of the IPCC target.

Table 1. City progress toward IPCC reduction targets for the buildings sectors

City	Progress towards IPCC target	Adoption year of city’s community-wide GHG goal	Per capita GHG emissions in year of adoption of community-wide GHG goal (MTCO ₂ e)	Per capita emissions targets in 2050 (80–90% reduction) (MTCO ₂ e)	Current annual rate of GHG emissions reduction
Boston	Not on track	2016	6.7	0.9 to 0.5	2.2%

City	Progress towards IPCC target	Adoption year of city's community-wide GHG goal	Per capita GHG emissions in year of adoption of community-wide GHG goal (MTCO ₂ e)	Per capita emissions targets in 2050 (80–90% reduction) (MTCO ₂ e)	Current annual rate of GHG emissions reduction
Minneapolis	On track	2015	7.4	0.7 to 0.3	6.6%
New York	Not on track	2014	3.8	0.7 to 0.4	-0.6%
San Francisco	On track	2010	4.3	0.4 to 0.2	5.5%
Seattle	On track	2012	2.1	0.2 to 0.1	7.7%
Washington, DC	On track	2013	9.3	1.1 to 0.6	3.6%

Source: GHG emissions values taken from city GHG emissions inventories. Notes: Cities with a negative value for the current rate of GHG emissions reduction are projected to increase buildings sector GHG emissions.

As mentioned above, the sectors included in a city's accounting of overall buildings sector GHG emissions can vary, so direct comparisons between cities are difficult to make. The following sections provide more information on each of the cities included in the analysis.

Boston

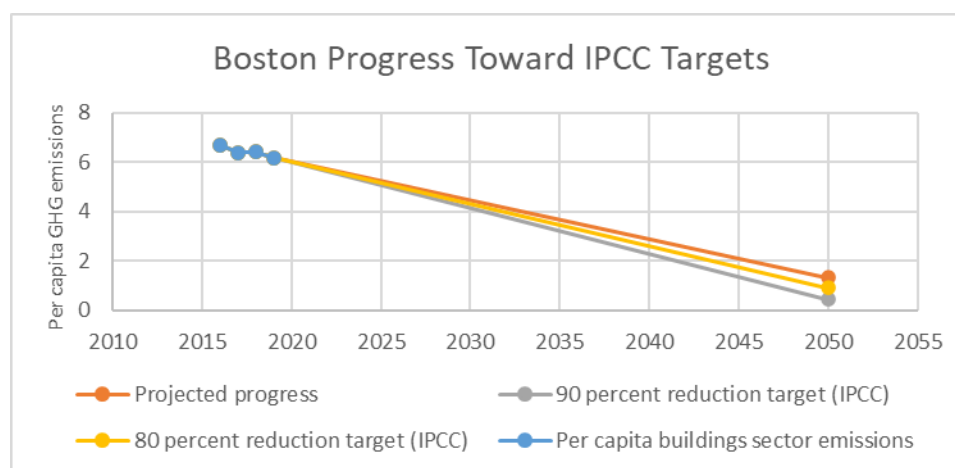


Figure 1. Boston's progress towards IPCC GHG emissions-reduction targets for the buildings sector. Source: City GHG emissions inventories.

Boston is currently projected to reduce buildings sector GHG emissions, but not enough to achieve the IPCC's goal of buildings sector emissions reductions of 80–90% by 2050. However, the city has a fairly advanced energy efficiency policy landscape, consistently placing among the top 5 cities in ACEEE's *City Clean Energy Scorecard* (Samarripas et al. 2021). Further, the city's recent activity suggests that Boston may yet achieve the goal. In 2021, the city amended its benchmarking and disclosure ordinance by adopting the Building Emissions Reduction and Disclosure Ordinance, which requires large buildings to achieve strict GHG emissions-reduction standards, with the goal to achieve net-zero GHG emissions in these buildings by 2050.

Minneapolis

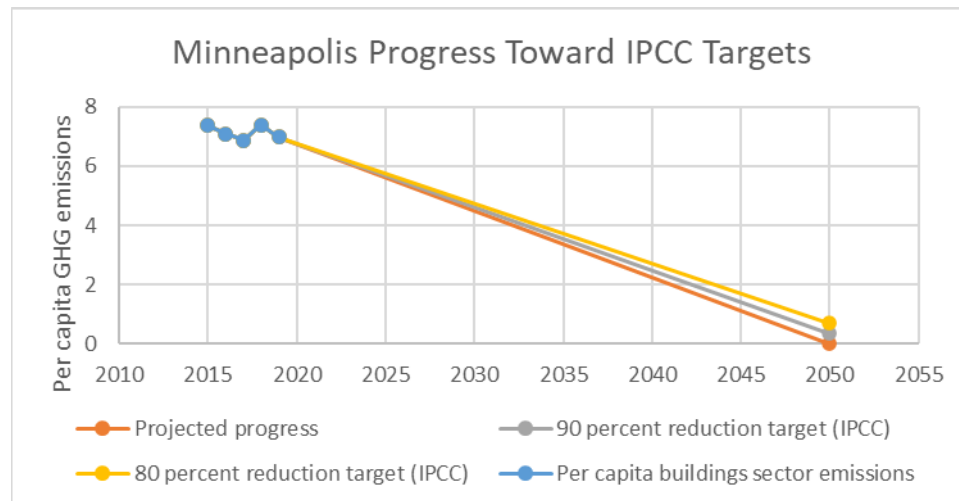


Figure 2. Minneapolis's progress toward IPCC GHG emissions-reduction targets for the buildings sector. Source: City GHG emissions inventories

Minneapolis is on track to achieve the IPCC reduction targets. Minneapolis has an innovative energy policy landscape, and, notably, the city has consistently ranked first in the *City Scorecard* for equity in policy and program delivery. This is evident in city policies and programs targeting the buildings sector, such as the time-of-rent energy disclosure policy, which requires landlords to provide prospective tenants with energy information on a given unit, and the Affordable 4D program, which requires incentive award recipients to comply with housing affordability covenants (Minneapolis 2022). Energy efficiency requirements for existing buildings generally focus on the disclosure of information. For example, the Building Energy Benchmarking and Transparency Ordinance requires large buildings to benchmark energy usage (Minneapolis 2013). The policy also requires covered buildings to perform either an energy audit or tune-up/retrocommissioning every five years. This focus may be because Minnesota prevents the city from adopting more-stringent energy efficiency requirements such as building performance standards. Given these limitations, initiatives promoting voluntary building electrification and increasing the supply of carbon-free energy may provide the most potential to achieve deep carbon reductions in the buildings sector.

New York

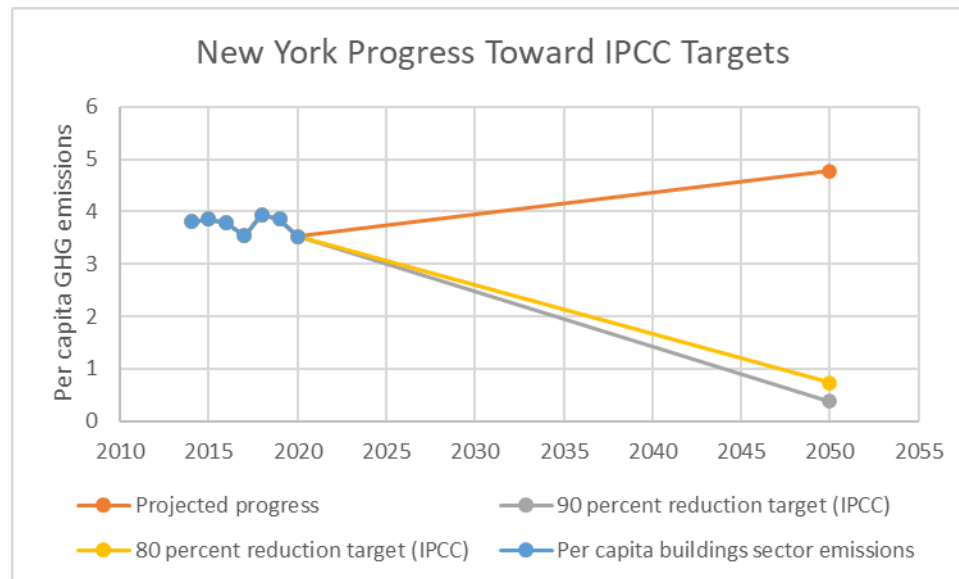


Figure 3. New York’s progress toward IPCC GHG emissions-reduction targets for the buildings sector. Source: City GHG emissions inventories

New York has one of the most advanced energy efficiency policy landscapes for existing buildings in the country. Despite this, New York is currently projected not to achieve the IPCC’s goal of buildings sector emissions reductions of 80–90% by 2050. The recent closure of the Indian Point Power Center is likely to complicate the city’s pursuit of this target, as the power plant provided New York City with 25% of its electricity needs with carbon-free power until 2020 and most of this electricity generation was replaced by natural gas-fired power plants. (McGeehan 2021). However, the city’s recent adoption of Local Law 97 of 2019 and Local Law 116 of 2020 set building performance standard for the residential, commercial, and affordable housing sectors. The laws have the potential to achieve significant GHG emissions reductions in the buildings sector.

San Francisco

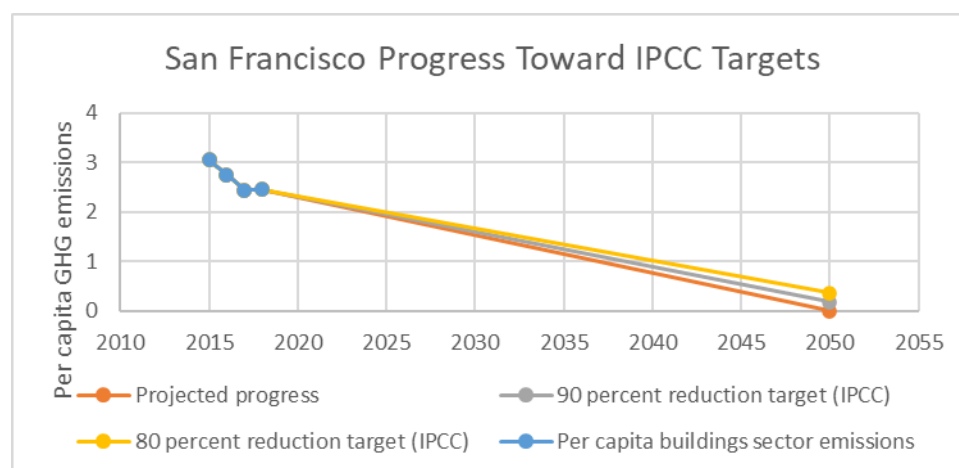


Figure 4. San Francisco's progress toward IPCC GHG emissions-reduction targets for the buildings sector. Source: City GHG emissions inventories

San Francisco is on track to achieve the IPCC reduction targets. A high percentage of carbon-free electricity aids the city's progress towards the target, as do innovative building energy policies. For example, the Renewable Energy for Commercial Buildings Ordinance requires large nonresidential buildings of at least 50,000 square feet to use 100% renewable energy for all on-site electricity demands (San Francisco 2019). San Francisco is the only city in the analysis to ban new fossil fuel connections in new buildings, fulfilling a key aspect of the IPCC's targets for buildings sector GHG emissions reductions.

Seattle

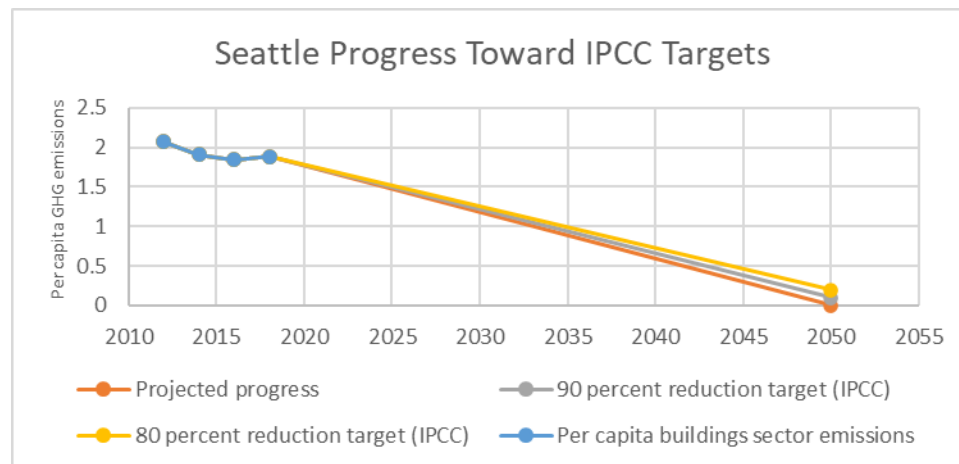


Figure 5. Seattle's progress toward IPCC GHG emissions-reduction targets for the buildings sector. Source: City GHG emissions inventories

Seattle is on track to achieve the IPCC reductions targets with more than 90% of its electricity originating from carbon-free generation sources (Seattle 2020). Therefore, decarbonizing Seattle's building stock will likely depend on the degree to which building owners and managers electrify natural gas and fuel systems in buildings. The city has adopted the Seattle Tune-Up Policy, which requires energy audits and tune-ups in nonresidential buildings. Further, the city's policy landscape has been bolstered by state support as Washington adopted the Clean Buildings for Washington Act, which set building performance standards for nonresidential buildings (Washington 2022).

Washington, DC

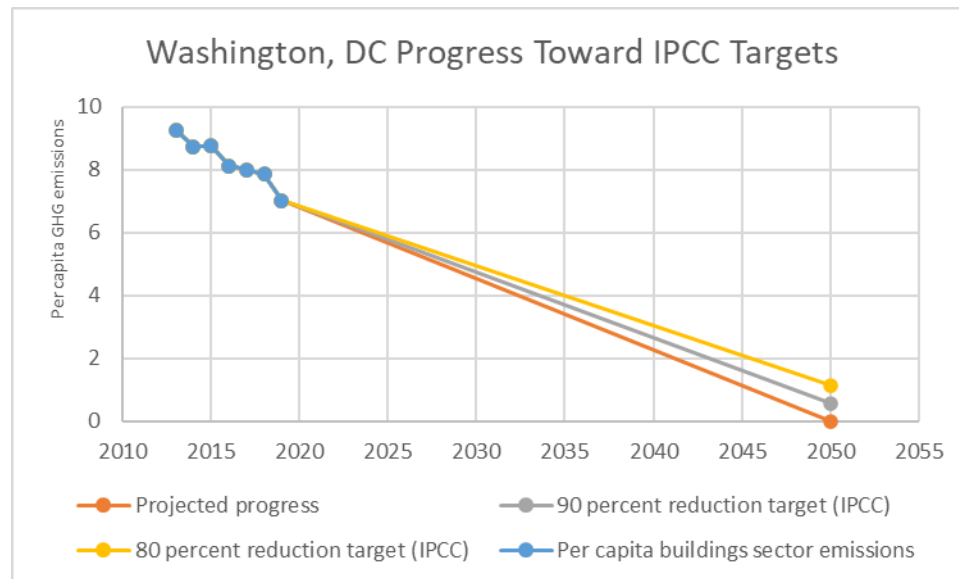


Figure 6. Washington, DC's progress toward IPCC GHG emissions-reduction targets for the buildings sector. Source: City GHG emissions inventories

Washington, DC, is currently projected to achieve the IPCC's goal of buildings sector emissions reductions of 80–90% by 2050. The city's Clean Energy Omnibus Act of 2018 has potential to help the city make sure the IPCC target projections come to fruition, as it includes building performance standards for residential and commercial buildings (Washington, DC 2018). Notably, the policy also covers the affordable housing sector and includes support to comply in the form of financial assistance, technical assistance, and extended compliance schedules.

Conclusion

This paper examines the progress of six U.S. cities toward the IPCC's target to reduce buildings sector GHG emissions by 80–90% by 2050. These GHG emissions reductions are necessary because they help create global warming scenarios with limited or no overshoot past 1.5°C of warming.

Of the six cities studied, most are on track to achieve their goals. The two cities that are not on track—Boston and New York—have adopted building performance standards. As these policies are relatively recent, past GHG emissions data do not reflect their impact. However, these policies have significant potential to reduce GHG emissions in the buildings sector and may prove helpful in getting these cities on track to achieve IPCC's target. As this paper examined only a small number of cities and used a linear projection, additional analysis will be needed to determine the extent to which cities across the United States are on track to achieve the IPCC's GHG emissions-reduction targets for the buildings sector.

References

- Census Bureau. 2019. "Explore Census Data." Accessed March 2022.
<https://data.census.gov/cedsci/>.
- IEA (International Energy Agency). 2021. *Empowering Cities for a Net Zero Future*. Paris, France: International Energy Agency. <https://www.iea.org/reports/empowering-cities-for-a-net-zero-future>.
- IPCC (Intergovernmental Panel on Climate Change). 2018. *Summary for Urban Policymakers*. Geneva, Switzerland: Intergovernmental Panel on Climate Change.
<https://www.ipcc.ch/site/assets/uploads/sites/2/2018/12/SPM-for-cities.pdf>.
- McGeehan, P. 2021. "Indian Point is Shutting Down. That Means More Fossil Fuel." *The New York Times*, April 12. <https://www.nytimes.com/2021/04/12/nyregion/indian-point-power-plant-closing.html>.
- Minneapolis. 2013. *Commercial and multifamily residential building rating and disclosure*.
https://library.municode.com/mn/minneapolis/codes/code_of_ordinances?nodeId=COOR_TIT3AIP0ENPR_CH47ENAIPO_47.190COMUREBURADI.
- . 2022. "4d Affordable Housing Incentive."
<https://www2.minneapolismn.gov/government/programs-initiatives/housing-development-assistance/rental-property/4d/>.
- Samarripas, S., K. Tanabe, A. Dewey, A. Jarrah, B. Jennings, A. Dreihobl, H. Bastian, S. Vaidyanathan, D. Morales, A. Patronella, S. Subramanian, and C. Tolentino. 2021. *The 2021 City Clean Energy Scorecard*. Washington, DC: American Council for an Energy-Efficient Economy. [aceee.org/research-report/u2107](https://www.aceee.org/research-report/u2107).
- San Francisco. 2019. *Renewable Energy for Commercial Buildings Ordinance*.
https://codelibrary.amlegal.com/codes/san_francisco/latest/sf_environment/0-0-0-48519.
- Seattle. 2020. "Energy and Environment". <https://www.seattle.gov/city-light/energy-and-environment>.
- Washington. 2022. *State energy performance standard*.
<https://app.leg.wa.gov/RCW/default.aspx?cite=19.27A.210>.
- Washington, DC. 2018. *Clean Energy Omnibus Act of 2018*.
<https://code.dccouncil.us/us/dc/council/laws/22-257>.