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**Community Perspectives Regarding Building Electrification as a Climate Mitigation
Strategy in Bellingham, WA: A Q-Study**

By

Sarah Parker

Accepted in Partial Completion
of the Requirements for the Degree
Master of Arts

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Master's Thesis

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Sarah Parker

May 20, 2021

**Community Perspectives Regarding Building Electrification as a Climate Mitigation
Strategy in Bellingham, WA: A Q-Study**

A Thesis
Presented to
The Faculty of
Western Washington University

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts

by
Sarah Parker
May 2021

Abstract

Americans have varying ideas about the validity of climate science, the risk that climate change poses, and what action should be taken to address that risk. To effectively address climate change, policy makers must imagine and implement solutions that are meaningful and affirming to people with fundamentally different ways of perceiving the topic. In this study, I utilized Q-method to uncover distinct perspectives that stakeholders in Bellingham, Washington have regarding two proposed climate mitigation measures that would require the electrification of the City's building sector. I conclude that the study participants represented three well-developed perspectives regarding the topic—the “Bold Climate Action Now” perspective, the “Unregulated Energy Independence” perspective, and the “Cost Concerned” perspective. Each perspective prioritized different concerns and values in their support for or opposition to the proposed measures. I discuss policies and strategies that the City can pursue to address building electrification while honoring these different perspectives. I suggest that such widely acceptable policies could be more viable, durable, and effective in mitigating for climate change than a policy rooted in just one perspective. My findings are relevant to policy makers and decision makers in Bellingham, Washington and beyond who seek to design and implement widely acceptable and long-lasting policies that effectively mitigate for climate change.

Keywords: Cultural theory; Cultural cognition; Clumsy solutions; Climate policy; Building electrification; Q-method

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Chapter 1: Introduction

“Climate change isn’t a science problem, it’s a human problem.”

-Paul Hawken

Today, climate change is one of the most highly polarized policy domains in the United States. The topic is more divisive for Americans than abortion, gun control and the death penalty (Leiserowitz et al., 2019). According to a recent study, when asked to rank 29 important issues for the 2020 presidential election, liberal Democrats ranked climate change as the third most important while conservative Republicans ranked it last (Leiserowitz et al., 2019).

Despite scientific consensus that human-caused climate change is happening—97% of climate scientists say that it is (Cook et al., 2016; Oreskes, 2004)—Americans have varying ideas about the validity of climate science, the risk that climate change poses, what action should be taken to address that risk, and who is responsible for taking action. In the United States, these conflicting ideas have historically manifested in climate policy gridlock, short-lived policies, and a lack of government commitment to climate action. Meanwhile, global greenhouse gas emissions (GHG) have increased dramatically over the past two decades, with the U.S. consistently ranking as one of the largest emitters (IPCC, 2014). This is concerning as the Intergovernmental Panel on Climate Change (IPCC) asserts that, to avoid the worst impacts of climate change, the world must dramatically reduce its GHG emissions by mid-century and prevent global warming from exceeding 1.5 °C (IPCC, 2018).

Over the last several decades, decision makers and climate advocates have used science as the factual and political basis for climate governance. They have maintained that educating the public about the scientific data should settle disputes. A growing body of literature suggests that

this dependence on factual information in justifying climate policies has contributed to polarization and policy gridlock (Kahan et al., 2012; Pielke, 2007; Sarewitz, 2004, 2011; Sarewitz & Pielke, 2000). This is the case for several reasons. First, scientific literature provides bodies of relevant data about climate change that support conflicting interests and understandings (Sarewitz, 2004, 2011). By cherry-picking data that supports their own values, actors with conflicting opinions can simultaneously validate their own arguments and undermine the opposition's. Next, scientific data is framed by the context of the specific question the researcher asks. This is true for climate science and other controversial topics. For example, in the debate over genetically modified organisms (GMOs), one actor will look at data showing the potential for GMOs to increase crop yield and will note GMOs' ability to increase global food production (Sarewitz, 2004). Another actor will look at data depicting the environmental risks associated with GMOs and see them as detrimental to the natural world (Sarewitz, 2004). By arguing over different problems (food security versus environmental risks, in this example), the actors talk past one another. Finally, science is steeped in uncertainty, and those opposed to climate policies have historically invoked scientific uncertainty as a tool to delay climate action (Pielke, 2007; Sarewitz & Pielke, 2000; Stokes, 2020). Climate advocates and scientists have focused on reducing uncertainty to undermine the skeptics rather than addressing the values at the heart of the issue (Pielke, 2007).

Today, policy makers are recognizing that, for a policy to be adopted, implemented, and durable, the policy needs to be socially acceptable to a wide range of people holding varying perspectives. Policies need to address and affirm, or at the least not threaten, the values and interests of these diverse individuals. To achieve this, policy makers must first work to uncover the complex and

dynamic ways that people think and feel about a particular topic (Kahan & Braman, 2006; Verweij et al., 2006).

My study investigates the case study of two climate mitigation measures that were recommended to the city of Bellingham, Washington in late 2019 by a city-organized Climate Action Task Force (CATF). Together, these two measures, which are detailed in Chapter Three, would phase out the use of appliances that combust natural gas on-site for space and water heating in the City. If implemented, these building electrification measures would significantly reduce the direct GHG emissions associated with the City's residential and commercial building stock. The viability of these proposed measures depends on how widely acceptable they are to stakeholders throughout Bellingham.

I utilized Q-method—a powerful tool for investigating participants' opinions and understandings of a topic—to investigate the following questions:

1. What perspectives do Bellingham stakeholders have regarding building electrification in the City?
2. What are potential ways to address building electrification while honoring the values and priorities of community members with varying perspectives?

In the following chapter, I outline the role that social and cultural relations play in shaping people's perspectives regarding climate change and other controversial policy topic. In Chapter Three, I introduce the case study of building electrification in Bellingham. In Chapter Four, I describe the procedures that I used to complete this study. In Chapter Five, I present the results of this Q-study, including three perspectives that Bellingham stakeholders have regarding the proposed building electrification measures. In Chapters Six and Seven, I highlight the larger

policy implications of the study findings and outline how the city of Bellingham can combine elements of the three identified perspectives to develop widely acceptable climate mitigation strategies. Such thoughtful and widely acceptable solutions offer an opportunity to address the failures of climate policy that I briefly introduced thus far.

Chapter 2: Theoretical Framework

Climate policies often face resistance because various stakeholders have different understandings of climate change and the risk that it poses. Rittel and Webber describe complex policy topics like climate change as *wicked* problems (1973). They suggest that, whereas science is designed to address *tame* problems with clear solutions, a wicked problem is hard to define, does not have a clear solution, does not have an obvious end goal or stopping point, and has real implications to society (Rittel & Webber, 1973).

Climate change is the epitome of a wicked problem. Not only is there no clear solution to the issue, but the problem of climate change itself cannot be easily defined. Individuals on opposing sides of the issue interpret the risks associated with climate change in varying ways, and thus, see fundamentally different problems relating to the topic (Dryzek, 2013; Hulme, 2009; Verweij et al., 2006). For some, climate change is an issue of excess greenhouse gases in the atmosphere, air pollution, transportation policy, and livelihood. For others, it is an issue of excessive government intervention in private affairs, property rights infringements, and government regulations. As those on opposing sides of the issue advocate for their own position, they talk past one another, driving polarization on the topic.

Decision makers must consider the social dimensions surrounding climate change as they determine which policies will be effective and widely acceptable to stakeholders holding varying perspectives. Two key questions to understanding the diversity in human responses to the topic are: 1) Why do different actors perceive the topic of climate change in varying ways? And, 2) how can policy makers use this understanding to move beyond polarization on the topic and take meaningful action? This chapter addresses these questions by considering how an individual's

social and cultural relations shape their perceptions of various topics. It then explores how these considerations can be used to develop effective and long-lasting climate policies.

Cultural Theory

One approach to understanding complex and multidimensional wicked problems is through the lens of cultural theory. First introduced by Mary Douglas and her colleagues, cultural theory asserts that cultural and social relations are the fundamental forces that shape the ways people see and experience the world (Douglas, 1970; Douglas & Wildavsky, 1982; Thompson et al., 1990). These forces interact and result in four distinct ways of life, or worldviews, each defined by specific ways that individuals organize, perceive, justify, and act on social relations (Douglas & Wildavsky, 1982; Thompson et al., 1990). These worldviews, described in detail in the next section, shape individuals' views on risk, nature, and the proper organization of society (Douglas & Wildavsky, 1982).

Social Dimensions and the Four Worldviews

Cultural theory uses a typology, depicted in Figure 1, to classify the four distinct worldviews along two dimensions: *group* and *grid* (Douglas & Wildavsky, 1982; Thompson et al., 1990). These axes describe individuals' cultural commitments including their ideas of how the world should look and how people should behave. *Group* measures the extent to which actors are committed to the collective versus the individual (Douglas & Wildavsky, 1982; Verweij et al., 2006). People who are *low group* (left side of the horizontal axis) perceive a just world as one where individuals support themselves without assistance from others and where the individuals' interests are prioritized. Those who are *high group* perceive a just world as one where a group's collective interests take precedence to those of the individual. *Grid* measures the way in which

identity and ranking constrain the behavior of individuals (Douglas & Wildavsky, 1982; Verweij et al., 2006). Individuals who are *high grid* (on the top of the vertical axis) believe that, in an ideal world, actors should have access to resources and opportunities based on a shared system of classification such as aspects of identity including race, class, gender, expertise, or authority. Those who are *low grid* (on the bottom of the vertical axis) believe that actors should have equal access to resources and opportunities.

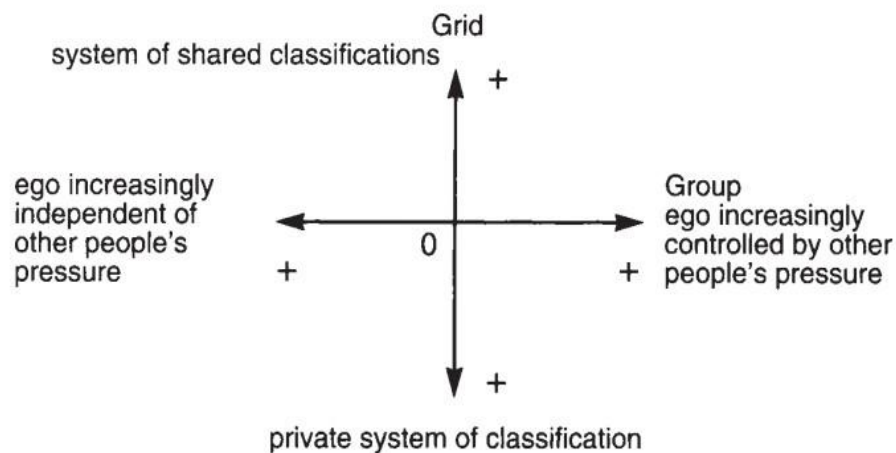


Figure 1. Cultural Theory's grid-group typology (Douglas, 1997).

Cultural theory identifies four cultural worldviews that exist between the intersection of the *grid* and *group* dimensions (Figure 2; Stoltz, 2014). These cultural worldviews—hierarchy, egalitarian, individualist, and fatalist—are distributed across humanity, and people subscribing to each different worldview qualify what makes a good and just world in a fundamentally different way. A summary of each worldview follows.

1. Individuals subscribing to the hierarchy worldview (*high group, high grid*) prefer a differentiation of roles, or hierarchy, to individual autonomy (Schwarz & Thompson, 1990; Thompson et al., 1990). Hierarchs support regulation in the interest of the

collective good because, for this worldview, collective interests take precedence over individual interests. They prefer to make sacrifices now to benefit the group in the future and are willing to take risks as long as they are advised by experts. Hierarchs perceive nature as tolerant and believe that humans can control it through careful regulation (Schwarz & Thompson, 1990).

2. Those subscribing to the egalitarian worldview (*high group, low grid*) perceive collective interests as more important than the individual's interests (Schwarz & Thompson, 1990; Thompson et al., 1990). They maintain that the rich and powerful threaten the well-being of the collective. They believe that economic growth and industry make it difficult to maintain equality as some people live in abundance and others do not. They desire equality of outcome for all people. Egalitarians see nature as fragile and believe that we must tread lightly on the earth (Schwarz & Thompson, 1990).
3. Those subscribing to the individualist worldview (*low group, low grid*) see humans as autonomous and self-serving (Schwarz & Thompson, 1990; Thompson et al., 1990). Whereas egalitarians desire equality of outcome, individualists support equality of opportunity. They believe that, through skill and hard work, an actor can shape their own fate. They support economic growth and independent markets. Individualists see nature as benign (Schwarz & Thompson, 1990).
4. Finally, the fatalist worldview (*low group, high grid*) maintains that what will be, will be (Thompson et al., 1990). Fatalists believe that individuals do not have control over their fate and, therefore, hard work and effort will not alter the course of events. Fatalists believe that we have no control over nature, so it does not matter what we do or do not do to it (Schwarz & Thompson, 1990).

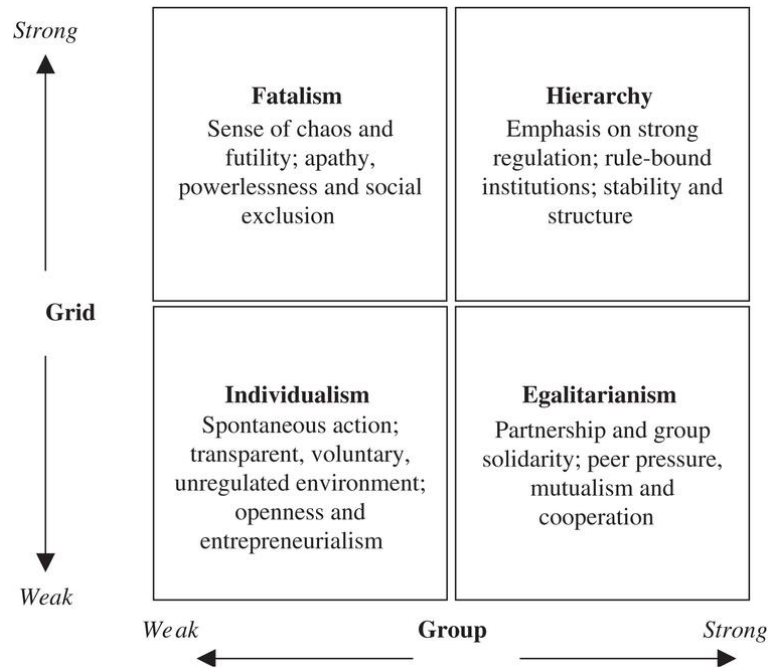


Figure 2. Several themes of each of the cultural worldviews (Stoltz, 2014).

According to cultural theory, while perspectives and arguments evolve over time and between contexts, they continue to adhere to the basic tendencies, values, and beliefs of these four distinct worldviews (Douglas & Wildavsky, 1982; Thompson et al., 1990).

Climate Change and Cultural Theory

Cultural theory has been used to analyze a range of topics (Swedlow, 2011). In this section, I outline four climate policy stories, or ways that people understand the topic, through the lens of each of the cultural worldviews (Verweij et al., 2006).

The hierarch version of the climate policy story maintains that society needs to strengthen a hierarchical response to climate change to tackle a failure of global planning (Verweij et al., 2006). According to the hierarch story, this failure in planning is the result of unchecked business and industry engaging in destructive practices to support their own bottom line. Those who subscribe to the hierarch worldview believe that there is still time to take meaningful action

to avoid the worst impacts of climate change. However, we must act on a global scale—the actions of individuals and households will not be adequate. The hierarch worldview contends that the governments of the world must prioritize climate governance through regulatory policy solutions (Verweij et al., 2006).

The egalitarian climate policy story asserts that climate change is a moral and ethical issue that is perpetuated by rich and industrialized countries (Verweij et al., 2006). According to this worldview, the fixation on economic growth, pushed by the rich and industrialized countries, is largely responsible for climate change. These countries are perpetuating global inequities that put the well-being of our planet and all humans at stake. Those who subscribe to the egalitarian worldview argue that we must tread lightly on the earth to promote the well-being of all and that decision-making should be made at the grassroots level rather than by the rich and powerful (Verweij et al., 2006).

Next, the individualist policy story holds that climate change is not as large of a threat as many have played it up to be (Verweij et al., 2006). According to this worldview, the hype around climate change represents a veiled attempt to reduce individual autonomy. Actors that subscribe to the individualistic worldview are skeptical of climate science and the theory that humans are emitting enough GHG emissions to drive climate change (Verweij et al., 2006). They believe that, even if human-caused climate change is happening, its negative impacts have been exaggerated. The individualistic worldview maintains that we should carry on with business as usual and that technology and the market will address any potential issues that do arise from climate change (Verweij et al., 2006).

Finally, the fatalist policy story maintains that there is no point in putting effort into climate politics or policies because such efforts will not change the outcome (Verweij et al., 2006). According to fatalists, we have no control over our future, and we are best to resign to the inevitable and not worry too much about climate change.

In this study, I do not test for the prevalence or existence of these four worldviews in the debate surrounding building electrification in Bellingham. Rather, I use the theoretical framework of cultural theory to ground and inform my research. I accept that various worldviews exist and that actors adhering to different worldviews interpret the topic of climate change in fundamentally different ways.

Cultural Cognition

Building on the work of Mary Douglas and other cultural theorists, cultural cognition theory (or cultural cognition) describes the tendency of individuals to conform their beliefs about a disputed topic to reflect their pre-established commitment to a specific worldview (Kahan, 2010; Kahan & Braman, 2006). The cultural cognition worldview typology differs slightly from that of cultural theory (Kahan, 2008; Kahan & Braman, 2006) just as the cultural theory and cultural cognition frameworks differ (Gastil et al., 2016; Kahan, 2008; Kahan & Braman, 2006). In the following section, I describe aspects of cultural cognition that shape how people make sense of information and form varying perspectives about policy topics.

Cultural cognition works through *motivated reasoning*, where an individual conforms their assessment of new information to an external goal rather than to most accurately reflect the evidence (Balciotis & Dunning, 2006; Dunning, 1999; Kahan, 2013; Kunda, 1990). According to cultural cognition, this external goal is for the individual to reflect the values, norms, and

perspectives of their cultural group and to maintain membership to this group. They accept information that aligns with their worldview and reject information that threatens it (Kahan, 2013; Kahan & Braman, 2006). As Naomi Klein summarizes, “If new information seems to confirm [our vision of the good society], we welcome it and integrate it easily. If it poses a threat to our belief system, then our brain immediately gets to work producing intellectual antibodies designed to repel the unwelcome invasion” (2015, p. 37). As this happens, perspectives, norms, and attitudes become more consistent within each worldview and more distinct from the other worldviews.

Next, cultural cognition describes how an individual evaluates an expert for credibility (Kahan, 2010). Generally, individuals trust those who share their same values and see the world in a similar way (Kahan et al., 2011; Kahan & Braman, 2006). For example, Kahan et al. found that, when presented with information about a PhD scientist who is a member of the U.S. National Academy of Sciences, individuals disagreed on whether the scientist was actually an expert (Kahan et al., 2011). Those who felt affirmed by the information about the scientist trusted the scientist as an expert. Those who felt that the information threatened their understanding of the world doubted the expertise of the scientist. These individuals did or did not trust the scientist based on whether his views lined up with their own views.

Once an individual establishes which experts are credible, they tend to conform their beliefs with the experts'. The average individual is generally unable to conduct a thorough investigation of the scientific literature and, on their own, determine the need for or the implications of a policy (Kahan et al., 2011; Kahan & Braman, 2006). Rather, they take the word of those that they trust on what evidence is credible. This further aligns their understandings and perceptions of a policy topic with those of the expert.

Finally, cultural cognition theory describes that an actor is unlikely to accept new information if it risks them losing credibility amongst their peers. If an individual accepts an argument that is not in line with their worldview, they risk driving a wedge between themselves and their like-minded friends and colleagues. For example, a worker at an oil refinery might risk being shunned by his coworkers if he expresses concerns about climate change (Kahan et al., 2012). Similarly, a professor at a university in Boston will likely see a similar fate if she suggests to her colleagues that climate change is a hoax (Kahan et al., 2012). As Kahan notes, “Given how much the ordinary individual depends on peers for support—material and emotional—and how little impact his beliefs have on the physical environment, he would likely be best off if he formed risk perceptions that minimized any danger of estrangement from his community” (2012, p. 734). Thus, individuals “have a strong emotional predisposition to reject [a claim that risks them losing credibility amongst their peers]” (Kahan, 2010, p. 296).

Each of the mechanisms described in the section contribute to a positive feedback loop, where individuals filter new information in a way that affirms their pre-established worldview. According to cultural cognition theory, more scientific information, expert opinions, and access to knowledge rarely interrupts this feedback loop enough to change an individual’s understanding of a particular topic (Kahan et al., 2011, 2012). In fact, Kahan et al. (2012) found that members of the public who were the most scientifically literate were not necessarily the most concerned about climate change. Rather, these scientifically literate individuals represented the greatest cultural polarization, and their concern about climate change aligned with their cultural worldview (Kahan et al., 2012). This suggests that the traditional methods of promoting climate policy through education and citing factual evidence are ineffective in garnering support from those who are predisposed to resist climate policy (Kahan et al., 2012; Sarewitz, 2011).

Clumsy Solutions

According to the theoretical framework discussed throughout this chapter, individuals with different worldviews understand the topic of climate change in fundamentally different ways (Verweij et al., 2006). Eliminating uncertainty and sharing factual information will likely not change people's perceptions about the topic. This does not undermine the possibility for people with varying worldviews to be enthusiastic about a given policy, but rather, calls for a new approach to climate governance. Verweij et al. (2006) suggest that *clumsy* solutions, or policies that consider and combine components of people's opposing perspectives on an issue, provide an opportunity to effectively combat climate change while honoring the values of each of the distinct worldviews. Rather than focusing on the question 'how do we solve climate change', decision-makers must ask, 'what values are at stake and which solutions will allow multiple groups to achieve their collective social goals?' (Hulme, 2009).

Clumsy solutions can make complex, seemingly intractable problems, like climate policy, tractable by generating widely-acceptable solutions that are devised from a system where all voices are heard and considered (Verweij et al., 2006). Such solutions include the voices of the hierarchs, the individualists, the egalitarians, and they even consider the fatalist stance that the problem is unsolvable (Verweij et al., 2006). Clumsy solutions increase the viability of a policy as more people with differing perspectives are open to or supportive of it (Verweij et al., 2006). They increase the quality of the policy as they consider multiple values and priorities (Verweij et al., 2006). While such solutions might appear ineloquent and clunky, they are more likely to be durable over time than a policy rooted in just one worldview. Throughout my study, I maintain that by considering the values and priorities of people with diverse perspectives, policy makers can shape widely accepted policies that are effective in combatting climate change.

Chapter 3: The Case Study of Building Electrification in Bellingham, Washington

This study explores perspectives held by stakeholders in the city of Bellingham, Washington regarding two climate mitigation measures that were recommended to the City in 2019 by a city-organized Climate Action Task Force (CATF). The two measures, which were recommended in the CATF final report, call for the electrification of both the existing building stock and new construction in Bellingham (City of Bellingham, 2019). Together, these measures would phase out the on-site use of natural gas for space and water heating in the City. This chapter summarizes the history of climate action in Bellingham, describes the proposed measures in more detail, and provides an overview of building electrification as a climate mitigation strategy.

The City of Bellingham and Climate Action

The city of Bellingham aims to reduce its GHG emissions to mitigate for climate change. In 2007, Bellingham adopted a Climate Protection Action Plan (CPAP) which set targets for the City to reduce its emissions by 2012 and 2020. The City updated the CPAP in 2018 with new emissions reductions targets to reduce municipal emissions to 85% below 2000 levels by 2030 and 100% below 2000 levels by 2050 and to reduce community emissions by 70% below 2000 levels by 2030 and 85% by 2050 (City of Bellingham, 2018).

That same year, Bellingham's City Council passed Resolution 2018-06 which prompted the formation of a city-organized Climate Action Task Force (CATF) (Resolution No. 2018-06, 2018). The CATF consisted of nine community members with expertise related to the topics of transportation, buildings, energy supply, energy efficiency, land use, and carbon emissions as well as an employee of Puget Sound Energy (PSE), a local natural gas and electricity utility (PSE does not supply natural gas within Bellingham) and several employees from the city of Bellingham. The group was assigned the task of developing policy recommendations that would

allow for the City to achieve its GHG emissions reduction targets. In late 2019, the CATF members presented their recommendations to City Council. Their recommendations included proposed measures that would reduce GHG emissions in the sectors of transportation, land use, buildings, and energy supply. At the time this study was completed, the City was considering whether they would move forward with the proposed measures.

Building Electrification in Bellingham

Amongst other components, the CATF recommended that the City take steps to decarbonize the building sector to meet the targets outlined by the CPAP 2018 Update (City of Bellingham, 2019). In Bellingham, the building sector contributes 43% of total GHG emissions, making it the largest emissions-contributing sector in the City (City of Bellingham, 2018). These emissions come primarily from two sources: 1) the fossil fuels used to generate the electricity supply that powers buildings, and 2) the fossil fuels used for heating and cooking appliances that rely on on-site fossil fuel combustion for end uses. To achieve emissions reductions goals, the CATF suggested that the City prioritize a combination of energy efficiency upgrades, building electrification, and renewable energy procurement in the entire building stock within city-limits (City of Bellingham, 2019).

This study focuses on two proposed building electrification measures. The first measure, Measure B4, calls for the electrification of heating and cooling systems in all existing buildings in Bellingham. If adopted, this measure would require that, upon the point of replacement or by 2040, existing natural gas-powered space and water heating systems within buildings be replaced with an electric heat pump or another efficient, electric technology. The second proposed measure, Measure B5, calls for the electrification of all new construction within city-limits. If implemented, this measure would require that all new buildings in Bellingham only use electric

systems and appliances for space and water heating and cooling. The CATF estimates that, if current fuel use patterns continue, the floor area of new construction in Bellingham would be responsible for 17.5% of total building sector emissions between 2019 and 2035 (City of Bellingham, 2019). If new construction includes only efficient, electric systems and appliances instead of those that rely on natural gas, Bellingham will greatly reduce the projected emissions associated with the growing building stock.

Building Electrification Overview

The proposed building electrification measures are in line with a robust pool of research concluding that eliminating direct emissions from residential and commercial buildings is part of the lowest-cost pathway to decarbonizing the building sector in the Pacific Northwest and most other regions of the U.S. (Aas et al., 2018, 2020; Steinberg et al., 2017; J. H. Williams et al., 2014, 2021). An estimated seventy million U.S. homes and businesses heat their space and water with fossil fuels (U.S. EIA, 2017), releasing the carbon dioxide equivalent of having 40 million cars on the road (Davis, 2021). The on-site burning of fossil fuels contributes to local particulate pollution (Zhu et al., 2020) and is associated with upstream externalities such as water contamination (Llewellyn et al., 2015; Olmstead et al., 2013). The extraction, transportation, and combustion of fossil fuels releases greenhouse gases into the atmosphere, accelerating the rate and intensity at which we experience climate change. During the extraction and transport of natural gas, a fossil fuel commonly used for space and water heating as well as cooking, unburnt methane leaks into the atmosphere (Alvarez et al., 2018; McKain et al., 2015). Pound for pound, this potent greenhouse gas' heat trapping impact is estimated to be 28 times greater than carbon dioxide's over a period of one hundred years (IPCC, 2014).

Today's efficient electric technology and cleaner electricity grid have created an opportunity to decarbonize the building sector through electrification (Billimoria et al., 2018). In past decades, building electrification included installing inefficient, electric resistance devices or older heat pumps that performed poorly in cold temperatures. Heating with these appliances, which relied on a coal-dominated grid, was dirtier and more expensive than burning natural gas on-site (Billimoria et al., 2018). Now, modern electric systems and appliances, such as air source heat pumps, can be a highly efficient, cost-effective way to satisfy space heating needs under the right conditions (Billimoria et al., 2018; Kaufman et al., 2019). The efficiency of heat pump technology (up to 300% efficiency) as compared to the most efficient modern combustion-field technology (up to 95% efficient) translates to significant emissions reductions for the same end-services (Department of Energy, n.d.). Additionally, in the United States, today's electricity grid is cleaner than it was in earlier decades (Billimoria et al., 2018). This is particularly true for the Pacific Northwest, which has an exceptionally clean grid due to high levels of hydropower (Evolved Energy Research, 2019; U.S. EIA, n.d.).

At the time this study was completed, several U.S. cities had already adopted measures to promote building electrification. In July 2019, Berkeley, California became the first city in the United States to ban natural gas systems and appliances in all new residential construction (Ord. 7672-NS § 1 (Part), 2019). Since then, more than thirty cities in California, including San Francisco, San Jose, and Oakland, have enacted measures that limit or prohibit the use of natural gas in new construction (Davis, 2021). In early 2021, the city of Seattle introduced a new energy code that will limit the use of natural gas for space and water heating in new commercial buildings and some apartment buildings (Derrick, 2020). While these cities are the early adopters

in the municipal building electrification movement in the U.S., jurisdictions across the country are considering similar measures.

The Debate Around Building Electrification in the Pacific Northwest

Despite the opportunity for building electrification policies to reduce GHG emissions, many stakeholders are critical of such measures. In Oregon and Washington, a group of stakeholders known as the Partnership for Energy Progress is pushing a \$1 million public relations campaign to promote natural gas as part of the Pacific Northwest's clean energy transformation (Baker, 2020; Bernton & Beekman, 2019). The group includes utility companies and other stakeholders in the northwest.

In Bellingham, a group of stakeholders including the Building Industry Association of Whatcom County (BIAWC, the local builders association), Cascade Natural Gas (the local gas utility), and several others distributed the flyer shown in Figure 3 shortly after the City's Climate Action Task Force (CATF) released their final report. Several members of the CATF and other interested stakeholders with relevant expertise have since contended that this flyer dramatically overestimated the costs associated with a conversion from natural gas systems and appliances to electric ones.

In my study, I investigated and detailed several perspectives that exist amongst stakeholders in Bellingham regarding building electrification. Through this research, I did not aim to capture every policy narrative nor make a judgement of whether building electrification is "right" or "wrong" or "good" or "bad." Rather, I depicted the complexity of people's opinions and values surrounding one potential climate policy option.

CONVERSION COSTS

From Natural Gas to Electricity

The City of Bellingham's Climate Action Task Force was launched in September 2018 with the purpose of determining the feasibility, costs, and impacts of the City's 100% renewable energy ambitions. A subcommittee of the CATF released preliminary recommendations for the building sector in June 2019, which included mandatory conversion of space and water heating systems by 2035, plus electrification of all commercial, residential, and center occupied heating systems, and solar PV installation to cover at least 50% of the building footprint through rooftop or offsite solar.



This could cost:
\$36,050 — \$82,750
 for a typical Bellingham home
 1,100 sq ft and 50 yrs old.

For every \$1,000 increase in the cost of a home, 113 local families are priced out of the market and cannot realize the American Dream of homeownership. This conversion will price 4,068 to 9,266+ households out of the Bellingham housing market (NAHB).

If newer homes convert, engineering and structural cost may decrease, but solar panel and heat pump costs increase due to larger square footage.

-  **PROFESSIONAL ENGINEER**
\$1,500 - \$2,500
-  **ROOF UPDATE**
\$3,500 - \$7,000
+ ceiling costs depending on work needed
\$5,000 - \$9,000 minimum for a new roof if existing roof is 10+ years old (solar installs are on new/newer rooftops).
-  **FOUNDATION UPDATE**
\$,555 - \$,555
depending on work needed
-  **SOLAR PANELS**
\$10,000 - \$40,000
Depending on roof line, roof size/home square footage
-  **DUCTLESS HEAT PUMP**
\$6,500 - \$10,000
+ \$600 electrical work minimum
More if ducts need installation
-  **WATER HEATER**
\$800 - \$1,000
+ \$500 - \$1,000 electrical work
+ \$800 for the change out
-  **CHANGE OUT OF 100 AMP**
\$1,850 + trenching a conduit
PSE transformer upgrades for larger HVAC systems
+ \$5,000 - \$9,000
-  **CITY OF BELLINGHAM**
+ \$\$\$\$
Unspecified permit fees and permit processing time

Share your concerns at: <https://www.cob.org/gov/public/Pages/Public-Comment.aspx>
 or email the City Council: ccmail@cob.org



Figure 3. This flyer was distributed to the public shortly after Bellingham's Climate Action Task Force released their final report.

Chapter 4: Methods

As discussed in Chapter Two, a key challenge in climate governance is that individuals with varying worldviews perceive the topic of climate change in different and often contradictory ways. Policy options that combine components of opposing perspectives on an issue can be both effective and widely acceptable (Verweij et al., 2006). To identify such options, policy makers must first query the perspectives and understandings of stakeholders regarding the policy topic. In this study, I apply this concept to the case study of the two proposed building electrification measures that were recommended to the city of Bellingham, Washington in late 2019. I utilized Q-method to explore the views of Bellingham stakeholders regarding the two proposed measures. In the following sections, I provide an overview of Q-methodology and describe the procedures I used to complete this study.

An Overview of Q-methodology

Q-methodology is a research tool that combines elements of quantitative and qualitative methods to systematically identify and describe the views of study participants regarding a particular topic (Brown, 1980; Stephenson, 1953). It groups individual viewpoints into a reduced number of clusters that represent shared ways that participants see the world.

Q-method, described in detail later in this section, was originally introduced as a tool to study human subjectivity in the field of psychology (Stephenson, 1935, 1953). More recently, it has been applied to a range of other disciplines. It is a particularly helpful tool for exploring various complex and polarized human-environment controversies such as the regulation of local water services (Asquer, 2014), wildlife management (Robbins, 2006), assisted colonization as a

climate change adaptation strategy (Neff & Larson, 2014), environmental activism (Salazar, 2009), and wind energy development (Jepson et al., 2012).

A typical Q-study consists of five stages: 1) Concourse development, 2) Q-set development, 3) Data collection (administering the Q-sort and post Q-sort interview), 4) Analysis, and 5) Interpretation. In the first stage, the researcher constructs the *concourse*, or a collection of statements covering the breadth of debate surrounding a topic (Brown, 1980). The concourse statements are generally sourced from within the relevant community, often through initial interviews with stakeholders or analysis of primary sources such as public comments, letters, and opinion articles. Through this process, the researcher collects statements of opinion in the words and framings of the participants (Addams & Proops, 2000). In Q-methodology, the concourse is considered the population studied.

In the second step of a Q-study, the researcher distills the concourse down to a selection of statements that convey a range of sentiments about the topic. This set of statements is referred to as the *Q-set*. Most Q-methodologists recommend between 30 and 80 statements as standard for the Q-set (Asquer, 2014; Barry & Proops, 1999; Watts & Stenner, 2012). In Q-methodology, sampling of the population (the concourse in a Q-study) occurs in the Q-set development stage. This is different from most other types of quantitative analysis where sampling occurs in the selection of participants. Additionally, the reduction of statements from the concourse to the Q-set is for practical purposes as participants may not have the time, will, or focus to sort too many statements.

Third, participants sort the Q-set statements into three piles: those they agree with, those they disagree with, and those they feel neutral about. Participants then refine the sort by placing the

In the fourth step of a Q-study, the researcher conducts a multivariate data reduction technique, such as a factor analysis, to identify common patterns among the Q-sorts. Whereas traditional social science methods, such as surveys, identify correlations between variables (for example, weight and height) across a sample of participants, Q-methodology identifies correlations between participants (Brown, 1980; Stephenson, 1953). Through the multivariate data reduction, similar Q-sorts are mathematically combined into groupings, or factors, that describe a *shared way of thinking* (Figure 5; O’Leary et al., 2013). A key assumption of Q-methodology is that, within a community, there are fewer discrete ways of thinking about a topic than there are individuals.



Figure 5. In the analysis stage of a Q-study, similar Q-sorts are combined to a reduced number of factors that represent shared ways of thinking (O’Leary et al., 2013).

Finally, in the interpretation stage of a Q-study, the researcher considers the quantitative patterns within each factor group and the qualitative data from the follow-up interviews to compile a narrative for each factor. Taken together, these narratives describe the participant pool’s perspectives regarding a particular topic.

Q-methodology is unique from other social research methods, such as surveys, in several ways. First, it combines quantitative and qualitative techniques, drawing upon the benefits of both (Brown, 1996). The combination of the numerical results (multivariate data reduction) and the

qualitative data (post Q-sort interviews) ensures that Q-methodology is rigorous while offering the researcher a window into the worlds of the participants. Q-methodology provides a middle ground between the quantitative structure of surveys and the rich qualitative properties of interviews.

Next, Q-methodology reveals areas of consensus and points of tension between the varying factor groups (Addams & Proops, 2000). This characteristic is unlike standard surveys which explore views about each topic separately. Policy makers or other stakeholders might utilize the areas of consensus identified through a Q-study to forge alliances or to establish traction between groups that are otherwise quite polarized. Policy makers might choose framings that address the points of tension strategically and thoughtfully, or they might choose to avoid these points altogether.

Third, unlike surveys which identify correlations between variables, Q-methodology identifies correlations between participants to distill participants' views into a manageable number of perspectives (Zabala et al., 2018). Rather than grouping traits, such as weight and height, Q-methodology groups participants based on the similarities in the ways they sorted the Q-set statements.

Finally, unlike surveys that require participants to respond to a prompt within the context of the researcher's framing, Q-methodology utilizes the words and framings of the participants (Addams & Proops, 2000). By ranking the statements, participants can portray how they think about ideas in relation to other ideas rather than simply rating how much they agree with each statement on its own (Brown, 1996). The participants can reflect their own perspectives in the context of the beliefs held by the larger community, as opposed to the context described by the

researcher. In summary, Q-methodology offers a more robust and nuanced understanding of participants' perspectives than traditional social research methods.

Q-methodology is a particularly effective tool in environmental policy analysis (Addams & Proops, 2000). While it is not intended to test causal relationships or to be generalizable to populations beyond the participant pool, it reveals distinct and detailed perspectives surrounding an issue. As Addams and Proops suggest, "Q [method] is shown to have tangible benefits in that it can be used both to provide policy makers and stakeholders with a better framework for understanding each other from the outset of the policy process and also to fruitfully increase policy options" (2000, p. 3). By understanding the different ways that people perceive an issue, policy makers can gather insight into policies that are appealing to individuals with varying values and priorities.

Study Procedures

Because of the COVID-19 pandemic and the need for social distancing, I conducted this Q-study remotely. I completed the following steps, which are described in detail in this section: 1) Developed the concourse; 2) Developed the Q-set; 3) Administered the online Q-sort; 4) Analyzed the data; and 5) Interpreted the results. The Western Washington University (WWU) Office of Research and Sponsored Program's Institutional Review Board (IRB) categorized this study as an exempt category #2 project with a protocol number of #3670EX20.

Step 1: Concourse Development

To develop the concourse, or the collection of statements covering a breadth of perspectives about the topic, I conducted semi-structured interviews with 17 study participants. Interviewees included stakeholders who live, work, or do regular business within Bellingham city-limits. The

participants were diverse in their employment as well as their knowledge of building electrification. Through the 17 interviews, I captured a wide breadth of thoughts and opinions about the proposed measures.

I recruited interviewees through a combination of methods. First, I collected names and contact information for individuals who submitted public comment to the city of Bellingham regarding the building electrification measures. I found this information on the public comment section of the City's website and in a public letter that was sent to the City by several critics of the proposed measures. Two staff members from the City reviewed the initial list of interviewees and recommended additional individuals to reach out to, which I did. After each interview, I asked the interviewee to forward my information and a summary of the study to other community members who might be interested in participating in an interview. I emphasized the importance of recruiting participants who held opinions different from their own. I recruited four of the 17 interviewees using this technique.

Before each interview, I asked participants to complete a short questionnaire (see Appendix A). The questionnaire asked for the individuals age, their address, their place of employment, their affiliation with a political party, and if they affiliate with any groups that have a stance on building electrification. In Q-studies, the participants are the variables, and the purpose of the method is to identify the thoughts and perspectives that exist about a particular topic amongst the participant pool (Brown, 1980). Q-studies do not evaluate the pervasiveness of the varying thoughts and perspectives nor do they identify demographic predictors (Brown, 1980). For this reason, I did not test for any correlation between the questionnaire information and the results. However, I did review the questionnaire responses to ensure that the participant pool was not homogenous. If a large majority of initial participants listed the same political party affiliation,

place of work, etc., I would have broadened my recruitment methods to ensure that participants represented a variety of these characteristics.

If I were to repeat this study, I would request that participants provide additional demographic information such as race and gender. By not requesting this information in my study, I limited my ability to determine if my participant pool was diverse in terms of these demographic identifiers. For example, I limited my ability to determine if any participants identified as black, indigenous, and/or people of color (BIPOC). As a researcher, it is critical that I take steps to ensure that the voices of historically less dominant narratives and perspectives, including those of BIPOC community members, are included in my research. By requesting this information in the questionnaire, I would be able to ensure that participants from various demographic groups, and particularly from groups that have historically been excluded from policy-making spaces and who face disproportionate impacts from climate change and the fossil fuel industry, were included in the study.

I conducted the interviews over Zoom, a video-conferencing platform, and, in several instances, over the phone. I used a list of guiding questions focused generally on the building electrification measures (included in Appendix B) to facilitate conversation, and I recorded each interview. The interviews lasted an average of 30 minutes. After each interview, I transcribed the recording and identified relevant, substantive statements from the transcriptions. I defined substantive statements as full thoughts that are relevant to the topic of the proposed building electrification measures in Bellingham. Statements varied in how they addressed the topic. For example, some statements related to the role of building electrification as a climate mitigation strategy, others related to the associated costs of electrification, and others related to the role of the City in promoting electrification. I compiled the statements from each interview, which resulted in a

concourse of 489 statements. Table 1 includes examples of several of the concourse statements.

Table 1. A subset of the substantive statements collected through interviews and public comments.

Example Concourse Statements	
1	“It is scientifically proven that the burning of fossil fuels and leaking of unburned natural gas into the environment is significantly affecting global climate change.”
2	“Instead of people, profits, and planet, the Task Force has placed the needs of regular Bellingham citizens, business owners, and low-income families on the back burner.”
3	“The city must take up appropriate funding mechanisms and implementation to make sure this is equitable.”
4	“We do not need to prop up Cascade Natural Gas.”
5	“I want a gas furnace, not a heat pump.”
6	“It is up to [City Council] to show leadership on this and make hard political decisions.”
7	“We need to know what the increased electric rate would be over natural gas. We know it will be something more and people already can't afford the houses they are in.”

Step 2: Q-Set Development

Next, I reduced the concourse to a subset of statements (n=40) that reflected the breadth of sentiments reflected in the concourse. This subset is known as the Q-set in Q-studies. The reduction of the concourse statements into the Q-set is for practical purposes as the quality of the Q-sort diminishes when a participant has more statements to process and sort.

To determine the Q-set, I discarded duplicate statements and reduced statements with similar meaning to one statement. I also identified recurring themes from the interviews relating to building electrification including: Natural gas viability, energy security, the role of government in climate mitigation, task force process, energy supply, building electrification costs, public health, climate science, climate risk, and housing affordability. I categorized the concourse statements into the themes and chose statements from each theme to ensure that all were represented in the Q-set. I chose the final statements based on their clarity, specificity, and relevance to the research topic. I edited the statements to ensure that they were clear and concise but did not change the content of the statements. After selecting the final subset of statements

(see Appendix C), I randomly ordered and numbered the statements for the purposes of the statistical analysis.

Step 3: Administering the Q-Sort

I utilized HtmlQ Flashware (v. 1.0.4; <https://github.com/aproxima/htmlq>), a Q-method software, to set up the online Q-sort. This allowed participants to complete the Q-sort remotely and to adhere to COVID-19 pandemic social-distancing guidelines. The Q-sort was hosted on the Western Washington University website. I administered the Q-sort to a total of 23 participants over the period of fall 2020.

To identify participants, I first reached out to the individuals who participated in the initial interviews (Step 1). Nine of these individuals responded to my inquiry and completed a Q-sort. I invited additional participants who were active on a thread about the proposed building electrification measures on the social media platform, NextDoor. Finally, I asked each participant to refer others who might want to participate in the study. To identify individuals with diverse perspectives, I specifically asked participants to refer others who hold opinions different than their own.

When participants visited the webpage to complete the Q-sort, I prompted them to watch a two-minute instructional video that I created for the activity. Next, I asked them to read through additional background information about the proposed building electrification measures and to complete an optional questionnaire (see Appendix 4). I did not test for correlation between perspectives and this information. Rather, I used the responses to the questionnaire to ensure that the participant pool was not homogenous. As discussed above, if I were to repeat this study, I would request that participants provide additional demographic characteristics in this form. This

would help me to ensure that I included participants who are part of specific identity groups that have historically been excluded from the policy-making space and who face disproportionate impacts from climate change and the fossil fuel industry.

I provided participants with instructions for completing the Q-sort. Participants first sorted the 40 Q-set statements into three piles: a pile including the statements they most agreed with, a pile including the statements they most disagreed with, and a pile including the statements they felt neutral or uncertain about. Participants then sorted the statement cards onto a distribution grid with nine columns ranging from +4 ('Agree') to -4 ('Disagree'), as shown in Figure 6. I instructed participants to assign the two statements they most agreed with from the agree pile to the cells at the positive extreme end of the distribution board (+4) and the two statements that they most disagreed with to the cells at the other extreme end of the distribution board (-4). Participants went back and forth between the agree and disagree pile, sorting statements from the extreme ends of the board inwards based on how much they agreed with the statement. Finally, participants placed the statements they felt neutral about in the cells towards the center of the grid. Once all the statements were placed on the grid, I prompted the participants to adjust the statements so that the distribution most accurately represented their viewpoint.

After completing the Q-sort, the participants had the opportunity to provide a written explanation of why they sorted the statements they did on the extreme ends of the distribution grid and of any additional thoughts they would like to share regarding the topic. The written explanations complimented the Q-sorts with a rich, detailed expression of the participants' thoughts and opinions about the topic.

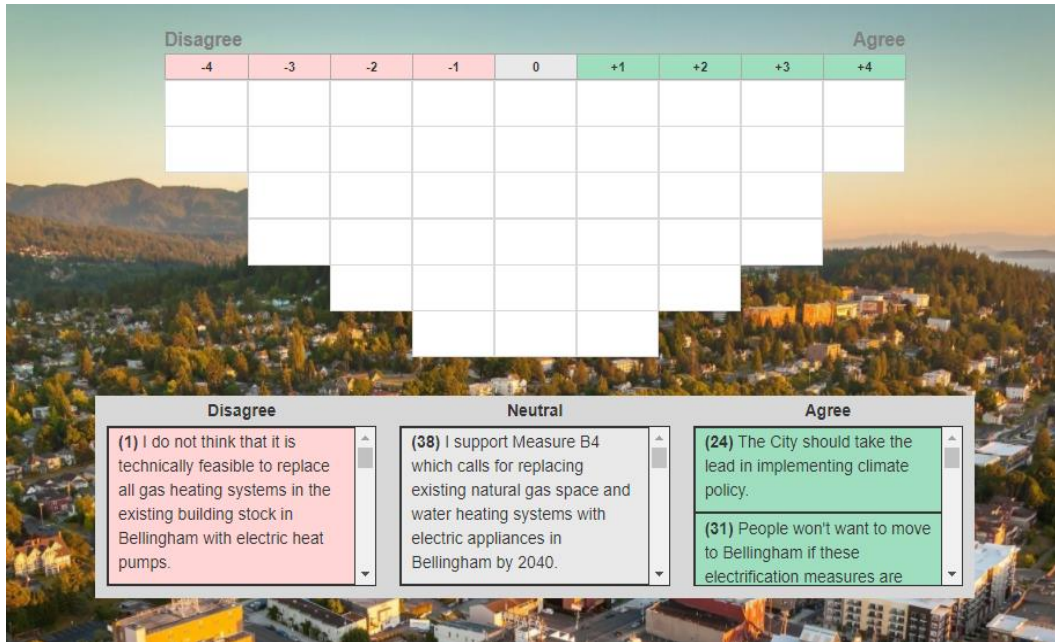


Figure 6. The online distribution grid and several statement cards used in this Q-study.

Step 4: Data Analysis

I used PQMethod software (v.2.35; <http://schmolck.org/qmethod/downpqwin.htm>), designed specifically for Q-studies, to complete a principle component analysis (PCA). PCA is a technique used to distill a large number of variables into fewer factors. In Q-method, the participants' Q-sorts are the variables (Brown, 1980).

I followed the instructions provided by PQMethod to enter the Q-set statements and the completed 23 Q-sorts into the program. I then directed PQMethod to complete the following three steps, described in detail in this section: 1) Run a PCA to identify groups with similar rankings; 2) Complete a varimax rotation on resulting factors; 3) Create factor arrays depicting the weighted average ranking for each statement within each factor group.

Step 4a: Principle Component Analysis

First, I ran a PCA, using the participants' Q-sorts as the variables to identify groupings of similar Q-sorts. These groupings, known as factors in Q-methodology, represent shared perspectives

amongst individual Q-sorts (Watts & Stenner, 2012). The PCA produced an unrotated correlation matrix which included a measure of similarity between every pairing of Q-sorts. Two Q-sorts that have a correlation score close to one are highly correlated, meaning the participants who completed each of those Q-sorts ranked statements in a similar way. Two Q-sorts that have a correlation score closer to zero in the correlation matrix have little in common.

Step 4b: Varimax Rotation

I then completed a factor rotation to maximize the overlap within each factor group and the differentiation between the factors. To determine the number of factors to rotate, I plotted the eigenvalues of factors on a scree plot (Figure 7). Based on the scree plot and qualitative analysis of the data, I initially retained and rotated two factors, PCA 1 (referred to as Factor 1 in this study) and PCA 2 (referred to as Factor 3 in this study). These two factors explained 67% of the total study variance.

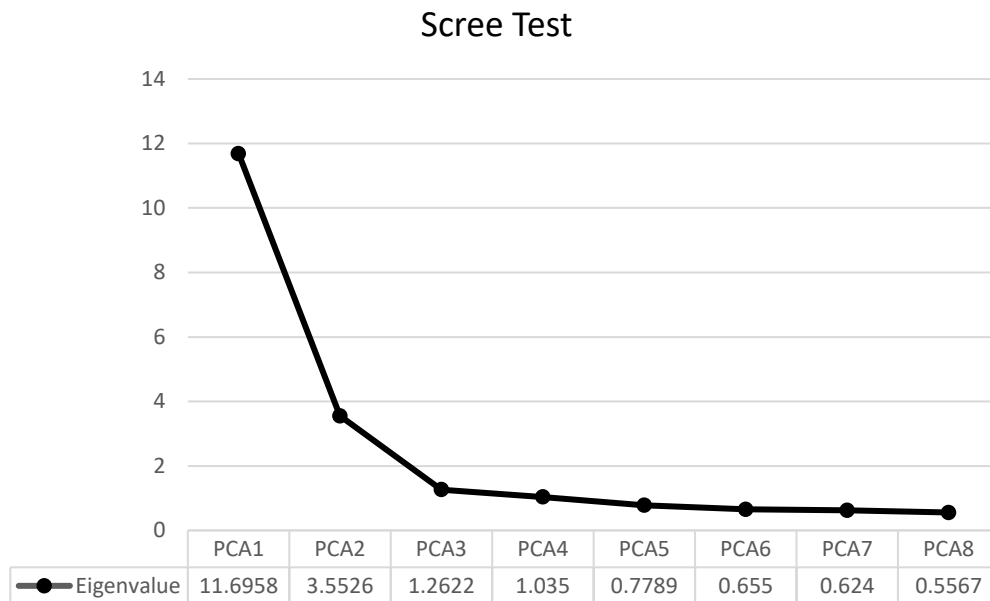


Figure 7. Scree plot of the eigenvalues of eight factors.

Two Q-sorts (sorts 14 and 23) were negatively associated with Factor 1 to a significant extent. This indicated that these Q-sorts represented the opposite of the other sorts associated with this factor. To isolate the sorts that were positively and negatively associated with Factor 1, I duplicated the factor and inverted a copy before continuing with the analysis.¹ Throughout the rest of the paper, I refer to the inverted factor as Factor 2.

The final analysis yielded a total of three factors, including the inverted factor. I wanted the Q-sort results to direct the analysis rather than my own subjectivity, so I utilized varimax rotation to rotate the three factors. Varimax positioned the factors automatically to account for the maximum amount of study variance (Watts & Stenner, 2012).

Step 4c: Factor Arrays

For each of the three factors, PQMethod assembled a factor array, which is essentially a Q-sort that represents the ideal viewpoint of a particular factor (Watts & Stenner, 2012). Each factor array captures the shared thinking for the group of participants represented by that factor. The factor arrays include the z scores, or weighted average scores, of the defining Q-sort's rankings of each statement for each factor. I used the factor arrays as the basis of factor interpretation.

¹ Steven Brown described the process for copying and inverting bipolar factors on the Q-method listserv (<https://listserv.kent.edu/cgi-bin/wa.exe?A0=Q-METHOD>) on September 9, 2008.

Step 5: Interpretation

I used both the quantitative results from the Q-analysis and the qualitative data from the post Q-sort written explanations to create narratives that illustrated the perspective represented by each factor.² I first highlighted which statements were ranked on either extreme (ex: +4, +3, -3, -4) in each factor array. These statements, which I called the defining statements, represent the ideas within the Q-set that each factor group felt most strongly about relative to the other statements. The defining statements included both those that each factor strongly agreed and disagreed with. Next, I noted the distinguishing statements for each factor, or the statements that were ranked in a very different way compared to other factors. The distinguishing statements highlight where one factor is different from the others. Appendix E includes the worksheets I developed to track this information for each factor. Finally, I walked through the factor array in its entirety and considered why each statement was ranked the way it was. I used the post-Q-sort written explanations to describe participant rationale behind the statements' rankings. At this point, I began to piece together the perspective represented by each factor group.

² Q-sorts 14 and 23 loaded onto both Factor 2 and Factor 3, indicating that they reflected the shared way of thinking represented by both of these factors. I included each sort in the quantitative analysis for the factor that it loaded onto most significantly—I included sort 14 in the quantitative analysis for Factor 3 and sort 23 in the quantitative analysis for Factor 2. I included the qualitative data associated with each sort in the interpretation of both factors.

I used an iterative process to develop the narratives describing each factor. I revisited the narratives on multiple occasions and, each time, I adjusted them so that they better reflected the statement rankings in the idealized sort and the participants' post Q-sort explanations. The final three factor narratives represent the study participants perspectives regarding the proposed building electrification measures. The narratives are included in the following chapter.

A Note on Q-Methodology

Researchers who use Q-method do not aim to produce results that are generalizable and do not make claims of validity or reliability, which are characteristics central to traditional social science methods (Brown, 1980). Q-method does not evaluate the pervasiveness of a perspective and does not claim to provide a comprehensive summary of all the perspectives that exist on a topic.

Q-methodology is rigorous in achieving what it claims to achieve—accessing and describing subjectivity in the words of the participants. The process for collecting and interpreting information is iterative and focused on the participants' framing as opposed to that of the researcher. In this Q-study, participants collectively provided the study statements in their words and context and, in their own terms, sorted the subset of statements in relationship to one another. Participants were then provided the opportunity to explain, in detail, why they sorted the statements the way they did, again, using their own words and context. The combination of both qualitative (interviews and Q-sort follow up questions) and quantitative (factor analysis) methods ensured that the results of the study represented the perspectives of participants as described by the participants. It is those perspectives which I turn to next.

Chapter 5: Results

I uncovered three factors in this study. The Q-set and each factor’s ranking of the statements, or factor array, are found in Table 2. Table 2 offers an easy way to compare how the statement rankings varied from factor to factor. Similar scores between factors suggest potential areas of consensus or common ground. Divergent statement scores between factors suggest areas of tension or disagreement.

Table 2. Building electrification priorities with factor scores depicted on a -4 (most disagree) to +4 (most agree) scale.

Statement	Factor #		
	1	2	3
1 I do not think that it is technically feasible to replace all heating systems in the existing building stock in Bellingham with electric heat pumps.	-1	1	2
2 Building electrification is necessary to achieve carbon neutrality.	2	-2	-4
3 There are so many other things to worry about that are much bigger than natural gas.	-2	3	0
4 The benefits of implementing these measures would outweigh the challenges.	1	-3	-1
5 Electricity costs too much compared to natural gas.	-1	0	-1
6 It is important to me to have a gas range to cook on.	-3	0	1
7 Having gas backup is important for if electricity goes out.	-1	3	0
8 I want to have the potential for energy options in my home or office.	-1	0	1
9 The consumer should be able to choose what type of energy they use for space and water heating.	-2	3	2
10 Let the market decide whether transitioning to electric systems and appliances makes sense.	-4	3	1
11 The City should focus on promoting incentives for installing efficient, electric appliances.	1	-1	2
12 I do not care if I use gas or electric appliances in my house, so long as I have a warm house and warm water.	0	0	0
13 We should focus on promoting energy efficiency in our existing and future building stock.	1	-1	2
14 The transition away from fossil fuels, including natural gas, is inevitable.	3	-4	-2
15 We need to source our electricity from 100% renewables before we implement the electrification measures.	-1	1	-3
16 We need to prioritize a process for overcoming the cost barrier associated with the transition to primarily electric systems and appliances.	2	2	3
17 There needs to be a deeper economic analysis to understand the true costs of implementing these measures.	0	1	4
18 I want to be conscious of how we use our natural resources.	3	1	1
19 Human-caused climate change is not a completely settled science.	-4	4	0
20 Climate change is a pressing issue.	4	-3	0
21 We need to prioritize reducing our greenhouse gas emissions.	4	-2	1
22 In considering these measures, Bellingham is right in line with where every city needs to curb the worst effects of climate change.	2	-1	-2
23 I believe that there are enough people in the City that can afford to electrify their houses and appliances on their own without being forced.	-2	0	-3
24 The City should take the lead in implementing climate policy.	3	-3	-1
25 The City should prioritize transitioning their own City buildings to use only efficient electric space and water heating systems.	1	-1	1
26 I want a gas furnace in my house.	-3	1	-1

27	I will voluntarily install a heat pump or other efficient electric system in my house or office when I replace my existing space and water heating system.	1	-2	-2
28	We need to consider the viability of our natural gas providers as we transition to a more sustainable future.	-2	0	-2
29	I am concerned that community members will lose their jobs if these measures are adopted.	-2	1	-1
30	We will see a community wide benefit of job creation if we adopt these measures.	0	-2	-3
31	People won't want to move to Bellingham if these electrification measures are adopted.	-3	2	-2
32	We must prioritize making housing more affordable in our community.	2	-1	4
33	The upfront capital cost is the number one barrier to installing efficient, electric heating systems, like heat pumps, for a large percentage of people.	1	-1	3
34	Transitioning the building stock to use primarily electric systems and appliances would increase the cost of housing in Bellingham.	0	2	3
35	Businesses won't want to do business in Bellingham if these measures are adopted.	-3	2	-1
36	There needs to be deeper consideration of public input before these measures are adopted.	0	4	3
37	There are major public health risks associated with natural gas.	0	-2	-3
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	2	-4	-4
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	3	-3	0
40	I need the City to provide more information before I decide if I do or do not support the measures.	-1	2	2

Table 3 depicts the degree to which each participant's Q-sort aligned with each of the three factor arrays as measured by the factor loading score (Watts & Stenner, 2012). Loading scores represent correlations between individual Q-sorts and factors, with higher scores indicating greater agreement between a participant and a factor group (Watts & Stenner, 2012). The defining Q-sorts for each factor, or the sorts with the highest loading score, are highlighted in bold in Table 3. Factor 1 is defined by 16 sorts, Factor 2 is defined by one sort, and Factor 3 is defined by six sorts. Taken together, the three factors accounted for 67 percent of the study variance.

Table 3. Factor loading scores with defining sorts in bold.

Q-sort No.	Factor #		
	1	2	3
1	0.7876	-0.7876	-0.1119
2	0.8225	-0.8225	-0.3534
3	-0.2224	0.2224	0.6479
4	0.9094	-0.9094	0.0077
5	0.3210	-0.3210	0.7935
6	0.8115	-0.8115	0.1660
7	0.7770	-0.7770	-0.1069
8	0.4720	-0.4720	0.0741
9	0.4591	-0.4591	0.6772
10	-0.1969	0.1969	0.7899
11	0.8974	-0.8974	-0.2275
12	0.8380	-0.8380	-0.2393
13	0.7225	-0.7225	-0.0614
14	-0.7641	0.7641	0.4753*
15	0.7428	-0.7428	0.2205
16	0.7351	-0.7351	0.1448
17	0.8145	-0.8145	0.0291
18	0.8758	-0.8758	-0.0077
19	0.7534	-0.7534	0.4669
20	0.8835	-0.8835	-0.0035
21	0.8895	-0.8895	-0.1659
22	-0.0001	0.0001	0.5032
23	-0.5890	0.5890*	0.6273
% explained variance	51	**	16

*Confounding Q-sorts, or those that have a significant loading score (at least 0.47) associated with more than one factor.
**Factor 2 is an inverted copy of Factor 1. Together, Factors 1 and 2 make up 51% of the study variance.

Factor Narratives

The three factor descriptions included in this section represent the Q-study participants’ perspectives towards the proposed building electrification measures that were recommended to the city of Bellingham. Table 4 includes a summary of each perspective and the associated factors correlation with other factors.

Table 4. Summary of the three factors and their associated perspectives.

Factor name	Defining characteristics	Correlation with other factors		
		1	2	3
Factor 1: The “Bold Climate Action Now” perspective	This group believed the city of Bellingham should adopt the building electrification measures, especially for new construction. They felt that natural gas is a major threat to the planet and human health. They supported bold climate governance and maintained that the City should take leadership in implementing climate action.	1.00	-0.77	-0.06
Factor 2: “Unregulated Energy Independence” perspective	This group opposed the building electrification measures. They were concerned about government intervention in individual decision making and believed that the City would be overstepping its role in mandating electrification. Further, they felt that the factual basis of climate change has been overexaggerated and did not believe that there is a need to reduce greenhouse gas emissions. Finally, they were concerned that the measures would be very costly to implement.	-0.77	1.00	0.46
Factor 3: The “Cost Concerned” perspective	This group believed that the City should not advance the proposed building electrification measures until they have a better understanding of the true costs associated with the measures and take more time to understand public input. They felt that the City should consider other policy options if they want to promote building electrification, such as promoting incentives for efficiency updates, rather than mandating electrification.	-0.06	0.46	1.00

Tables 5, 6, and 7, included respectively in each of the following three factor narratives, exhibit the defining statements for each factor group. The defining statements highlight the common ways of thinking amongst participants associated with each factor. Tables 5, 6, and 7 use a weighted average of the defining Q-sort’s rankings of each statement for each factor (known as the z score in Q-methodology) to facilitate an easy comparison of how a particular statement has been ranked by each factor (Watts & Stenner, 2012). Each statement included in Tables 5, 6, and 7 has a z score less than -1 or greater than +1. The tables also include the factor score of each defining statement (on the +4, ‘Most Agree’ to -4, ‘Most Disagree’).

Factor 1: The “Bold Climate Action Now” Perspective

The “Bold Climate Action Now” perspective ranged from individuals who, before participating in this study, were unfamiliar with the concept of building electrification to those who are intimately familiar with the topic through work, activism, or personal experience. They included sustainable builders, energy efficiency experts, government employees, architects, and clean energy advocates, amongst other Bellingham community members.

Table 5. Defining statements for the “Bold Climate Action Now” perspective (Z-scores greater than 1 or lower than -1).

Statement no.	Statement	Rank	Z-score
Strongly agrees with the following statements			
20	Climate change is a pressing issue.	4	1.91
21	We need to prioritize reducing our greenhouse gas emissions.	4	1.51
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	3	1.36
24	The City should take the lead in implementing climate policy.	3	1.24
18	I want to be conscious of how we use our natural resources.	3	1.09
14	The transition away from fossil fuels, including natural gas, is inevitable.	3	1.06
Strongly disagrees with the following statements			
35	Businesses won't want to do business in Bellingham if these measures are adopted.	-3	-1.27
26	I want a gas furnace in my house.	-3	-1.33
31	People won't want to move to Bellingham if these electrification measures are adopted.	-3	-1.45
10	Let the market decide whether or not transitioning to electric systems and appliances makes sense.	-4	-1.70
19	Human-caused climate change is not a completely settled science.	-4	-2.07

The “Bold Climate Action Now” perspective reflected two primary beliefs: human-caused climate change is happening, and we need to do something about it. They believe that promoting building electrification in Bellingham is an effective and necessary strategy to reduce the City’s GHG emissions and mitigate for climate change. The “Bold Climate Action Now” perspective supported Measure B5, which calls for the electrification of new construction within Bellingham city-limits. Measure B4, which calls for the electrification of Bellingham’s existing building

stock through retrofits and upgrading from natural gas systems to efficient, electric appliances like heat pumps at point-of-replacement, was also popular amongst this group because of the anticipated GHG emissions reductions. Some participants were concerned about the technical feasibility and economic viability of such a transition.

In their follow-up explanations, several participants expressed the urgency with which they felt the community must take climate action. One individual noted, “The time to act is yesterday. No more delays!” Another participant said, “If we don't act collectively on a global scale to avert catastrophic climate change, the result could be many times more damaging than the COVID-19 pandemic, and for not just years, but centuries or millennia... The costs of inaction (or inadequate action) are probably incalculable.”

Participants in this group supported the City taking the lead in promoting climate action within Bellingham, particularly since in their perspective the federal government has not implemented adequate policy. Some participants felt that, at this point, city intervention is necessary in promoting climate action. As one participant suggested, “I think people won't implement the changes necessary to address climate change on their own and need city policies to make sure those changes happen.” Other participants expressed their trust in the City in making the right decision. One participant shared: “I trust that if the people on the task force that put time and research into the options think this is our best strategy then I am willing to trust their recommendations.”

Those associated with the “Bold Climate Action Now” perspective indicated that they would be proud to see their city step up as an early adopter of building electrification. One participant shared, “It is not easy to be a leader and early adopter. This is not without cost or sacrifice, but

the alternative is.... mass species extinction, major food shortages and forced human migration resulting in global resource conflicts. This is the moral imperative of our time, and possibly of all time.” Another participant was hopeful that by adopting these measures, Bellingham could help spur a larger movement. This participant shared, “I believe that change can start on a small scale—communities can make large strides towards fighting climate change and reducing our footprint on the earth without waiting for federal mandates.”

Most participants associated with the “Bold Climate Action Now” perspective believed that building electrification will have benefits beyond GHG emissions reductions. As one participant noted, “We are just coming to understand the true, and truly alarming, health and safety impacts of gas consumption in our homes and other buildings. Even if gas combustion had no negative climate impacts, this alone is a major enough concern for us to worry about using this fuel.”

Several participants noted that, because of these risks, they did not want natural gas appliances in their own homes. Some participants suggested that phasing the use of natural gas out of the City would make Bellingham more attractive—people will want to live here and do business here if they do not have to worry about the health and safety risks associated with natural gas.

Despite the support for these measures, the “Bold Climate Action Now” perspective was concerned about the costs associated with electrifying the existing building stock. Participants associated with this factor cited the up-front costs of purchasing efficient, electric appliances and of retrofitting homes as the number one barrier to implementing these measures. They agreed that a process for overcoming the cost barrier must go hand in hand with these measures, particularly for the electrification of the existing building stock. Most participants noted wanting to see the City promote incentives for electrification, and several participants suggested that subsidies and financing programs could eliminate this cost barrier altogether.

In summary, the “Bold Climate Action Now” perspective felt that natural gas is a major threat to the planet and human health. Those holding this perspective supported bold climate action including mandated building electrification. Participants felt that the City should take leadership in climate policy adoption and economic assistance.

Factor 2: The “Unregulated Energy Independence” Perspective

Those associated with the “Unregulated Energy Independence” perspective consisted of a retired engineer and another community member who did not provide background information. The “Unregulated Energy Independence” perspective did not support the City adopting the building electrification measures. They justified their opposition to the measures by citing that human-caused climate change is not a settled science. In their follow-up explanation, one individual associated with the “Unregulated Energy Independence” perspective wrote: “CO₂ is not a cause of climate change. The geological record does not show a causative association between levels of CO₂ and climate change.” Therefore, this perspective felt that phasing out fossil fuels is unnecessary and would likely even be damaging to our community.

The “Unregulated Energy Independence” perspective felt that the benefits of natural gas and fossil fuels are a significant reason to oppose the building electrification measures. They cited that natural gas, a dispatchable source of energy, is more reliable than variable renewable energy sources that provide intermittent energy to our electrical grid. The idea that there are major public health risks associated with natural gas was unpopular amongst the “Unregulated Energy Independence” perspective. Rather, they believed that fossil fuels are essential to our well-being and life as we know it. In the follow-up explanation, one individual wrote: “Fossil fuels are, for the foreseeable future, essential for the health and quality of life of all people on the planet. Besides heat, electricity and transportation, carbon fuels are used as feedstock for many

industrial processes. Right now, a transition away from fossil fuels would make us much poorer and give support to our enemies.” Unlike the “Bold Climate Action Now” perspective, the “Unregulated Energy Independence” perspective saw a place for fossil fuels, including natural gas, in the future.

Table 6. Defining statements for Factor 2 (Z-scores greater than 1 or lower than -1).

Statement no.	Statement	Rank	Z-score
Strongly agrees with the following statements			
19	Human-caused climate change is not a completely settled science.	4	1.82
36	There needs to be deeper consideration of public input before these measures are adopted.	4	1.82
3	There are so many other things to worry about that are much bigger than natural gas.	3	1.37
7	Having gas backup is important for if electricity goes out.	3	1.37
9	The consumer should be able to choose what type of energy they use for space and water heating.	3	1.37
10	Let the market decide whether or not transitioning to electric systems and appliances makes sense.	3	1.37
Strongly disagrees with the following statements			
4	The benefits of implementing these measures would outweigh the challenges.	-3	-1.37
20	Climate change is a pressing issue.	-3	-1.37
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	-3	-1.37
24	The City should take the lead in implementing climate policy.	-3	-1.37
14	The transition away from fossil fuels, including natural gas, is inevitable.	-4	-1.82
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	-4	-1.82

The “Unregulated Energy Independence” perspective felt that the city of Bellingham is out of line in attempting to mandate that residents use a certain form of energy and specific types of appliances in their homes. They believed that the consumer should choose what type of energy they use in their own homes and businesses. Additionally, they supported the claim that, if electrification makes sense, the market will reflect that.

The group was also concerned about the process by which these measures were recommended to the City. Participants noted that there needs to be more opportunity for and deeper consideration of public input before the City goes any further with these measures. In the follow-up explanation, one participant said: “We need a lengthy public outreach on this. Most people don't even know about it. People must buy in on such a costly venture or it will result in endless litigation. If climate change is that important an issue, the city should be able to make its case to the people.”

Finally, the “Unregulated Energy Independence” perspective raised concerns about the costs of the measures. One participant stated that, “The costs of [electrifying the existing building stock] and the damage to our community will be enormous. Before embarking on such an effort there must be a clear and extensive cost-benefit analysis, which has not been done.” Participants were concerned that the costs associated with these measures would exacerbate the housing crisis already burdening Bellingham and that such a mandate would deter people from moving to or doing business in the City. One participant noted that the “necessity [of electrification] has been grossly exaggerated and economic impacts grossly underrepresented.”

In summary, the “Unregulated Energy Independence” perspective was opposed to the electrification measures. They were concerned about government intervention in individual decision making and believed that the City would be overstepping its role in mandating building electrification. Beyond that, they felt that the factual basis of climate change has been exaggerated, and they did not believe that there is a need to reduce GHG emissions. Finally, the “Unregulated Energy Independence” perspective was concerned that the measures would be damagingly costly to implement.

Factor 3: The “Cost Concerned” Perspective

The “Cost Concerned” perspective included an employee working in the natural gas industry, an individual associated with the local building association, an employee of a local sustainability focused non-profit, and a rental home proprietor, amongst other community members.

The “Cost Concerned” perspective was strongly opposed to the measure that would require the electrification of the existing building stock (Measure B4). In their follow-up explanations, several participants stated that mandating such a transition would be frivolous and might not even be technically feasible. As one participant noted, “There are many buildings that it would be extremely cost prohibitive to change the entire system to electric, and in some, it is impossible. One cannot just make a statement that everyone should change over. It sounds great in theory, but it is NOT realistic.” Participants were concerned that required electrification of the existing building stock would further exacerbate the housing crisis in Bellingham by increasing the cost of living. One participant noted that: “Bellingham is facing a housing affordability crisis. It's also facing a homelessness crisis... Electrification by any means necessary is not only wrong-headed, but it results in increased energy burden to those least able to afford it. If the point of fighting climate change is to ensure a prosperous and healthy future for all people, that cannot be accomplished by exacerbating the energy burden and sacrificing the well-being of those it seeks to protect. Instead, there must be a balance. Affordability and economic security **MUST** be a priority.” Another participant shared, “I am a firm believer in the current Climate Crisis - we must act now, but we must make changes that can have a real impact, not just virtue signaling... I have several rentals, if I am **FORCED** to change all to electric, then I will no longer have these units in the rental pool, because I am not in a position to pay for the changes... We cannot concurrently solve our housing problem, while forcing landlords to electrify.” In summary, this

group felt that requiring electrification in the existing building stock would be unfairly costly to many already cost-burdened community members.

Table 7. Defining statements for Factor 3 (Z-scores greater than 1 or lower than -1)

Statement no.	Statement	Rank	Z-score
Strongly agrees with the following statements			
32	We must prioritize making housing more affordable in our community.	4	1.86
17	There needs to be a deeper economic analysis to understand the true costs of implementing these measures.	4	1.85
36	There needs to be deeper consideration of public input before these measures are adopted.	3	1.65
34	Transitioning the building stock to use primarily electric systems and appliances would increase the cost of housing in Bellingham.	3	1.51
16	We need to prioritize a process for overcoming the cost barrier associated with the transition to primarily electric systems and appliances.	3	1.39
Strongly disagrees with the following statements			
28	We need to consider the viability of our natural gas providers as we transition to a more sustainable future.	-2	-1.03
15	We need to source our electricity from 100% renewables before we implement the electrification measures.	-3	-1.23
23	I believe that there are enough people in the City that can afford to electrify their houses and appliances on their own without being forced.	-3	-1.37
30	We will see a community wide benefit of job creation if we adopt these measures.	-3	-1.58
37	There are major public health risks associated with natural gas.	-3	-1.61
2	Building electrification is necessary to achieve carbon neutrality.	-4	-1.79
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	-4	-1.97

While they were strongly opposed to proposed Measure B4, those associated with the “Cost Concerned” perspective were less resistant to proposed Measure B5, which would require electrification in new construction. They justified some hesitation toward Measure B5 by citing a concern that the City does not know the full financial implications of adopting these measures. This group felt that the City must complete a deeper economic analysis to uncover the cost implications associated with building electrification.

Some participants in this group were also very concerned about the process through which the City came to consider these recommendations. One participant noted, “The Bellingham Climate

Action Plan and the Task Force Report are mostly biased propaganda and make claims that are factually false to create alarm.” Several participants noted that the City should have included more voices in the process. As one participant shared, “I think the [city of Bellingham] created a team, [the Climate Action Task Force], that had a hard agenda - Electrification. They did not seem to explore any other options, trees, nuclear, etc... We need way more research with REAL WORLD homeowners, landlords, electricians, builders, contractors.” The “Cost Concerned” perspective would like to see the City elicit and consider more public input before these measures go any further. One participant suggested that “This needs to be a fair process that involves more voices. I think in future the City could benefit from a neutral facilitator who allows ALL ideas and solutions to be brought to the table and treated with consideration and respect. It's hard to engage in earnest and foster creative brainstorming when your ideas are shouted down and not allowed at the table... What ideas were left on the table in the name of an all-or-nothing electrification plan?”

Within this group, participants did not agree on the topic of climate change. Just over half of the participants felt that human-caused climate change is not a completely settled science. One participant suggested that the science has been misinterpreted and that we should not be concerned about climate change. Another participant noted, “It’s pretty clear to me that people cause climate change.” Regardless of their stance on climate change, those associated with the “Cost Concerned” perspective were more concerned about the financial implications of the proposed building electrification measures than they were about the risk that climate change does or does not pose.

In summary, the “Cost Concerned” perspective believed that the City should not move any further with the electrification measures until they have a better understanding of the true costs

associated with the measures and take more time to understand public input. This group felt that the City should consider other policy options if they want to promote building electrification, such as promoting incentives for efficiency updates, rather than mandating electrification.

Reflections from the Researcher

The results of my study provide a useful description of three of the perspectives that exist in Bellingham regarding the proposed building electrification measures. Because of the nature of the method that I used and my upstream research choices, my findings likely did not capture all the perspectives that exist in Bellingham. While Q-methodology is not designed to capture a comprehensive summary of all the perspectives that exist regarding a given topic, the researcher can take steps to ensure that important perspectives are not missed. If I were to repeat this study, I would take several additional steps to ensure that I did not miss important perspectives or, at least, to be able to describe in more detail who was and was not included in the study.

In identifying participants for the initial interviews and Q-sorts, I relied on public comments to identify my “seed” participants who had well-developed views on building electrification. While I did recruit participants with well-developed perspectives about the topic using this method, this first step excluded participants who have well-developed perspectives but did not share them through a public comment to the City. Next, I asked the seed participants to refer other participants who have opinions different than their own. Generally, participants either did not refer others or referred others who had similar opinions to their own. This method was effective in identifying participants with different perspectives in a couple of instances, but still, these participants were in the same general social circles. To recruit my final participants for the Q-sort, I sought out individuals who were vocal about the topic of the building electrification measures on NextDoor. Again, while I did recruit participants with well-developed perspectives

through this method, the strategy excluded individuals who were not vocal about their perspectives on the social media site. It is likely that, because of the participant recruitment choices that I made, certain perspectives were not included in my study.

If I were to repeat this study, I would broaden my recruitment methods. I would seek out participants in person rather than online. I would recruit participants at events and in spaces that are frequented by a variety of people holding varying perspectives, like the grocery store or the library. I would also ask each participant which voices needed to be represented in the study and ensure that these voices were, indeed, represented.

Next, if I were to repeat this study, I would collect the participants' demographic information, such as race, ethnicity, and gender, as part of the pre-interview and pre-Q-sort questionnaire. I would use the demographic information to ensure that I included groups who have historically been underrepresented in policy-making spaces and who face disproportionate impacts from climate change and the fossil fuel industry in the study, such as tribal members living in Bellingham. Without explicitly asking participants for demographic information, I was unable to confirm if these folks were or were not included in the study. Because certain perspectives were likely not included in the study, the ideas that are most important to these perspectives might not have been included in the concourse or the Q-set.

Finally, the decisions that I made on how to extract factors shaped the perspectives that emerged from the study. While Q-methodology requires the researcher to make decisions regarding factor extraction, it is important to note that my own understanding of the topic influenced the results of the quantitative analysis.

I acknowledge that the results of this study were influenced by some of the choices that I made as the researcher and are limited to the participant pool that I included in the study. Still, the theoretical and empirical insights from this study offer wisdom that the city of Bellingham should consider as they move forward with building electrification and other climate mitigation strategies. In the following chapter, I consider the perspectives captured by this study and make several recommendations for how the city of Bellingham can identify policies that are both widely acceptable to people with diverse perspectives and effective in mitigating for climate change.

Chapter 6: Discussion

As described in Chapter Two, cultural theory and cultural cognition theory assert that the varying ways that people understand a policy topic are rooted in four competing ways of life, or cultural worldviews (Douglas & Wildavsky, 1982; Kahan & Braman, 2006). According to cultural cognition, people process information in a way that reflects the tendencies of their cultural worldview as they work to maintain membership to their cultural group (Kahan & Braman, 2006). They accept information that affirms their worldview and reject information that threatens it (Kahan & Braman, 2006). According to this framework, an individual's worldview shapes the way that they perceive and understand the world more than any other factor (Douglas & Wildavsky, 1982; Kahan & Braman, 2006).

Historically, climate policy advocates have relied on promoting factual information to garner support for climate policies. Despite scientific consensus that human-caused climate change is happening, people with worldviews that are predisposed to resist climate policy will not change their minds when provided with more information about climate change (Kahan, 2012). People with different cultural worldviews perceive the topic in fundamentally different ways and will continue to do so no matter what the best available science suggests (Kahan & Braman, 2006; Verweij et al., 2006). The reliance on promoting factual information has prolonged and deepened the controversy surrounding climate change by obscuring the varying values at the heart of the issue (Kahan, 2012). In response to this, policy makers must reframe their approach to combatting climate change by imagining and implementing solutions that are meaningful and beneficial to stakeholders with varying perspectives (Kahan et al., 2012; Verweij et al., 2006).

In this chapter, I recommend how the city of Bellingham can utilize the theoretical framework that I drew on throughout this research and the results from my study to reframe their approach

to addressing climate change. I suggest that, by imagining and implementing solutions that are meaningful and beneficial to stakeholders with varying perspectives, the City can effectively combat climate change with policies that are 1) more viable, 2) more durable, 3) and overall better policies than those that consider the priorities and concerns of just one perspective (Verweij et al., 2006).

The results of my Q-study indicate that multiple distinct perspectives regarding the proposed building electrification measures exist in Bellingham. The study participants represented three well-developed perspectives—the “Bold Climate Action Now” perspective, the “Unregulated Energy Independence” perspective, and the “Cost Concerned” perspective. Each perspective prioritized different concerns and values. Specifically, I found that differing notions of several themes underpinned the perspectives: 1) climate change risk, 2) social, environmental, and economic priorities, and 3) the need for government intervention.

As discussed in Chapter Five, the results of my research are limited to the participant pool included in this study. Because of the nature of the method that I used and my upstream research choices, I likely did not capture all the distinct perspectives regarding building electrification that exist in Bellingham. For example, my results did not address the significant environmental justice concerns associated with natural gas extraction and transportation, which are well cited in the literature (McKenzie et al., 2012; Vidic et al., 2013; H. F. L. Williams et al., 2008). This might indicate limited sampling of participants. While the results of this study likely do not offer a complete picture of all the perspectives that exist in Bellingham, they offer empirical evidence that distinct perspectives towards building electrification do exist in the City. They also provide a rich description of three perspectives that do exist. As noted throughout this chapter, in addition to considering the theoretical and empirical insights addressed by my study, the city of

Bellingham should take steps to uncover any other perspectives that were not addressed by my results.

Building Electrification and Two-Channel Communication

As the city of Bellingham determines how to move forward with the proposed building electrification measures, they should consider how to effectively communicate the benefits of electrification in a way that is meaningful to people who hold varying perspectives about the topic. Cultural cognition scholars suggest that utilizing a *two-channel communication strategy* in addressing complex issues promotes open-mindedness amongst those with different ways of seeing the world (Kahan et al., 2015). The two-channel strategy combines content (channel 1), or sound information that is conveyed in a way that is comprehensible to the public, with social meaning (channel 2), or addressing the content in a way that is affirming and meaningful to people (Kahan et al., 2015). The strategy recognizes that the individual will assess information to determine if assenting to it will connect that individual to others who share the same worldview or estrange them from their like-minded peers (Kahan et al., 2015). If they perceive that information is going to drive a wedge between them and others who adhere to their worldview, they are going to react to that information in a close-minded way (Kahan et al., 2015). If the information is presented to them in a way that is meaningful to and affirming of their worldview, they are more likely to respond in an open-minded way (Kahan et al., 2015).

To utilize the two-channel strategy, the City might steer away from relying on the climate change framing of this policy, as the varying perspectives identified in this study have different perceptions of the risk that human-caused climate change poses. The City should instead emphasize the many additional benefits of all-electric buildings beyond the potential for GHG

emissions reductions. For example, a growing body of research shows that, in many scenarios, new all-electric buildings result in cost savings compared to buildings with gas systems and appliances considering the avoided cost of gas infrastructure and services associated with natural gas (Billimoria et al., 2018; Evolved Energy Research, 2019). In existing conditions, heat pumps generally have higher up-front costs than their gas counterparts, but the cost savings associated with reduced energy consumption reduces the total cost over the lifetime of the appliance (Billimoria et al., 2018). In new homes, heat pumps are the lowest cost option for customers who want both heating and air conditioning as one heat pump can serve both functions (Billimoria et al., 2018; Deason et al., 2018). These points, framed around affordability and cost savings, will likely be more palatable to the “Cost Concerned” perspective and, potentially, to the “Unregulated Energy Independence” perspective than purely relying on a climate change framing. The “Bold Climate Action Now” perspective will likely continue to support the measure because of its role in curbing climate change, even if this point is not the focus in the messaging for the measure.

Additional benefits of electrification include improved indoor air quality (Seals & Krasner, 2020), enhanced comfort, increased efficiency, potential for reduced utility bills (Billimoria et al., 2018), and a reduction in social and environmental injustices associated with natural gas and other fossil fuels (Phillips & Goldberg, 2013). The City should consider naming initiatives or programs related to building electrification in a way that highlights these benefits. For example, “Better Buildings” is a building efficiency initiative of the U.S. Department of Energy (DOE). By highlighting all-electric buildings as better buildings, the DOE promotes efficient, electric technology as modern and desirable. Comfort 365 is a partnership based out of Boulder, CO that focuses on efficiency and electrification. By highlighting comfort in their title, rather than calling

themselves Carbon 365 or Climate 365, the partnership is more likely to garner the support of people who might be turned off or just not motivated by the climate framing.

Finally, the City should avoid framing building electrification in a way that threatens the values and priorities of the varying perspectives. For example, the City should avoid pushing anti-fossil fuel and anti-industry messages when addressing the transition away from fossil fuels. The “Unregulated Energy Independence” perspective feels that fossil fuels are imperative to the community’s way of life, and they will likely perceive the potential elimination of fossil fuels from the City’s building sector as threatening. While addressing the role that fossil fuels play in global warming will be imperative as Bellingham strives to reach its GHG emission reduction targets, writing off the concerns and values of the “Unregulated Energy Independence” perspective risks alienating a portion of the community. Such alienation could lead to and exacerbate issues of trust between this group and the City and could be detrimental to the government’s capacity to implement meaningful policies and solve problems in the future. Therefore, the City should avoid anti-industry and anti-fossil fuel messaging. Instead, the City might promote messaging around the potential for technological innovation and economic growth associated with building electrification and other strategies to reduce GHG emissions (Kahan, 2007).

In utilizing the two-channel strategy, the City can garner support for electrification from a broader audience. If the messaging surrounding building electrification responds to the values and concerns of the varying perspectives, more stakeholders will see the electrification as beneficial, be it for different primary reasons.

Building Electrification the Clumsy Way

To effectively mitigate for climate change, the city of Bellingham should consider how to move forward with building electrification in a way that affirms, or at least does not threaten, the values and priorities of those holding varying perspectives. As introduced in Chapter Two, the notion of clumsy solutions suggests that policies that consider and combine components of the varying cultural worldviews can make complex, seemingly-intractable problems, like climate policy, tractable (Verweij et al., 2006). Clumsy solutions are viable as they affirm the values and priorities of the different worldviews and durable over time. Additionally, they are powerful in that they provide an opportunity to address multiple issues at once.

Generally, clumsy solutions are identified early in the policy process—usually before a specific policy option is seriously considered. At the time I conducted my study, the two proposed building electrification measures had already been recommended to the city of Bellingham as climate mitigation measures by a select group, the Climate Action Task Force, and were being considered by decision makers. Arguably, the opportunity for these measures to represent a clumsy solution had passed. Still, the City can draw from the notion of clumsy solutions as they determine how to move forward with the proposed measures.

In considering clumsy solutions to building electrification, the City should consider the three perspectives that I identified in this study and work to uncover additional perspectives regarding the topic that exist within city-limits. Specifically, the City should work to identify groups who have historically been underrepresented in policy making spaces and/or who face disproportionate impacts from climate change and the fossil fuel industry. This might include tribal members living in Bellingham, low-income communities, and other marginalized identity

groups. The City might host focus groups or use another method to uncover additional perspectives.

The three perspectives uncovered by my study indicated varying levels of support for Measure B5, which would require that only electric systems and appliances be installed in new construction within Bellingham city-limits. The “Bold Climate Action Now” perspective and the “Unregulated Energy Independence” perspective were polarized in their support for this measure (ranked at +3 and -3, respectively). The “Cost Concerned” perspective did not indicate overwhelming support for or criticism towards the measure (ranked at 0), but individuals associated with this perspective were consistently concerned about the price of building electrification in Bellingham. If the City chooses to move forward with mandating electrification in new construction, policy makers should consider messaging that make this policy palatable to those with varying perspectives towards the topic, as discussed in the previous section. They should also consider ways to address the concerns of the varying perspectives, as discussed in the following paragraphs.

The perspectives identified in my study also varied in their support for recommended Measure B4, which calls for replacing natural gas space and water heating systems with electric appliances in the existing building stock in Bellingham by 2040. While the “Bold Climate Action Now” perspective generally supported this measure (ranked at +2), some participants were hesitant because of the potential costs and technical complexity of implementing such a policy. Both the “Unregulated Energy Independence” perspective and the “Cost Concerned” perspective strongly disagreed with this measure (both ranked the statement at -4). If this policy were adopted, it is likely that it would face resistance. This resistance could lead to ineffective implementation and polarity between those holding varying perspectives.

The City should consider alternatives to the command and control approach to encourage the uptake of efficient, electric appliances. For example, through subsidizing the cost of these appliances, the City can help make them cost competitive with natural gas alternatives and accelerate electrification through market forces. The City should partner with Puget Sound Energy (PSE), the local electricity utility, or another group or organization to promote subsidies and other incentives that encourage households and building owners to upgrade to efficient, electric systems and appliances on their own. At the time this study was completed, PSE offered rebates to customers who purchased electric space and water heat pumps. By financially supporting this program and promoting the rebates, the City could increase the programs' capacity and effectiveness. The City might also offer additional rebates or provide financial and technical assistance to a local organization to further subsidize the cost of new electric appliances. Policy makers might look to the city of Boulder, Colorado who offers rebates on heat pumps through the Comfort 365 partnership with Boulder County. Incentivizing electrification will likely be affirming to the "Bold Climate Action Now" perspective for its climate implications and to the "Cost Concerned" for its affordability implications. Both the "Bold Climate Action Now" perspective and the "Cost Concerned" perspectives indicated support for the City promoting incentives for electrification (ranked at +1 and +2, respectively).

While the "Unregulated Energy Independence" perspective did not support the City promoting incentives (ranked the statement at -1), they agreed with the other two perspectives that the City needs to find a way to overcome the cost barrier associated with building electrification. In response to this, the City might consider promoting financing options that help individuals spread out the up-front cost associated with purchasing efficient, electric appliances. For example, on-bill financing and on-bill repayment programs offer options for property owners or

renters to pay for investments in clean energy and efficiency upgrades over time through their utility. Through on-bill financing, a utility incurs the cost of an energy upgrade, and the customer pays the utility back through monthly charges on their utility bill (DOE, n.d.). On-bill repayment uses the same concept, but the investment is paid for by a third party rather than the utility (DOE, n.d.). Orcas Power and Light Co-op in Washington offers a “Switch It Up!” on-bill financing program that provides customers with a way to finance heat pumps and the removal of fossil-fuel powered systems and appliances without taking on debt. The City might consider ways to incentivize and support PSE or another third party in offering on-bill financing or repayment programs.

Clumsy Solutions to Climate Change

Moving forward, the city of Bellingham and other cities should seek out clumsy solutions to climate change early in the policy process. The process of identifying a clumsy solution relies on dialogue-based problem-solving strategies (Ney & Verweij, 2015). These strategies include the voices of all worldviews and encourage discourse and debate around the varying policy stories. Both the “Cost Concerned” perspective and the “Unregulated Energy Independence” noted that they felt that important voices had been excluded from the Climate Action Task Force and that they would like the City to facilitate a more inclusive process to climate governance in the future. By nature, the process of identifying clumsy solutions does just that. Ney and Verweij (2015) identify processes that are most likely to promote dialogue and elicit clumsy solutions. Each of the strategies they identify require individuals to talk to one another, rather than past one another.

The perspectives identified in my study, paired with insights from cultural theory and cultural cognition, offer ideas of clumsy solutions that the City may explore in the future. First, policy

makers might consider ways to address both housing affordability and climate mitigation through one policy. In fact, policy makers might identify a housing affordability policy that just happens to have climate benefits as well. During the 2021 legislative session, the state of Washington considered a bill, HB 1157, that would increase housing supply through providing housing density tax incentives for local governments (HB 1157, 2021). This would both increase housing supply and affordability, to the appeal of the “Cost Concerned” perspective, and reduce GHG emissions by limiting sprawl, which would likely be well received by the “Climate Action Now” perspective. While this bill stalled in the legislative session, Bellingham might consider how to promote similar solutions that would address the concerns of multiple perspectives at once. In doing this, the City can help develop good community faith in local government action while also taking steps to mitigate for climate change.

In considering clumsy solutions to climate change, the City might consider ways to promote business and industry focused on clean energy and efficient, electric technology. For example, by using regulatory measures to promote innovation in the energy sector, the City could assist companies in making renewable energy and efficient products more affordable. This would both mitigate for climate change and support economic growth and entrepreneurship (Verweij et al., 2006). The use of market forces would likely be appealing to the “Unregulated Energy Independence” perspective. The cost competitiveness component would likely be attractive to the “Cost Concerned” perspective. Finally, the “Climate Action Now” perspective would likely support the opportunity for government leadership in addressing climate change.

Through considering clumsy solutions to climate change, the City is not committing itself to a specific course of action. Rather, policy makers can consider a wide array of potential solutions that are affirming to those coming from multiple worldviews and encourage stakeholders with

varying perspectives to talk to and listen to one another. By considering clumsy solutions, policy makers can identify solutions that are viable, durable, and effective in combatting climate change. Policy makers might also find that seemingly unrelated topics, like climate action and housing affordability, are made coherent and compatible through clumsy solutions.

Chapter 7: Conclusion

In this study, I utilized Q-methodology to identify three perspectives regarding two proposed building electrification measures that were recommended to the city of Bellingham, Washington by the City's Climate Action Task Force (CATF) in 2019. Individuals associated with the three perspectives—the “Bold Climate Action Now” perspective, the “Unregulated Energy Independence” perspective, and the “Cost Concerned” perspective—had varying opinions about and levels of support for the two proposed measures. I found that these varying opinions were underpinned by differing notions of climate change risk, social, environmental, and economic priorities, and the need for government intervention. Despite the differences in these perspectives, I identified opportunities for policy makers to consider strategies to mitigate for climate change and address the values and priorities of each of the perspectives.

While the results of this research cannot be generalized to Bellingham as a whole or communities in other places, they offer a rich description of perspectives that exist within the community—perspectives which deserve further consideration by City leadership if these proposed measures and future strategies to combat climate change are to be politically tenable. The city of Bellingham should investigate and consider the values, priorities, and concerns of additional perspectives that might exist amongst Bellingham stakeholders. Specifically, they should seek out perspectives of stakeholders who historically have been left out of policy making spaces and/or who face disproportionate impacts from climate change and the fossil fuel industry. By considering each of these perspectives, the city of Bellingham can identify policies and framings that are meaningful and mutually agreeable to individuals with varying ways of thinking about the topic.

The results of Q-studies are, by nature, indicative of the perspectives of the participant pool and are not generalizable to the larger population. As discussed in Chapter Five, I likely missed perspectives that should be included in the policy making space. Future research might seek a comprehensive portrayal of all perspectives regarding the building electrification measures within the city of Bellingham. Future research might also seek generalizable results (through a survey informed by this work, for instance) to determine how prevalent each perspective is within the community. Additional research might explore potential clumsy solutions and gauge the level of community support for alternative policy options, including those introduced in Chapter Six.

Beyond Bellingham, climate policy makers in other cities can use this research as insight into perspectives that may exist in their city as they work to identify climate policy solutions. Again, the results of my study are not generalizable so it cannot be assumed that the same perspectives exist elsewhere. However, the theoretical framework that I drew on throughout this research suggests that similar values and priorities regarding building electrification and other climate policies likely exist in other contexts (Douglas & Wildavsky, 1982). Policy makers in other cities may replicate the methods of this study to understand the nuances of perspectives in their own cities as they work to identify thoughtful and effective climate policies. By considering and responding to all voices, policy makers can develop climate solutions that are viable, durable over time, and overall, better policies as they address multiple issues at once.

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Appendix A: Pre-Interview Demographic Questionnaire

1. What is your date of birth?
2. What is your address?
3. If you are employed, what is your place of employment?
4. What political party do you affiliate with?
5. Do you affiliate with any groups or organization that have a public stance on building electrification, natural gas, climate action, etc.? If so, what group(s) do you affiliate with?

Appendix B: Interview Question Guide

Interview Questions:

1. Do you think the City of Bellingham should adopt the building electrification measures, B4 and B5 that call for the electrification of all new construction and the gradual full electrification of existing buildings? Why or why not?
2. What do you see as the primary benefits of building electrification?
3. What are your concerns with building electrification in general? Can you expand on that?
4. What are your primary concerns with these proposed measures, if any?
5. If these measures are adopted by the City, do you foresee there being any “losers” or individuals or groups of people who will not benefit from these measures? If these measures are adopted, how do we address that?
6. If supporter: If these measures are adopted, what do you see as the most important considerations or next steps to implement them?
7. What do you think of the City’s process for climate action planning? What does a more inclusive climate planning strategy look like to you? Who needs a seat at the table?
8. When is background research/a study enough? When do we know we have enough information to move forward?
9. How much of a risk does climate change pose to our community?
10. What is the need for local climate action?
11. Who should be responsible for climate action?

Appendix C: Q-set

1. I do not think that it is technically feasible to replace all heating systems in the existing building stock in Bellingham with electric heat pumps.
2. Building electrification is necessary to achieve carbon neutrality.
3. There are so many other things to worry about that are much bigger than natural gas.
4. The benefits of implementing these measures would outweigh the challenges.
5. Electricity costs too much compared to natural gas.
6. It is important to me to have a gas range to cook on.
7. Having gas backup is important for if electricity goes out.
8. I want to have the potential for energy options in my home or office.
9. The consumer should be able to choose what type of energy they use for space and water heating.
10. Let the market decide whether or not transitioning to electric systems and appliances makes sense.
11. The City should focus on promoting incentives for installing efficient, electric appliances.
12. I do not care if I use gas or electric appliances in my house, so long as I have a warm house and warm water.
13. We should focus on promoting energy efficiency in our existing and future building stock.
14. The transition away from fossil fuels, including natural gas, is inevitable.
15. We need to source our electricity from 100% renewables before we implement the electrification measures.
16. We need to prioritize a process for overcoming the cost barrier associated with the transition to primarily electric systems and appliances.
17. There needs to be a deeper economic analysis to understand the true costs of implementing these measures.
18. I want to be conscious of how we use our natural resources.
19. Human-caused climate change is not a completely settled science.
20. Climate change is a pressing issue.
21. We need to prioritize reducing our greenhouse gas emissions.
22. In considering these measures, Bellingham is right in line with where every city needs to curb the worst effects of climate change.
23. I believe that there are enough people in the City that can afford to electrify their houses and appliances on their own without being forced.
24. The City should take the lead in implementing climate policy.
25. The City should prioritize transitioning their own City buildings to use only efficient electric space and water heating systems.
26. I want a gas furnace in my house.
27. I will voluntarily install a heat pump or other efficient electric system in my house or office when I replace my existing space and water heating system.
28. We need to consider the viability of our natural gas providers as we transition to a more sustainable future.
29. I am concerned that community members will lose their jobs if these measures are adopted.
30. We will see a community wide benefit of job creation if we adopt these measures.
31. People won't want to move to Bellingham if these electrification measures are adopted.

32. We must prioritize making housing more affordable in our community.
33. The upfront capital cost is the number one barrier to installing efficient, electric heating systems, like heat pumps, for a large percentage of people.
34. Transitioning the building stock to use primarily electric systems and appliances would increase the cost of housing in Bellingham.
35. Businesses won't want to do business in Bellingham if these measures are adopted.
36. There needs to be deeper consideration of public input before these measures are adopted.
37. There are major public health risks associated with natural gas.
38. I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.
39. I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.
40. I need the City to provide more information before I decide if I do or do not support the measures.

Appendix D: Q-Sort Demographic Form

Please answer the following questions to help ensure that a range of perspectives are included in this study. The recorded personal information will not be shared in the final paper or presentation.

Name: _____

Age (Enter Year of Birth): _____

Home Zip Code: _____

Do you affiliate with any groups or organizations that have a public stance on building electrification, natural gas, climate action, etc.? If so, what group(s) do you affiliate with? _____

Is there anything else you would like to share about your feelings towards transitioning the building stock in Bellingham to use primarily electric systems and appliances?: _____

Appendix E: Factor Crib Sheets

Table 8. Factor 1 draft crib sheet for factor interpretation.

Statement no.	Statement	Rank	Z-score
* Indicates distinguishing statements with significance at P<0.05.			
** Indicates distinguishing statements with significance at P<0.01.			
Strongly agrees with the following statements			
20	Climate change is a pressing issue.	4	1.91**
21	We need to prioritize reducing our greenhouse gas emissions.	4	1.51**
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	3	1.36**
24	The City should take the lead in implementing climate policy.	3	1.24**
18	I want to be conscious of how we use our natural resources.	3	1.09
14	The transition away from fossil fuels, including natural gas, is inevitable.	3	1.06**
Strongly disagrees with the following statements			
6	It is important to me to have a gas range to cook on.	-3	-0.99*
35	Businesses won't want to do business in Bellingham if these measures are adopted.	-3	-1.27**
26	I want a gas furnace in my house.	-3	-1.33**
31	People won't want to move to Bellingham if these electrification measures are adopted.	-3	-1.45**
10	Let the market decide whether or not transitioning to electric systems and appliances makes sense.	-4	-1.70**
19	Human-caused climate change is not a completely settled science.	-4	-2.07**
Additional distinguishing statements (* significance at P<0.05; ** significance at P<0.01)			
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	2	0.99**
2	Building electrification is necessary to achieve carbon neutrality.	2	0.95**
22	In considering these measures, Bellingham is right in line with where every city needs to curb the worst effects of climate change.	2	0.93**
32	We must prioritize making housing more affordable in our community.	2	0.86**
4	The benefits of implementing these measures would outweigh the challenges.	1	0.81**
27	I will voluntarily install a heat pump or other efficient electric system in my house or office when I replace my existing space and water heating system.	1	0.61**
30	We will see a community wide benefit of job creation if we adopt these measures.	0	0.47**
37	There are major public health risks associated with natural gas.	0	0.32**
36	There needs to be deeper consideration of public input before these measures are adopted.	0	-0.12**
34	Transitioning the building stock to use primarily electric systems and appliances would increase the cost of housing in Bellingham.	0	-0.52**
15	We need to source our electricity from 100% renewables before we implement the electrification measures.	-1	-0.54*
1	I do not think that it is technically feasible to replace all heating	-1	-0.58*

	systems in the existing building stock in Bellingham with electric heat pumps.		
40	I need the City to provide more information before I decide if I do or do not support the measures.	-1	-0.59**
7	Having gas backup is important for if electricity goes out.	-1	-0.70**
3	There are so many other things to worry about that are much bigger than natural gas.	-2	-0.85**
9	The consumer should be able to choose what type of energy they use for space and water heating.	-2	-0.93**

Table 9. Factor 2 draft crib sheet for factor interpretation.

Statement no.	Statement	Rank	Z-score
* Indicates distinguishing statements with significance at P<0.05.			
** Indicates distinguishing statements with significance at P<0.01.			
Strongly agrees with the following statements			
19	Human-caused climate change is not a completely settled science.	4	1.82**
36	There needs to be deeper consideration of public input before these measures are adopted.	4	1.82
3	There are so many other things to worry about that are much bigger than natural gas.	3	1.37*
7	Having gas backup is important for if electricity goes out.	3	1.37*
9	The consumer should be able to choose what type of energy they use for space and water heating.	3	1.37
10	Let the market decide whether or not transitioning to electric systems and appliances makes sense.	3	1.37
Strongly disagrees with the following statements			
4	The benefits of implementing these measures would outweigh the challenges.	-3	-1.37
20	Climate change is a pressing issue.	-3	-1.37**
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	-3	-1.37**
24	The City should take the lead in implementing climate policy.	-3	-1.37
14	The transition away from fossil fuels, including natural gas, is inevitable.	-4	-1.82
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	-4	-1.82
Additional distinguishing statements (* significance at P<0.05; ** significance at P<0.01)			
31	People won't want to move to Bellingham if these electrification measures are adopted.	2	0.91**
35	Businesses won't want to do business in Bellingham if these measures are adopted.	2	0.91*
15	We need to source our electricity from 100% renewables before we implement the electrification measures.	1	-0.46*
29	I am concerned that community members will lose their jobs if these measures are adopted.	1	-0.46*
13	We should focus on promoting energy efficiency in our existing and future building stock.	-1	-0.46**
32	We must prioritize making housing more affordable in our community.	-1	-0.46**
33	The upfront capital cost is the number one barrier to installing efficient, electric heating systems, like heat pumps, for a large percentage of people.	-1	-0.46*
11	The City should focus on promoting incentives for installing efficient, electric appliances.	-1	-0.46*
21	We need to prioritize reducing our greenhouse gas emissions.	-2	-0.91*

Table 10. Factor 3 draft crib sheet for factor interpretation.

Statement no.	Statement	Rank	Z-score
* Indicates distinguishing statements with significance at P<0.05.			
** Indicates distinguishing statements with significance at P<0.01.			
Strongly agrees with the following statements			
32	We must prioritize making housing more affordable in our community.	4	1.86**
17	There needs to be a deeper economic analysis to understand the true costs of implementing these measures.	4	1.85**
36	There needs to be deeper consideration of public input before these measures are adopted.	3	1.65
34	Transitioning the building stock to use primarily electric systems and appliances would increase the cost of housing in Bellingham.	3	1.51
16	We need to prioritize a process for overcoming the cost barrier associated with the transition to primarily electric systems and appliances.	3	1.39
33	The upfront capital cost is the number one barrier to installing efficient, electric heating systems, like heat pumps, for a large percentage of people.	3	0.93
Strongly disagrees with the following statements			
15	We need to source our electricity from 100% renewables before we implement the electrification measures.	-3	-1.23
23	I believe that there are enough people in the City that can afford to electrify their houses and appliances on their own without being forced.	-3	-1.37**
30	We will see a community wide benefit of job creation if we adopt these measures.	-3	-1.58
37	There are major public health risks associated with natural gas.	-3	-1.61
2	Building electrification is necessary to achieve carbon neutrality.	-4	-1.79
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	-4	-1.97
Additional distinguishing statements (* significance at P<0.05; ** significance at P<0.01)			
7	Having gas backup is important for if electricity goes out.	0	0.22*
3	There are so many other things to worry about that are much bigger than natural gas.	0	0.13*
20	Climate change is a pressing issue.	0	0.12**
19	Human-caused climate change is not a completely settled science.	0	-0.06**
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	0	-0.08**
35	Businesses won't want to do business in Bellingham if these measures are adopted.	-1	-0.31*
31	People won't want to move to Bellingham if these electrification measures are adopted.	-2	-0.56**

Appendix F: Statements Sorted by Consensus and Disagreement

Table 11. Factor Q-Sort values for statements sorted by consensus vs. disagreement

Statement no.	Statement	Factor 1	Factor 2	Factor 3
12	I do not care if I use gas or electric appliances in my house, so long as I have a warm house and warm water.	0	0	0
16	We need to prioritize a process for overcoming the cost barrier associated with the transition to primarily electric systems and appliances.	2	2	3
18	I want to be conscious of how we use our natural resources.	3	1	1
8	I want to have the potential for energy options in my home or office.	-1	0	1
28	We need to consider the viability of our natural gas providers as we transition to a more sustainable future.	-2	0	-2
25	The City should prioritize transitioning their own City buildings to use only efficient electric space and water heating systems.	1	-1	1
23	I believe that there are enough people in the City that can afford to electrify their houses and appliances on their own without being forced.	-2	0	-3
11	The City should focus on promoting incentives for installing efficient, electric appliances.	1	-1	2
1	I do not think that it is technically feasible to replace all heating systems in the existing building stock in Bellingham with electric heat pumps.	-1	1	2
29	I am concerned that community members will lose their jobs if these measures are adopted.	-2	1	-1
33	The upfront capital cost is the number one barrier to installing efficient, electric heating systems, like heat pumps, for a large percentage of people.	1	-1	3
13	We should focus on promoting energy efficiency in our existing and future building stock.	1	-1	2
6	It is important to me to have a gas range to cook on.	-3	0	1
40	I need the City to provide more information before I decide if I do or do not support the measures.	-1	2	2
15	We need to source our electricity from 100% renewables before we implement the electrification measures.	-1	1	-3
27	I will voluntarily install a heat pump or other efficient electric system in my house or office when I replace my existing space and water heating system.	1	-2	-2
22	In considering these measures, Bellingham is right in line with where every city needs to curb the worst effects of climate change.	2	-1	-2
26	I want a gas furnace in my house.	-3	1	-1
37	There are major public health risks associated with natural gas.	0	-2	-3
7	Having gas backup is important for if electricity goes out.	-1	3	0
30	We will see a community wide benefit of job creation if we adopt these measures.	0	-2	-3
34	Transitioning the building stock to use primarily electric systems and appliances would increase the cost of housing in Bellingham.	0	2	3
36	There needs to be deeper consideration of public input before these measures are adopted.	0	4	3
17	There needs to be a deeper economic analysis to understand the true costs of implementing these measures.	0	1	4
35	Businesses won't want to do business in Bellingham if these measures are adopted.	-3	2	-1
4	The benefits of implementing these measures would outweigh the challenges.	1	-3	-1
3	There are so many other things to worry about that are much bigger than natural gas.	-2	3	0

32	We must prioritize making housing more affordable in our community.	2	-1	4
31	People won't want to move to Bellingham if these electrification measures are adopted.	-3	2	-2
21	We need to prioritize reducing our greenhouse gas emissions.	4	-2	1
9	The consumer should be able to choose what type of energy they use for space and water heating.	-2	3	2
24	The City should take the lead in implementing climate policy.	3	-3	-1
39	I support Measure B5 which would require that only electric systems and appliances be installed in new construction within Bellingham city limits.	3	-3	0
2	Building electrification is necessary to achieve carbon neutrality.	2	-2	-4
14	The transition away from fossil fuels, including natural gas, is inevitable.	3	-4	-2
10	Let the market decide whether or not transitioning to electric systems and appliances makes sense.	-4	3	1
20	Climate change is a pressing issue.	4	-3	0
38	I support Measure B4 which calls for replacing existing natural gas space and water heating systems with electric appliances in Bellingham by 2040.	2	-4	-4
19	Human-caused climate change is not a completely settled science.	-4	4	0
