Citizen acceptance of new fossil fuel infrastructure: Value theory and Canada’s Northern Gateway Pipeline

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HIGHLIGHTS

- Acceptance of the proposed Northern Gateway Pipeline (NGP) varies by region.
- Regional variations in perceptions correspond with differing risks and benefits.
- Opposition is highest among citizens with strong biospheric–altruistic values.
- Acceptance is highest for citizens with strong traditional or egoistic values.
- Values may shape citizen perceptions of economic benefits and environmental risks.

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A B S T R A C T

Development of unconventional fossil fuels is generating controversy in North America, where citizen support or opposition can shape political decisions. This study explores the role of values in citizen perceptions. The case study is Canada’s proposed Northern Gateway Pipeline (NGP), which would transport bitumen from Alberta’s oil sands to British Columbia’s (BC) northern coast for export. Data were collected in 2013 from a sample of Canadian citizens (n=2628). The survey instrument elicited citizen perceptions of the NGP, as well as values and attitudes. Respondents in the Alberta subsample are the most likely to support the NGP and to perceive economic benefits. Respondents in the BC subsample are the most likely to oppose the NGP and to perceive environmental risks. To explore heterogeneity in motivations among both subsamples, respondent clusters are constructed based on values. In both regions, opposition is highest in clusters with strong biospheric–altruistic values, while acceptance is highest in clusters with strong traditional values. Regional effects are also substantial; NGP acceptance is higher in each of Alberta’s clusters relative to equivalent clusters in BC. Regional context seems to shape how values correspond with perceptions. Insights are drawn for energy project development, public consultation and energy planning.

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1. Introduction

This study explores citizen acceptance of the development of infrastructure relating to unconventional fossil fuels. Unconventional fossil fuels include oil sands, oil shale and shale gas and in recent years have become increasingly cost-competitive with other forms of energy. In North America, proposals for new infrastructure relating to unconventional fossil fuels are generating public controversy that is influencing political decisions. Such projects are often framed by media and politicians according to a tradeoff between economic benefits and environmental risks. Purposed economic benefits may include increased GDP and job creation, while environmental risks can include contribution to climate change, risks of spill or contamination of ecosystems or drinking water.

Amidst such controversy, policymakers struggle to understand citizen perceptions and to anticipate support or opposition. Polling is often conducted to gauge public perceptions, typically measured as overall support and how support varies among respondents of different income, education and age levels. Some studies also elicit respondent perceptions of project impacts, including benefits and risks. However, a focus on such perceptions does not provide insights regarding citizens’ values or worldview, or how citizens form such perceptions (Devine-Wright, 2011). Evaluation of large energy projects involves tradeoffs among a number of benefits, costs and risks (Shum, 2013), each of which involves a high degree of uncertainty. Such tradeoffs are difficult for energy experts to rationally evaluate, let alone the general public. Citizens’ perceptions tend to be shaped by their values, which influence how they access and perceive information from different sources (Stern et al.,

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Understanding these processes can help policymakers to more effectively engage citizens in energy planning.

This study applies value theory to explore citizen acceptance of Canada’s Northern Gateway Project (NGP). The NGP refers to a pipeline proposed to transport unconventional oil (bitumen) 1172 km from Alberta’s oil sands to British Columbia’s northern coast for export. The 36-inch pipeline would transport approximately 525,000 barrels of oil (in bitumen form) per day, which is equivalent to about one-quarter of the total oil that Canada exported in 2011. The NGP has generated polarized debate since it was first proposed in the mid-2000s. Proponents claim that the project would generate $9.2 billion of Canadian GDP per year and create 907,000 person years of employment across Canada (Eglinton et al., 2012). Critics argue that such claims overstate the economic benefits and understate environmental risks such as the potential for oil spills in sensitive ecosystems (Gunter and Broadbent, 2012). Another criticism is that the NGP’s facilitation of the expansion of Alberta oil sands counters Canada’s greenhouse gas emission goals (Palen et al., 2014). At times, the Canadian government has shown little interest in addressing such environmental concerns—in 2012 the natural resources minister dismissed NGP opposition as occurring only among “environmental and other radical groups” (Payton, 2012). In 2014 a federally appointed Joint Review panel recommended approval of the NGP, subject to 209 conditions (National Energy Board, 2013). At the time of writing this article, the fate of the NGP is still uncertain—in September of 2014, the project president stated that the NGP would likely be unable to achieve the planned 2018 start date (Kruegel, 2014).

Controversy surrounding the NGP is not limited to organized stakeholder groups, but has also developed among citizens throughout the country. The NGP has been covered extensively in regional and national media from 2008 to 2014; during this time the project was mentioned in over 1000 articles published in the top two national newspapers (Factiva, 2014). One 2013 poll indicates that the vast majority of western Canadian citizens are aware of the pipeline, but opinions vary widely between residents in British Columbia (BC) and Alberta—the two provinces that are most directly affected (Insights West, 2013). In particular, stated citizen support is higher in Alberta, which contains oil sands operations and stands to gain the most direct economic benefits. Citizen opposition is higher in BC, the province that would contain most of the pipeline and the marine terminals and coastal tanker traffic, and would thus face greater local environmental risks.

This study explores how such a complex energy issue can engender citizens of different regions, whose perceptions may be shaped by their underlying values. An interesting aspect of the NGP is that it presents differing impacts to two distinct regions in Canada, the provinces of Alberta and British Columbia, where citizens of each are likely to perceive different benefits and risks. For this study I collected survey data from citizens in both regions to assess NGP acceptance and beliefs, and role of individual values. Research objectives are to:

1. compare beliefs and support/opposition of the pipeline by Canadian region;
2. use measures of citizen values to identify respondent segments (clusters) within the two regions of focus (BC and Alberta), and;
3. describe respondents’ NGP beliefs and support by cluster and region.

2. Conceptual framework

2.1. Contextualizing citizen acceptance

Wüstenhagen et al. (2007) conceptualize three levels of social acceptance of energy projects. Socio-political acceptance addresses acceptance of the technology or project by policymakers, key stakeholders and the public more generally. Community acceptance addresses acceptance of the project by locally-affected stakeholders and residents, and considers perceptions of procedural justice, distributional justice and trust. Finally, market acceptance addresses the perceptions of consumers and investors relating to the project. Overall social acceptance of an energy project involves interactions among all three levels. My present focus is on public (or citizen) acceptance of the NGP, which is one component of socio-political acceptance.

2.2. Understanding citizen acceptance of energy projects

Research on citizen acceptance of energy infrastructure has tended to focus on case studies relating to wind energy, carbon capture and storage and nuclear power (Poumadère et al., 2011). Fewer published studies address fossil fuels, though some consider offshore oil drilling (Carlisle et al., 2010; Smith et al., 2010), and hydraulic fracturing projects for natural gas extraction or “fracking” (Boudet et al., 2014; Theodori et al., 2014). Reviews of citizen acceptance studies identify a variety of factors that influence project acceptance, including citizen trust in implementers and operators, political affiliation, proximity to the project site, perceptions of distributive fairness, and perceptions of the novelty of the project (Devine-Wright, 2011; Poumadère et al., 2011). Presently, I focus on the role of citizen beliefs about a project’s impacts, and how these beliefs can be shaped by the citizen’s values.

Citizen perceptions or beliefs about the benefits and risks of a project are typically important predictors of acceptance or opposition (Huijts et al., 2012). For example, support for wind power can be associated with perceptions of benefits such as pollution reduction, reduced energy imports, and association with the project being a symbol of renewable energy (Klick and Smith, 2010). Opposition can be associated with perceptions of increased electricity costs and lower property values. Similarly, citizen support of natural gas fracking in the U.S. is associated with perceptions of economic benefits, while opposition is associated with perceptions of local environmental risks (Boudet et al., 2014). Such perceptions can change with context also; a time-series analysis shows that citizen support for offshore oil drilling in California between 1976 and 2007 was positively associated with oil prices, and negatively associated with environmental disaster, i.e. the Exxon-Valdez oil spill in 1989 (Smith et al., 2010).

Media is thought to play a strong role in the formation of citizen perceptions, but the effect is difficult to predict. Newspapers were found to be the most influential and trusted source of Pennsylvania citizens’ information about fracking—on par with university professors and conservation and environmental groups (Theodori et al., 2014). A broader body of research explains that media can play a strong role in “framing” political issues—where information about an energy project is presented according to a particular storyline focusing on particular benefits and costs (Druckman, 2004; Luhmann, 1989; Stephens et al., 2009, 2008). Often, energy project are presented according to an economic benefit frame or an environmental risk frame, or as a tradeoff between the two (Shelby, 2011; Stephens et al., 2009). Research suggests that the presence of multiple competing frames for clean energy, both positive and negative, can effectively cancel out and have little overall effect on citizen perceptions (Aitkin and Urpelainen, 2013).

Constructs such as worldview and values are also thought to play a role in the formation of perceptions—providing a deeper understanding of citizen motivations (Devine-Wright, 2011; Devine-Wright and Devine-Wright, 2006). For example, grid-group culture theory categorizes people according to four different worldviews: fatalism, collectivism, individualism and egalitarianism (Aaron, 1987). “Egalitarian” citizens—those that were concerned
about social equality and the fragility of nature—are most likely to support renewable energy projects (West et al., 2010). In contrast, “individualist” citizens—who tend to believe that the environment is tolerant to human impacts—support renewable projects with clear economic benefits and no impact on lifestyle. In the case of fossil fuel projects, an egalitarian worldview is associated with citizen opposition while an individualist worldview is associated with acceptance (Boudet et al., 2014; Smith, 2001). Worldviews can also shape how citizens react to new information; citizens with egalitarian worldviews expressed lower confidence in information stating that offshore oil drilling was safe, relative to citizens with individualist worldviews (Carlisle et al., 2010).

My present study focuses on citizen values, which is a similar construct to worldviews in that it describes a relatively stable aspect of the citizen that shapes more specific attitudes and perceptions. I follow Schwartz and Bilsky’s (1987) general definition of values as “(a) concepts or beliefs, (b) about desirable end states or behaviors, (c) that transcend specific situations, (d) guide selection or evaluation of behavior and events, and (e) are ordered by relative importance” (p551). Schwartz’s (1994) attempt to establish a universal set of values identifies ten motivational categories that fit along two broad dimensions: self-enhancement (egoistic) versus self-transcendence and conservation (or tradition) versus openness to change. Value theory has since been applied to pro-environmental behavior, which tends to be positively predicted by high biospheric and altruistic values (higher self-transcendence), and negatively predicted by high egoistic values (higher self-enhancement) (Stern et al., 1995a).

In applying value theory to energy project acceptance, Stern et al. (1995a) would describe an energy project as an “attitude object”—in this case a proposed object that citizens evaluate as they gain exposure through experience, media, social interaction and other information sources. According to value theory, citizen evaluation of an energy project is in part guided or motivated by their pre-existing core values. Pre-existing values will sensitize the individual to “particular sets of consequences of environmental conditions” and make them “especially receptive to messages from social movement actors they view as supportive of those values” (Stern et al., 1995a, p1624). Stern et al. (1995a) hypothesize that beliefs about the attitude object will align with one’s values, e.g. where “beliefs about the negative consequences of environmental conditions…would be strongest for those who most strongly value those objects” (p1624). Thus, an individual’s core values will shape their formation of beliefs regarding the NGP as well as their stated support or opposition to the project. Part of the explanation for this pattern is that an individual will likely be exposed to media, social interactions and other experiences that are consistent with their core values due to self-selection in media exposure and social network membership.

A number of studies have explored the relationship between citizen values and acceptance of different energy projects. Support for wind energy is associated with altruistic and biospheric values, negatively associated with traditional values, and not significantly associated with egoistic values (Bidwell, 2013). In contrast, support for nuclear power is positively associated with traditional values and negatively associated with altruistic values (de Groot et al., 2013; Whitfield et al., 2009). In some cases, egoistic values are found to have no relationship with citizen support, while the de Groot et al.’s (2013) study found positive association with support of nuclear power. Confusion or inconsistency regarding the role of egoistic values may relate to the specific context—although egoistic values tend to correspond with an interest in material gain, a self-interested citizen might also be concerned about local environmental impacts (Upham, 2009). To my knowledge, Stern et al.’s (1995a) value theory has not been applied to studies of fossil fuel acceptance, though insights can be drawn from the grid-group culture studies cited above—biospheric and altruistic values correspond with an egalitarian worldview, while egoistic values correspond with an individualist worldview.

2.3. Present framework: applying value theory to the northern gateway pipeline

This literature review can be used to generate hypotheses about how values may relate to citizen support and perceptions of the NGP. As has been observed with oil drilling and fracking projects, citizens are likely to associate the NGP with perceptions of economic benefits such as job creation and economic development, and with environmental risks such as local oil spill risks and global climate change impacts. All else held constant, citizens that perceive greater economic benefits are more likely to support the NGP, and citizens that perceive greater environmental risks are more likely to oppose the NGP.

Research strongly suggests that both biospheric and altruistic values will be associated with perceptions of environmental risk and with overall opposition to the NGP. The roles of traditional and egoistic values are perhaps less obvious. Drawing from research on nuclear energy, citizens with traditional values may be more likely to support the NGP—provided that the NGP is analogous to a nuclear power plant in terms of perceived benefits and risks. Egoistic values have exhibited an inconsistent relationship with citizen acceptance across case studies. If egoism is analogous to the culture theory construct of individualism, then citizens with egoistic values are more likely to perceive the NGP as safe, and support is likely to be higher. On the other hand, high egoism could feasibly translate to higher concern about local environmental impacts, which would be associated with opposition to the NGP.

I further hypothesize that relationships between values, beliefs and acceptance can differ by region. As noted in the introduction, previous polling studies suggest that NGP support is substantially higher in the province of Alberta relative to BC (Insights West, 2013). If citizens tend to identify with their province of residence, then BC citizens will be more likely to perceive greater local environmental risks given that most of the NGP’s environmental impacts will be in BC. In contrast, Alberta citizens are more likely to perceive economic benefits, given that the Alberta economy is closely linked to the fossil fuel industry. Further, if media is an important source of NGP-related information for citizens, any differences in media coverage between BC and Alberta could shape citizen perceptions and acceptance. I consider these regional effects to be an exploratory objective in the present study because it is difficult to predict how relationships may differ.

A particular novelty of this study is to explore if there is one or more segment of citizens that subscribe to multiple values that correspond with conflicting NGP frames. To my knowledge, such value conflicts have not been explored in previous research on citizen acceptance. A starting hypothesis is that citizens with high levels of multiple values are more likely to perceive both frames—economic benefits and environmental risks. This combined perception pattern might translate to confusion or perhaps neutrality in the citizen’s stated acceptance of the NGP.

3. Method

3.1. Data collection: a survey of Canadian citizens

I collected citizen data through a web-based survey of adults residing in Canada. The survey instrument was primarily designed for a transportation-related research project, and the target population was new vehicle buying households in Canada—which is a subset of the full population of Canadian citizens. The
sampling frame includes a wide distribution of citizens by various socio-demographic variables and values, drawn from respondent panels maintained by two market research companies: Sentis Market Research and Survey Sampling International. Because this NGP study is more concerned with exploring links between variables than with attaining representative distributions of individual variables, this data set facilitates exploration of the stated research objectives. The sample includes respondents from all Canadian provinces (except Quebec), including intentional oversamples of British Columbia and Alberta citizens which permits regional comparison of respondents from the two provinces directly affected by the NGP.

The survey instrument includes questions relating to NGP acceptance and perceptions, as well as respondent values, attitudes, lifestyle and socio-demographic variables. The NGP-specific questions consist of seven statements relating to the NGP, each with a five-point Likert-type response scale (strongly disagree to strongly agree). Following a brief explanation of the NGP, support or opposition to the NGP was elicited in response to the statement: “I support the Enbridge Northern Gateway Pipeline.” The other six statements relate to specific beliefs about whether the NGP “will create jobs,” “will provide benefits to my province,” “will provide economic benefits to Canadians,” “has unacceptable environmental risks,” “will increase overall greenhouse gas emissions,” and “should instead be built to eastern Canada or the United States.” The survey also elicited respondents’ opinions related to the future of the Alberta oil sands (“expand,” “keep at the same size,” “decrease” or “shut down”) and the environmental impacts of the oil sands (“none,” “minor,” or “major”). Each of these survey questions included an “I don’t know” response category.

Core values were elicited using Stern et al.’s (1998) “brief” values inventory, which is a shorter, more environmentally-relevant version of Schwartz’s (1992) original 56-item value scale. The values inventory includes 12 value statements asking respondents to “indicate how important each value is as a guiding principle in your life.” The four response categories range from “not important” to “very important.” The 12 statements relate to four “core” value categories (three statements per category): biospheric, altruistic, egoistic and traditional values.

The survey also includes a brief, eight-item version of the New Environmental Paradigm (NEP) scale (Cordano et al., 2003). The NEP scale is widely applied as a measure of respondent acceptance of a pro-environmental worldview, attitudes or values. However, Stern et al. (1995b) found that the NEP scale is better described as a scale of general awareness of environmental impacts or consequences from human behavior. Thus, I use the NEP scale as a measure of environmental concern regarding environmental impacts.

The survey elicited respondent engagement in different lifestyles by asking about frequency of engagement in 47 different activities with 5-point response categories ranging from “never” to “very frequently.” Five of these activities relate to the environment, including “engaging in environmental conservation activities,” “attending environmental meetings” and “promoting environmental conservation (talking to people about the environment).” The purpose of this larger set of lifestyle questions is to facilitate later use of factor analysis to identify a “pro-environmental lifestyle” factor as described in the next section.

3.2. Data analysis

Responses to questions on NGP acceptance and perceptions are compared between Canadian regions, and then compared according to value-based “clusters,” using chi-square tests of association.

To set up the cluster analysis, the more established multi-item scales (values and NEP) are first confirmed using Cronbach’s alpha as a test of internal reliability for each scale. Then, a composite scale is calculated for each by summing the scores for each response.

The survey also elicited respondent engagement in a “pro-environmental lifestyle.” Axsen et al. (2012) demonstrate that this measure can be identified through exploratory factor analysis of a larger set of lifestyle items. Factor analysis identifies patterns in empirical data by grouping correlated variables into a smaller number of factors (Rummel, 1970). I presently use this method to identify if a “pro-environmental lifestyle” factor emerges as a group of correlated pro-environmental activities—which I expect would include all or some subset of the five pro-environmental lifestyle items included in the 47-item question set. The exploratory factor analysis is performed using the principal axis factoring method in SPSS with varimax rotation, which finds an orthogonal factor solution—factors have no correlation with one another (Costello and Osborne, 2005).

Cluster analysis is used as a citizen-centric approach to data analysis. Rather than focus on the association between values and NGP acceptance in aggregate (e.g. through regression analysis), I instead seek to represent heterogeneity across the sample using cluster analysis. Specifically, I use K-means cluster analysis in SPSS using standardized data from the six scales described above: four value scales, the NEP scale, and the pro-environmental lifestyle scale. The main purpose of cluster analysis is to identify groups of respondents that are similar to each other, and different from respondents in other groups (SPSS Inc., 2004). The K-means algorithm works iteratively to assign each respondent to a cluster (group) so that there is minimal distance between the respondent’s scores on the selected variables and means of those scores for that cluster as a whole. My selection of the number of clusters is based on the goals of finding a solution that is: interpretable, avoids proportionally large clusters (e.g. greater than 50% of sample) or very small clusters (e.g. less than 5% of sample), and has at least the number of clusters where inter-cluster variability exceeds intra-cluster variability. I then compare the clusters by region and according to demographic variables, NGP acceptance and beliefs, and other variables that may lend insight into the present research objectives.

4. Results

4.1. Canada survey sample

The web-based survey collected respondent data between February and May of 2013 inclusively. Respondents were screened to represent target population distributions of age, gender, income and education (as noted above, that target population was new vehicle buying households). Of the 12,978 respondents invited, 4590 met the criteria of the screener and were accepted into the study. Of the 3643 that started the survey, 2835 completed it. A further 207 were removed due to low quality responses or duplicate responses from the same household. A total of 2628 useable responses were collected, including oversamples of BC (n=813) and Alberta (n=508). For an initial Canada-wide comparison, I group respondents from Saskatchewan, Manitoba and Ontario into the “Central Canada” region (n=1111), and respondents from Nova Scotia, New Brunswick, Prince Edward Island and Newfoundland into the “Atlantic Canada” region (n=196). Quebec was omitted from the survey’s sampling frame due to the added costs of language translation.

Table 1 depicts the characteristics of the entire sample, as well as the BC and Alberta subsamples, each compared with Canadian census data. Respondents are more likely to be male than Census data, and more likely to have higher education levels. The Canada-wide and BC samples tend to be younger than Census data. All samples have a lower proportion of low-income households.
The primary objective of this study is to explore and explain variations in NGP acceptance and beliefs according to values. I construct respondent segments using six scales from standardized survey data: four values scales from Stern et al. (1998), one attitudinal/belief scale (Dunlap et al., 2000), and one pro-environmental lifestyle scale identified through factor analysis. Each of the four composite value scales is based on three items, and has a reasonable degree of internal reliability (Cronbach’s alpha values between 0.7 and 0.9). The biospheric and altruistic value scales have alpha values of 0.90 and 0.81, respectively. The self-enhancement (egoistic) and conservative (traditional) value scales have alpha values of 0.73 and 0.75, respectively. The New Environmental Paradigm (NEP) or “general awareness impact” scale is based on eight items and has an alpha of 0.82.

To establish a lifestyle scale for “pro-environmental” activities, I conducted a factor analysis on respondent engagement in 47 activities. The most interpretable factor solution including a total of 10 factors with one obvious factor; the following variables loaded strongly onto that factor: thinking about protecting the environment, trying to help the environment through daily actions, engaging in environmental conservation activities, and promoting environmental conservation (talking to people about the environment). Taken on their
own, responses to these four pro-environmental activity items have a Cronbach's alpha of 0.85. I use this factor as a variable representing respondent engagement in pro-environmental lifestyle.

Average responses within the BC and Alberta subsamples are fairly consistent across these question scales. The BC and Alberta subsamples show no significant differences on the four core values scales. On average, BC respondents have a slightly higher NEP score and slightly higher stated engagement in pro-environmental lifestyle than Albert respondents. Because differences between these regions (and between all regions in the total sample) are only slight, I conduct the cluster analysis using the entire Canada sample ($n=2628$), rather than conducting a separate cluster analysis for each subsample.

Table 2 depicts the six-cluster solution. In my judgment, this solution best meets the clustering objectives stated in Section 3.2: the identified clusters are interpretable with differences that align with the conceptual framework; each cluster is of an appropriate size, with none containing more than 50% or less than 5% of the sample; and the solution has between-cluster variability greater than within-cluster variability as indicated by SPSS outputs.

I split the six clusters into two general categories, where the first three clusters exhibit some degree of pro-environmental orientation. Respondents in the “Strong Environmental” cluster are the most dedicated to environmental issues. This cluster has relatively high cluster centers (average standardized scores) for biospheric and altruistic values, pro-environmental lifestyle, and NEP score (Table 2). The “Concerned Only” cluster does not exhibit

![Fig. 2. Regional comparison of respondent beliefs relating to Alberta oil sands and the Northern Gateway Pipeline (British Columbia, $n=813$; and Alberta, $n=508$).](image-url)

Table 2: Value-based Cluster descriptions and center values.

<table>
<thead>
<tr>
<th>Values</th>
<th>Some environmental orientationb</th>
<th>No environmental orientationb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong Enviro.</td>
<td>Concerned Only</td>
</tr>
<tr>
<td>Traditional (conservative)</td>
<td>0.44</td>
<td>0.79</td>
</tr>
<tr>
<td>Self-enhancement (egoistic)</td>
<td>-0.38</td>
<td>-0.88</td>
</tr>
<tr>
<td>Biospheric</td>
<td>0.95</td>
<td>-0.29</td>
</tr>
<tr>
<td>Altruistic</td>
<td>0.66</td>
<td>-0.15</td>
</tr>
<tr>
<td>Pro-environment lifestyle</td>
<td>0.97</td>
<td>0.29</td>
</tr>
<tr>
<td>Environmental concern (NEP)</td>
<td>1.07</td>
<td>0.29</td>
</tr>
</tbody>
</table>

- No significant differences in cluster proportions between regions at a 95% confidence level.
- Cluster analysis used the k-means clustering procedure in SPSS software. Clusters are constructed using standardized variables, so the depicted cluster centers are also standardized. This table only depicts cluster centers that are substantially different from zero, either greater than 0.15 or less than -0.15.
strong centers for biospheric values or lifestyle, but does have a relatively high cluster center for environmental concern (NEP score). The “Multi Valued” cluster exhibits high biospheric and altruistic values centers, as well as a high cluster center for traditional values. The three non-environmental clusters include respondents that score highly only on egoistic values (“Self Only”) and traditional values (“Tradition Only”). Finally, the “Unengaged” cluster has negative cluster centers for all tested variables. The proportion of respondents within each cluster is not significantly different between regions; for example, the BC subsample has about the same proportion of “Strong Environmental” respondents as does the Alberta subsample.

Table 3 compares the six clusters according to several socio-demographic factors. The six clusters exhibit no statistically significant differences in education or income. Respondents in the three environment-oriented clusters are more likely to be female, and are more likely to be older than the other clusters. Overall, the socio-demographic variables do not substantially vary across the clusters—indicating that the main differences between clusters are the six variables used to construct the clusters.

4.4. Comparing NGP acceptance by cluster and region

Fig. 3 depicts how NGP acceptance varies among these six clusters within each region (BC and Alberta). There are statistically significant chi-square associations between cluster membership and NGP support and opposition for each region (Table 3). For both regions, the highest levels of NGP opposition and lowest levels of support are observed in the Strong Environmental cluster—where biospheric and altruistic values are highest. The Concerned Only cluster has relatively high opposition levels only in the BC version—perhaps where environmental concern is more likely to translate to concern over local environmental impacts. Although the Multi Valued cluster has high biospheric and altruistic values at levels similar to the Strong Environmental cluster, the additional presence of high traditional values corresponds with a relative lack of environmental concern and a lack pro-environmental lifestyle engagement. The levels of NGP support and opposition observed in this cluster are less extreme than the Strong Environmental and Tradition Only clusters.

As expected, the Tradition Only cluster exhibits the strongest NGP support and lowest opposition—especially in the Alberta subsample. The Self Only cluster exhibits relatively high acceptance in both subsamples, but the BC version also exhibits a relatively high level of opposition. The Unengaged cluster exhibits a slight tendency towards support in both subsamples.

The between-region comparison of value-based clusters is striking in its consistency across corresponding clusters. The Alberta version of each cluster has higher levels of NGP support and lower levels of NGP resistance relative to its BC equivalent. Each of these between-region cluster differences is significant at a 99% confidence level, except for the difference between “Unengaged” clusters. There is a consistent absence of opposition among all of the Alberta clusters—other than the Strong Environmental cluster (30%), stated opposition does not exceed 11%.

Table 4 compares responses to a number of NGP-related belief questions by cluster, by region. There are statistically significant variations among clusters for nearly every belief, for both regions. These differences are largely consistent with each cluster’s defining values. Respondents in the Strong Environmental cluster are the most likely to perceive that the NGP has unacceptable environmental risks, that the Alberta oil sands have major environmental impacts and should be decreased in size, and that climate change is a serious problem. In contrast, respondents in the Tradition Only cluster are most likely to associate the NGP with economic benefits (particularly in the Alberta cluster), to support maintaining or expanding the scale of oil sands, and to believe that climate change is not a serious problem.

5. Discussion

5.1. Citizen perceptions and acceptance by region

As expected, there are statistically significant differences in citizen perceptions and support of the NGP by regional subsample.

Table 3

<table>
<thead>
<tr>
<th>Respondent gender¹</th>
<th>Some environmental orientation</th>
<th>No environmental orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong Enviro.</td>
<td>Concerned Only</td>
</tr>
<tr>
<td>Female</td>
<td>66.5</td>
<td>63.2</td>
</tr>
<tr>
<td>Respondent age²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 35 years old</td>
<td>25.7</td>
<td>24.2</td>
</tr>
<tr>
<td>35–54 years old</td>
<td>40.7</td>
<td>41.0</td>
</tr>
<tr>
<td>55 years and older</td>
<td>33.5</td>
<td>34.8</td>
</tr>
<tr>
<td>Respondent education level³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College diploma or trade degree</td>
<td>35.4</td>
<td>32.0</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>20.6</td>
<td>26.7</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>10.7</td>
<td>10.7</td>
</tr>
<tr>
<td>Household income⁴</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$70–99 k/year</td>
<td>44.9</td>
<td>38.6</td>
</tr>
<tr>
<td>$100 k/year or more</td>
<td>25.7</td>
<td>26.2</td>
</tr>
<tr>
<td>Not reported</td>
<td>8.8</td>
<td>9.3</td>
</tr>
<tr>
<td>Household size⁵</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 person</td>
<td>14.0</td>
<td>13.0</td>
</tr>
<tr>
<td>2 people</td>
<td>38.7</td>
<td>43.2</td>
</tr>
<tr>
<td>3 or more</td>
<td>47.3</td>
<td>43.8</td>
</tr>
</tbody>
</table>

¹ No significant association with value cluster.
² Significant association at 95% confidence level (chi-square).
³ Significant association at 99% confidence level (chi-square).
Respondents exhibit the highest support in the Alberta subsample, the lowest support in the BC subsample, and the most neutrality in the other Canadian subsamples. Although these subsamples exhibit some demographic biases relative to Canadian Census data, these regional differences largely correspond with polling data collected in the same year (Insights West, 2013).

Alberta respondents are more likely to perceive that the NGP will have economic benefits and create jobs, and are more likely to support the oil sands more generally. In contrast, BC respondents are more likely to perceive environmental risks, including local impacts and contributions to climate change. In both regions, only minorities of respondents perceive that the NGP would contribute to climate change. This lack of perceived global impacts seems to correspond with the federally-appointed NGP Joint Review Panel’s decision to formally ignore discussion of climate impacts (Palen et al., 2014).

Regional differences in perception can be interpreted from a materialistic perspective. The province of Alberta stands to gain more economically from the NGP due to the associated expansion of Alberta oil sands development, while the province of BC faces more environmental risks because it would contain most of the pipeline’s length, as well as the marine terminal and oil tanker traffic. The next step of this study builds from this materialistic perspective to explore the heterogeneity in citizen motives behind NGP perceptions and acceptance levels.

5.2. Describing the six citizen clusters

The primary objective of this study is to explore how values relate to acceptance of the NGP. Cluster analysis was used to construct six citizen segments based on values, environmental concern and engagement in a pro-environmental lifestyle as elicited through the survey. The first three clusters have some degree of environmental orientation, while the latter three do not.

Each cluster can be described by the average values, concern, support, and perceptions and of its members.

First, respondents in the Strong Environmental cluster (20% of respondents) have on average the highest levels of biospheric and altruistic values and environmental concern, and are the most likely to frequently engage in pro-environmental activities. Both the BC and Alberta versions of this cluster exhibit the highest opposition to the NGP, and are relatively less likely to perceive economic benefits, more likely to perceive environmental risk, and more likely to oppose Alberta oil sands operations more generally. These respondents are the most likely to perceive climate change as a “serious threat” (over 50% in both regions) and to believe that the NGP will increase greenhouse gas emissions. This association between altruistic–biospheric values (analogous to an egalitarian worldview) and increased environmental risk perception is consistent with past studies on citizen perceptions of fracking, oil drilling and nuclear power (Boudet et al., 2014; Smith, 2001; Whitfield et al., 2009).

Respondents in the Concerned Only cluster (21%) score low on all values measured, but express environmental concern that is slightly above average (as measured by the New Ecological Paradigm or NEP scale). In the BC subsample, this cluster exhibits the second highest level of NGP opposition. In contrast, the Alberta version of this cluster has support levels that are similar to the Multi Valued and Unengaged clusters, and has low perceptions of environmental risks. It seems that general environmental concern is more likely to translate to perceptions of risk and NGP opposition in the region where the local environmental risks are highest (BC).

Respondents in the Multi Valued cluster (21%) score high on biospheric and altruistic values—which are typically correlated with one another—and score highly on traditional values. According to value theory, these values sets are not contradictory in themselves because the values fall on independent value dimensions; biospheric–altruistic values oppose egoistic values, while...
traditional or conservative values oppose openness-to-change (Stern et al., 1995a). However, previous citizen acceptance research suggests that biospheric–altruistic and traditional values tend to have significant and opposite associations with citizen support (Bidwell, 2013; Whitfield et al., 2009). In the present study, this combination of values seems to have a suppressive effect; despite having biospheric–altruistic values that are similar to the Strong Environmental cluster, respondents in the Multi Valued cluster are less likely to express environmental concern or to engage in pro-environmental activities—a main priority. This interpretation is consistent with research indicating that exposure to competing or contradictory frames can cancel out any effect on the citizen’s perceptions of energy (Akl and Urpelainen, 2013).

Respondents in the Self Only cluster (16%) exhibit the highest level of egoistic (conservative) values. As hypothesized, respondents in this cluster tend to support the NGP and fossil fuel development in both subsamples, and are more likely to perceive economic benefits—which is consistent with previous research on fossil fuel acceptance (Boudet et al., 2014; Smith, 2001). However, the BC version of this cluster also exhibits a relatively high level of NGP opposition, and is more likely to perceive environmental risk than the other “non-environmental” clusters—despite having low levels of general environmental concern. This result supports the hypothesis that egoistic values might translate to concern about local environmental impacts, if those impacts are perceived to potentially negatively affect the individual (Upham, 2009).

Respondents in the Tradition Only cluster (14%) have high traditional (conservative) values, and score particularly low in biospheric values, environmental concern, and pro-environmental

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### Table 4
Comparing value-based clusters acceptance and support within each region (%).

<table>
<thead>
<tr>
<th>Region</th>
<th>Some environmental orientation</th>
<th>No environmental orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strong Enviro.</td>
<td>Concerned Only</td>
</tr>
<tr>
<td>BC</td>
<td>12.6</td>
<td>23.3</td>
</tr>
<tr>
<td>Alberta c</td>
<td>31.5</td>
<td>46.9</td>
</tr>
<tr>
<td>BC</td>
<td>58.1</td>
<td>38.6</td>
</tr>
<tr>
<td>Alberta c</td>
<td>30.3</td>
<td>10.8</td>
</tr>
</tbody>
</table>

**Beliefs about the pipeline project** (% “agree” or “strongly agree”)

- Will create jobs.
- BC 73.6, Alberta c 85.4
- Will provide benefits to my province.
- BC 49.4, Alberta c 68.5
- Will provide economic benefits to Canadians.
- BC 58.6, Alberta c 64.0
- Has unacceptable environmental risks.
- BC 72.4, Alberta c 56.2
- Will increase overall greenhouse gas emissions.
- BC 55.7, Alberta c 47.2
- Should instead be built to eastern Canada or US.
- BC 15.5, Alberta c 18.0

**Beliefs about Alberta Oil Sands** (% selecting a given response)

- There are major environmental impacts from oil sands.
  - BC 69.0, Alberta c 65.2
- Canada should decrease or shut down the oil sands.
  - BC 37.4, Alberta c 28.1
- Canada should keep or expand the size of the oil sands.
  - BC 36.8, Alberta c 49.4

**Beliefs about Climate Change** (% selecting 1 of the 5 responses)

- A serious problem, immediate action is necessary.
  - BC 60.9, Alberta c 51.7
- Could be a serious problem, should take some action.
  - BC 29.9, Alberta c 32.6
- More research is needed before deciding.
  - BC 5.7, Alberta c 9.0
- It is not a problem and does not require any action.
  - BC 1.7, Alberta c 1.1
- I don’t know enough about the issue.
  - BC 1.7, Alberta c 5.6

**Self-assessment: I see my overall lifestyle as...** (% selecting 1 of the 4 responses)

- Dark green—environ. activities a main priority
  - BC 9.8, Alberta c 7.9
- Medium green—environ. activities general priority
  - BC 67.2, Alberta c 56.2
- Light green—environ. activities sometimes a priority
  - BC 23.0, Alberta c 32.6
- Not green—environ. activities not a priority.
  - BC 0.0, Alberta c 3.4

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* No significant association with value cluster.
* Significant association at 95% confidence level (chi-square).
lifestyle. Members of this cluster are highly supportive of oil sands development more generally, and are the least likely to believe that climate change is a “serious problem” (less than 6% in both subsamples). This cluster exhibits the highest level of NGP support and lowest level of opposition in both regional subsamples, is highly likely to perceive economic benefits and is unlikely to perceive environmental risks. These findings are consistent with previous research on nuclear energy (Whitfield et al., 2009).

Finally, respondents in the Unengaged cluster (9%) have lower than average scores for all variables used for clustering. These respondents are less likely to have an opinion on the NGP, and are less likely to perceive economic benefits or environmental risks associated with the project. Members of this cluster are perhaps better described by core values that were not assessed with this survey instrument.

5.3. Implications for value theory and citizen acceptance

The present findings largely support previous studies of citizen support for nuclear power and fossil fuel development: biophysical–altruistic values are generally associated with opposition, and egoistic and traditional values are generally associated with support. However, this analysis also uncovers some nuances about how values can translate to perceptions and support in different contexts. These findings can be used to generate hypotheses to be further tested in future research on citizen acceptance of fossil fuel projects.

Results support the notion that citizen values shape beliefs about an energy project; respondents’ stated beliefs tend to correspond with their values, though this association can vary by context. Although it cannot be tested with the present dataset, value theory explains this process of perception formation: citizens tend to receive, filter, and process information from media, institutions, and social interactions that frame issues to align with their existing values (Stern et al., 1995a). For example, it has been found that citizens are more likely to believe information on oil drilling if the message corresponds with their values (Carlisle et al., 2010). Further exploration is required to understand exactly how citizen values shape their access to media, which is likely to be an important source of information relating to the NGP.

Results also suggest that values may have different relationships with citizen perceptions in different regions. Regional differences in citizen support for the NGP are substantial and strikingly consistent across clusters. Each of the six clusters in the Alberta subsample exhibits higher NGP support and lower opposition relative its counterpart in the BC subsample. Otherwise, Alberta and BC respondents do not exhibit significantly different levels of values or cluster membership, and differences in environmental awareness and lifestyle are only slight. The materialistic explanation for these regional differences in support is that NGP benefits and risks actually vary by region. Value theory provides an additional layer of explanation: citizen values translate to perception formation in different ways for each region. For example, BC versions of the Concerned Only and Self Only clusters exhibited proportionally higher opposition rates than the Alberta versions. Thus, citizen values seem to interact with citizen perceptions of the materialistic differences in benefits and costs in each region.

Though it is beyond the scope of the present study, one might speculate that media coverage and public discourse differs between these two regions. I hypothesize that Alberta media is more likely to focus on the economic benefits frame of the NGP, and BC media is more likely to focus on the environmental risk frame. Potentially, respondents in each region have exposure to a different “pool” of information. Even if a respondent tends to select information that is consistent with their core values, citizens are exposed to different types of information in each region.

5.4. Limitations and directions for future research

There are several limitations of this study that should be explored in future research on citizen acceptance of the NGP. This survey did not elicit perceptions relating to the rights of First Nations (aboriginal) groups and the impacts they may face, and did not elicit perceptions directly from specific communities that would be most directly affected by NGP such as communities residing near the planned pipeline or marine terminal sites. The survey also did not measure respondent trust in various NGP actors and stakeholders—several studies suggest that trust can be very important component of citizen acceptance (Aas et al., 2014; Firestone et al., 2012; Kim et al., 2014; Whitfield et al., 2009). It would also be useful to elicit details of the sources that citizens consult to learn about the NGP, and how influential these different sources were regarding their perceptions and support levels. The present study also omitted consideration of a domestic “energy security” frame because Canada is a net exporter of energy. However, energy security frames may play a larger role in energy importing countries like the U.S.

6. Conclusions and policy implications

There is increasing pressure to expand the development of unconventional fossil fuels in North America, including oil sands, shale gas and shale oil. Citizen acceptance is one factor of social acceptance that can shape political decisions regarding fossil fuel infrastructure projects. Citizen acceptance is not just a matter of materialism or self-interest—such projects can resonate with a variety of citizen values in ways that differ substantially by context, such as across regions with real or perceived differences in potential benefits and risks (Devine-Wright, 2011). The tradeoff between perceived economic benefits and environmental risks is a particularly strong theme in the NGP and other fossil fuel project proposals, and the formation of such perceptions can be shaped by citizen values.

Governments seeking to navigate public opinion will need to understand the complexities of citizen acceptance, and carefully frame political decisions to propose, accept or reject such large-scale energy projects—anticipating how these frames will connect or clash with different core values. At times, the Canadian government has seemed to follow a “decide-announce-defend” approach to the NGP (Devine-Wright, 2011), such as when the minister of natural resources simply dismissed opposition as being rallied by “environmental and other radical groups” (Payton, 2012). More genuine citizen engagement can better understand citizen values, and how these values interact with place and regional context (Devine-Wright, 2011).

Potentially, public controversy can be alleviated by the provision of a strong, consistent vision by political leaders. Presently, Canada lacks a national energy plan—leaving a vacuum for provincial governments to plan and implement energy projects, often in an uncoordinated patchwork of decisions. Perhaps the articulation of such a national vision might serve to reduce controversy and uncertainty regarding project benefits and risks (Shum, 2013). The use of effective consultation processes can assure that the concerns and values expressed by different citizen groups are integrated into the regional and national energy goals, potentially reducing later opposition (Devine-Wright, 2011).

Opponents of fossil fuel development may be concerned that only a minority of respondents in this study associate the NGP with climate change impacts. NGP opponents could more
effectively frame the NGP according to global environmental impacts, which might engage citizens with a broader set of values. To date, the Canadian Government seems to be actively avoiding the climate change frame, as evidenced by the federally-appointed Joint Review panel’s decision to formally omit consideration of climate change impacts (Palen et al., 2014).

This study also suggests that citizen values are not necessarily a “hard constraint” to acceptance of (or opposition to) new fossil fuel infrastructure proposals. Values can be leveraged in different ways—for example, self-oriented citizens in the BC subsample exhibited relatively high opposition to the NGP, perhaps due to self-based concerns of local impacts. Perhaps the strong NGP support exhibited by citizens with traditional values also may be subject to change—for example if the negative local or global environmental impacts of the NGP are perceived as somehow disrupting to the economy, or threatening to family security.

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