Ecological Economics 137 (2017) 56–69

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

Exploring Citizen Support for Different Types of Climate Policy

Ekaterina Rhodes *, Jonn Axsen, Mark Jaccard

School of Resource and Environmental Management, Simon Fraser University, 8888 University Dr., Burnaby V5A 1S6, BC, Canada

ARTICLE INFO

Article history:
Received 19 February 2016
Received in revised form 24 February 2017
Accepted 25 February 2017
Available online 10 March 2017

Keywords:
Climate policy
Citizen support
Policy support
Carbon tax
Climate regulations
Attitude-Behaviour-Context

ABSTRACT

Citizen support for climate policies is considered an important criterion in climate policy-making. While there is a growing body of literature exploring factors of citizen support, most studies tend to use climate policy support as an aggregate variable, overlooking differences in support for different climate policy types. This study examines citizen support for several market-based, regulatory, and voluntary climate policies using survey data collected from a representative sample of Canadian citizens (n = 1306). Specifically, the research objectives are to (1) assess citizen support for different types of climate policies, (2) identify the key factors associated with citizen support for different policy types, and (3) explore heterogeneity across respondents based on policy support patterns. Results indicate that most regulatory and voluntary policies receive high levels of support (83–90% of respondents), while a carbon tax receives the highest levels of opposition (47%). Regression analysis identifies several factors associated with citizen support, including values, trust, and household features. However, only a few factors are consistently associated with support across policy types, including being concerned about climate change, having trust in scientists, and being female. Other significant factors are unique to different policy types. Cluster analysis identifies four distinct respondent clusters based on policy support.

1. Introduction

Policy analysts recommend that several key criteria be considered when choosing among climate policy options (Goulder and Parry, 2008). First, the policy should be effective and efficient in order to meet greenhouse gas emission targets at the lowest cost to society. Second, the policy should be politically acceptable in a way that does not provoke strong opposition, thereby enabling its implementation and endurance. This paper explores one key component of political acceptability: citizen support. In particular, our goal is to help policy-makers understand citizen preferences and motivations behind climate policy choices in order to design climate policies that are both effective and politically acceptable.

The first objective of this study is to assess citizen support for different types of climate policies. Climate policies can be categorized based on their degree of compulsoriness, i.e. the extent to which emission reducing actions are required by government or some other external agent (Jaccard, 2006). More compulsory policies typically include regulations that mandate specific requirements for emissions or technologies, and carbon taxes that set unit charges for emissions. Less compulsory policies include voluntary measures such as educational programs and subsidies to purchase low-carbon technologies (Goulder and Parry, 2008). While carbon taxes are generally considered more efficient and effective in reducing emissions, empirical research suggests that they tend to be the least popular type of climate policy (Drews and van den Bergh, 2015). In contrast, regulatory and voluntary policies appear to receive relatively high support (Lachapelle et al., 2014). This paper aims to contribute to this line of research by assessing levels of citizen support for different types of climate policy in Canada.

The second objective of the paper is to identify individual characteristics of citizen support for different policy types. In this context, researchers look at a variety of individual characteristics. Some studies focus on psychological aspects of policy support, such as personal values and beliefs regarding causes and threats of climate change (Harring and Jagers, 2013; Lam, 2014). Others focus mostly on contextual characteristics, including economic, social, and geographic factors (Franzen and Vogl, 2013; Bernauer and Gampfer, 2013; Owen et al., 2012). However, most studies do not distinguish between policy types when studying individual characteristics of policy support. Instead, researchers tend to construct a composite index that amalgamates policies and emission-reducing actions (Dietz et al., 2007; Shwom et al., 2010; Zahran et al., 2006). As a result, individual characteristics of the support for various policy types may be overlooked. Nilsson and Biel (2008), Lam (2014), and Tobler et al. (2012) are among a few studies that examined factors of support

* Corresponding author.
E-mail addresses: katya_rhodes@sfu.ca (E. Rhodes), jaxsen@sfu.ca (J. Axsen), jaccard@sfu.ca (M. Jaccard).

http://dx.doi.org/10.1016/j.ecolecon.2017.02.027
0921-8009/

for different types of climate policies. However, these studies used non-representative samples and focused mostly on psychological aspects of policy support, without accounting for contextual forces which may have unique effects across policy types. This paper employs a more comprehensive theoretical perspective—the Attitude-Behaviour-Context (ABC) framework—that combines some of the attitudinal, contextual, and socio-demographic characteristics of support (Stern, 2000). We explore how these variables might be associated with support for various policy types using a representative sample of Canadian citizens (n = 1306).

The third objective of this study is to explore heterogeneity across respondents based on climate policy support patterns. Most studies in this area tend to focus on overall associations between individual characteristics and policy support. This paper explores the degree of heterogeneity in citizen support using cluster analysis.

The study is organized as follows. Section 2 reviews the literature pertaining to public perceptions of different policy types and conceptual frameworks that can be used to describe patterns of citizen support. Section 3 describes the employed research method, including the survey sample and data analysis techniques. Section 4 presents the study results, and Section 5 discusses their relevance to the existing climate policy literature, and provides conclusions.

2. Literature Review

2.1. Understanding Types and Perceptions of Climate Policies

As noted, climate policies vary in their degree of compulsoriness (Jaccard, 2006). Compulsory policies require emission reductions via regulation of technologies or fuels, or financially penalize emissions to such an extent that many firms and households are bound to take emission-reducing actions. Regulatory policies include vehicle efficiency regulations, building efficiency standards, and renewable portfolio standards that set electricity generation requirements for industry. Policies that can significantly increase the cost of emitting include carbon taxes and emission caps with tradable emission permits (also called 'cap-and-trade'). These policies do not prescribe specific actions but compel businesses and individuals to either pay emission charges (i.e., unit charges or permit price) or invest in emission reduction technologies to lower their charges (Goulder and Parry, 2008). In contrast, non-compulsory policies encourage voluntary behaviour to reduce emissions without entailing any negative consequences for non-compliance. Some examples include subsidies to purchase low-carbon technologies, educational and informational programs, and direct government investments.

Empirical survey evidence suggests that citizen support for carbon taxes and cap-and-trade is limited, while regulatory and voluntary policies tend to receive relatively high support (Drews and van den Bergh, 2015). For example, Lachapelle et al. (2014) conducted national surveys on public attitudes toward climate policies in Canada (n = 1502, margin of error ± 2.5%) and the U.S. (n = 984, margin of error ± 3.5%) in 2013, and found that in both countries carbon tax receive the highest opposition (41% of Canadian and 71% of U.S. respondents 'somewhat oppose' and 'strongly oppose' the policy), while a renewable portfolio standard the highest support (82% in Canada and 72% in the U.S.). Similar trends are observed in Switzerland, where a national survey (n = 916) showed that citizens are more likely to approve subsidies for renewable electricity, sustainable buildings and heating systems rather than carbon taxation (Tobler et al., 2012). Studies of policy support suggest similar patterns in Asia. Lam (2014) finds that Taiwanese citizens (n = 394) prefer subsidies for renewable energy (85% 'support' and 'strongly support') over increases electricity prices (29% 'support' and 'strongly support') or implementation of a gas guzzler tax (59% 'support' and 'strongly support').

Other studies explore the role of individual characteristics in citizen support of climate policy. However, most of these studies combine all policy types into a composite dependent variable, commonly referred to as an 'index of policy support'—amalgamating or averaging responses to a variety of policy and behaviour questions (Dietz et al., 2007; O'Connor et al., 2002; Shwom et al., 2010; Steg et al., 2005; Zahran et al., 2006). In the remainder of the paper, dependent variables consisting of several policy measures are referred to as 'composite variables' or 'composite indices'. The composite indices often include (a) policies at different levels of government, (b) international agreements, and (c) actions to reduce emissions, all of which vary considerably in their nature. For instance, Zahran et al. (2006) constructed a composite variable of 'climate policy support' that included support for carbon taxes on industries and individuals, fuel efficiency regulations, and public education about climate change actions. The same scale also included climate actions such as support for the development of renewable energy sources, reduction of methane in agriculture, and the protection of coastal settlements and water supplies. While the use of composite indices can provide general insights into common factors of policy support, they may overlook potential differences in individual characteristics of support for individual policy types.

Only a few studies have examined factors of support for different types of climate policies, i.e. without the use of composite dependent variables. Nilsson and Biel (2008) studied four types of policies varying in their compulsoriness—informational programs, subsidies, taxes, and regulations. They found that support for all policy measures (other than subsidies) was positively associated with environmental values. However, the study focused primarily on the effect of values and personal norms using a non-representative sample of Swedish decision-makers in private companies (n = 236). Thus, the results might not be broadly applicable and do not account for other contextual and socio-demographic characteristics which may have unique effects across policy types. Similarly, Lam (2014) used a non-representative sample of Taiwanese citizens (n = 394) to test a psychological model of policy support focusing specifically on the beliefs of negative consequences of climate change as explanatory variables, without consideration of individual values and contextual factors. Tobler et al. (2012) studied citizen support for nine policy items, which formed two dependent variables: subsidies, and CO2 restrictions such as carbon taxes and vehicle emission regulations. Similar to these studies, Tobler et al. (2012) used a non-representative sample (n = 916) and did not account for contextual factors.

In short, previous literature exploring citizen support for climate policies has tended to focus on overall support for different policy types (without exploration of individual characteristics associated with policy support), or to identify factors for climate policy and actions in general (combined into composite dependent variables). The few studies that have taken an exploratory approach with multiple climate policies have followed a limited theoretical approach and relied on non-representative samples for data analysis. Our present effort seeks to fill this apparent gap in the literature by exploring citizen support for multiple climate policies, using a comprehensive framework (theory) to guide our selection of independent variables, applied to data collected from a representative sample of citizens (residing in Canada). We next explore several theories of citizen support for climate policy and then explain our present conceptual framework.

2.2. Exploring Citizen Support for Climate Policies

The notions of saliency and self-serving bias provide one perspective on citizen policy support. Long before climate change mitigation was a policy concern, economists suggested that support for public policies can be influenced by small groups, including those who already wield significant political power by virtue of their economic and social significance, on the one hand, and groups who face concentrated costs from specific policies focused on specific objectives like GHG reduction, on the other (Galbraith, 1952; Olson, 1971).

Consistent with this explanation, Caplan (2007) noted that a self-serving bias (i.e., believing in or supporting things or ideas that appear to be beneficial to one self) contributes to the discrepancy between citizen and expert assessments of policy effectiveness and ultimate policy support. Consequently, highly salient policies with visible costs, such as carbon taxes, tend to attract strong opposition from interests who believe the policies to be especially disadvantageous to them, whereas less salient policies, such as regulations, appear to avoid such opposition (Chetty et al., 2009; Harrison, 2012).

Policy support is also likely to be affected by factors other than perceived costs and individual impacts. Specifically, some social psychologists suggest that support among individuals can vary in association with multiple characteristics, including individual values, social norms, and other contextual factors (e.g., Dietz et al., 2007; Shwom et al., 2010; Semenza et al., 2008). To study climate policy support, researchers draw from various models of pro-environmental behaviour. The models are typically divided into three major categories: internalist, externalist, and integrative models (Jackson, 2005). Internalist frameworks treat pro-environmental behaviour mainly as a function of attitudinal motivations that are considered 'internal' to the individual, such as values, beliefs, emotions, and habits (Ajzen, 1991; Schwartz, 1992; Stern et al., 1999). These models tend to be weak predictors of difficult and costly behaviours that might be influenced by various contextual forces including social processes (e.g., community expectations, trust in governments), financial constraints (e.g., income, cost of low-carbon technologies) and institutional factors (e.g., availability of public transit, building design) (Bamberg and Schmidt, 2003). In contrast, externalist theories focus mostly on cultural, political, and economic factors, and tend to ignore many attitudinal characteristics associated with pro-environmental behaviour (Leiserowitz, 2006; Thompson et al., 1990). Integrative models combine insights from the 'internalist' and 'externalist' approaches to offer a broader perspective on determinants of pro-environmental behaviour. Stern's (2000) Attitude-Behaviour-Context framework is among a few integrative models that account for multiple 'internal' and 'external' factors, while being parsimonious and practical enough to facilitate empirical testing.

Specifically, Stern (2000) suggests three categories of individual characteristics of pro-environmental behaviour: attitudinal, contextual, and personal capability variables. Attitudinal variables typically include values, general environmental concerns, and specific concerns about climate change. Dietz et al. (2005) and Steg et al. (2005) find that altruistic and biospheric values are associated with higher citizen support, while egoistic and openness-to-change values are associated with higher opposition. Further, people that are generally concerned about environmental problems (as measured through New Ecological Paradigm (NEP)) and/or concerned about climate change in particular, are more likely to adopt low-carbon behaviours and pay the cost of climate policy (Clark et al., 2003; Dietz et al., 2007; O'Connor et al., 2002; Zahran et al., 2006). Tobler et al.'s (2012) study in Switzerland suggests that specific concerns about climate change are not associated with higher support for carbon taxes and regulations but appear to be unique characteristics of support for voluntary measures such as subsidies for low-emission buildings, renewable electricity generation, and climate research.

The second category of variables in the ABC model is contextual variables, which includes social, political, and economic factors. Social and political variables are typically measured through trust. 'Trust theory' suggests that when people do not possess sufficient knowledge or time to assess environmental issues, their trust in entities assessing and solving those issues tends to influence their individual policy support (Castelfranchi and Falcone, 2010; Cvetkovich et al., 2002). Trust in governments tends to be one of the most important factors of support for carbon taxes, likely because governments are directly responsible for the collection and use of tax revenues (Harring and Jagers, 2013; Kallbekken and Sælen, 2011). However, trust in government does not seem to be associated with citizen support for climate policies when combined in a composite index (Dietz et al., 2007). Trust in the fossil fuel industry tends to have a negative effect on support for climate policies (Shwom et al., 2010), while trust in university scientists tends to have a positive effect (Dietz et al., 2007). Economic factors are typically measured through household variables including area of residence, home type, mode and duration of commute to work, and ownership of a personal vehicle. Consistent with the notions of a self-serving bias and policy salience (Caplan, 2007; Chetty et al., 2009), these economic factors might be barriers to citizen support if they are associated with the highest impacts of the policy. Some evidence suggests that urban residents are likely to show higher environmental policy support because they are exposed to highly visible effects of air pollution and less directly dependent for income on the extraction of natural resources (Elliott et al., 1997; Shwom et al., 2010). Also, urban areas have more transportation options which make driving less of a necessity (Kallbekken and Sælen, 2011). In contrast, people relying on a personal vehicle are more likely to oppose climate policies that increase the cost of driving (Shwom et al., 2010).

The final category in the ABC model is personal capability, which includes variables generally assessed through socio-demographic characteristics (Stern, 2000). Younger, wealthier, more educated and female citizens tend to support environmental policies (Elliott et al., 1997; Klineberg et al., 1998). In addition, a citizen's regional location tends to affect policy support. Regions heavily dependent on carbon intensive industries (e.g., fossil fuel production) typically show lower support for climate policies (Shwom et al., 2008; Matisoff and Edwards, 2014).

2.3. Variables Hypothesized to Describe Climate Policy Support

This study draws from Stern's (2000) ABC model discussed in the previous section. This paper does not test the model but rather uses it as a framework of potential independent variables that may be associated with citizen support (or opposition) for different types of climate policy. Therefore, the framework is used primarily to inform our second and third research objectives, that is, to improve our understanding of patterns of citizen support (or opposition) for different climate policies, with an ultimate goal of providing practical advice to policy-makers and analysts. Table 1 summarizes some of these independent variables and their hypothesized effects on citizen support for climates policies.

Among attitudinal variables, altruistic and biospheric values, general environmental and specific climate change concerns are expected to be associated with citizen support for most policies (Dietz et al., 2005; Steg et al., 2005) with the exception of voluntary policies, support for which was not associated with biospheric values in the past (Nilsson and Biel, 2008).

For contextual variables, trust in governments is expected to be associated with support only for a carbon tax (Harring and Jagers, 2013), while trust in the renewable energy industry is only expected to be associated with support for a clean electricity standard (Shwom et al., 2010). Trust in university scientists is hypothesized to be associated with support for all policies, while trust in the fossil fuel industry is expected to be associated with opposition to all policies (Dietz et al., 2007). Respondents living in urban areas with many available transportation options are expected to show higher support for policies that increase the cost of driving, such as carbon taxes and low carbon fuel standards, while residents of rural and suburban areas are more likely to oppose them. This relationship has not been explored in past research, but is consistent with the self-serving bias (Caplan, 2007). For the same reason, these policies are expected to receive more opposition from vehicle-dependent households driving to work or school and/or owning several

Table 1
Variables hypothesized to describe citizen support based on Stern's (2000) framework.

Variable name	Hypothesized effect and references
Attitudinal variables	
Values	
Biospheric and altruistic	Positive (Dietz et al., 2005; Harring and Jagers, 2013) except for no effect of biospheric values for voluntary policies (Nilsson and Biel, 2008)
Egoistic and openness to change	Negative (Dietz et al., 2005; Nilsson and Biel, 2008)
General environmental concern (NEP)	Positive (Attari et al., 2009; Dietz et al., 2007)
Climate change concern	Positive (Clark et al., 2003; O'Connor et al., 2002; Zahran et al., 2006)
Contextual variables	
Trust	
Government	Positive for a carbon tax only (Harring and Jagers, 2013; Kallbekken and Sælen, 2011)
Fossil fuel industry	Negative (Dietz et al., 2007)
Renewable industry	Positive for a clean electricity standard only (Rhodes et al., 2014)
Scientists	Positive (Dietz et al., 2007)
Living area	
Urban (city centre with dense housing)	Positive for a carbon tax and LCFS (Freudenburg, 1991; Elliott et al., 1997)
Suburban (just outside a city, with more spread out housing) and rural (far away from a city, with very spread out housing)	Negative for a carbon tax and LCFS (Freudenburg, 1991; Elliott et al., 1997)
Home type	
Attached	Positive for building regulations (Guerra Santin et al., 2009)
Detached	Negative for building regulations (Guerra Santin et al., 2009)
Commute mode	
Drive myself	Negative for a carbon tax and LCFS (Rhodes et al., 2015)
Other modes (public transit, bike, carpool)	Positive for a carbon tax and LCFS (Rhodes et al., 2015)
Daily commute time to work/school	Negative (Rhodes et al., 2015)
Number of vehicles in a household	Negative for a carbon tax and LCFS (Rhodes et al., 2015)
Personal capability variables	
Age	Negative (Elliott et al., 1997; Klineberg et al., 1998)
Gender	
Female	Positive (Elliott et al., 1997; Klineberg et al., 1998)
Male	Negative (Elliott et al., 1997; Klineberg et al., 1998)
Education	Positive (Elliott et al., 1997; Klineberg et al., 1998)
Income	Positive (Elliott et al., 1997; Klineberg et al., 1998)
Region	
Regions heavily reliant on carbon intensive industries or fossil fuel production (e.g., Alberta, Ontario)	Negative (Shwom et al., 2008; Matisoff and Edwards, 2014)
Regions less reliant on carbon intensive industries or fossil fuel production (e.g., British Columbia, Quebec)	Positive (Shwom et al., 2008; Matisoff and Edwards, 2014)

vehicles. Also, residents of detached homes are hypothesized to oppose building regulations based on the study of Guerra Santin et al. (2009).

Among personal capability variables, younger age, higher income, education, and being female is hypothesized to have a positive effect on support for most policies (Elliott et al., 1997; Klineberg et al., 1998). Finally, citizens residing in fossil fuel abundant jurisdictions (which we explore at the provincial level) are expected to show lower support for most climate policies (Shwom et al., 2008).

3. Methods: Data Collection and Analysis

3.1. Survey Data and Measurement

We conducted a web-based survey of Canadian citizens (n = 1306) aged 19 or older in January 2013. As part of this national survey, we separated and oversampled British Columbia respondents (n = 475) for the purpose of conducting another study on citizen awareness of British Columbia's climate policies (Rhodes et al., 2014). We hired a market research company, Harris Interactive, to recruit respondents through a web-panel of Canadian citizens to complete the survey. This web-based panel includes a large distribution of people recruited to provide samples that represent the general population. All respondents in the sampling frame had an equal chance of being selected. A total of 1893 respondents were invited from this panel to complete the survey. Of those, 1401 respondents completed the survey. Ninety-five were removed due to incomplete responses, leaving a total of 1306 for the nationwide sample.

Table 2 shows the distributions of the sample relative to census data. Compared to the Census data for the entire Canadian population, our sample was slightly wealthier, more educated, and older (first column in Table 2). The hired market research company applied a common weighting adjustment procedure to minimize these demographic differences and to ensure that the sample is representative of Canada's actual income, education, age, gender, and regional composition (second column in Table 2). The corrective procedure assigned an adjustment weight to each respondent in a way that under-represented respondents receive a weight larger than one, and over-represented respondents receive a weight smaller than one.

The median time to complete the survey was about 25 min. To establish trust and increase the perceived benefits of participation, respondents received personalized survey invitations explaining how survey results could benefit them and others, and were given survey participation points by the research company which could be exchanged for gift cards or $10 per 1250 points. We used simple language and short questions to minimize the expected cost and difficulty of completing the survey. All survey questions were pretested with a wide range of volunteers of different occupations, ages, genders, and education.

The survey questionnaire consisted of four sections (see Appendix A for full survey questions). First, respondents were asked questions about their concerns regarding causes and consequences of climate change. Using questions from Dietz et al. (2007) and Steg et al. (2005), respondents were asked to indicate their agreement on a five-point scale from 'strongly disagree' to 'strongly agree' (with an option 'I do not understand') with general statements about carbon emissions, scientific certainty about climate change, causes and threats of climate

Table 2
Socio-demographics of the sample: unweighted and weighted sample distributions.

Socio-demographic variables	Canada (n = 1306)	
	Unweighted sample distributions, %	Weighted sample distributions (according to Canada Census), %
Income		
Less than $49,999	35.6	38.8
$50,000 to $99,999	34.5	33.3
$100,000 or over	18.1	16.0
Education		
Secondary or less	61.2	83.4
Post-secondary (bachelor's or postgraduate degree)	38.8	16.6
Age		
19–39	25.0	39.7
40–64	56.0	44.1
65+	19.0	16.2
Gender		
Male	49.2	48.4
Female	50.8	51.6
Region		
Atlantic provinces (NL, PEI, NS, NB)	4.9	7.7
Quebec	14.2	24.6
Ontario	37.2	38.0
Manitoba and Saskatchewan	3.4	6.7
Alberta	3.9	9.7
British Columbia	36.4	13.3

change to human health, environmental quality, finances, and standard of living (Cronbach's $\alpha = 0.93$).

Second, respondents were required to indicate their level of support on a four-point scale from 'strongly oppose' to 'strongly support' (with no neutral response category) for nine hypothetical climate policies, as if there were a referendum on implementing them in Canada. Prior to asking these questions, climate policies were defined as 'actions that are meant to reduce greenhouse gas emissions, such as carbon emissions from burning gasoline. The goal of such policies is to reduce climate change/global warming'.

Third, attitudinal questions assessed respondents' values and general environmental concerns. Using Schwartz's modified value scale (Stern et al., 1998), respondents were asked to rate the importance of biospheric, altruistic, egoistic, and openness-to-change values in their life, on a five-point scale ranging from 'not important at all' to 'extremely important'. Biospheric value questions included statements about respecting the earth, unity with nature, and environmental protection (Cronbach's $\alpha = 0.90$), and altruistic value questions included statements pertaining to social justice, equality, and helping others (Cronbach's $\alpha = 0.86$). Egoistic value questions focused on the role of authority, social power, influence, and wealth (Cronbach's $\alpha = 0.76$). Finally, openness-to-change values included statements about novelty, change, new experiences, and curiosity (Cronbach's $\alpha = 0.81$). To examine respondents' general environmental concerns about human-environment relationships, eight worldview items were adapted from the revised New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). Using a five-point scale from 'strongly disagree' to 'strongly agree', respondents were asked to indicate their level of agreement with statements about human impacts on nature, ethical considerations toward non-human life, and resource scarcity (Cronbach's $\alpha = 0.85$).

The final section of the questionnaire focused on contextual aspects of climate policy support, including household characteristics, socio-demographic attributes, and degree of trust in various individuals, corporations and governments involved in addressing climate change. On a five-point scale ranging from 'very low' to 'very high', with an option 'I do not know', respondents were asked to indicate their level of trust in governments, the fossil fuel and renewable energy industries, and scientists associated with the climate change threat and its solutions. Trust in governments consisted of questions measuring trust in the federal and trust in the provincial governments (Cronbach's $\alpha = 0.80$). Trust in the fossil fuel industry included questions about trust in the industry and trust in scientists employed by the industry (Cronbach's $\alpha = 0.84$).Trust in scientists was measured through questions about trust in scientists working for universities and trust in scientists working for the International Panel on Climate Change (IPCC) (Cronbach's $\alpha = 0.66$). Household characteristics were assessed through questions about the area of residence (i.e., urban, suburban, or rural), home type (i.e., detached or attached), number of vehicles in a household, the length and mode of daily commute to work/school (i.e., driving, taking transit, biking, or carpooling). Finally, to assess socio-demographic characteristics of the sample, respondents were asked questions about their age, gender, education, income, and the province of residence.

3.2. Statistical Analyses

This study employed the IBM SPSS statistical software (version 21) to perform all statistical analyses. First, descriptive statistics were used to assess levels of citizen support for nine hypothetical climate policies, including:

Market-based policies:

1. a carbon tax applying to all individuals and businesses; and
2. a cap for businesses with tradable emission permits (cap-and-trade).

Regulatory policies:

3. a clean electricity standard that requires electric utilities to generate at least 50% of new electricity from zero-emission sources;
4. vehicle efficiency regulations that require vehicles to be 30% more fuel efficient by the year 2020;
5. a low carbon fuel standard that requires fuels to have lower carbon emissions by 20% by the year 2020; and
6. building efficiency regulations that require new buildings, appliances, and equipment to be more energy efficient.

Voluntary policies:

7. subsidies (such as tax rebates) to households/businesses that purchase energy efficient appliances/equipment, fuel efficient vehicles, or use solar and wind energy;
8. educational programs for citizens about climate change and actions to reduce it; and
9. government investments into research into clean energy sources, such as hydro, solar, or wind (called 'research and development (R&D)' in the remainder of the paper).

Second, binary logistic regressions were run to estimate how independent variables from Table 1 are associated with respondent support for climate policies. Because binary logistic regressions measure the probability of a binary response, responses to policy support questions were recoded to have two aggregate categories—'oppose' (a composite of 'oppose' and 'strongly oppose') and 'support' (a composite of 'support' and 'strongly support'). The reliability analysis and the exploratory factor analysis of policy support indicated that support variables for vehicle efficiency regulations, building efficiency regulations, and the low carbon fuel standard were inter-correlated (Cronbach's $\alpha = 0.75$). Therefore, these policies were grouped into a new support variable called 'supply-focused regulations', implying that they set emission reduction requirements for industry rather than consumers. Similarly, inter-correlation was observed among variables measuring support for all voluntary policies, including subsidies, education, and research and development programs (Cronbach's $\alpha = 0.67$). Hence, these policies were combined into a new variable called 'voluntary policies'. As a result

of these modifications, a total of five binary logistic regressions were run to explore support for the carbon tax, cap-and-trade, clean electricity standard, supply-focused regulations, and voluntary policies.

To represent heterogeneity across the sample, K-means cluster analysis was performed based on standardized citizen support data for the reduced five policy variables discussed above. We used the same five policy variables to ensure consistency and comparability of our regression results with the findings of the cluster analysis. The policy support variables were kept as dummy variables for the purpose of this analysis. The key objective of cluster analysis is to identify groups (called 'clusters') of respondents that are more similar to each other than respondents in other groups (Kinnear and Gray, 2004). Working in an iterative fashion, the K-means algorithm allocates each respondent to a cluster based on the criterion of minimizing the distance from the individual respondent data points. The selection of the number of clusters in this study was based on the goal of finding the most interpretable solution that has (1) appropriate sample sizes for each cluster that are smaller than 50% but >5% of the entire sample, and (2) at least the number of clusters where inter-cluster variability exceeds the intra-cluster variability. We described each cluster in terms of attitudinal, contextual, and personal capability variables from Table 1, using cross-tabulations along with chi-square tests for categorical data and ANOVA analysis for continuous data.

4. Results

4.1. Citizen Support for Climate Policies

Fig. 1 shows the results of descriptive analysis of climate policy support levels. All regulations and voluntary policies are supported (i.e., an aggregate of 'support' and 'strongly support') by the majority of respondents (83–90%). The highest support is observed for building efficiency regulations (90%) among regulatory measures, and educational programs (90%) among voluntary policies. The carbon tax achieves the lowest support (53%) followed by the cap with emission permits (70%).

4.2. Exploring Citizen Support for Climate Policies

Table 3 shows the results of binary logistic regressions describing citizen support for five climate policy variables: the carbon tan tax, cap-and-trade, clean electricity standard, supply-focused regulations, and voluntary policies. The classification results show that all models correctly classify the outcome for 72% to 93% of the cases.

Due to the nature of logistic regressions, the coefficients in Table 3 are presented in the form of log-relative odds (representing an expected change in log odds for a one-unit increase in continuous independent variables) or a log odds ratio between response categories for categorical independent variables. The coefficients are presented in the unstandardized form, which is typical in the logistic regression context (Hosmer et al., 2013). Because unstandardized regression coefficients indicate the average change in the dependent variable associated with a one-unit change in the independent variable, we cannot compare the relative strength of the coefficients. Instead we interpret the coefficients in terms of their overall statistical significance for shaping climate policy support.

The regression results suggest that only three variables are consistently associated with support across different policy types (being significantly associated with support for four of the five policy types): climate change concerns, trust in university and IPCC scientists, and female gender. Trust in the fossil fuel industry is the only common strong characteristic of opposition to all policies ($\beta > -0.2$ at $p < 0.01$) except for cap-and-trade. Other statistically significant attitudinal and contextual characteristics are unique to different types of climate policies.

Among attitudinal variables, biospheric values are positively associated with support for the carbon tax and supply-focused regulations (i.e., low carbon fuel standard, vehicle and building efficiency regulations), while altruistic values are positively associated with higher support for supply-focused regulations only. General environmental concern (as measured via the NEP scale) is positively associated with support for voluntary policies (i.e., subsidies, educational program, and R&D) and a clean electricity standard.

In terms of contextual characteristics, trust in governments is the only variable associated with support for the carbon tax, which might be attributed to the government's direct responsibility for the collection and use of tax revenues. Trust in the renewable energy industry is associated with higher support for the clean electricity standard—this might be attributed to the policy's requirement to generate electricity from zero-emission sources, as defined in the survey. Interestingly, the area of residence and the degree of a respondent's dependence on driving has contrasting effects on support for a carbon tax and supply-focused regulations. Respondents living in urban areas and not relying on personal vehicles are more likely to support the carbon tax, while the opposite is true for supply-focused regulations. Voluntary policies, including subsidies, educational programs and R&D programs, are more likely to be supported by suburbanites and less-vehicle dependent respondents.

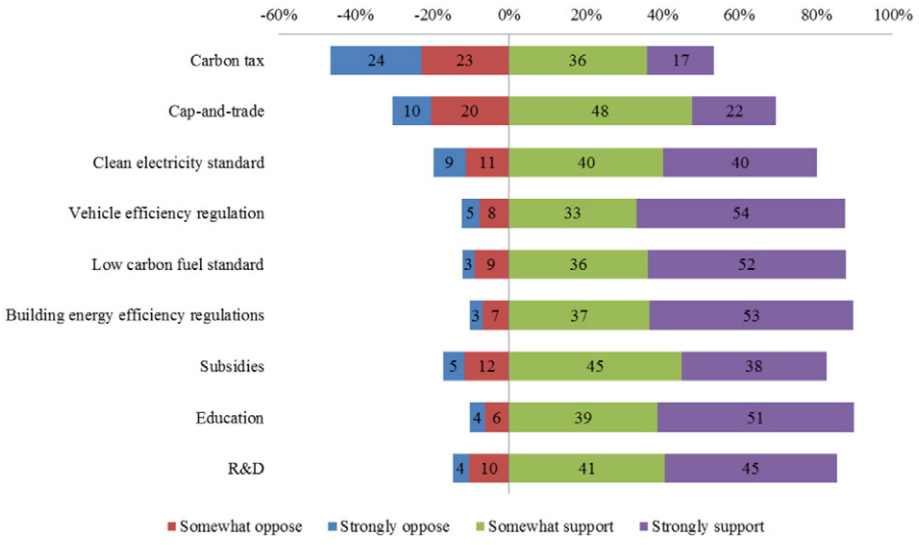

Fig. 1. Support for climate policies (%).

Table 3
Binary logistic regression results (unstandardized β coefficients presented in the form of log-relative odds).

	Carbon tax	Cap-and-trade	CES	Supply focused-regulations	Voluntary policies
Attitudinal variables					
Values					
Biospheric	0.578[b]	0.235	0.129	0.711[b]	−0.228
Altruistic	−0.041	0.016	0.271	0.489[a]	0.847[b]
Egoistic	0.049	0.203	−0.218	−0.724[b]	−0.870[b]
Openness to change	−0.193	−0.050	0.327[a]	0.037	0.386
General environmental concern (NEP)	0.004	0.024	0.063[a]	−0.022	0.113[b]
Climate change concern	0.071[b]	0.038[b]	0.038[b]	0.081[b]	0.017
Contextual variables					
Trust					
Government	0.220[a]	−0.120	0.114	0.046	0.169
Fossil fuel industry	−0.246[b]	−0.067	−0.659[b]	−0.558[b]	−0.584[b]
Renewable industry	0.023	0.125	0.550[b]	−0.293	0.145
Scientists	0.267[a]	0.271[a]	0.069	0.509[a]	0.679[b]
Living area (reference 'urban')					
Suburban	−0.274	0.234	−0.548[b]	0.409	0.679[a]
Rural	−0.686[b]	0.143	0.153	0.801	−0.275
Home type 'attached' (reference 'detached')	0.138	0.305[a]	0.100	−0.079	0.163
Commute mode 'other (public transit, bike, carpool)' (reference 'drive myself')	0.447[b]	0.061	0.081	0.545	1.136[b]
Daily commute time	0.185	0.162	−0.035	0.136	0.045
No of vehicles in a household	0.001	0.146	0.141	0.527[a]	0.289
Socio-demographics					
Age	−0.082	−0.165	−0.158	0.882[b]	−0.106
Gender 'female' (reference 'male')	0.541[b]	0.822[b]	0.849[b]	0.467	0.825[b]
Education	0.189	−0.153	0.375	−0.236	0.705
Income	0.184	0.160	0.187	0.023	0.466[a]
Region (reference 'Ontario')					
Atlantic (NL, PE, NS, NB)	−0.363	0.050	0.920[a]	1.799[a]	0.586
Quebec	0.088	0.216	1.074[b]	−0.094	0.674[a]
Alberta	0.775[b]	0.095	0.693[a]	0.394	2.200[b]
Manitoba/Saskatchewan	0.621[a]	0.521	−0.191	0.768	2.533[a]
British Columbia	0.400	−0.074	0.787[b]	−0.025	−0.231
Constant	−4.425[b]	−2.869[b]	−3.203[b]	−3.034[a]	−4.346[a]
Model summary (goodness of fit measures)	Nagelkerke R^2 33.1% H-L test $\chi^2 = 17.490$, $df = 8$, $p = 0.025$ Class. accur. 71.9%	Nagelkerke R^2 22.5% H-L test $\chi^2 = 9.504$, $df = 8$, $p = 0.302$ Class. accur. 75.4%	Nagelkerke R^2 38.6% H-L test $\chi^2 = 8.508$, $df = 8$, $p = 0.385$ Class. accur. 85.0%	Nagelkerke R^2 42.8% H-L test $\chi^2 = 33.683$, $df = 8$, $p < 0.01$ Class. accur. 93.3%	Nagelkerke R^2 39.4% H-L test $\chi^2 = 19.429$, $df = 8$, $p = 0.013$ Class. accur. 92.2%

[a] Significant at 95% confidence level.
[b] Significant at 99% confidence level.

As part of the contextual variables, we also tested for the effect of political ideology on climate policy support. (In Canada, these are the Conservative Party, the Liberal Party, the New Democratic Party, Bloc Quebeqois, and the Green Party). However, the variable caused multicollinearity among the independent variables and did not appear to have a statistically significant effect on support for any of the tested policies. For these reasons, we removed the variable 'political ideology' from the regression models.

Among personal capability variables, age is associated with support only for supply-focused regulations, while income is associated with only for support of voluntary policies. Regional location has an effect on support for most policies except for cap-and-trade. Controlling for all other factors in the models, the carbon tax is more likely to be supported by residents of the Canadian Provinces of Alberta, Manitoba and Saskatchewan when compared to Ontario, which is somewhat surprising given that these provinces are more heavily dependent on the fossil fuel industry than Ontario. Supply-focused regulations are more likely to be supported in Atlantic provinces. Finally, voluntary policies are more likely to receive support from residents of Quebec, Alberta, Manitoba and Saskatchewan.

Table 4
Cluster descriptions and centre values (standardized; values less than ±0.15 are removed).

Cluster name	Pro-Policy			
Cluster variables: 'citizen support for…'	1 'Universal Strong Support'	2 'Universal Moderate Support'	3 'Regulations Support Only'	4 'Anti-Policy'
Carbon tax	0.91	0.29	−1.04	−1.07
Cap-and-trade	0.65			−1.25
Clean electricity standard	0.66	−0.23	0.29	−1.52
Supply-focused regulations (vehicle and building efficiency, LCFS)	0.80	−0.41	0.30	−1.51
Voluntary policies (subsidies, education, R&D)	0.77	−0.30	0.18	−1.47
Number of respondents	446	375	293	192
% of total sample (n = 1306)	34.1	28.7	22.4	14.7

4.3. Characterizing Heterogeneity Across Respondents

Cluster analysis yielded four homogenous clusters of respondents based on their support for the five different policy categories. Table 4 shows cluster centre values for each policy category. The cluster centre indicates where the cluster's level of policy support compares to the average across the entire sample—a positive center indicates higher support than average, while a negative center indicates lower support. Fig. 2 shows the levels of citizen support for the studied policies in each cluster. We determined that the four cluster solution was ideal because it produced clusters with: appropriate sample sizes (i.e., smaller than 50% but >5% of the entire sample), inter-cluster variability that exceeds the intra-cluster variability, and categorical and interpretable difference from one another.

The first three clusters are all in the 'Pro-Policy' category, with different variations of support for different policy types. Respondents in cluster 1, 'Universal Strong Support' (34.1% of respondents), show broad support for all climate policies, as indicated by the high positive cluster centres in Table 4 and high levels of support (92–100%) in Fig. 2. Cluster 2, 'Universal Moderate Support' (28.7% of respondents), is characterized by a positive cluster centre for the carbon tax but negative cluster centres for all regulations and voluntary policies. This cluster shows moderate support for all policies as demonstrated by the relatively high number of 'somewhat support' responses (62–80%), and the second highest levels of support for a carbon tax (70% 'somewhat support' and 'strongly support'). Cluster 3, 'Regulations Support Only' (22.4%), has positive cluster centres for regulations and voluntary policies but a high negative cluster centre for a carbon tax. Respondents in this cluster are broadly supportive of all regulations and voluntary policies (92–98% 'somewhat support' and 'strongly support') but are opposed to a carbon tax (98% 'somewhat oppose' and 'strongly oppose'). Finally, respondents in cluster 4, 'Anti-Policy' (14.7%), do not show support for any climate policies as demonstrated by high negative cluster centres. This cluster shows resistance to all policies, especially a carbon tax (98%), cap-and-trade (89%), and a clean electricity standard (80%).

Table 5 summarizes attitudinal, contextual, and demographic characteristics of each cluster. Consistent with the regression results, respondents in all three 'Pro-Policy' clusters are more likely to be females, to have high climate change concerns, and to have strong trust in university and IPCC scientists. These variables were consistent characteristics of support across different policy types. Other attitudinal and contextual characteristics are unique descriptors of each cluster.

As expected, respondents in the 'Universal Strong Support' cluster compared to other clusters score the highest on biospheric and altruistic values, general environmental and climate change concerns, trust in scientists and the renewable industry, and the use of alternative modes of transportation (e.g., transit, bike, carpool). Most respondents in this cluster are of older age (64% are above 40), females (59%), and urbanites (52%). The 'Anti-Policy' cluster exhibits the opposite characteristics of the 'Strong Climate Support' cluster. The Anti-Policy respondents are not concerned about the environment and climate change, distrust environmentalists and scientists, but show high trust in the fossil fuel industry. These respondents are more likely to be less educated, males, and residents of Alberta and Ontario.

Compared to the 'Universal Moderate Support' cluster, respondents in the 'Regulations Support Only' cluster have higher altruistic and biospheric values, show less concern about climate change but greater concern about the environment in general. Respondents in this cluster are more likely to live in rural areas and single-family homes, own at least one vehicle, and drive personal vehicles to work. In contrast, the 'Universal Moderate Support' cluster is more likely to be characterized by living in an urban location, lower dependence on a single occupancy use of a vehicle, and higher trust in the federal and provincial governments. Respondents in this cluster show higher concern about climate change but lower concern about the environment in general, implying that citizens seem to link the carbon tax directly with climate change, but do not necessarily see the carbon tax as associated with environment issues in general. One explanation could be that some or all of the studied regulations are more likely to be associated with environmental benefits other than climate change mitigation, including reduced land impacts or improved air quality due to the use of lower-

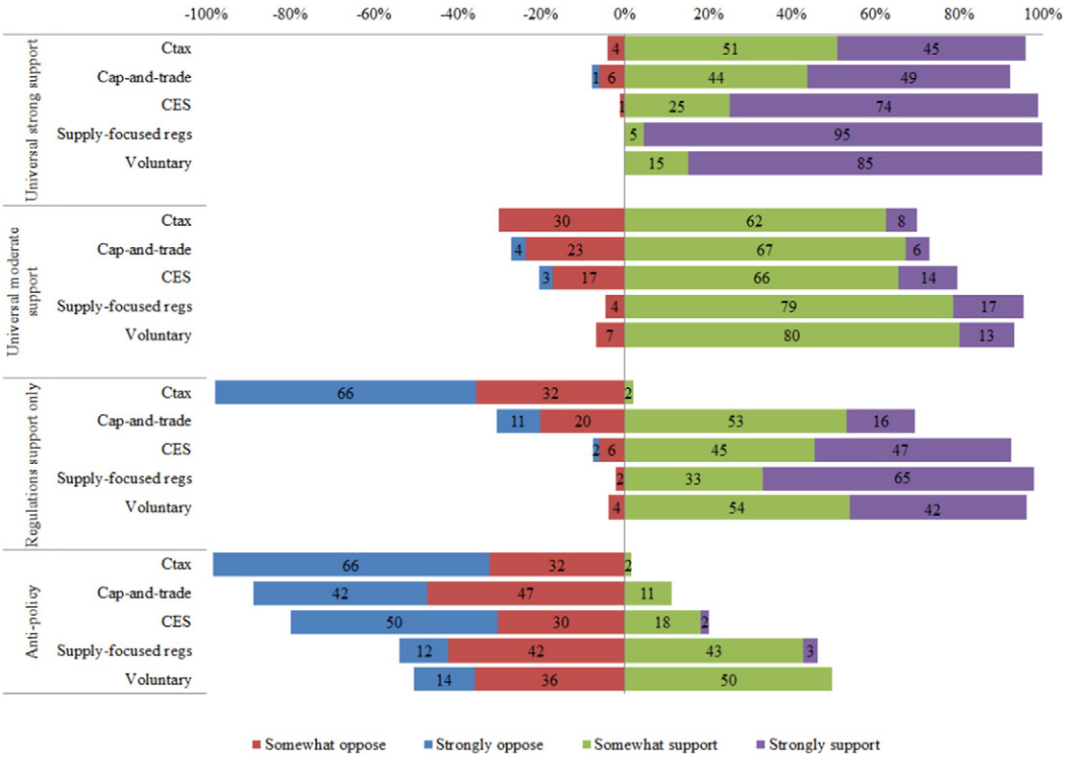

Fig. 2. Climate policy support in each cluster (%).

Table 5
Characteristics of each respondent cluster.

	Pro-Policy			Anti-Policy	Sample average
	1 'Universal Strong Support'	2 'Universal Moderate Support'	3 'Regulations Support Only'		
Attitudinal variables					
Values (1 to 5 rating)					
Biospheric[b]	4.4	3.7	3.9	3.0	3.9
Altruistic[b]	4.4	3.8	4.1	3.2	4.0
Egoistic	2.8	2.9	2.8	2.7	2.8
Openness to change[b]	3.8	3.5	3.7	3.1	3.6
General environmental concern (NEP) (−15 to 16 rating)[b]	9.3	4.7	6.3	−0.4	5.9
Climate change concern (−30 to 30 rating)[b]	16.5	10.1	8.6	−2.6	10.1
Contextual variables					
Trust (1 to 5 rating)[b]					
Fossil fuel industry	1.9	2.3	2.0	2.5	2.1
Scientists in the fossil fuel industry	2.1	2.5	2.1	2.6	2.3
Renewable industry	3.4	3.0	2.9	2.7	3.1
Federal government	3.1	3.1	2.7	2.9	3.0
Provincial government	3.0	2.9	2.6	2.7	2.8
University scientists	3.7	3.3	3.3	3.0	3.4
IPCC scientists	3.5	3.1	2.9	2.5	3.1
Living area (%)[b]					
Urban	51.6	49.5	40.4	47.9	47.9
Suburban	35.4	35.8	36.3	38	36.4
Rural	13	14.7	23.3	14.1	16
Home type (%)[a]					
Detached	53.4	46.7	59	52.8	52.6
Attached (townhouse, apartment)	46.6	53.3	41	47.2	47.4
Commute mode (%)[b]					
Drive myself	34.3	30.1	42.3	46.4	36.7
Other (public transit, bike, carpool)	65.7	69.9	57.7	53.6	63.3
Daily commute time (%)[b]					
Not applicable	37.8	35.2	31.7	24.9	33.8
Less than an hour	51.2	46.9	53.9	61.1	52.1
An hour or longer	11.0	17.9	14.3	14.0	14.2
No of vehicles in a household (%)[b]					
None	18.8	14.4	7.5	7.8	13.4
One	44.8	42.7	51.2	43.0	45.4
Two or more	36.3	42.9	41.3	49.2	41.2
Political ideology (%)[b]					
Conservative Party	8.3	15.0	15.4	33.7	15.6
Liberal Party	18.0	16.3	14.3	10.9	15.6
New Democratic Party	18.0	13.9	5.5	9.8	12.8
Bloc Quebecois	3.6	5.6	1.4	8.8	4.4
Green Party	6.1	2.7	1.4	3.6	3.7
Other or no affiliation	45.9	46.5	62.1	33.2	47.9
Socio-demographics					
Age (%)[a]					
<40	35.7	47.5	36.9	40.9	40.1
40–64	45.3	37.9	45.7	45.6	43.3
65 or older	19.1	14.7	17.4	13.5	16.6
Gender (%)[b]					
Male	40.8	44.8	50.9	73.4	49.0
Female	59.2	55.2	49.1	26.6	51.0
Education (%)					
Below bachelor's	87.2	86.1	90.1	91.1	88.1
Bachelor's degree	7.4	8.3	6.5	5.2	7.1
Graduate degree	5.4	5.6	3.4	3.6	4.7
Income					
<$75 k	70.3	71.7	68.3	62.0	69.0
$75 k to $100 k	11.2	12.5	14.7	19.8	13.6
$100 k or more	18.4	15.7	17.1	18.2	17.3
Region (% by province)[b]					
Atlantic (NL, PE, NS, NB)	6.3	5.6	13.7	5.8	7.7
Quebec	23.3	27.1	23.5	23.6	24.5
Alberta	7.6	11.7	7.5	13.6	9.6
Manitoba/Saskatchewan	8.3	7.4	6.5	2.1	6.7
British Columbia	13.7	15.2	13.3	10.5	13.6
Ontario	40.8	33.0	35.5	44.5	37.9

[a] Significant at 95% confidence level (chi-square for categorical and ANOVA for continuous data).
[b] Significant at 99% confidence level (chi-square for categorical and ANOVA for continuous data).

emission fuels and technology (e.g., biofuels, solar panels, energy efficient technologies) (Clark et al., 2003). Future research could explore why addressing the risks associated with climate change might not equate to addressing broader environmental concerns. Most of these characteristics align with the regression results on support for the carbon tax and supply-focused regulations.

Finally, Table 5 characterizes respondents in each cluster in terms of their political affiliation with the key parties in Canada (as noted above, this characteristic was removed from the regression analysis for the reasons of multicollinearity and non-significance). The significant chi-square test indicates that political ideology is associated with cluster membership. Respondents in the 'Anti-Policy' cluster are more likely to be affiliated with the Conservative party of Canada (34%) or have no affiliation (33%). However, most respondents in each 'Pro-Policy' cluster do not have any political affiliation (46–62%). One explanation for why our regression models did not estimate significant coefficients for political affiliation could be due to the high proportion of respondents with 'no political affiliation'.

5. Discussion and Conclusion

Understanding citizen perceptions of climate policies can help policy-makers design and implement effective and acceptable climate policies. This study provides insights into how and why people support various types of climate policies using survey data collected from a representative sample of Canadian citizens. Our findings indicate that supply-focused regulations and voluntary policies receive the highest support (83–90%), while market-based instruments such as carbon taxes and cap-and-trade receive the highest opposition (47 and 30% respectively). These overall results are consistent with several survey-based studies in North America, Europe, and Asia suggesting that carbon taxes face higher opposition than voluntary and regulatory measures that set requirements for industry (Lachapelle et al., 2014; Tobler et al., 2012; Lam, 2014).

We further assess individual characteristics of support and opposition for these policies. This knowledge is useful for (1) policy-makers that want to assess the potential for public controversy of climate policies under consideration, (2) policy-makers in jurisdictions where similar climate policies already exist and can be affected by changes in the political climate or changes in stringency, which might generate more media attention, and (3) the academic literature which has not yet studied factors influencing citizen support for individual types of regulatory and voluntary climate policies.

Regression analyses suggest that the only consistent characteristics of support across different types of policies are concern about climate change, higher trust in scientists, lower trust in the fossil fuel industry, and being female. All four relationships have been found in previous research that used composite indices for measuring policy support (Dietz et al., 2007; Elliott et al., 1997; O'Connor et al., 2002; Zahran et al., 2006). The effects of other variables, including values and specific contextual factors, are unique to different policy types. Specifically, support for a carbon tax is associated with higher biospheric values and trust in government. The strong effect of biospheric values might be attributed to positive perceptions of a given policy's beneficial impact on the environment (Nilsson and Biel, 2008), or by a strong prioritization of the environment over other values. Trust in the federal government may be important due to citizens' concerns regarding the use of revenues from carbon taxes, as suggested by Hsu et al. (2008) and Kallbekken and Sælen (2011). Opposition to the carbon tax is higher among segments of the public who reside in rural areas, as well as those who rely on personal vehicles for commuting to work. Elliott et al. (1997) explain that rural residents have less public transportation options and are more directly dependent for income on the extraction of natural resources. These results are consistent with notions of a self-serving bias and cost saliency, where those that are the most likely to bear higher costs of a carbon tax (relative to the rest of the population) are statistically less likely to support it.

In contrast, support for three supply-focused regulations (the low carbon fuel standard and vehicle and building efficiency regulations) is higher among vehicle-dependent respondents. Support for these regulatory policies is also associated with higher biospheric and altruistic values, older age, and residence in Atlantic provinces. While Dietz et al. (2007) and Zahran et al. (2006) point to the significance of some of these characteristics for policy support, the authors do not differentiate the effects of these variables by policy type.

For the clean electricity standard, regression results indicate that trust in the renewable energy industry is a unique characteristic of support—it is not significant for any other policy type. The significance of trust might be related to the requirement of the clean electricity standard to generate new electricity from zero-emission sources, such as hydro, solar, and wind (Rhodes et al., 2014; Shwom et al., 2010). The clean electricity policy is also more likely to be supported by residents of Quebec and British Columbia. In these regions the vast majority of electricity is currently generated from renewable energy sources and therefore people in these jurisdictions are likely to see renewable electricity as a realistic possibility in future as it was in the past. Observations of higher support in these provinces is thus consistent with the notion of a self-serving bias. Finally, voluntary policies, including subsidies, information and research and development programs, are more likely to be supported by wealthier, suburban respondents with higher altruistic values and general environmental concerns, as well as by those not relying on a single occupancy use of a vehicle.

To explore heterogeneity among citizens, cluster analysis identifies four groups of respondents based on their stated support for the different policy types: those that strongly support all climate policies (34% of respondents), those that are moderately supportive of all policies including the carbon tax (28%), those that support policies other than the carbon tax (22%), and those that strongly oppose most climate policies (14%). Respondents that strongly support all policies are more likely to be urbanites and female, and score higher than other clusters in terms of biospheric and altruistic values, general environmental concern (NEP score), climate change concerns, trust in scientists and the renewable industry, and present use of 'greener' modes of transportation including public transit, biking, and carpooling. The opposite characteristics describe respondents that strongly oppose climate policies. Respondents who oppose most climate policies are also likely to be affiliated with the Conservative party of Canada. Consistent with the regression results, most respondents that are moderately supportive of all policies, including carbon taxation, show high trust in government, live in urban areas, and do not rely on personal vehicles. In contrast, respondents supportive of regulations and voluntary policies are more likely to live in rural areas and single-family homes, and show higher dependence on personal vehicles for commuting to work/school. These findings provide important insights into heterogeneity across respondents, including how framing different policies according do different motives and impacts may resonate uniquely with different citizen segments. Such insights could also be used to generate hypotheses for future research in other regions.

Both the regression and cluster analysis suggest that when implementing climate policies, policy-makers should consider individual characteristics of support for each policy separately and prepare targeted proposals. Our present analysis indicates that while it may be reasonable to create composite variables of policy support for relatively similar policies (e.g., building and vehicle efficiency regulations), the levels and patterns of support for different policy types are categorically different. Namely, we find unique patterns for the five policy categories we construct: carbon tax, cap-and-trade, clean electricity standard, supply-focused regulations, and voluntary policies. While carbon taxes are presumed by economists and policy experts to reduce total emissions at the lowest possible cost to society, they are likely to face opposition in Canada, particular from citizen segments that are vehicle-dependent and rural. Given that most citizens, including those who reside in rural areas and drive personal vehicles, are supportive of regulations, policy-makers might need to prioritize effective regulatory approaches over market-based policies. That being said, policy-makers should be aware that relatively high levels of policy support and low levels of opposition do not necessarily imply successful policy implementation—further attention should be paid to the strength and

nature of opposition. Groups that exercise significant political power by virtue of their economic and social significance, and those who face concentrated costs from specific policies, may have strong influence on policy implementation (Galbraith, 1952; Olson, 1971). More research in this area can prove fruitful.

This study has several limitations. First, several attitudinal and contextual variables suggested by Stern (2000) were removed from the study in the interest of simplicity, including perceived responsibility for climate change mitigation, personal norms, social networks, and political ideology. These variables could be incorporated and analysed as part of a more comprehensive framework on climate policy support. Second, while this study identified several unique individual characteristics of support for different policy types, the reasons for their unique effects were not investigated. Future research can assess why some individual variables matter for certain types of climate policies. Third, the survey questionnaire had fairly limited definitions of climate policies. For instance, there was no information about the different methods or actions to comply with certain regulations, the expected emission reductions or the expected distributional impacts of each policy. As a result, some responses may have been influenced by the wording presented in the survey. Future research should investigate how broader policy definitions and different ways of framing survey questions could affect citizen support. Finally, while citizen support is one of the key components of political acceptability of climate policies, other interest groups and institution could also have a strong influence on climate-policy making. Complimentary research could explore how stakeholder perceptions may affect climate policy decisions.

Acknowledgements

This work was funded by the Pacific Institute for Climate Solutions and the Social Sciences under Grant no. 31-641048, and Social Sciences and Humanities Research Council of Canada (Vanier Canada Graduate Scholarships program) under Grant no. 201211DVC-236457-303356.

Appendix A. Survey questions

Section 1 Global environmental issues.

Regardless of whether you know much about climate change/global warming, to what extent do you agree or disagree with the following statements (please select "I don't understand" if you are not familiar with any issues or do not understand them).

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree	I don't understand
1) Carbon dioxide is a greenhouse gas	○	○	○	○	○	○
2) Climate change/global warming is caused by excessive amounts of greenhouse gases	○	○	○	○	○	○
3) The major cause of increasing atmospheric concentrations of greenhouse gases is burning of fossil fuels (such as gasoline)	○	○	○	○	○	○
4) Climate change/global warming may lead to weather extremes, such as temperature increases, flooding, sea level rise, and extreme storms	○	○	○	○	○	○
5) Climate change/global warming has been established as a serious problem for society and immediate action is necessary	○	○	○	○	○	○
6) Scientists do not know enough about climate change/global warming and more research is necessary before we take action	○	○	○	○	○	○
7) Energy savings help reduce climate change/global warming	○	○	○	○	○	○
8) More species will be lost in my province due to climate change/global warming	○	○	○	○	○	○
9) More species will be lost in the world due to climate change/global warming	○	○	○	○	○	○
10) Health problems in my province will increase due to climate change/global warming	○	○	○	○	○	○
11) Health problems in the world will increase due to climate change/global warming	○	○	○	○	○	○
12) The economy in my province will suffer due to climate change/global warming	○	○	○	○	○	○
13) The world economy will suffer due to climate change/global warming	○	○	○	○	○	○
14) The standard of living of many people in my province will decrease due to climate change/global warming	○	○	○	○	○	○
15) The standard of living of many people in the world will decrease due to climate change/global warming	○	○	○	○	○	○

Section 2 Actions to reduce global warming.

Governments often consider different climate policies—actions that are meant to reduce greenhouse gas emissions, such as carbon emissions from burning gasoline. The goal of such policies is to reduce climate change/global warming. We would like to know if you would support or oppose a referendum on such policies in Canada.

2.1 How much would you support or oppose a tax on greenhouse gas emissions, such as carbon emissions from burning gasoline? The tax will apply to all individuals and businesses contributing to climate change/global warming.

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.2 How much would you support or oppose electricity regulations that require electric utilities to generate at least 50% of new electricity from clean sources, such as hydro, solar, or wind?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.3 How much would you support or oppose providing subsidies (such as tax rebates) to households/businesses that purchase energy efficient appliances/equipment, fuel efficient vehicles, or use solar and wind energy?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.4 How much would you support or oppose regulations that require new buildings, appliances, and equipment to be more energy efficient?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.5 How much would you support or oppose regulations that require vehicles to be 30% more fuel efficient by the year 2020?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.6 How much would you support or oppose regulations that require fuels to have lower carbon emissions by 20% by the year 2020?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.7 How much would you support or oppose setting an emissions limit (cap) for businesses and allocating emissions permits to them (emission permits add up to the cap). If permit trading is allowed, this is called cap-and-trade.

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.8 How much would you support or oppose educating citizens about climate change/global warming and actions to reduce it?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

2.9 How much would you support or oppose the government funding more research into clean energy sources, such as hydro, solar, or wind?

o Strongly oppose
o Somewhat oppose
o Somewhat support
o Strongly support

Section 3 Your values and activities.

3.1 Please rate the importance of each of the following values in your life.

	Not important at all	Not important	Moderately important	Important	Extremely important
1) Respecting the earth (living in harmony with other species)	○	○	○	○	○
2) Unity with nature (fitting into nature)	○	○	○	○	○
3) Environmental protection (preserving nature)	○	○	○	○	○
4) Pollution prevention	○	○	○	○	○
5) Social justice (correcting injustice, care for the weak)	○	○	○	○	○
6) Equality (equal opportunities for all)	○	○	○	○	○
7) Helping others (working for the welfare of others)	○	○	○	○	○
8) A world of peace (free of war and conflict)	○	○	○	○	○
9) Authority (the right to lead and command)	○	○	○	○	○
10) Social power (control over others, dominance)	○	○	○	○	○
11) Influence (having an impact on people and events)	○	○	○	○	○
12) Wealth (material possessions, money)	○	○	○	○	○
13) A varied life, filled with challenge, novelty, and change	○	○	○	○	○
14) An exciting life, stimulating experiences	○	○	○	○	○
15) Curiosity, many interests, desire to explore	○	○	○	○	○

3.2 Please indicate to what extent you agree or disagree with the following statements about natural environments.

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
1) The so-called "ecological crises" facing humankind has been greatly exaggerated	○	○	○	○	○
2) If things continue on their present course, we will soon experience a major ecological catastrophe	○	○	○	○	○
3) Humans have the right to modify the natural environment to suit their needs	○	○	○	○	○
4) Plants and animals have as much right as humans to exist	○	○	○	○	○
5) Humans are severely abusing the environment	○	○	○	○	○
6) When humans interfere with nature, it often produces disastrous consequences	○	○	○	○	○
7) The balance of nature is very delicate and easily upset	○	○	○	○	○
8) The earth is like a spaceship with limited room and resources	○	○	○	○	○

3.3 In assessing the climate change/global warming issue and associated solutions, please indicate your level of trust in each of the following organizations. Please select "I don't know" if you are not familiar with any entities or not sure about your level of trust in them.

	Very low	Low	Medium	High	Very high	I don't know
1) Environment Canada (federal environmental agencies)	○	○	○	○	○	○
2) Ministry of Environment in my province/territory (provincial environmental agency)	○	○	○	○	○	○
3) Scientists employed by government	○	○	○	○	○	○
4) Oil and gas companies	○	○	○	○	○	○
5) Renewable (clean) energy companies	○	○	○	○	○	○
6) Scientists employed by industry	○	○	○	○	○	○
7) Non-profit environmental groups, such as David Suzuki Foundation, Greenpeace, and the Pembina Institute	○	○	○	○	○	○
8) Scientists employed by environmental groups	○	○	○	○	○	○
9) Scientists working for the IPCC (International Panel on Climate Change)	○	○	○	○	○	○
10) Academic journals and magazines	○	○	○	○	○	○
11) Scientists employed by universities	○	○	○	○	○	○
12) Mass media (non-academic journals, magazines, newspapers)	○	○	○	○	○	○

Section 4 Socio-demographic details.

The information in this section will be used only for descriptive/statistical purposes.

4.1 What is your primary province of residence?

o Alberta
o British Columbia
o Manitoba
o New Brunswick
o Newfoundland
o Nova Scotia
o Ontario
o Prince Edward Island
o Quebec
o Saskatchewan
o Northwest Territories
o Nunavut
o Yukon

4.2 Could you please indicate your age group?

o 19 to 24 years
o 25 to 34 years
o 35 to 44 years
o 45 to 54 years
o 55 to 64 years
o 65 years and over

4.3 Could you please indicate your gender?

o Male
o Female

4.4 Could you please indicate the highest level of education you have completed?

o No certificate, diploma or degree
o High school certificate or equivalent
o Apprenticeship or trades certificate or diploma
o College, CEGEP or other non-university certificate or diploma
o University certificate or diploma below bachelor level
o Bachelor's degree
o University certificate or diploma above bachelor level
o Degree in medicine, dentistry, veterinary medicine or optometry
o Master's degree
o Doctorate or PhD degree

4.5 Could you please indicate your approximate *annual household income*?

o Without income
o Under $5000
o $5000 to $9999
o $10,000 to $19,999
o $20,000 to $29,999
o $30,000 to $39,999
o $40,000 to $49,999
o $50,000 to $59,999
o $60,000 to $69,999
o $70,000 to $79,999
o $80,000 and over
o I prefer not to answer

4.6 Could you please indicate the length of your total daily commute to work/school?

o <30 min
o 30 min to less than an hour
o An hour to 2 h
o More than 2 h
o Not applicable (I don't commute to work/school)

4.7 Could you please indicate your primary mode of transportation to commute to work/school?

o Drive myself
o Carpool
o Public transit
o Bicycle
o Walk
o Taxi
o Other
o Not applicable (I don't commute to work/school)

4.8 Which of the following categories best describes the area where you live in?

o Urban (city centre with dense housing)
o Suburban (just outside a city, with more spread out housing)
o Rural (far away from a city, with very spread out housing)

4.9 How would you describe your home?

o Detached house
o Attached house (townhouse, duplex, triplex, etc.)
o Apartment
o Mobile home
o Other

4.10 How many vehicles does your household currently own or lease that are driven regularly? *By "vehicles" we mean cars, trucks, vans, minivans, sport utility vehicles—any of the sort of motor vehicles a household normally uses for day to day travel. Please do not include motorcycles, recreational vehicles, motor homes, or non-motorized vehicles (such as bicycles).*

o None
o 1
o 2
o 3
o 4 or more

References

Ajzen, I., 1991. The theory of planned behavior. Organ. Behav. Hum. Decis. Process. 50: 179–211. http://dx.doi.org/10.1016/0749-5978/91.

Attari, S.Z., Schoen, M., Davidson, C.I., DeKay, M.L., Bruine de Bruin, W., Dawes, R., Small, M.J., 2009. Preferences for change: do individuals prefer voluntary actions, soft regulations, or hard regulations to decrease fossil fuel consumption? Ecol. Econ. 68: 1701–1710. http://dx.doi.org/10.1016/j.ecolecon.2008.10.007.

Bamberg, S., Schmidt, S., 2003. Incentives, morality or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. Environ. Behav. 35:264–285. http://dx.doi.org/10.1177/0013916502250134.

Bernauer, T., Gampfer, R., 2013. Effects of civil society involvement on popular legitimacy of global environmental governance. Glob. Environ. Chang. 23:439–449. http://dx.doi.org/10.1016/j.gloenvcha.2013.01.001.

Caplan, B., 2007. The Myth of the Rational Voter: Why Democracies Choose Bad Policies. Princeton University Press, Princeton.

Castelfranchi, C., Falcone, R., 2010. Trust Theory: a Socio-cognitive and Computational Model. Wiley Publishing.

Chetty, R., Looney, A., Kroft, K., 2009. Salience and taxation: theory and evidence. Am. Econ. Rev. 99 (4):1145–1177. http://dx.doi.org/10.1257/aer.99.4.1145.

Clark, C.F., Kotchen, M.J., Moore, M.R., 2003. Internal and external influences on pro-environmental behavior: participation in a green electricity program. J. Environ. Psychol. 23 (3):237–246. http://dx.doi.org/10.1016/S0272-4944(02)00105-6.

Cvetkovich, G., Siegrist, M., Murray, R., Tragesser, S., 2002. New information and social trust: asymmetry and perseverance of attributions about hazard managers. Risk Anal. 22:359–367. http://dx.doi.org/10.1111/0272-4332.00030.

Dietz, T., Fitzgerald, A., Shwom, R., 2005. Environmental values. Annu. Rev. Environ. Resour. 30:335–372. http://dx.doi.org/10.1146/annurev.energy.30.050504.144444.

Dietz, T., Dan, A., Shwom, R., 2007. Support for climate change policy: social psychological and social structural influences. Rural. Sociol. 72 (2):185–214. http://dx.doi.org/10.1526/003601107781170026.

Drews, S., van den Bergh, J.C.J.M., 2015. What explains public support for climate policies? A review of empirical and experimental studies. Clim. Pol. August:1–22. http://dx.doi.org/10.1080/14693062.2015.1058240.

Dunlap, R., Van Liere, K., Mertig, A., Jones, R., 2000. Measuing endorsement of the New Ecological Paradigm: a revised NEP scale. J. Soc. Issues 56, 425–442.

Elliott, E., Seldon, B., Regens, J., 1997. Political and economic determinants of individuals' support for environmental spending. J. Environ. Manag. 51, 15–27.

Franzen, A., Vogl, D., 2013. Two decades of measuring environmental attitudes: a comparative analysis of 33 countries. Glob. Environ. Chang. 23:1001–1008. http://dx.doi.org/10.1016/j.gloenvcha.2013.03.009.

Freudenburg, W.R., 1991. Rural–urban differences in environmental concern: a closer look. Sociol. Inq. 61:167–198. http://dx.doi.org/10.1111/j.1475-682X.1991.tb00274.x.

Galbraith, J.K., 1952. American Capitalist—the Concept of Countervailing Power. Houghton Mifflin, Boston.

Goulder, L.H., Parry, I.W.H., 2008. Instrument choice in environmental policy. Rev. Environ. Econ. Policy 2(2). Oxford University Press, Oxford, pp. 152–174.

Guerra Santin, O., Itard, L., Visscher, H., 2009. The effect of occupancy and building characteristics on energy use for space and water heating in Dutch residential stock. Energ. Buildings 41:1223–1232. http://dx.doi.org/10.1016/j.enbuild.2009.07.002.

Harring, N., Jagers, S.C., 2013. Should we trust in values? Explaining public support for pro-environmental taxes. Sustainability (Switzerland) 5:210–227. http://dx.doi.org/10.3390/su5010210.

Harrison, K., 2012. A tale of two taxes: the fate of environmental tax reform in Canada. Rev. Policy Res. 29 (3), 383–407.

Hosmer, D.W., Lemeshow, S., Sturdivant, R.X., 2013. Applied Logistic Regression. John Wiley & Sons Inc., Hoboken, NJ http://dx.doi.org/10.1002/9781118548387.

Hsu, S.L., Walters, J., Purgas, A., 2008. Pollution tax heuristics: an empirical study of willingness to pay higher gasoline taxes. Energy Policy 36:3612–3619. http://dx.doi.org/10.1016/j.enpol.2008.06.010.

Jaccard, 2006. Mobilizing producers toward environmental sustainability: the prospects for market-oriented regulations. In: Toner, G. (Ed.), Building Canadian Capacity: Sustainable Production and the Knowledge Economy. UBC Press, Vancouver.

Jackson, T., 2005. Motivating Sustainable Consumption. SDRN Briefing One. Sustainable Development Research Network, London, UK.

Kallbekken, S., Sælen, H., 2011. Public acceptance for environmental taxes: self-interest, environmental and distributional concerns. Energy Policy 39 (5):2966–2973. http://dx.doi.org/10.1016/j.enpol.2011.03.006.

Kinnear, P.R., Gray, C.D., 2004. SPSS12 Made Simple. Psychology Press, New York.

Klineberg, S.L., McKeever, M., Rothenbach, B., 1998. Demographic predictors of environmental concern: it does make a difference how it's measured. Soc. Sci. Q. 79, 734–753.

Lachapelle, E., Borick, C., Rabe, B.G., 2014. 2013 Canada-US Comparative Climate Opinion Survey. Canada 2020, Montreal.

Lam, S.P., 2014. Predicting support of climate policies by using a protection motivation model. Clim. Pol. 14 (August):321–338. http://dx.doi.org/10.1080/14693062.2014.916599.

Leiserowitz, A., 2006. Climate change risk perception and policy preferences: the role of affect, imagery, and values. Clim. Chang. 77 (1–2):45–72. http://dx.doi.org/10.1007/s10584-006-9059-9.

Matisoff, D., Edwards, J., 2014. Kindred spirits or intergovernmental competition? The innovation and diffusion of energy policies in the American states (1990–2008). Environ. Polit. 23 (5):795–817. http://dx.doi.org/10.1080/09644016.2014.923639.

Nilsson, A., Biel, A., 2008. Acceptance of climate change policy measures: role framing and value guidance. Eur. Environ. 18 (4):203–215. http://dx.doi.org/10.1002/eet.477.

O'Connor, R.E., Bord, R.J., Yarnal, B., Wiefek, N., 2002. Who wants to reduce greenhouse gas emissions? Soc. Sci. Q. 83 (1):1–17. http://dx.doi.org/10.1111/1540-6237.00067.

Olson, M., 1971. The Logic of Collective Action: Public Goods and the Theory of Groups. Harvard University Press, Cambridge, MA.

Owen, A. L., Conover, E., Videras, J., &Wu, S. (2012). Heat waves, droughts, and preferences for environmental policy. J. Policy Anal. Manage., 31, 556–577. doi:10.1002/pam.21599.

Rhodes, E., Axsen, J., Jaccard, M., 2014. Does effective climate policy require well-informed citizen support? Glob. Environ. Chang. 29:92–104. http://dx.doi.org/10.1016/j.gloenvcha.2014.09.001.

Rhodes, E., Axsen, J., Jaccard, M., 2015. Gauging citizen support for a low carbon fuel standard. Energy Policy 79:104–114. http://dx.doi.org/10.1016/j.enpol.2015.01.019.

Schwartz, S.H., 1992. Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. Adv. Exp. Soc. Psychol. 25:1–65. http://dx.doi.org/10.1016/S0065-2601(08)60281-6.

Semenza, J.C., Hall, D.E., Wilsond, D.J., Bontempo, B.D., Sailor, D.J., George, L.A., 2008. Public perception of climate change: voluntary mitigation and barriers to behavior change. Am. J. Prev. Med. 35 (5), 479–487.

Shwom, R., Dan, A., Dietz, T., 2008. The effects of information and state of residence on climate change policy preferences. Clim. Chang. 90 (4):343–358. http://dx.doi.org/10.1007/s10584-008-9428-7.

Shwom, R., Bidwell, D., Dan, A., Dietz, T., 2010. Understanding U.S. public support for domestic climate change policies. Glob. Environ. Chang. 20 (3):472–482. http://dx.doi.org/10.1016/j.gloenvcha.2010.02.003.

Steg, L., Dreijerink, L., Abrahamse, W., 2005. Factors influencing the acceptability of energy policies: a test of VBN theory. J. Environ. Psychol. 25 (4):415–425. http://dx.doi.org/10.1016/j.jenvp.2005.08.003.

Stern, P.C., 2000. Toward a coherent theory of environmentally significant behavior. J. Soc. Issues 56 (3):407–424. http://dx.doi.org/10.1111/0022-4537.00175.

Stern, P.C., Dietz, T., Guagnano, G.A., 1998. A brief inventory of values. Educ. Psychol. Meas. 58, 984–1001.

Stern, P.C., Dietz, T., Abel, T., Guagnano, G., Kalof, L., 1999. A value-belief-norm theory of support for social movements: the case of environmentalism. Hum. Ecol. Rev. 6, 81–97 (doi:10.1.1.195.5410).

Thompson, M., Ellis, R., Wildavsky, A., 1990. Cultural Theory. West View, Oxford.

Tobler, C., Visschers, V.H.M., Siegrist, M., 2012. Addressing climate change: determinants of consumers' willingness to act and to support policy measures. J. Environ. Psychol. 32 (3):197–207. http://dx.doi.org/10.1016/j.jenvp.2012.02.001.

Zahran, S., Brody, S.D., Grover, H., Vedlitz, A., 2006. Climate change vulnerability and policy support. Soc. Nat. Resour. 19 (9):771–789. http://dx.doi.org/10.1080/08941920600835528.