

# BENEFICIAL ELECTRIFICATION IN COLORADO

*Market Barriers and  
Policy Recommendations*

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**FINAL REPORT**

*prepared for*

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<b>1 EXECUTIVE SUMMARY.....</b>	<b>1</b>
1.1 Overview .....	1
1.2 Findings and Recommendations .....	2
<b>2 INTRODUCTION .....</b>	<b>8</b>
2.1 Background and Colorado’s Policy Context.....	9
<b>3 STAKEHOLDER INTERVIEW RESULTS.....</b>	<b>12</b>
3.1 Colorado Marketplace Challenges to Beneficial Electrification .....	12
3.2 Policies in Other States .....	21
<b>4 CONCLUSIONS.....</b>	<b>26</b>

# 1 Executive Summary

## 1.1 OVERVIEW

This report summarizes the findings and recommendations GDS Associates, Inc. (GDS) for a beneficial electrification market barrier and policy analysis study commissioned by the Colorado Energy Office (CEO). This report is a companion to a beneficial electrification modeling report.<sup>1</sup> The modeling report estimated the potential for residential, commercial, and industrial building electrification from 2021-2030 to help Colorado meet its greenhouse gas emissions reduction goals. This market barriers and policy report presents additional information on the current market challenges to beneficial electrification in Colorado and presents recommendations for policy options to help overcome those barriers or other challenges to beneficial electrification, laying the foundation for achieving the potential over the next decade and beyond.

The key findings and recommendations that emerged from this study reflect the combination of two primary sources of data: in-depth interviews with a range of stakeholders in Colorado and literature reviews identifying the status of electrification policies in Colorado and other states. GDS wants to thank the interviewed stakeholders for their time and contribution to the research, which shed invaluable light on the many perspectives related to Colorado's electrification market and policies.

As a note to the reader – although beneficial electrification is a general term, it has a specific definition in Colorado statute, which was added in 2019 in Senate Bill 236.<sup>2</sup> The statute defines beneficial electrification as changing the “energy source powering an end use from a nonelectric source to an electric source, including transportation, water heating, space heating, or industrial processes, if the change:

- Reduces system costs for the utility's customers;
- Reduces net carbon dioxide emissions; or
- Provides for a more efficient utilization of grid resources.”

In other states, different terms are also used to convey the same core concept. When using the term “beneficial electrification” this report refers to the Colorado statute definition (described in the Introduction section). Other terms – electrification, strategic electrification, and energy optimization, are used to reflect a jurisdiction's perspective or otherwise used to convey the general concept of electrification in which energy-using technologies are converted from fossil fuels to electricity in a goal to reduce greenhouse gas emissions.

The following key findings and recommendations summarize the results of GDS' research into the current state of the market for beneficial electrification in Colorado and key policy recommendations for the State to consider.

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<sup>1</sup> GDS Associates, Inc. *Beneficial Electrification in Colorado, Market Potential 2021-2030*. Prepared for the Colorado Energy Office, June 2020.

<sup>2</sup> C.R.S. 40-3.2-106(6)(a), [https://leg.colorado.gov/sites/default/files/2019a\\_236\\_signed.pdf](https://leg.colorado.gov/sites/default/files/2019a_236_signed.pdf)

## 1.2 FINDINGS AND RECOMMENDATIONS

Below we summarize the key findings and recommendations that emerged from interviews with Colorado stakeholders and our literature reviews. The findings include a summary of market barriers which may impede beneficial electrification in the building sector and policy recommendations that the State of Colorado should consider implementing to overcome these barriers. The policy recommendations are intended to lay a foundation from which the beneficial electrification markets and programs can grow. As the market for beneficial electrification grows, new or evolving opportunities may warrant the development of additional policies and programs. We discuss these additional themes and policy considerations in Section 3, Interview Results.

### Market Barriers Summary

Throughout our stakeholder interviews, GDS found many common themes and observations regarding market barriers to beneficial electrification in Colorado buildings. Market barriers represent conditions in a marketplace that prevent or limit outcomes from what may be optimal or are otherwise reflected in policy goals. For beneficial electrification the barriers cover aspects related to current market conditions and behaviors that limit market development and growth. The market barriers are interrelated and create challenges for rapidly expanding beneficial electrification for residential and commercial buildings absent policy and programmatic support. Below we provide a short summary, with more detail provided for each in the body of the report.

#### **Market Barrier #1: Limited consumer awareness and demand**

Interviews revealed a view that Colorado's residential and commercial building owners are not familiar with heat pumps for space heating and water heating. The lack of awareness leads to low interest or demand for products. Additionally, poor experience with prior electric technologies or myths about heat pumps may also hinder demand. Finally, the high upfront cost of heat pumps and other electrification technologies compared to traditional gas or propane equipment can hinder demand regardless of the potential long-term financial and health benefits.

#### **Market Barrier #2: Limited product availability**

Heat pumps are not common in Colorado. Interview respondents repeatedly relayed challenges for consumers who seek to have heat pumps installed, only to learn at the time of purchase, interview respondents indicated that the available stock of heat pumps was limited or unavailable. The lack of readily available supply creates lost opportunities to grow the heat pump market, particularly when homeowners or businesses must make a quick decision when faced with the need to replace failing existing equipment.

#### **Market Barrier #3: Marketplace reluctance to promote or sell heat pumps**

Interview respondents reported that many HVAC or plumbing contractors actively discourage or simply do not sell heat pump technologies. This reluctance may be due to outdated perspectives on heat pump performance, a lack of expertise on how to design and install systems or concerns over installing and servicing unfamiliar technology. For new construction, home builders may be reluctant to consider all-electric options since consumers desire features such as gas ranges and gas log fireplaces.

#### **Market Barrier #4: Workforce limitations**

Several interview respondents raised the issue of contractor shortages for both skilled and unskilled workers in Colorado's HVAC and plumbing workforce. High turnover in the trades as well as the fact that the available workforce is focused on traditional fossil fuel space heating and water heating technologies

exacerbates this challenge. When combined with limited equipment supply and unfamiliar technologies, workforce limitations may also increase prices of electrification retrofits relative to what a more mature market would offer.

**Market Barrier #5: Uncertainty with the Regulatory Framework Related to Fuel Switching**

In our interviews, respondents regularly brought up a perception that utility promotion of fuel switching is prohibited or otherwise discouraged. One clear example is Colorado Public Utilities Commission (PUC) rule, 4 CCR 723-4-4756(b), which prohibits natural gas utilities from incorporating fuel switching away from natural gas in their energy efficiency programs. There is a perception that utilities regulated by the PUC cannot promote fuel switching and, by extension, beneficial electrification. However, our research did not identify any other specific limitations or prohibitions.

**Market Barrier #6: Energy Efficiency Program Focus and Messaging**

Colorado's investor-owned and other utilities have primarily focused energy efficiency messaging on "like for like" energy savings; the fuel switching messaging is uncommon. The success of energy-efficiency programs and messaging has been to reinforce traditional space heating and water heating technologies.

**Market Barrier #7: Some of the existing residential and commercial building stock may not be able to easily integrate heat pumps.**

Interview respondents noted that many of Colorado's buildings, particularly homes, may not have adequate electrical infrastructure (e.g. service panels or wiring) or may need duct work or other improvements to integrate heat pumps. In some cases, heat pump water heaters may be too large to install in the location of existing water heating equipment. Without adequate electricity infrastructure in a home or business or a need to address air distribution or other infrastructure limits, the additional complexities can increase installation costs or may require additional skillsets that are not typically required when addressing retrofits would otherwise use a system similar to the one already in place.

**Market Barrier #8: Electricity market price signals or programs at the wholesale or retail level may not adequately capture the potential value of heat pump technologies or other electrification technologies.**

Some of our interview respondents expressed that electricity markets in Colorado may not have pricing structures that capture or enable the value of beneficial electrification technologies. Many electrification technologies have the ability to enable load control, load shifting or otherwise adjusting use patterns in response to utility demand or price signals. Respondents noted that this can include long term wholesale contracts that may not value short-term shifts in demand (e.g. hourly or narrow peaks) as well as retail rates with demand charge structures that do not link to utility controllable loads.

**Market Barrier #9: Uncertainty in rules related to HB 19-1261<sup>3</sup>, a driver of statewide decarbonization efforts, creates risk for electric utilities to utilize beneficial electrification to meet greenhouse gas reduction goals.**

While HB 19-1261 set targets for reducing statewide greenhouse gas (GHG) emissions relative to a 2005 baseline, the rules for allocating baseline emissions to different portions of Colorado's economy are not settled. With beneficial electrification being a potential means of reducing economy-wide GHG emissions, electric utilities may be reluctant to promote beneficial electrification due to the risk that it would increase their emissions beyond what they would otherwise need to reduce relative to their share of the 2005 baseline. Even without utility-sponsored programs, beneficial electrification creates risk to electric utilities unless there is a mechanism to account for their emissions targets while crediting others with emissions

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<sup>3</sup> [https://leg.colorado.gov/sites/default/files/2019a\\_1261\\_signed.pdf](https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf)

reductions. Additionally, rules related to accounting and tracking emissions reduction that involve two parties (e.g. a gas utility and an electric utility) are needed to track compliance and allocate GHG emissions reductions. With rules in place, electric utilities or others can plan for and promote beneficial electrification as appropriate.

**Market Barrier #10: Electricity rate structures may not envision or allocate costs in a manner that reflects a high penetration of beneficial electrification technologies.**

Current electricity rate designs may not reflect the opportunities that beneficial electrification technologies can bring to utilities' or customers' load management or control options. Additionally, the structure and approach to demand charges may not reflect how heat pumps or other electrification technologies impact the utility system. For example, demand charges set without regard to time of use potentially penalize winter or nighttime energy demand. As a result, current electricity pricing may limit load management program opportunities and the ability of utilities or customers to fully capture the value that beneficial electrification technologies can bring, potentially inflating operating costs from what may otherwise be possible. Current rates and wholesale contracts may also not reflect the resource mix and penetration of electrification technologies in the future, limiting adoption in the present.

## **Policy Recommendations**

GDS developed the following policy recommendations based on interviews with stakeholders, research into other States' electrification policies, and current policies that affect electrification in Colorado. The policies reflect opportunities to not only overcome the market barriers, summarized above, but also to expand beneficial electrification and reduce Colorado's greenhouse gas emissions. These policies are presented as a general order of priority and selected to address near-term needs to expand the market for beneficial electrification in Colorado.

**Policy Recommendation #1: Either through legislation and subsequent rulemaking, or directly through rulemaking, the PUC should establish clear rules for regulated utilities to promote beneficial electrification.**

Beneficial electrification cannot become a substantial portion of electricity demand-side management programs without a clear regulatory framework. To the degree the PUC requires legislation to take action, the Legislature should build from SB 19-236 and HB 19-1261 and establish a foundation for the PUC to act. The existing legislative definition of beneficial electrification should be used as the cornerstone, with a clear framework for related to quantifying net greenhouse gas emissions impacts a key consideration. Additionally, the PUC should consider programmatic features that allow for program participation equity across ratepayers, including low- or moderate-income homeowners or renters, and hard to reach businesses.

**Policy Recommendation #2: Colorado should establish clear greenhouse gas emissions baselines and accounting practices to support rules associated with HB 19-1261 and incorporate beneficial electrification into those rules.**

Utilities will need a standard practice for quantifying greenhouse gas emissions reductions to track the long-term carbon reduction effects of electrification. The State should establish rules with simplified emissions reductions metrics for the myriad small electrification measures that may be installed via utility programs. For example, attempting to quantify each individual heat pump installation's impacts would be burdensome. These rules and metrics will enable electric utilities to plan and track their performance relative to their responsibilities under HB 19-1261. General principles and metrics will facilitate electrification and can be updated periodically based on electricity grid emissions factors or updates to



the impacts of electrification equipment. This process would be similar to how energy efficiency goals are tracked and credited today. Doing so will enable Colorado's electric utilities to plan for beneficial electrification, contribute to reductions in statewide greenhouse gas emissions, and equitably track the reductions in greenhouse gas emissions associated with beneficial electrification.

**Recommendation #3: The PUC should update cost-effectiveness calculation approaches used by utilities in their energy efficiency programs, integrated resource plans, and other decision making.**

The current formulation of the modified Total Resource Cost (mTRC) test was designed to support energy efficiency programs and follows standard industry practice. Even with utility integrated resource plans filed with the PUC incorporating a social cost of carbon, the formulation does not fully address beneficial electrification. Updating the role of non-energy benefits in the formulation of the costs and benefits will help address the trade-offs of shifting from fossil fuels to electricity. For example, health and safety considerations for fuel switching, such as improvements to indoor air quality, are not explicitly addressed in the current formulation. Factors to ensure that low- or moderate-income customers receive no-cost electrification measures should also ensure that program outcomes do not lead to increased operating costs for these customers. The PUC may want to consider whether the avoided costs used in the current formulation of the mTRC test reflect the avoided costs associated with reductions in greenhouse gas emissions. For natural gas, this might include the cost of alternatives to fossil fuel natural gas, such as renewable natural gas, as one component of the avoided natural gas cost. Finally, the PUC should consider the treatment of net savings for beneficial electrification and whether the current immature state of the market and future growth should receive a net to gross ratio of 1.0.

**Policy Recommendation #4: The State should coordinate with a broader set of stakeholders interested in advancing beneficial electrification.**

Coordination with utilities, advocates, market actors, and others will help drive consistency in how the many stakeholders in beneficial electrification work together to develop the market. Coordination can take many forms. One that may be needed in the near term includes establishing a long-term market tracking mechanism so that utilities and the State can monitor electrification progress across diverse utilities and industries. A second opportunity in the near-term is to support Colorado organizations seeking to address the market barriers above – there is risk of many small and disparate efforts not achieving a scale that will enable beneficial electrification to meet Colorado's greenhouse gas emissions reduction goals. These organizations could include trade associations, utilities, local governments, clean energy advocates, product manufacturers, distributors, developers, workforce representation, or organizations that bring them all together. Supporting existing organizations and coordinating efforts will help facilitate the sharing of lessons learned, reduce potential redundancy, and develop consistent messaging that will create a resilient network to promote beneficial electrification into the future.

**Policy Recommendation #5: The State of Colorado should develop workforce development initiatives focused on beneficial electrification.**

Colorado has a high demand and possible shortage of heating, ventilation, and air conditioning (HVAC) and plumbing industry workers. Beneficial electrification will require workers with new skill sets and an understanding of technology. Leveraging the existing workforce education infrastructure and trades, the State should ensure that electrification becomes a part of technical training apprenticeships, and professional licensure. The State should also support the integration of electrification and energy concepts into school curriculums and utility trade partnership programs. Training efforts to develop knowledge and skills for architects, engineers, builders, and associated trades are particularly important to promote beneficial electrification in the new construction market and to ensure quality design and installation practices and high efficiency electrified buildings.



**Policy Recommendation #6: The Colorado Energy Office (CEO) should promote advanced building energy codes and support local jurisdictions with crafting energy codes to address electrification readiness in new construction or otherwise.**

As a home-rule state, Colorado's local jurisdictions adopt building codes. While HB 19-1260<sup>4</sup> requires local jurisdictions to adopt one of the latest three editions of the International Energy Conservation Code (IECC) upon updating or adopting any other building code, those codes do not directly address electrification. Further, whereas some Colorado jurisdictions are leaders in adopting more advanced energy codes, many others need guidance and consistency in developing their own codes. The CEO can build from its current Energy Code Adoption Toolkit<sup>5</sup> to address building electrification opportunities, similar to the guidance provided for electric vehicle (EV) ready ordinances.

**Policy Recommendation #7: The State should prioritize electrification in its own buildings, leading by example and helping develop the marketplace.**

The State has considerable purchasing power and can demonstrate its leadership and help develop the marketplace by electrifying its own buildings. Incorporating beneficial electrification into its High-Performance Certification Program and updating purchasing policies to favor the appropriate installation of heat pumps or heat pump water heaters into its own buildings will create demand that can have effects into the broader marketplace. Influencing stocking practices at distributors and creating successful examples for others to learn from will help create awareness and experience in the marketplace. As a consideration, the State could incorporate the social cost of carbon into its own purchasing economic criteria.

**Recommendation #8: The Colorado Legislature should consider implementing legislation to develop beneficial electrification funds or goals for electric utilities and funding for State-sponsored programming. Electric utilities should participate at an equivalent level with programmatic expenditures used to facilitate program participation by low- and moderate-income households and small businesses.**

Beneficial electrification in buildings is unlikely to substantially increase its market share over the coming decade without considerable programmatic support. Other states have developed utility-sponsored programs to support the market with incentives, technical support, and related market development activities. In our research, the establishment of goals to support electrification predominated, with utility program funding emerging from the goals. In our interviews with utilities, concern over a system benefits charge primarily focused on issues of equivalency and consistency across the multiple utilities in Colorado. While investor-owned utilities may be able to develop programs via PUC rulemaking, unregulated utilities have no such mechanism. But even for regulated utilities, the lack of legislated goals leads to uncertainty and the possibility for inconsistency. Whether via goals or funding, a legislated system benefits charge ensures that all Colorado ratepayers contribute to and have access to beneficial electrification programs, while equivalent goals create consistency in outcome expectations. To ensure equity across the diversity of the residential and nonresidential customer base, a requirement that a percentage of funds be spent on low- or moderate-income and hard-to-reach small businesses will enable a broad range of program participation and avoid customers with particular demographic or firmographic challenges from being left behind. The legislature may want to consider a "ramp-in" to either funding or goals, with early expectations reflecting the reality that the current market requires preparation, with higher levels of

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<sup>4</sup> [https://leg.colorado.gov/sites/default/files/2019a\\_1260\\_signed.pdf](https://leg.colorado.gov/sites/default/files/2019a_1260_signed.pdf)

<sup>5</sup> <https://energyoffice.colorado.gov/climate-energy/energy-policy/building-energy-codes/energy-code-adoption-toolkit>

spending or goal expectations supporting a more robust market later in the decade. A system benefits charge or goal could be structured as a percent of retail revenue or sales, similar to Vermont. Vermont uses goals, with an increasing expectation for achievements over time, ramping from two percent of retail electricity sales in 2017 to 12 percent in 2032. Any goals or funding should also be treated as separate from energy efficiency programs in order to retain the value those programs offer.

In the next section we provide an introduction to this study and a background on Colorado's current policies that relate to beneficial electrification.

## 2 Introduction

This report presents the results of research into beneficial electrification market barriers and policy related to Colorado’s residential and commercial buildings. The purpose of the report is to present the key market barriers for Colorado that were identified through our research and policy recommendations that the State should consider implementing. The study builds from a market assessment in which GDS modeled the potential for and adoption impacts of beneficial electrification that could occur over the next decade (2021-2030). Both the modeling study and this report take into account legislation passed in 2019 and publicly announced utility plans that will result in a substantial reduction in greenhouse gas emissions in the electricity sector over the next ten years and beyond.<sup>6</sup>

To complete the study GDS relied on two major sources of information.

- 1) Interviews with Colorado representatives from investor-owned, municipal, and cooperative utilities, a power supplier, clean energy advocacy organizations, income-qualified energy efficiency service providers, an efficiency trade association, and sustainability staff from two cities
- 2) A literature review of current policies in states with the most advanced beneficial electrification policies and programs

In order to drive beneficial electrification in Colorado, GDS identified four major factors that interact to affect the market for beneficial electrification. As shown in Figure 2-1, Colorado will need to tackle the combination of market demand with workforce development, beneficial electrification policies, and programs.

**Figure 2-1 Interrelated Drivers of Beneficial Electrification**



<sup>6</sup> The modeling report developed a base case that assumed an 80 percent reduction in greenhouse gas emissions from electric utilities in 2030 from a 2005 baseline, and achieving a 100 percent emissions reduction in 2050, aligning with SB 19-236 and Xcel Energy’s carbon-reduction commitment.

The set of market barriers, program ideas, and policy recommendations presented in this report are meant to provide a set of issues and next steps for Colorado to consider in its development of the beneficial electrification market. There is no one solution, but a mix of solutions that will be necessary to meet the challenge. No single government or market actor action will resolve the challenges. Indeed, even for states with advanced electrification policies, those policies are evolving over time. Colorado can also expect its own markets and policies to evolve over the coming decade, too.

Below we present a summary of Colorado's recent legislative background and policy context for beneficial electrification. Discussions related to Colorado's marketplace for beneficial electrification are presented in our summary of interview results. Lastly, we provide summaries of beneficial electrification policies in four other states. The combination of interview results and policy research led to the development of the key market barriers and policy recommendations presented in the Executive Summary.

## 2.1 BACKGROUND AND COLORADO'S POLICY CONTEXT

Colorado is making substantial progress in decarbonizing its electricity sector. In 2019, Governor Polis signed landmark legislation (SB 19-236) to address avoiding the worst impacts of climate change.<sup>7</sup> This legislation mandated that electric utilities with over 500,000 customers reduce emissions by 80 percent of 2005 levels by 2030, with a target of providing customers with 100 percent clean energy by 2050. Additionally, the legislation codified the concept of beneficial electrification as electrification of an end-use if that electrification:

- Reduces system costs for the utility's customers;
- Reduces net carbon dioxide emissions; or
- Provides for a more efficient utilization of grid resources.

The legislation also directed the Colorado Public Utilities Commission (PUC) to apply a social cost of carbon (SCC) in the benefit-cost calculation of beneficial electrification programs and required public utilities to include SCC as a cost-effectiveness factor in electric resource planning.

As the state decarbonizes its electricity grid, Colorado has the opportunity to further reduce its carbon footprint by shifting other energy uses from fossil fuels to the cleaner grid. Quite simply, with a low-carbon electricity supply, converting end-uses of carbon emitting fuels to electricity provides a pathway for further carbon reductions. Beneficial electrification solves a major challenge of reducing the carbon footprint from the use of fossil fuels since it is difficult with current technologies to cost-effectively scale renewable forms of combustion fuels. Renewable natural gas and hydrogen could theoretically provide a renewable source of combustion fuels but are currently in a nascent market position or still in the research stage of development. Electricity, however, is widely available, has an existing distribution system, and in Colorado, is expected to substantially reduce its carbon footprint by 2030. Hence, electrification can offer a pathway to reducing the use of fossil fuels and their resulting carbon emissions.

Colorado has a complex energy landscape. A majority of its residents are served by two investor-owned utilities – Xcel Energy and Black Hills Energy, with each providing both electricity and natural gas service. Colorado also has a large land area served by 22 rural electric cooperatives that purchase electricity from wholesale power suppliers. There are also more than 25 public power utilities, some of which also provide

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<sup>7</sup> [https://leg.colorado.gov/sites/default/files/2019a\\_236\\_signed.pdf](https://leg.colorado.gov/sites/default/files/2019a_236_signed.pdf)

multiple commodity services including electricity, natural gas, or water. Only investor-owned utilities are regulated by the Colorado Public Utilities Commission. Across the patchwork of energy utilities, electricity and natural gas service territories do not consistently overlap, resulting in two utilities serving a single customer in many cases. Outside of utilities, propane marketers sell and deliver propane to consumers and businesses for space heating, water heating, and other end uses.

Against this backdrop, Colorado utilities have administered demand-side management programs for many years. While investor-owned utilities are mandated to provide these programs, both municipal and cooperative utilities offer programs to their customers. Further, Colorado utilities, and its homes and businesses have made substantial investments in renewable energy, doubling net renewable energy generation to 25 percent between 2010 and 2019.<sup>8</sup> Much more is expected over the next ten years and beyond. The combination of utility- and customer-owned renewable generation and Colorado's experience in delivering energy efficiency services provides a strong foundation for beneficial electrification.

In addition to SB 19-236, Colorado has two recent legislative drivers that influence rules and other policies that can affect beneficial electrification. House Bill 19-1261, signed in May of 2019, commits Colorado to achieve a 50 percent reduction in statewide greenhouse gas pollution by 2030 and 90 percent reduction by 2050, relative to a 2005 baseline.<sup>9</sup> The rules for implementing this economy-wide goal are under development. Unlike SB-19-236 and the mandate for utilities with over 500,000 customers to reduce carbon emission by 80 percent by 2030, this legislation covers all utilities whether regulated by the PUC or not and irrespective of size or energy supply services.

In 2019, Colorado also strengthened its building energy code requirements for local jurisdictions. While local governments still retain jurisdiction over how and when to adopt building codes, HB 19-1260 requires that local jurisdictions adopt one of the three most recent versions of the International Energy Conservation Code (IECC) published by the International Code Council when they make any other building code changes.<sup>10</sup> Local jurisdictions can amend or strengthen the selected IECC code version so long as it does not reduce the energy efficiency outcomes of the code. Additionally, for State funded or owned buildings using 25 percent or more of State funds, the buildings must conform to the State's High-Performance Certification Program.<sup>11</sup> This program also requires that for such buildings undergoing renovations exceeding 25 percent of the building's value, the building must achieve the highest possible Leadership in Energy and Environmental Design (LEED) certification.

Current PUC rules may limit the ability for investor-owned utilities to promote fuel switching, and therefore beneficial electrification, within their energy efficiency and other demand side management programs. In our interviews with utilities and other stakeholders, GDS regularly heard about a "prohibition to fuel switching." These programs impact both natural gas and electricity consumption, but our interviews indicated limited fuel switching measures being offered. Rule 4 CCR 723-4-4756(b) prohibits natural gas utilities regulated by the PUC from promoting fuel switching to other fossil fuel derived energy sources as part of demand side energy programs. Interview respondents were unaware of any other rule, settlement, or regulatory barrier to fuel switching. This uncertainty regarding investor-owned utility prohibitions against fuel switching is an area for regulatory clarification or for new rules to ensure that

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<sup>8</sup> <https://www.eia.gov/state/?sid=CO>

<sup>9</sup> [https://leg.colorado.gov/sites/default/files/2019a\\_1261\\_signed.pdf](https://leg.colorado.gov/sites/default/files/2019a_1261_signed.pdf)

<sup>10</sup> <https://energyoffice.colorado.gov/climate-energy/energy-policy/building-energy-codes>

<sup>11</sup> <https://www.energycodes.gov/adoption/states/colorado>

beneficial electrification can be promoted in demand-side management programs. No such limitation exists for cooperative or municipal utilities, which are not regulated by the PUC.

Notwithstanding Rule 4 CCR 723-4-4756(b), these major energy laws, regulations, and policies serve as the foundation that can drive beneficial electrification in Colorado.

In the next section of the report we present the results of interviews with Colorado stakeholders regarding beneficial electrification, the state of the market, and barriers to electrification, as well as policy and programmatic actions that the State should consider supporting.

## 3 Stakeholder Interview Results

To understand Colorado’s market barriers to beneficial electrification and gain perspectives on possible policy solutions or future program considerations, GDS interviewed stakeholders from March through May of 2020. These stakeholders came from a wide range of backgrounds and professions, totaling 24 individuals representing their organizations or as representatives of associations. The range of perspectives included:

- Clean energy advocates
- Colorado cities
- Investor-owned utilities
- Cooperative utilities
- Municipal utilities
- Trade associations
- Low-income energy service providers

All respondents had experience with beneficial electrification bringing experience and perspectives ranging from market or program engagement, utilities and policy. The focus of the discussions was on beneficial electrification related to residential and commercial buildings and the challenges or opportunities to drive greenhouse gas emissions reductions via beneficial electrification. The following interview summaries combine the results, retain anonymity for respondents, and are organized by major topic area. Starting with marketplace challenges, the results move to utility considerations, with policy and program considerations included throughout.

### 3.1 COLORADO MARKETPLACE CHALLENGES TO BENEFICIAL ELECTRIFICATION

A major topic for the interviews was to explore how respondents viewed the current Colorado marketplace for beneficial electrification and challenges for expansion. GDS identified several universal themes, plus a few other commonly mentioned topics. We discuss each below.

#### 3.1.1 Limited Consumer Awareness and Demand

Every interview resulted in discussion around the current state of Colorado’s residential and commercial consumers and their perceptions or awareness of beneficial electrification technology or concepts. Respondents indicated that there is a very low market penetration and awareness of beneficial electrification technologies for buildings –particularly heat pumps, heat pump water heaters, and induction cooktops. While most respondents indicated that *some* electrification was happening in residential and commercial buildings, demand was tepid.

One interview respondent noted that building electrification technologies suffer from an issue similar to electric vehicles – customers do not have a sense of how much energy a product may use and cannot easily convert from more familiar fossil-fuel ratings (e.g. miles per gallon) to make a comparison of what an electrified technology would consume. The absence of an intuitive understanding or at least familiarity with modern beneficial electrification technology is a substantial market barrier to overcome.



Our interview respondents noted that most people simply do not know about the available technology and associated benefits. Additionally, market messages from the past may dampen enthusiasm. For example, our respondents made the following general comments:

- People may think of heat pumps as only working in warmer climates; they are unaware of modern cold-climate technology
- Gas cooking is popular and viewed as superior to traditional electric stoves, with induction cooktops being associated with stoves using electric resistance technology, rather than as a distinct cooking experience
- Consumers may not be aware of the negative health impacts gas cooking can have on their indoor air quality

Perhaps the largest barrier identified by respondents related to consumer habits. Quite simply, people will tend to stick with what they are familiar with, particularly if there is no additional social attribute to drive value. Respondents indicated that space heating and water heating equipment is often not at the top of people's minds. When equipment breaks down, they certainly become aware. However, furnaces, heat pumps, and water heaters otherwise tend to be ignored.

Additionally, the initial cost of equipment is a major barrier. Heat pumps and heat pump water heaters are expensive items for a household or business. Moreover, the availability of capital to invest in a new technology can be an impediment to consumer demand. In general, it will be cheaper to replace a natural gas furnace with another furnace rather than install a heat pump. Household budgets, particularly for low- and moderate-income consumers may not allow for purchasing a heat pump, even if the operating costs of the system decrease. While upfront cost is a traditional barrier to energy efficiency, it may be magnified for beneficial electrification due to consumer or contractor uncertainty regarding operating costs or performance.

As a specific challenge, all our respondents touched on the market for new construction, particularly for new homes. While some noted that there are builders expressing interest in "all-electric" construction, most were viewed as preferring to focus on traditional fossil fuel space heating, water heating, and cooking. Even for buildings willing to install heat pumps for space heating and water heating, the perceived desirability of natural gas for cooking can overcome cost considerations for extending gas service to new homes. Interview respondents viewed the new construction market as being cautious.

Finally, current and historical market messages may work against driving consumer interest and demand. Respondents spoke of a reluctance by contractors to offer beneficial electrification technologies, or to actively recommend against them. Explored further below, contractors are a key delivery channel for space heating and water heating technologies. Without endorsement by contractors and supported by other positive messaging, homes and businesses may be reluctant to make a change. The view was that, without obvious demand by homebuyers or a desire to differentiate their homes, builders would be cautious about adopting electrification technologies.

Respondents indicated that any future programs will need to develop broad public awareness campaigns with consistent messaging regarding the benefits of beneficial electrification technologies in order to build familiarity and to overcome consumer reluctance. Additionally, programs will likely need to provide significant incentives and/or financing to overcome limitations to -capital availability. Overcoming electrification reluctance by builders was viewed as a crucial program element in avoiding the need for future electrification retrofits and capturing the benefits of designing a home for beneficial electrification from the start.

### 3.1.2 Marketplace Barriers

Interview respondents spoke to the current marketplace for beneficial electrification technologies, noting several key barriers related to the available supply of equipment or contractor practices.

Space conditioning (heating or cooling) and water heating equipment are usually installed by contractors. These contractors typically get their products from distributors, who keep stock on-hand, ready for contractors to make sales. The distributors purchase equipment from manufacturers. For space heating and water heating, this supply chain is crucial to delivering beneficial electrification technologies for Colorado's residential and commercial buildings. Indeed, the most successful energy efficiency programs leverage this supply chain to achieve savings. The key to the supply chain is to ensure that product is available when a consumer is ready to purchase it.

Nearly all our respondents touched on concerns that beneficial electrification technologies may be poorly stocked or stocked with less desirable equipment. Distributors will stock the volume and type of equipment they think will sell. With Colorado's market dominated by natural gas and propane consuming furnaces and water heaters, electrification technologies have limited available shelf-space.

Further compounding the challenge is the nature of purchase decisions. Typically, one will replace a water heater or furnace when it fails. While some consumers will plan ahead and anticipate replacements, "replace on failure" opportunities require quick action to ensure a home is kept warm or cool, and hot water is available. Energy efficiency programs can drive some early replacement sales if energy savings or other value propositions are significant enough to warrant changes. However, equipment must be available at the time a consumer is ready to make a purchase. Even for a consumer ready to install a heat pump or water heater, absent the right equipment being available, the consumer will make an alternative purchase and create a lost opportunity for beneficial electrification. A cycle emerges in which the lack of equipment leads to a lack of sales which leads to a lack of perceived demand which returns to a lack of equipment.

Our respondents also commonly referenced concerns about how contractors may be reluctant to promote or install heat pumps for space conditioning or water heating. Several common themes emerged:

- Contractors may be faced with an unfamiliar technology and be reluctant to learn or risk customer satisfaction. Their lack of confidence leads to a lack of promotion or direct discouragement of beneficial electrification technologies
- Contractors are comfortable with selling and installing fossil fuel technologies and have a natural tendency to take a simpler sales pathway compared to the risk of losing a sale by promoting a different technology that a competitor may not
- Prices may be inflated for heat pump technology due to the lack of familiarity and need to manage risk in the event the installed equipment fails to perform. Higher than necessary prices may also drive their customers to favor less expensive fossil fuel technology.
- Retrofitting a heat pump into a home or business may add complexity and time to a job or require a skill set their firm does not possess or practice. For example, adding a wire run to serve a heat pump with electricity adds time, cost, specific skills, and complexity to a job that can be easily resolved with a fossil fuel system, simply replacing what was already installed.

These issues are all very natural marketplace behaviors but combine to create a supply chain for building owners interested in beneficial electrification technologies that limits the ability for Colorado to scale up

the market without programmatic assistance. Challenges related to contractors are also explored in the next topic related to Colorado's workforce.

### 3.1.3 Workforce Challenges

In every interview we conducted, respondents raised the issue of workforce challenges. These challenges were described in two primary forms:

- a high demand and short supply of HVAC, plumbing, and other associated trades across Colorado's economy, and
- a shortage of workers skilled in heat pump and other beneficial electrification technology installation

These two workforce challenges describe a bottleneck in the supply chain for beneficial electrification, though also for any market relying on workers in the building trades. Respondents described a tight marketplace for labor, with contracting firms competing to attract talent. The effect of this limited labor pool is to drive up the cost of having equipment installed (beneficial electrification or otherwise). It also has the effect of limiting the ability for contractors to develop new product lines and services, including beneficial electrification.

In addition to a tight labor market, our respondents indicated that the skill and knowledge base within the existing labor market directly limits the ability to ramp-up beneficial electrification market share. Quite simply, there is a gap in Colorado's workforce when it comes to awareness, knowledge, and skills associated with specifying, selling, installing, and servicing heat pumps and other beneficial electrification technologies. The effect is that firms that may consider offering beneficial electrification cannot do so or must take on risk with selling and installing equipment their labor force is unfamiliar with.

Our respondents indicated that this issue is an essential concern and should be a part of any program or set of programs. Existing energy efficiency programs have worked with the trades and may be a channel to promote awareness, training, and best practices to build the workforce. However, some respondents indicated that a much broader effort is needed, incorporating Colorado's technical schools, education policies, and approach to developing the next generation of Colorado's HVAC, plumbing, construction, and related industries' workforce.

### 3.1.4 Past Energy Efficiency Program Messaging

Colorado has a history of strong utility energy efficiency programs. Investor-owned utilities, cooperative utilities, and municipal utilities have offered energy efficiency programs for many years. These programs have worked with customers and supply chains to develop products, services, and marketing to promote energy savings. Many of our interview respondents indicated that the messages coming from these programs was positive but may have created a general concern over fuel switching or electrification.

A primary example relates to heating fuels. As noted above, gas utilities regulated by the PUC are prohibited from promoting fuel switching away from natural gas. Historically, electrification options were not viewed as desirable due to cost and performance compared to natural gas. Cold-climate heat pumps and heat pump water heaters are relatively new technologies compared to the options for energy efficiency. Our respondents indicated that the traditional messages related to heat pumps or other electrical heating have created an understanding within the marketplace that using electricity for space heating or water heating is less desirable than high efficiency fossil fuel equipment.

The messaging to customers, contractors, and others in the marketplace have shaped perceptions of electrification equipment. Additionally, incentives for programs have generally been structured as a “like for like” option, with fuel switching not being incentivized. For some technologies, incentives are available, but based on the assumption that a customer was already going to use electrical technology, potentially limiting the incentive by only incentivizing the incremental difference to a more efficient technology.

Our interview respondents all spoke of a need to shift messaging. One challenge is balancing the need to promote efficiency messaging while adding the beneficial electrification message. Effectively communicating the concept of beneficial electrification will add a level of complexity to consumer and trade ally communications. Additionally, some respondents expressed apprehension over how aggressively beneficial electrification should be promoted due to uncertainty regarding customer economics or possible experiences in an immature market.

While some of our utility respondents indicated offering incentives for electrification technologies and promoting them to customers, all indicated limited uptake. Utilities and other respondents spoke of a need to develop consistent messaging related to beneficial electrification, suggesting a need to coordinate across utilities and markets to avoid creating confusion.

### 3.1.5 Uncertainty Related to Electrification in Regulations

During the interviews, two areas of regulatory uncertainty emerged. These areas are:

- Prohibitions against fuel switching for investor-owned utilities
- Uncertainty regarding appropriate funding levels
- Uncertainty regarding the treatment of beneficial electrification in response to HB 19-1261.

These points of uncertainty have an important market barrier component. Utility demand-side management programs are a part of the marketplace. Absent certainty, energy efficiency programs may continue, but beneficial electrification programs may be limited.

As part of the interviews, GDS requested information related to prohibitions to fuel switching in legislation or rules. Municipal utilities and cooperative utilities indicated no legislative or regulatory hurdles to promoting fuel switching or beneficial electrification. Indeed, some of these utilities actively promoted heat pumps and other electrification technologies. For investor-owned utilities, Rule 4 CCR 723-4-4756(b) prohibits a natural gas utility from claiming savings in its demand-side management programs by having customers switch from natural gas to another energy source. However, there was a collective view that promoting fuel switching was generally prohibited for investor-owned utilities, a view shared by multiple interview respondents, including non-utility representative respondents. When asked to provide the rules, settlements, legislation, or other descriptions of fuel switching prohibition, only Rule 4 CCR 723-4-4756(b) was provided.

Regardless of the details related to fuel switching prohibitions, there appears to be a general view that investor-owned utilities may not be able to promote beneficial electrification within their demand-side management programs. Utility energy efficiency programs are an important element in markets for building HVAC and plumbing services and technologies, as well as helping shape the market for new building construction. Our respondents indicated that the PUC should clarify the status of fuel switching or beneficial electrification. Absent the PUC having the authority to do so (a point of uncertainty), respondents suggested that the Colorado legislature should establish the clarity or explicitly authorize the PUC to do so.

A second issue associated with regulatory uncertainty ties to potential program funding levels or goals. Whether a utility is regulated by the PUC or not, beneficial electrification programs will require adequate funding to grow the market and capture the benefits that beneficial electrification can bring. Our interview respondents all made this general observation but offered different perspectives on the issues associated with program funding. These perspectives included:

- A need to develop financing or rebate-style programs to overcome capital availability limitations by customers or to address other market barriers
- The need to ensure that income-limited households and small businesses can participate
- An interest to consider equity *among utilities* to ensure comparative funding levels (e.g. percent of retail revenue) such that all Colorado ratepayers can participate and would experience similar rate effects of funding
- Considerations for an electric utility's natural market incentive to increase electricity sales, suggesting a difference from current energy efficiency programs which create a reduction in revenue
- The ability to link energy efficiency to beneficial electrification efforts in order to continue progress with energy efficiency and leverage it for beneficial electrification, as appropriate, with beneficial electrification operating as a parallel effort to energy efficiency

The lack of certainty regarding funding levels or goals that drive funding limits the electric utility market's ability to move forward in a consistent and assertive manner. Some of our interview respondents suggested this uncertainty could be addressed through establishing statewide funding or goals, while others indicated it could be addressed in the regulatory context of HB 19-1261.

A third area of regulatory uncertainty stems from yet unsettled rules related to HB 19-1261, which developed statewide targets for greenhouse gas emissions reductions, seeking a 50 percent reduction in 2030 from 2005 levels. All our electric utility respondents indicated that without rules addressing electrification, they faced risks that beneficial electrification could create a penalty due to increased emissions driven by increased electricity consumption. While electrification may reduce emissions associated with fossil fuels, there was no mechanism or accounting system to "hold harmless" an electric utility whose emissions would otherwise increase even though net greenhouse gas emissions would decrease.

HB 19-1261 requires the Colorado Air Quality Control Commission (AQCC) to promulgate rules to achieve the reductions targeted in the law.<sup>12</sup> Our respondents suggested a need for the rules to allow for crediting electric utilities with emissions reductions achieved through beneficial electrification or at least be held harmless as more fossil fuel consumption shifts to electricity sources. While Colorado's electric utilities are on a path to substantially reduce carbon emissions, increasing loads through electrification has the potential to increase their own emissions. Despite a net emissions reduction within Colorado as a whole, without an emissions crediting or accounting system, an electric utility and its ratepayers will need to make additional investments due to the choices of others and risk not meeting its GHG emissions targets.

In discussing how these rules might address the challenge that beneficial electrification poses to electric utilities under HB 19-1261, several key recommendations emerged:

- A need for a standardized and simple accounting system to address emissions impacts associated with beneficial electrification measures. Beneficial electrification will result in hundreds of

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<sup>12</sup> <https://www.denverlawreview.org/dlr-online-article/implementation-of-hb-1261>

thousands of small purchases. An efficient accounting system that credits the energy and emissions impacts similar to how energy efficiency programs claim savings will be needed. Respondents viewed it as essential to avoid measure or premise-level accounting for these small transactions.

- Electric utilities will need to know their specific emissions reduction targets from the 2005 baseline in order to take action and track progress to meeting targets.
- The AQCC HB 19-1261 rules should be incorporated into utility integrated resource plans, along with the expected changes in energy loads associated with beneficial electrification.

### **3.1.6 Many Buildings May Not Be Able to Easily Integrate Electrification Technologies**

Nearly all our interview respondents indicated that many residential and commercial buildings may have challenges integrating heat pumps and other beneficial electrification technologies. The primary concern related to having an adequately sized electric service panel within the building. This affects both existing buildings and new buildings. In many cases, homes or businesses may need to upgrade electric infrastructure to accommodate the additional electricity demand, adding cost and complexity to potential electrification projects. For new construction, this issue was linked to current building codes and the creation of lost opportunities that could exist for decades to come.

For existing buildings, the state of whole-building energy efficiency was viewed as a challenge. Poorly insulated buildings or buildings with high rates of air leakage mean that heat pumps will need to be larger than otherwise needed, adding cost to the project. Additionally, buildings with inefficient shells may create peak conditions that could lead to suboptimal customer experiences – at very cold temperatures even cold-climate heat pumps may have a challenge responding to rapid swings in the demand for heat. Respondents linked this issue to the ongoing need for energy efficiency programs to help improve whole-building performance. Effectively, a well-designed building or one that has had its shell improved will be better able to integrate a heat pump for space heating while also minimizing the additional electric load on the building.

Respondents that touched on challenges for larger buildings indicated that in some cases heat pumps were very difficult to integrate. For example, buildings designed with large centralized heating systems would require large centralized heat pumps, an expensive and non-typical retrofit option. Others mentioned that water heaters designed for small utility closets may only be able to use electric resistance technology due to space constraints hindering heat pump water heaters. While certainly not a universal issue, the respondents pointed out that in some cases and with current technology and building designs, overcoming technical challenges could be technically accomplished, but only at substantial cost. In cases faced with such a challenge, early adoption of beneficial electrification may not be realistic.

Solutions suggested by the respondents included a mix of possible program options:

- 1) Using advanced building codes to promote building designs that improve the performance of or ease the integration of beneficial electrification technologies,
- 2) Promoting whole building energy efficiency and “electrification ready” designs and upgrades. Respondents indicated a possible mix of utility demand-side management programs as well as financing programs through on-bill financing or property assessed clean energy (PACE) style financing
- 3) Leveraging local programs to incentivize electrified or electric-ready building designs.



### 3.1.7 Electricity Contracts and Rate Designs Do Not Capture Electrification Opportunities

Interview respondents familiar with electricity utility wholesale contracts and customer rate designs indicated that current approaches did not always align with widespread beneficial electrification. Respondents identified a need to develop new approaches or considerations in wholesale contracts and retail rates to optimize the marketplace for beneficial electrification.

The specific issues and concerns varied across respondents. The collective set of concerns point a need for a review of Colorado's electricity markets and how wholesale contracts and retail rates may need to evolve to reflect the changes beneficial electrification may bring. These changes include when and how utility or customer peak loads occur, the structure of demand charges, or the value of having controllable electric loads. The issues overlap and create risks or uncertainty for electric customers and limit utility tariff benefits. The challenges and opportunities include:

- Utilities with low thresholds for triggering demand charge tariffs create a risk for substantially higher electricity bills if customers electrify their loads. This is primarily a risk for smaller commercial customers whose peak winter loads could increase through the use of heat pumps for space heating.
- Setting demand-ratchet tariffs based on 15-minute intervals creates a risk that a single 15-minute period of high demand can increase costs for a month or year. Transient start-up loads may also trigger a higher demand charge than if demand charges were set over a longer time period. Ideally these would align with solar and storage time periods to facilitate customer optimization across several clean energy technologies.
- A lack of critical peak pricing spreads out the peak-demand window for time-of-use rates and reduces the value of short-term load management options available to customers or utilities.
- Long-term bi-lateral wholesale contracts may not have adequate pricing variability or time sensitivity to facilitate load management programs. The wholesale price signal may not be adequate to justify robust and comprehensive load management programs that would help mitigate peak load management.
- A lack of "all electric" rate categories and load management programs reduce the value proposition for customers to consider all-electric buildings and provide their beneficial electrification technologies as a load management asset.

In general, respondents who discussed wholesale contracts and rates indicated that the current electricity marketplace was not adequately capturing the value that electrification technologies could offer, thereby creating risk to those customers who do electrify and dampening demand by reducing the possible benefits of those who might consider electrifying or promoting electrification.

### 3.1.8 Low- and Moderate-Income Households May Not Be Able to Participate in the Beneficial Electrification Market

All interviews touched on the subject of low- and moderate-income Colorado residents, with many touching on challenges serving rural residences. To varying degrees, they raised concerns about the ability of these households to capture benefits associated with beneficial electrification. Further, respondents were concerned that over time, low- and moderate-income households may end up burdened with covering a disproportionate share of stranded costs for a natural gas system that others have exited. While



stranded costs are a long-term issue, the more pressing concern relates to enabling customers with limited incomes to participate in the market. For propane customers, the economic benefits can be substantial, reducing customers' energy burden. However, without access to capital or programs providing substantial cost coverage, many respondents felt that these households would be unable to afford the up-front costs. This issue may also extend to hard-to-reach small businesses.

Under the assumption that ratepayers from electric utilities would fund a beneficial electrification program, our respondents felt that households with limited income should be able to participate as a simple point of equity. Two respondents intimately familiar with low-income energy efficiency programs also pointed out challenges to watch if programs supporting customers emerges. First, energy efficiency technologies should ensure lower operating costs for a household – this may require a careful consideration of total energy cost savings, including air-conditioning and overall efficiency than may be considered now in programs focused on only energy efficiency. However, for homes without air conditioning the savings that modern heat pumps can bring to the total project economics are unavailable. In our modeling report, air-conditioner efficiency improvements were an important part of making a measure cost effective. Additionally, the limited funds available to each household from Colorado's Weatherization Assistance Program (WAP) may not be able to cover the full range of electrical system, building shell upgrades *and* heat pumps or water heating systems. Carefully balancing available utility funding with WAP funding can optimize opportunities for low-income households but may require an expansion in available funding. On-bill financing, which leverages utility capital, may be another option for improving access to energy efficiency and beneficial electrification for any household, but especially those with a limited income.

Second, there was a view that the program infrastructure and staff may not be well versed and familiar with the details of installing a heat pump or making a home "electrification ready." Some respondents felt it might be better to focus on building shell improvements and incrementally work toward getting homes ready for electrification as a programmatic stepping-stone, though some service providers are well versed in the technologies and challenges, and have completed installations of heat pumps in low-income households in the recent past.

All respondents indicated the need to not leave limited-income households or hard-to-reach small businesses behind as beneficial electrification moves forward. Most suggested that current income-qualified energy efficiency programs could be leveraged to include beneficial electrification. However, the issues of electrification will require new creativity in program designs, coordination across funding and delivery services, and care to not increase energy burdens on low-income households over what energy efficiency alone would provide.

In the case of rural residents, particularly limited-income rural residents, respondents expressed concerns that the market barriers to beneficial electrification were magnified, other than perhaps for customers who could reap the cost savings associated with electrifying propane end uses. Programs should work to ensure broad coverage of households (and businesses) in rural areas of Colorado.

In the next section of this report we discuss policy solutions that other states have pursued in supporting electrification efforts as a means to mitigate climate change.

## 3.2 POLICIES IN OTHER STATES

GDS investigated electrification policies in several states that have taken a lead on promoting electrification. California, Vermont, Massachusetts, and New York have each crafted policy directions to help move their energy markets forward to utilize electrification as a means of reducing future greenhouse gas emissions. Each state is unique in its marketplace, history, approach to regulations, and the policy options. Together they provide useful frameworks and examples of opportunities for Colorado to consider.

One theme that GDS identified across several of the states is coordination between state and local governments, utilities, demand-side management programs, and market actors. In particular, coordination appears to play a key role in shifting utility programs from focusing largely on the efficient use of energy to one that considers the overall use efficiency and carbon impact across energy sources. In some cases the coordination extends to linking state-enacted building codes with a larger effort to increase efficiency and drive electrification. Additionally, in California and New York, state facilities are being viewed as an important component to drive markets and emissions reductions.

Below we summarize electrification-related policies from each of the four states to serve as possible examples for Colorado to consider. GDS used the policy experiences of these states to inform our recommendations for Colorado.

### 3.2.1 California

California has long been a leader in clean energy development, including renewable energy, energy efficiency, and fuel economy standards. 2018 legislation requires that 60 percent of California's electricity be generated from clean energy sources by 2030 and 100 percent by 2045 (SB 100).<sup>13</sup> The California Energy Commission is tasked with assessing how the State's facilities can reduce carbon emissions by 40 percent from 1990 levels by 2030. Fuel substitution rules have recently been updated to reflect the benefits that electrification can have for ratepayers and to reduce carbon emissions.

Fuel substitution – the substitution of either electricity for natural gas or natural gas for electricity (regulated fuels) has been allowed as part of California's utility energy efficiency programs. In 2019, the California Public Utilities Commission (CPUC) updated its three-pronged test in response to petitioner concerns that the rule in place at the time did not address changes in the electricity production fuel mix or broader greenhouse gas emissions, as well as needing clarity in terms of application of the rule.<sup>14</sup> The rule was updated to address many of the petitioners' concerns and provides a framework for regulated fuel substitutions. The three-pronged test was modified to:

- No longer require that fuel substitution measures pass cost-effectiveness at the measure level, with cost-effectiveness reflected in a program administrator's overall energy efficiency portfolio
- A net-to-gross ratio of 1.0 is assumed until a net-to-gross evaluation is conducted, thereafter applying the net-to-gross ratio within the overall energy efficiency portfolio
- Require that for utility programs driving fuel substitution, the ratepayers of the fuel being substituted to (e.g. electricity in the case of beneficial electrification) fund the fuel substitution. The ratepayers funding the fuel substitution then have the energy savings accrue to them. The original fuel's energy savings goals are then reduced by the amount of fuel savings

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<sup>13</sup> <https://www.sacbee.com/news/politics-government/capitol-alert/article218128485.html>

<sup>14</sup> <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M310/K053/310053527.PDF>

- Clarified that the baseline condition of the measure would follow the same logic as used for the original fuel's baseline – that could be a code baseline, industry standard practice, or existing conditions.

The approach taken in California helps to clarify rules associated with utility-funded electrification efforts for natural gas fuel substitution by electricity consuming measures. It clearly indicates that an electric utility and its ratepayers pay for the fuel substitution, but also gain the benefits, establishes standard baseline and net-to-gross practices, and indicates how fuel substitution fits within the cost-effectiveness framework. The fuel substitution rule has additional provisions that were retained. These include:

- The program must not increase source-BTU consumption<sup>15</sup> (the California Energy Commission establishes the heat rates used for this comparison)
- The program must not adversely impact the environment, with the rule referencing residual emissions factors established in the avoided cost rule.

The fuel substitution rule did not directly address fuel switching from non-regulated fuels (e.g. propane or fuel oil), but referenced a separate proceeding related to building decarbonization (R. 19-01-011).<sup>16</sup> As of this report, the proceedings are still underway but have led to a proposal of several building decarbonization pilot programs.

### 3.2.2 Vermont

In 2015, Vermont enacted a renewable energy standard (RES) that integrated a renewable energy performance standard with distributed renewable energy resources and options for compliance based on “Energy Transformation.”<sup>17</sup> The legislation requires electric distribution utilities to retire renewable energy credits (RECS) and associated attributes equal to 55 percent of annual retail electricity sales starting in 2017 (Tier 1). The percentage rises to 75 percent of retail sales in 2032. Distribution utilities are also required to retire RECs associated with distributed generation technologies (nameplate capacity less than 5 MW) equal to one percent of their retail sales (Tier 2). Eligible systems must have been commissioned after June 30, 2015. Finally, under “Energy Transformation,” electric distribution utilities are required to either achieve fossil fuel savings or retire distributed renewable energy system credits equal to two percent of retail sales in 2017, rising to 12 percent by 2032 (Tier 3). For all three tiers, utilities have an option to pay an Alternative Compliance Charge. Small municipal utilities (less than 6,000 retail customers) had a two-year delay, to 2019, to meet the requirements.<sup>18</sup>

The Tier 3 Energy Transformation requirements affect electrification. Electric distribution utilities can meet their obligations in several ways, including weatherizing buildings, installing air-source or geothermal heat pumps, biomass heating systems, and other high efficiency heating systems, switching industrial processes from fossil fuel to electric, increasing the use of biofuels, or deploying electric vehicles and charging infrastructure. In this set of options for utilities to consider, electrification of fossil fuel resources enables crediting toward RES obligations. Utilities can earn credits toward Tier 3 obligations via MWh credits derived from a conversion from fossil fuel savings to electricity equivalency. Electric utilities

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<sup>15</sup> Source BTU consumption refers to consumption at the point the energy source is produced, not consumed. For example, the energy source for natural gas is typically the point of combustion, while for electricity is the power system.

<sup>16</sup> <https://www.cpuc.ca.gov/BuildingDecarb/>

<sup>17</sup> [https://publicservice.vermont.gov/renewable\\_energy/state\\_goals](https://publicservice.vermont.gov/renewable_energy/state_goals)

<sup>18</sup> <https://legislature.vermont.gov/statutes/section/30/089/08005>

can meet a given year's goal by booking the lifetime of energy savings of Tier 3 projects in the year they were installed. The achievements toward Tier 3 goals then resets each year. Utilities have an option to pay \$0.06 per kWh to meet their Tier 3 obligations as an alternative to implementing projects.

Vermont's implementation of programs and initiatives related to electrification are conducted by several types of entities. This includes Efficiency Vermont, the statewide energy efficiency program, the Clean Energy Development Fund<sup>19</sup>, focused on wood heating and overseen by the Department of Public Service, and programs offered by utilities themselves. The three groups coordinate incentives and programs that can be used to help meet overall state clean energy goals and reduce greenhouse gas emissions from fossil fuels. Incentives are available for heat pumps and other electrification technologies.

### 3.2.3 Massachusetts

In 2018 the State of Massachusetts enacted Chapter 227 of its 2018 bills, stemming from its House of Representatives bill 4857.<sup>20</sup> Among the bill's provisions included language related to strategic electrification. The law expanded what was allowed within utility energy efficiency and load management plans and programs to include strategic electrification. Along with energy storage and other active demand management strategies, strategic electrification is described as "measures that are designed to result in cost-effective reductions in greenhouse gas emissions through the use of expanded electricity consumption while minimizing ratepayer cost."<sup>21</sup> The law clearly defined strategic electrification in the context of reducing greenhouse gas emissions via increasing electricity consumption. When combined with managing ratepayer cost, this legislation is similar to Colorado's current definition of beneficial electrification.

In late 2018, the State of Massachusetts published its Comprehensive Energy Plan (CEP).<sup>22</sup> The CEP identified a number of policy directions leveraging "investments made in the clean energy sector through electrification," with a key goal to "increase electrification of the thermal sector by providing program incentives for air source heat pumps for heating through Mass Save." Mass Save is Massachusetts's statewide energy efficiency collaborative in which all investor-owned utilities participate. Secondly, the CEP seeks to "drive market/consumer demand for energy efficiency measures and fuel switching." This policy notes that "buildings are long-term assets and choices made in building construction today" have long-term impacts that last decades.

Since that time, Massachusetts's investor-owned electric utilities have introduced measures into their demand-side management programs to incentivize heat pumps for space heating and water heating. The programs have been limited to consumers who would otherwise have used fuel oil or propane as an energy source. In various analyses of cost effectiveness, switching from natural gas to electricity has not been found to be cost effective. As such different incentive offers are available to customers based on their existing equipment and energy uses. Higher incentives are available for customers under "energy

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<sup>19</sup>[https://publicservice.vermont.gov/sites/dps/files/documents/Renewable\\_Energy/CEDF/Reports/FY20\\_Program%20Plan%20and%20Program%20Allocations%20FINAL.pdf](https://publicservice.vermont.gov/sites/dps/files/documents/Renewable_Energy/CEDF/Reports/FY20_Program%20Plan%20and%20Program%20Allocations%20FINAL.pdf)

<sup>20</sup> <https://malegislature.gov/Laws/SessionLaws/Acts/2018/Chapter227>

<sup>21</sup> Accessed from <https://malegislature.gov/Bills/190/H4857>

<sup>22</sup> <https://www.mass.gov/service-details/massachusetts-comprehensive-energy-plan-cep>

optimization” incentives targeting electric resistance, fuel oil, and propane using customers, reflecting greater cost effectiveness and a different baseline condition than natural gas users.<sup>23</sup>

Massachusetts also addresses the market for new construction via utility programs (Mass Save) and energy codes. Under Mass Save, new homes receive incentives based on their expected energy performance as determined by a home energy rater. Homes with electricity, natural gas, propane, and fuel oil are all eligible for incentives. Market-based baselines are used to estimate the level of savings, which are all above energy code requirements. Natural gas homes receive their own baseline, while customers choosing other energy sources use a blended baseline assuming a mix of electric, propane, and fuel oil site-based energy consumption efficiencies.<sup>24</sup>

Massachusetts offers two options for energy code adoption by local jurisdictions – a base code and a more stringent stretch code. Local jurisdictions must at least adopt the base code, typically the latest version of the IECC codes or ASHRAE 90.1. The Department of Energy Resources develops a companion stretch code that local jurisdictions can choose to adopt in order to facilitate higher levels of energy efficiency in new construction. Increasing the base code and stretch code is one tool being used to encourage electrification within the new construction market. With increasing building performance standards, the stretch code can drive builders to consider high efficiency cold-climate heat pumps or heat pump water heaters as the efficiency gains over baseline equipment can typically lower a HERS-based performance easier with a heat pump than with a high efficiency furnace. Hence, codes and code policy to promote more stringent building designs are seen as a tool to drive the new construction market toward electrification technologies.

### 3.2.4 New York

The State of New York has been a leader in energy efficiency, setting aggressive reductions in greenhouse gas emissions, and leveraging beneficial electrification. Recently passed greenhouse gas emissions targets envision a 40 percent reduction in statewide emissions by 2030 and 85 percent by 2050, relative to a 1990 baseline.<sup>25</sup> In 2018, the New York State Research and Development Authority (NYSERDA) and the Department of Public Service issued a report outlining broad policy approaches that link energy efficiency programs with energy resource planning, building codes, and electrification, titled *New Efficiency: New York*.<sup>26</sup> An overall Btu reduction goal was set as a means of moving all markets toward increasing efficiency and greenhouse gas emissions reductions. From these goals, utilities proposed their own programs and targets.

The *New Efficiency: New York* plan identifies the following key drivers that relate either directly or indirectly to electrification:

- Lead by example and leverage the State’s purchasing and decision making in its own facilities to catalyze market development and adoption, while generating cost savings

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<sup>23</sup> <https://www.masssave.com/rebates>

<sup>24</sup> [http://ma-eeac.org/wordpress/wp-content/uploads/MA19X02-B-RNCBL\\_ResBaselineOverallReport\\_Final\\_2020.04.01\\_v2.pdf](http://ma-eeac.org/wordpress/wp-content/uploads/MA19X02-B-RNCBL_ResBaselineOverallReport_Final_2020.04.01_v2.pdf)

<sup>25</sup> <https://www.nytimes.com/2019/06/18/nyregion/greenhouse-gases-ny.html>

<sup>26</sup> <https://www.nyserda.ny.gov/About/Publications/New-Efficiency>

- Build a skilled workforce and promoting training for New York workers to accelerate energy efficiency [and by extension, electrification] investments
- Drive energy efficiency and carbon reduction through energy codes and appliance standards
- Improve access for low- to moderate-income consumers
- Develop fuel neutral programs to drive deep energy retrofits and manage challenges in fuel and energy supplies during winter months.<sup>27</sup> The Commission is recommended to address issues associated with the potential scale of cost-effective cross-fuel programs as well as the criteria for determining cost-effectiveness relative to carbon reductions and the benefit cost analysis framework.

The plan also outlines several crucial elements related specifically to beneficial electrification. These include:

- Developing “separate accounting of goals and progress outside of an electricity efficiency sub-target” within the larger Btu reduction goal
- Supporting heat pump adoption to decarbonize heating and cooling
- Utilizing codes and technology to deliver efficient electrification

In January 2020, the Department of Public Service published rules to implement the targets outlined by the carbon reduction legislation and the New Efficiency: New York plan.<sup>28</sup> The Department’s rules acknowledged the overlapping roles of the State and utilities in achieving the outcomes. The ruling set targets for utilities, with separate gas and electric targets for each utility (gas and electric, respectively). The utility plans that were approved in the ruling note the prior and expected ongoing collaboration between the utilities and NYSERDA on efficiency and electrification.

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<sup>27</sup> Some areas of New York experience gas supply constraints

<sup>28</sup> <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b06B0FDEC-62EC-4A97-A7D7-7082F71B68B8%7d>

## 4 Conclusions

Colorado is well positioned to leverage beneficial electrification for residential and commercial buildings to mitigate GHG emissions. Two foundational laws – SB 19-236 and HB 19-1261 – ensure an electricity grid that will continue to reduce emissions and set targets for GHG pollution reductions across Colorado’s economy. Rules and plans emerging from this legislation will chart a course for beneficial electrification efforts over the next decade and beyond. The legislation alone, however, does not ensure that beneficial electrification will be a major contributor to Colorado’s efforts to reduce GHG emissions. To realize the full potential that beneficial electrification offers will require additional policies, leadership, and coordinated approaches to stimulate the market and overcome barriers.

GDS Associates’ research identified key market barriers that policy or programmatic efforts need to overcome in order to drive beneficial electrification in residential and commercial buildings. These include:

- Limited market awareness by consumers and contractors
- Potential lack of capital to cover upfront costs
- Workforce labor availability and knowledge/skills
- Limited product availability and sales efforts by market actors
- A lack of clarity or consensus on regulated utilities to offer beneficial electrification fuel switching programs or measures
- Challenges related to current building infrastructure that increase the cost or complexity of installing beneficial electrification technology
- An electricity market that does not send price signals that encourage rate design or load control techniques, reducing the value of electrification technologies
- Uncertainty regarding the rules related to HB 19-1261
- A lack of consistent marketing messages to promote and educate the marketplace regarding beneficial electrification

These market barriers can be addressed with policies and programs. The policy recommendations presented in this report will aid the transition to an economy with no net carbon emissions. These include:

- Clarifying fuel switching rules related to beneficial electrification
- Implementing rules related to HB 19-1261 that consider how to manage increased electricity loads and net carbon metrics for electric utilities or others promoting beneficial electrification
- Developing workforce development policies and programs that expand consumer options for implementing beneficial electrification
- State support for localities seeking to implement advanced building codes
- The State leading by example in its own purchasing policies
- Updates to the PUC’s cost-effectiveness tests to account for beneficial electrification
- Developing a statewide approach to ensure consistent, equitable, and adequate utility program funding
- The State coordinating and supporting the set of stakeholders engaged in beneficial electrification to develop a network of resilient market actors, long-term market tracking and consistent messaging



Taken together, these policies will help advance Colorado’s beneficial electrification marketplace over the next ten years. Colorado should expect that policies and initiatives may need updating based on market responses or unanticipated challenges. If implemented, this initial set of recommendations will help move the market forward and enable Colorado to identify the next evolution of beneficial electrification policies and programs.

# BENEFICIAL ELECTRIFICATION IN COLORADO

*Market Barriers and  
Policy Recommendations*

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**FINAL REPORT**

*prepared for*

**COLORADO ENERGY OFFICE**

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