

City of Boulder Policy Review for Healthy Buildings and Stronger Communities

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ABSTRACT

The City of Boulder (Boulder) aims to achieve net-zero emissions by 2035. To accelerate progress toward this goal, Arup conducted a comprehensive policy review to identify gaps in Boulder's current approach to building decarbonization and opportunities to integrate equity and resilience objectives.

The research progressed through four phases: (i) Reviewing existing local policies, (ii) Defining goals and desired outcomes, (iii) Researching and analyzing case studies, and (iv) Implementing findings to a city's building stock. This process uncovered a suite of strategies for policies such as regulatory levers to enforce decarbonization, equity guardrails to protect vulnerable communities, and resilience co-benefits that enhance the impact of decarbonization for all. Analysis of policies within a changing political climate revealed that complementary policies can prove as backup against legal opposition: if one policy is repealed, there should be other policies in place to continue decarbonization efforts. Furthermore, gap analysis indicates a need for policy targeting residential housing typologies, which often encompasses a significant portion of a city's building emissions, and yet are less regulated.

The resulting decarbonization roadmap for Boulder provides a comprehensive strategy across all building types and offers a replicable framework for jurisdictions pursuing ambitious climate targets. Policy recommendations include enforcing decarbonization through building performance standards (BPS) and energy code updates, driving market transformation through appliance standards, supporting under-resourced buildings, and implementing tenant protections, resilience co-benefits, and workforce development initiatives. This approach positions Boulder to decarbonize its building stock while advancing equity and resilience goals.

Introduction

Transitioning to clean energy sources for buildings requires supportive local decarbonization policies. Many cities now require building owners to reduce carbon emissions through upgrades or pay non-compliance fees (IMT n.d.a). While decarbonization policies are important for reducing a city's building emissions, implementation without consideration of impact on communities can lead to unintended consequences. Without sufficient funding and technical assistance, small landlords and low-to-moderate income households may be unable to afford the required upgrades. Moreover, landlords facing high upgrade costs may increase rent to pay for it, putting tenants at risk of displacement (Kirk 2023).

Some decarbonization upgrades also influence climate resilience. Measures like insulation and air-sealing can reduce energy use and help buildings maintain safe temperatures during power outages. Consideration of these benefits should be integrated into policy design to optimize resilience co-benefits. For example, expanding air-conditioning access improves indoor safety during heatwaves, but waste heat from air conditioning can intensify the urban heat island (UHI) effect outdoors (Salamanca et.al 2014). These tradeoffs show why decarbonization, equity, and resilience must be evaluated together to mitigate unintended consequences.

Across the industry, decarbonization policy continues to advance through better data, benchmarking, community engagement, and market analysis. Jone Lang Lasalle (JLL)'s City Climate & Resilience Policy Tracker offers a valuable global framework for understanding climate regulations and climate resilience considerations (Torres 2025). Similarly, the Institute for Market Transformation (IMT) centers equity through its emphasis on inclusive engagement in Building Performance Standard (BPS) development (IMT n.d.a). The Boulder Policy Review contributes to this work by using an intersectional lens to examine how policies affect different populations and expands focus from BPS to the full range of local decarbonization tools demonstrated by other innovative jurisdictions.

The review brings together leading building decarbonization policies and examines how regulatory tools, resilience co-benefits, equity guardrails, and workforce strategies are implemented at the local level. Drawing on case studies from more than 20 cities, these findings were applied to Boulder, Colorado, informing the *Healthy Buildings, Stronger Communities Roadmap* (Boulder's Roadmap) (City of Boulder 2025; Collins and Kadam 2025). The analysis shows how other cities can use similar methods to advance decarbonization strategies that reflect community needs and resilience goals.

Although this paper focuses on policy design, it is important to note that the broader project included building-stock analysis and community outreach. The building-stock assessment helped ground the policy review in the City of Boulder's (Boulder) local context by analyzing factors such as building age, existing HVAC systems, and emissions intensity (Brannon, Lueker, and Swedberg 2025).

Methodology: A Four-Phase Integrated Policy Review

The Policy Review took a four-phase methodology designed to identify effective decarbonization strategies that integrate equity considerations and climate resilience measures. While this policy review directly supported the development of Boulder's Roadmap, the broader aim of the methodology is to offer a replicable framework for other cities. The process included:

- **Phase One: Reviewing existing local policies** – The review identified more than 50 relevant policies and programs across building codes, energy standards, incentive programs, and strategic plans. It drew from state, county, and city sources to capture Boulder's layered regulatory environment. Each policy was categorized by building typology (commercial, residential, multifamily, single family, and manufactured housing) and by its areas of thematic focus (decarbonization, equity, and climate resilience). This revealed both well-

supported areas and notable gaps. These findings indicated what additional policies may be needed to strengthen Boulder’s overall decarbonization strategy.

- **Phase Two: Defining goals and desired outcomes** – Findings from the scan of existing local policy policies were reviewed with City staff and key stakeholders to refine the goals and desired outcomes. These insights were translated into a set of goals and outcomes focused on advancing decarbonization, ensuring the equitable distribution of benefits, and enhancing climate resilience. These goals are summarized and aligned with the corresponding desired outcomes in Table 1.

Table 1. City Goals for a Decarbonization Roadmap

Goal	Accelerate decarbonization actions to meet climate goals.	Mitigate harm by thoughtfully and equitably distributing benefits , reversing historic harms	Bolster the resilience of Boulder by addressing mitigation, adaptation, and other needs
Outcome	Triggering emissions reductions in existing buildings	Reducing burden of compliance on equity priority communities and preventing unintended consequences through proactive support	Bringing benefits (including resilience) to equity priority communities

- **Phase Three: Researching and analyzing case studies** – The review examined policies and programs from 20 cities, 11 states, and four countries. The strategies identified encompassed a broad range of interventions, from regulatory tools such as BPS, to equity-focused measures such as tenant protections, to resilience co-benefits such as integrated weatherization requirements. Additionally, workforce development emerged as an important need, tying together all three core goals. By analyzing how leading jurisdictions structure their building decarbonization policies, the review identified a set of strategies with strong potential adaptation within Boulder’s context.
- **Phase Four: Implementing findings to a city’s building stock**– Findings from the case study review were shared with City staff and local stakeholders in a workshop, where existing policies from Boulder and other jurisdictions were mapped to Boulder’s goals. A set of framing questions guided the discussion of what implementation would like in practice, including identifying related efforts Boulder is already pursuing, determining which strategies were not feasible in the local context, and assessing which strategies appear well-suited for local adoption. The workshop concluded with a set of priority strategies for incorporation into Boulder’s Roadmap.

Findings I: Policy Design Patterns Across Jurisdictions

The case study research resulted in a suite of strategies demonstrating how jurisdictions are deploying regulatory levers, equity guardrails, resilience co-benefits, and workforce development programs to advance their building sector goals. Collectively, the case-studies show how policies can be designed to reinforce one another and advance the city's goals while considering the local context.

Regulatory Levers

Policy research uncovered three main regulatory levers to mandate building decarbonization across building typologies: building performance standards (BPS), appliance standards, and energy codes. These three regulation opportunities have distinct requirements by building type and means of enforcement.

Building Performance Standards (BPS). BPS advances building-sector decarbonization by establishing performance requirements, such as emissions or energy-use limits, paired with defined penalties for non-compliance, often monetary (IMT n.d.b). Most BPS policies focus on large commercial and multifamily buildings because they account for a larger share of building sector emissions and are typically already benchmarked through benchmarking ordinances, making it a cost-effective opportunity for reducing greenhouse gas (GHG) emissions within a city's inventory. Denver's BPS mandates benchmarking and compliance with Energy Use Intensity (EUI) for existing buildings over 25,000 square feet. Full compliance is expected to support Denver's climate action goal of achieving net-zero GHG emissions from existing buildings by (City of Denver, 2026b). The policy's success is attributed to its whole-building energy framework and the availability of multiple compliance pathways, which help accommodate multiple building types and unique operational conditions. Boulder currently enforces a Building Performance Ordinance (BPO), which functions as a partial BPS by requiring covered commercial buildings to benchmark and report energy and water use (Mattrey n.d.). In addition, Boulder's SmartRegs policy mandates prescriptive energy-efficiency upgrades for landlords as a condition of obtaining a rental license (City of Boulder n.d.c). However, neither the BPO and SmartRegs establishes enforceable emissions limits, which are a defining feature of a true BPS.

Appliance Standards. Appliance standards affect the market of products available to use in buildings, shifting compliance responsibility from homeowners or building owners to manufacturers. By restricting the sale of fossil-fuel-powered, high-polluting, or inefficient appliances, these standards reduce emissions and deliver substantial environmental health benefits at the community level. Under the Energy Policy and Conservation Act (EPCA), state and local governments are preempted from establishing appliance efficiency standards that exceed federal requirements (U.S. Department of Energy 2025). However, EPCA does permit regulation of nitrogen oxide (NOx) emissions, offering an important pathway for jurisdictions to address local air quality and greenhouse gas reduction goals. In California, the Bay Area Air

Quality Management District (BAAQMD) adopted zero-NO_x requirements for new residential furnaces and water heaters in the San Francisco Bay Area (Bay Area Air District 2024). Similarly, the South Coast Air Quality Management District (SCAQMD) in California proposed zero-NO_x standards for water-heating and space-heating equipment within its authority. Since these rules govern the sale of appliances rather than overall building performance, they allow property owners to comply through equipment replacement at the end of a system's useful life (Dadashi, Horowitz, and Stein 2022). Furthermore, appliances with zero-NO_x emissions typically have significantly reduced carbon emissions, providing a path for decarbonization through appliance standards permitted by EPCA. Boulder currently does not have appliance standards and complies by Colorado state appliance standards; this case study research presents appliance standards as a new regulatory opportunity.

Energy Codes. Although building energy codes are primarily designed to ensure that new construction meets modern efficiency and carbon-reduction goals, they also apply during renovations and equipment replacements. When a building owner replaces heating, ventilation, air conditioning (HVAC) systems nearing the end of useful life (EUL), energy codes can require the installation of higher-efficiency or all-electric equipment. As a result, codes become a powerful mechanism for decarbonizing the existing building stock by aligning routine equipment upgrades with long-term climate objectives. California's 2025 Building Energy Efficiency Standards illustrate this potential. The update mandates heat-pump replacements for certain rooftop systems at EUL in commercial buildings. It also requires electric-ready infrastructure in commercial kitchens to support eventual transitions to cleaner appliances (California Energy Commission 2026). These provisions demonstrate how energy codes, paired with HVAC replacement at EUL, can drive significant emissions reductions in existing buildings without requiring major capital retrofits. Boulder's current energy code requires all electric equipment in new construction and major renovations, but it does not yet require high efficiency EUL upgrades (City of Boulder 2024a).

Equity Guardrails

As cities implement regulatory levers, the costs associated with building upgrades or penalties for noncompliance can create barriers for policy adoption and risks for renters. The policy review identified strategies for developing equity guardrails for both under-resourced buildings and tenants, ensuring the benefits of decarbonization are distributed equally.

Supporting Under-Resourced Buildings. Under-resourced buildings, such as low-income homeowners, small landlords, and small businesses, may not have the financial resources to meet decarbonization regulations. Therefore, jurisdictions are creating targeted technical and financial assistance programs to give building owners resources to comply. In Denver, owners of "equity-priority buildings" (inclusive of multifamily housing, affordable apartment buildings, income qualified residential condominium, nonprofit organizations, and financially small commercial buildings) receive hands-on technical assistance and rebates for the city's BPS program, including step-by-step support throughout the compliance process (City of Denver 2026c; City of Denver 2026e). Denver uses its Climate Protection Fund, supported by the city's sales tax, to

finance technical assistance for equity-priority building owners (City of Denver, 2026a). Similarly, in Washington, D.C, non-compliance payments from their BPS program are directed into a BPS technical assistance fund for affordable housing (D.C. Law 22-257 2019). These resources help building owners comply with regulatory requirements without being burdened by the financial cost, time, or administrative complexity of the process. Boulder supports energy efficiency upgrades for homeowners, landlords, and businesses with their Climate Tax (City of Boulder n.d.a). Providing additional support for under-resourced building is essential to any decarbonization strategy.

Tenant Protections. When landlords retrofit their buildings to comply with city decarbonization policies, they may pass the expenses on to tenants through rent increases, or in extreme cases, eviction. In addition to supporting building owners, renters must also be protected against pass-through costs of decarbonization. Some jurisdictions are restricting rent increase for landlords who utilize city funds to upgrade their buildings. For example, the state of California requires landlords who receive funding from its Weatherization Assistance Program (WAP) to not raise rent for two years (Carpenter-Gold 2023). To ensure renters are not displaced during the retrofit process, many jurisdictions are prioritizing tenant-in place retrofits and requiring that any necessary relocation occur within the same building or housing complex. A strong example of this approach comes from BC Housing in British Columbia, which implemented a tenant liaison role, responsible for serving as the primary point of communication between residents and the construction team. One of the liaison's core responsibilities is ensuring that tenants have a safe and comfortable place to stay during each stage of the retrofit process, thereby reducing harassment and preventing displacement (Kennedy 2020). In addition, Boulder protects renters from eviction due to building retrofit through its Eviction Prevention and Rental Assistance Services Program (City of Boulder n.d.b). Protecting renters from displacement caused by rising rents or retrofit activities is essential to equitable decarbonization.

Resilience Co-Benefits

While building decarbonization is important for mitigating greenhouse gas emissions, buildings also need to adapt to future climate conditions. Between 1980 and 2024, more than 400 weather and climate disasters occurred across the United States, resulting in over \$2 trillion in damages (NOAA 2024). In response, jurisdictions are integrating resilience co-benefits and considering increased climate risks from decarbonization measures into their decarbonization policies, specifically weatherization and green infrastructure. Specifically, Boulder supports climate resilience through initiatives such as its Community Wildfire Protection Plan and the Boulder Heat Mapping tool (City of Boulder n.d.b; City of Boulder 2022).

Weatherization. Including stringent weatherization requirements is one way to integrate climate resilience into decarbonization policies. Weatherization strategies include increasing insulation, air-sealing building envelopes, and upgrading to high-efficiency windows, allowing for higher-efficiency buildings and improved thermal comfort. The City of Chula Vista requires weatherization as part of their Building Energy Saving Ordinance (BESO) (City of Chula Vista

2024). In the event of a power outage, building occupants may not have access to heating or cooling, leaving the building envelope as the only barrier between extreme weather conditions and people. High-performing building envelopes improve passive survivability for occupants, maintaining a safer temperature and improving climate resilience.

Green Infrastructure. Recent efforts towards “Cooling for All” improves indoor resilience against heatwaves but increases risk of heat exposure outdoors, since cooling systems expel heat and exacerbate the urban heat island (UHI) effect (Salamanca et.al 2014). In fact, studies show that at nighttime, waste heat emitted from air conditioning systems can increase the air temperature by more than 1°C in urban areas (Salamanca et.al 2014). To mitigate the UHI effect, integration of green infrastructure into site development provides mutually reinforcing benefits for both decarbonization and climate resilience. Increased vegetation contributes to carbon sequestration, which offsets carbon emissions while also reducing energy demand by providing natural cooling. At the same time, green infrastructure reduces stormwater runoff, making communities more adaptable to extreme heat and heavy precipitation. Jurisdictions are incentivizing these practices through mechanisms such as stormwater fees based on the amount of pervious surface on the property. For example, the Boston Water and Sewer Commission (BWSC) introduced a stormwater charge that scales with a property’s pervious area. Revenue generated through this fee supports the city’s stormwater management best-practices fund, which finances the installation of permeable surfaces like green infrastructure across the city (BWSC 2024). This model motivates property owners to adopt green infrastructure and reinvests into expanding it.

Workforce Development

A decarbonized and climate resilient building stock requires a strong green workforce capable of carrying out necessary projects. Developing this workforce represents a major opportunity to invest in communities and strengthen local resilience. Nationally, the all-electric transition is projected to create an estimated 25 million jobs in the near term and an additional 5 million jobs in the longer term (Griffith and Calisch, 2020). Cities across the country are recognizing this opportunity, including Boulder, who has an opportunity to support workforce development with their Climate Tax (City of Boulder n.d.a).

To accelerate heat-pump adoption statewide, TECH Clean California invested in workforce development and committed 40% of its funding to equity-focused incentives, training, and grants. These investments prioritize contractors and customers in language-isolate, low-income, and otherwise disadvantage communities (TECH Clean California n.d.). Denver is also supporting workforce development through their Green Workforce Program. The program provides grants for paid green workforce development training programs. These programs include “wrap-around services” for participants, including transportation, interview, mental health, and clothing assistance (City of Denver, 2026d). Jurisdictions should collaborate with local organizations, unions, and community colleges to design and support training programs that prepare workers for clean-energy jobs. In addition, these training programs and jobs should be high quality, providing fair wages, benefits, and wrap-around services that help

workers succeed. Recruitment efforts should intentionally focus on under-resourced communities, including neighborhoods with high unemployment, to ensure equitable access.

Legal Constraints that Shape Policy Choices

When proposing new policies, it is essential to work within the legal constraints of the local and state context. Many climate policies, including BPS and tenant-protection measures, face legal challenges. For example, several states preempt local authority to regulate rent increases, limiting cities' ability to prevent pass-through costs to tenants. Likewise, federal statutes such as the EPCA constrain how local governments can regulate appliances.

Under EPCA, state and local authorities are prohibited from developing appliance standards that are more stringent than the Federal standards (U.S. Department of Energy 2025). This created legal risks for some decarbonization policies. In the case of the California Restaurant Association (CRA) v. City of Berkeley, plaintiffs argued that Berkeley's ban on natural-gas piping in new construction effectively prevented the use of EPCA-covered gas appliances, and therefore the BPS was not complying with EPCA. The court agreed, and the ordinance was repealed (Long et al., 2024). This case illustrates how local decarbonization policies can be vulnerable if they are interpreted as regulating appliances. However, jurisdictions such as Denver demonstrate how decarbonization policies can avoid EPCA conflicts while still advancing climate goals. Because Denver's BPS regulates whole-building performance, rather than specific appliances, it avoids triggering EPCA preemption (Carpenter-Gold 2024). Denver also strengthened the program's durability by providing multiple compliance pathways, adjusting timeline, reducing penalties, and expanding flexibility of HVAC replacements, steps that helped the policy withstand pushback from property owners (City of Denver, 2026b). These examples highlight the importance of designing decarbonization policies with legal defensibility in mind, particularly by ensuring jurisdictions offer varied compliance pathways and avoid appliance-specific mandates.

Another key legal barrier involves rent regulation. In several states, including Colorado, local jurisdictions are prohibited from controlling rent increase (Wenzler 2023). This creates challenges for tenant protection, as cities cannot directly prevent landlords from raising rents after upgrades. In states where rent stabilization ordinances are not allowed, jurisdictions should instead adopt voluntary agreements tied to incentive programs, such as requiring landlords who receive city funds to stabilize rent.

Reinforcing Policies

Redundancy across policy is a key strategy for effective decarbonization. Leading jurisdictions, including Denver, Boston, Chula Vista, and British Columbia, have implemented multiple policies that target the same outcome from different angles. Some mechanisms for implementation include financial incentives, technical assistance, equity guardrails, workforce development programs, and climate resilient policies.

No single mechanism can simultaneously protect the full ecosystem of barriers. For example, a BPS may create the regulatory requirement to cut emissions; however,

complementary weatherization requirements, financial incentives for under-resourced buildings, and restriction on rent-increase ensures more equitable and resilient implementation. When used in isolation, policy impact can be limited. Recognizing the value of strategic redundancy ultimately guided the development of the key strategies incorporated into Boulder’s Roadmap.

Findings II: Gaps in Building Typology

The policy review also revealed significant gaps in the decarbonization pathways available to several residential building typologies. This exclusion represents a missed opportunity, given that residential buildings account for 16% of Scope 1 and 15% of Scope 2 building sector greenhouse gas (GHG) emissions in the City of Boulder, see Figure 1 (Brannon, Lueker, and Swedberg 2025). In many jurisdictions, residential buildings, particularly single-family homes, multifamily homes, and manufactured housing, are not fully included in decarbonization policies, which often focus on the commercial sector. Decarbonizing residential buildings not only reduces a city’s building emissions but also provides health-related co-benefits such as improved air quality and enhanced comfort.

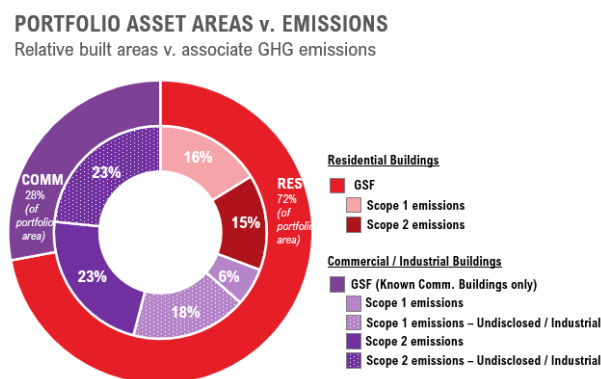


Figure 1: Proportion of emissions to building area in Boulder, Colorado (Brannon, Lueker, and Swedberg 2025).

Single-Family Housing. Single-family housing is often excluded from decarbonization policies because they are time-consuming and expensive to regulate. Most BPS and BPO do not include single-family homes. For example, single-family homes are currently not covered under BPO, which requires commercial, industrial, and multifamily buildings 5,000 square feet or larger to report their emissions (Mattrey n.d.). Some jurisdictions, however, have begun to integrate single-family homes into their decarbonization strategies by establishing time-of-sale requirements. A notable example is San Francisco’s Residential Energy Conservation Ordinance (RECO), part of the San Francisco Housing Code. RECO identifies the property sale as a legal trigger for required energy efficiency upgrades. When homeowners decide to sell their property, they are required to implement energy and water efficiency retrofits such as air-sealing, weather-stripping, and installation of low-flow fixtures. After implementation of these measures, the homeowner must prove compliance to receive permission to sell the house (San Francisco Building Code 2019). This approach allows jurisdictions to gradually improve the performance

of single-family homes over time.

Multifamily Rental Housing. Multifamily rental housing is also frequently excluded from decarbonization policies such as BPS, particularly smaller apartment buildings. Boulder is unique in that it requires energy-efficiency upgrades across all multifamily rental housing through their SmartRegs policy. Landlords must comply with the building performance requirements in SmartRegs to receive their rental license, which must be renewed every two years; without the license, landlords will face fines (City of Boulder n.d.c). However, for such programs to be effective, small landlords must have access to robust financial assistance and technical support to streamline compliance pathways. This need is amplified by the ongoing shifts in the US rental market. While individual owners once owned most rental properties, corporate landlords have owned the largest share since 2018 (Ferrer 2021). The consolidation of corporate multifamily building owners places additional pressure on small property owners, who may struggle to comply with decarbonization requirements. Jurisdictions are developing dedicated support programs for landlords alongside tenant-protection ordinances. The State of California offers financing assistance for energy efficiency upgrades for landlords through programs such as the federal WAP and TECH Clean program. California also requires landlords who receive WAP funding to refrain from rent raise for two years, protecting tenants from pass-through costs (Carpenter-Gold 2023). This paired approach protects renters while supporting small landlords in building decarbonization for multifamily housing.

Manufactured Housing. Manufactured housing is becoming an increasingly important affordable housing option in high-cost communities like Boulder. Currently, Boulder is home to five manufactured housing communities (MHCCs), totaling to over 1,000 units (City of Boulder 2024c). Despite their significance in the residential housing stock, manufactured housing is often excluded from decarbonization policies. For example, manufactured homes are not currently covered under Boulder's SmartRegs program (City of Boulder n.d.c). This exclusion is largely driven by the upfront costs of retrofit, though completing these upgrades could lower utility costs and improve indoor thermal comfort. Other jurisdictions are beginning to develop strategies that better support efficiency in manufactured housing by creating standardized, pre-approved housing plans. A useful example can be seen in California's approach to Accessory Dwelling Units (ADUs), which are like manufactured residential units located on the same lot as a single-family home. Many California cities, including Chula Vista and San Diego, have adopted pre-approved ADU plans that expedite permitting and construction by standardizing designs. In 2025, California Assembly Bill 1332 mandated that all cities and counties establish a program for pre-ADU plans to significantly shorten permitting times (California Legislative Information 2023). Because these new ADUs are designed to current energy codes, they achieve far higher efficiency than older units. Moreover, pre-approved plans can be designed to meet net-zero energy, ensuring that newly built manufacturing homes align with cities' decarbonization goals.

Application: Boulder's Decarbonization Roadmap

Boulder's Roadmap builds upon the findings of the Policy Review and identifies policies for implementation (City of Boulder 2025). Although tailored to Boulder, the strategies outlined below can be adapted and replicated by other cities based on their own local conditions.

1. **Implementation of a Building Performance Standard (BPS):** Boulder's existing Building Performance Ordinance (BPO) requires covered commercial buildings to benchmark and report energy and water use, conduct periodic energy audits, complete retro-commissioning every ten years, and perform one-time lighting upgrades (Mattrey n.d.). Boulder's Roadmap proposes expanding BPO coverage to include multifamily, mid-sized commercial, and industrial buildings. Boulder also plans to establish a new BPS in alignment with Colorado State's BPS.
2. **Update Energy Code for End-of-Useful Life (EUL) Replacements:** Boulder's 2024 Energy Conservation Code requires all-electric equipment in new construction and major renovations, but it currently does not require high-efficiency end-of-useful-life (EUL) upgrades (City of Boulder 2024c). Boulder's Roadmap proposes mandating EUL heat-pump replacements in the next code cycle, leveraging routine equipment turnover as a mechanism to electrify the existing building stock.
3. **Use of Time-of-Sale to Trigger Decarbonization:** To include single-family homes in the decarbonization process, Boulder's Roadmap commits to evaluating how a time-of-sale energy efficiency policy could be adapted locally. At a minimum, requiring energy audits and reporting at time-of-sale could motivate sellers to pursue energy-efficiency improvements.
4. **Implementation of a Zero-NO_x Standard:** Since Boulder does not currently have air-quality standards, Boulder's Roadmap identifies future consideration of zero-NO_x equipment standards.
5. **Support for Under-Resourced Buildings:** To support under-resourced buildings' ability to comply with decarbonization policies, Boulder's Roadmap plans to implement the following supports:
 - City-funded incentives for homeowners under 150% of the Area Median Income (AMI) and additional rebates for households below 100% AMI
 - Free resources for mobile homeowners
 - Additional resources for small businesses and equity-priority buildings
 - Technical assistance for homeowner associations (HOAs) to support building upgrades
6. **Enforcement of Tenant Protections:** To protect tenants from increased rent due to building upgrades, Boulder's Roadmap plans to implement Voluntary Agreements for landlords who utilize city-funds to upgrade their buildings. Landlords who use city-funds must stabilize their rent for a certain period.
7. **Creation of Workforce Development Programs:** To implement workforce development initiatives, Boulder's Roadmap plans to create regional partnerships to create workforce programs and expand the existing Boulder's Clean Energy Workforce program. Additionally,

they plan to provide wraparound services, such as transportation and childcare, to under-resource workers to reduce barriers to entry.

Discussion

This policy review offers a model that other jurisdictions can use to build decarbonization pathways that integrate equity, resilience, and workforce considerations. Unlike reviews focused on single goals, it assesses how policies intersect across multiple outcomes. The analysis shows that measures such as weatherization, financial assistance, tenant protections, and workforce programs can strengthen a Building Performance Standard (BPS) and make compliance more feasible for low- and moderate-income households and small landlords. These approaches also help prevent tenant displacement and expand local economic opportunities.

The study also identifies gaps across residential building types, particularly single-family, multifamily, and manufactured housing, which are often overlooked in decarbonization policy. Tools such as time-of-sale requirements and expanded technical and financial assistance can help address these gaps. These interventions must include equity guardrails to ensure policy benefits are distributed equally and do not exacerbate existing inequities.

The findings directly informed Boulder's Roadmap. Policies identified in the review, such as BPS, time-of-sale measures, and zero-NOx standards, were incorporated into the city's strategy. More residential building types were also included, and equity guardrails were applied through rent limits, supportive programs for building owners, and workforce services. Climate resilience was incorporated by reviewing decarbonization policies through a resilience lens to avoid negative trade-offs, while also identifying decarbonization solutions that support overall community resilience.

Limitations and Next Steps. Although the review informed Boulder's Roadmap, it does not evaluate the real-world effectiveness of the case studies examined. The case studies were selected based on recognized success in existing literature, but this study did not assess outcomes directly. Similarly, Boulder's strategies have not yet been implemented, so their impacts cannot be measured. Future work should focus on evaluating Boulder's policy implementation and tracking outcomes in the precedent jurisdictions. Additional research is also needed on policies that explicitly strengthen climate resilience, along with topics such as adaptive reuse and reducing household energy burden. These analyses will help refine decarbonization policies to support more resilient and equitable results.

Conclusion

This review shows that cities pursuing building decarbonization need integrated strategies that address equity and resilience alongside emissions reductions. By examining policies from more than 20 jurisdictions and applying them to a local case, the study offers a practical framework for translating precedents into actionable city policy. Effective decarbonization requires a combination of regulatory tools, such as BPS, updated codes, and appliance standards,

supported by equity measures like tenant protections, financial and technical assistance, as well as resilience co-benefits and strong workforce development. In Boulder, this approach helped shape the *Healthy Buildings, Stronger Communities Roadmap* to better align decarbonization with community needs (City of Boulder 2025). More broadly, the review illustrates how cities can reduce emissions while strengthening housing stability, climate preparedness, and economic opportunity. As climate impacts intensify, integrated and equity-focused policy frameworks will be essential for creating healthier and more resilient communities.

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AI Disclosure

This paper used Copilot to draft, edit, proofread, and research sources. The authors reviewed and verified all content, calculations, and citations.