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

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ABSTRACT
Proposals to build infrastructure for unconventional fossil fuels are increasingly generating controversy among citizens. This study explores the case of Canada's proposed Northern Gateway Pipeline (NGP), which would transport unconventional oil (bitumen) 1,172 km from Alberta's oil sands to British Columbia's northern coast for export. The NGP has received extensive media coverage in the two most affected provinces (Alberta and BC). I implemented a web-based survey (n = 2,628) in 2013 to collect data on citizen acceptance, values and beliefs related to two common frames of the NGP: economic benefits and environmental risks. I draw from value theory to explain variations in citizen acceptance within and between the two regions, constructing value-based clusters of respondents based on survey data. NGP acceptance varies considerably among clusters in each region; the highest acceptance is among citizens with strong traditional (conservative) values and acceptance is lowest among citizens with strong biospheric-altruistic values. Contextual or regional effects are also substantial; NGP acceptance is higher in every one of Alberta's value-based clusters relative to BC. Differences in media and stakeholder framing between the regions may help to explain why citizens with the same core values hold different perceptions of the NGP.

Keywords: citizen acceptance; values; fossil fuels; climate change.

1. Introduction

1.1 Background: The Northern Gateway Pipeline

Unconventional fossil fuels are becoming more cost-competitive and their unbridled development risks undermining climate abatement efforts. In North America, proposals for new infrastructure relating to unconventional fossil fuels are generating public controversy that is influencing political decisions. One example is the Keystone XL pipeline in the U.S. (one proposed expansion phase for the overall Keystone Pipeline system) which would transport oil from Canada and the northern U.S. (including oil sands bitumen and Bakken shale oil) to the Texas Gulf coast for refinement. This study explores citizen acceptance of a second and related pipeline proposal: Canada's Northern Gateway Project (NGP).

The NGP is proposed to transport unconventional oil (bitumen) 1,172 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 for export, 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. Supporters claims that the project would generate $9.2 billion of Canadian GDP per year and create 907,000 person years of employment across Canada (Eglington 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 (Gunton 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—analysis suggests that oil sands operations will have to inevitably decrease if Canada or oil sands importing countries enact stringent climate policy (Chan et al., 2012). NGP controversy seems to also exist among citizens in the region; one poll shows that the vast majority of western Canadian citizens are aware of the pipeline, but opinions vary widely between the two affected provinces (BC and Alberta) (Insights West, 2013).

This study uses the NGP as a case to explore how citizen acceptance and perceptions can vary by region, personal values, beliefs and lifestyle. Citizen resistance to large energy projects is often explained simply as "NIMBYism"—citizens protesting any developments that produce a local impact. However, the motives and dynamics of citizen acceptance are more varied and complex (West et al., 2010). 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 evaluate, let alone the general public whose perceptions are often skewed by media framing effects (Aklin and Urpelainen, In Press; Druckman, 2004; Luhmann, 1989; Stephens et al., 2009b).

This study explores citizen acceptance of the Northern Gateway Project (NGP) proposal. An interesting aspect of the NGP is that it impacts two distinct regions in Canada, the provinces of Alberta and British Columbia, where citizens of each are likely to be presented with different benefits and risks from different media sources. I collected survey data from citizens in both regions to assess NGP acceptance, beliefs, and the relation to individual values. Analysis seeks answers to the following questions:

1. How do citizen perceptions of the NGP vary by region?
2. How does citizen acceptance within each region, and between regions, vary according to personal values, beliefs and lifestyle?

1.2. Explaining citizen acceptance of energy projects

There has been little peer-reviewed study of citizen acceptance of new fossil fuel infrastructure—acceptance research has focused more on renewable and low-carbon energy projects (Poumadère et al., 2011). In general, citizen perceptions of energy projects can be highly unstable (Mercer et al., 2011; Poumadère et al., 2011; Sharp et al., 2009), and have been shown to change with exposure to different types of information (Stephens et al., 2009a; Wallquist et al., 2010) as well as public consultation (Bradbury et al., 2009; Terwel et al., 2010). It is thus useful to understand motives behind citizen acceptance, drawing from behavioral theory.

Theoretical frameworks provide guidance regarding citizen perceptions and motivations. Such frameworks can range in focus from the individual citizen to the broader social system. Huijts et al. (2012) present one individual-based framework that summarizes the influences of several context-specific factors on citizen acceptance of energy projects, combining elements of the theory of planned behaviour (Ajzen, 1991) and Schwartz's norm activation model (Schwartz, 1977; Steg and de Groot, 2010). Huijts et al.'s integrative framework proposes several explanatory variables, including: experience and knowledge relating to the project, trust in the actors relating to the project, perceptions of fairness in the project's implementation, beliefs about the benefits, costs and risks of the project, perceptions of equitable distribution of costs, benefits and risks, and personal and social norms about taking action regarding the project.

West et al. (2010) instead focus on explaining differences in citizen support based on relatively stable aspects of the individual—what they call worldviews. The authors identify four citizen categories (or ideal types) from grid-group cultural theory (Aaron, 1987), which they apply to qualitative interviews eliciting citizen perceptions of renewable energy technology. "Egalitarian" citizens were most likely to support renewable energy projects, provided that local environmental impacts were minimized. In contrast, "individualist" citizens only supported projects with clear economic benefits and no impact on lifestyle. The implication is that citizen acceptance of energy projets can be constructed from a variety of viewpoints, beliefs and processes.

Other frameworks and studies look even more broadly at the socio-political context of energy projects, focusing on the influence and power of different institutions and stakeholders. For example, Stephens et al. (2008) propose the socio-political evaluation of energy deployment (SPEED) framework to assess and compare regional readiness for and deployment of alternative energy technologies according to technical, institutional, and social factors. Applications of SPEED can use methods such as policy review, media analysis, focus groups and stakeholder interviews to assess and anticipate the deployment of energy technology in a given region.

1.3. Value theory as a conceptual framework

I presently focus on the role of citizen values in the construction of citizen beliefs and acceptance. Values are a relatively durable characteristic of individuals, and of the three frameworks summarized above value theory is closest to West et al.'s application of cultural theory (focusing less on context-specific factors or broader institutional dynamics). There has been little application of values theory to the acceptance of large energy projects. I presently draw from Stern et al.'s (1995a) application of value theory to pro-environmental behavior. Stern et al. would describe the NGP as an "attitude object"—in this case a proposed object that citizens evaluate as they gain exposure through experience, media, social interaction and other sources. Citizen evaluation of the NGP is in part guided or motivated by their pre-existing core values. To

further explain this framework, I first provide more specific definitions of the concepts of acceptance, values, beliefs, and framing.

Regarding citizen acceptance, Huijts et al. (Huijts et al., 2012) provide a useful discussion. I presently define citizen acceptance as a measure of how the general public (not necessarily "citizens" by an immigration definition) evaluates the energy project. Huijts et al. distinguish between four levels of citizen acceptance: i) support is positive evaluation that is paired with action (e.g. advocating for the technology), ii) tolerance is positive evaluation without action, iii) connivance is negative evaluation without action, and iv) resistance is negative evaluation with action (e.g. protesting the technology). Although citizen acceptance can be measured in terms of specific actions relating to the energy technology (e.g, protesting or putting up supportive posters) (Huijts et al., 2012), I presently refer to acceptance more generally as a continuous scale ranging from strongly resist to strongly support—neglecting a measure of specific actions.

Value theory assumes that citizen acceptance is shaped in part by the citizen's values. I follow Schwartz and Bilsky's (Schwartz and Bilsky, 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 and Bilsky, 1987). Values are thus more stable and general than specific attitudes or beliefs, and core values can be conceptualized as components of an individual's self-concept or identity (Axsen and Kurani, 2013b; Hitlin, 2003). Schwartz (1994) identifies ten motivational categories that fit along two broad dimensions: self-enhancement (egoistic) versus self-transcendence and conservation (or tradition) versus openness to change. Pro-environmental behaviour is 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). Value theory has not been previously applied to energy project acceptance.

I define citizen beliefs as perceptions and evaluations of specific aspects or attributes of the energy project, e.g. perceptions that the NGP will benefit the economy or harm the environment. Following Stern et al. (1995a), I posit that an individual's core values shape their formation of beliefs regarding the energy project as well as their overall evaluation. An individual will likely be exposed to media, social interactions and other experiences that are consistent with their core values (due to self-selection regarding media exposure and social network membership). Further, within that exposure, the individual likely filters information they receive to focus on messages consistent with their core values.

Of course, the citizen only has access to a finite set of messages and information sources relating to the energy project. Each message will be consistent with one or more "frame"—where information about the energy project is presented according to a particular argument (Druckman, 2004; Luhmann, 1989; Stephens et al., 2009b; Stephens et al., 2008). Media, industry, and other stakeholders can present the NGP according to a number of frames, for example as a source of economic benefit and development, or as an unacceptable environmental risk—typical frames for energy projects (Shelby, 2011; Stephens et al., 2009b). Framing effects can influence individual perceptions in a variety of contexts (Tversky and Kahneman, 1981), including, in some cases, the formation of political preferences (Druckman, 2004). One experimental study indicates that the issuing of multiple competing frames for clean energy, both positive and negative, can effectively cancel out and have little overall effect on consumer acceptance (Aklin and

Urpelainen, In Press). However, research has not explored how such competing "frames" may be selectively perceived by individuals with different core values.

Drawing from the above discussion, I apply value theory to the case of NGP acceptance according to the following conceptual framework:

1. Citizen acceptance of a large energy infrastructure project is, in part, a function of the citizen's core values. Four particular "core value" types are likely to be particularly important: altruisim, biospheric, egoistic (self-enhancement), and traditional (conservative) values.
2. Media and other institutions may present multiple, competing frames of the energy project (Aklin and Urpelainen, In Press). In the case of the NGP, two important frames emphasize economic benefits or environmental risks.
3. Citizen values shape belief formation. Higher altruistic and biospheric values correspond with beliefs relating to the environmental risk frame (e.g. oil spill and climate change). Higher egoistic or traditional values correspond with the economic benefits frame (e.g. creating jobs and supporting economic growth).
4. Energy project acceptance and beliefs may also vary with contextual variables independent of values, such as region. For the NGP case, Alberta and BC citizens may perceive different benefits and risks and may be subject to different sets of media frames.
5. Citizens that subscribe to multiple, conflicting core values (e.g. biospheric and egoistic, which combines self-enhancement and self-transcendence) will encounter competing frames of the energy project, and thus tend to construct less polarized beliefs about the project relative to citizens with more consistent core values (e.g. biospheric and altruistic—both are self-transcendent)

2. Method

2.1 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 designed for another research objective (assessing consumer demand for electric vehicles), but several questions relating to the NGP were included. The target population for this alternate objective was new vehicle buying households in Canada, which is only a subset of the full population of Canadian citizens. The large sample size includes a wide distribution of citizens by various socio-demographic variables and values. Because this present study is more concerned with exploring causal links between variables than with attaining representative distributions of individual variables, the slightly constrained sampling frame should not be a large concern. The sample includes respondents from all Canadian provinces (except Quebec), including intentional oversamples of British Columbia and Alberta to permit regional comparison of the two provinces directly affected by the NGP.

The survey includes questions relating to NGP acceptance and belief, as well as values, attitudes, lifestyle and socio-demographic variables. The NGP-specific questions present 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 project, the general acceptance statement is "I support the Enbridge Northern Gateway Pipeline." The other six statements relate to specific beliefs about whether the NGP will "create jobs," "provide benefits to my province," "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 elicits 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"). All NGP and oil sand survey questions include an "I don't know" response category.

Core values are elicited using Stern et al.'s "brief" values inventory (Stern et al., 1998), which is a shorter, more environmentally relevant version of Schwartz's original 56-item value scale (Schwartz, 1992). The survey 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 does not include questions from Stern et al.'s "openness to change" value category because it does not seem to be strongly related to pro-environmental behavior (Stern et al., 1995a). Although a related measure of respondent "liminality" (transitional lifestyle) has recently been found to be related to consumer interest in new pro-environmental technologies (Axsen and Kurani, 2013a; Axsen et al., 2012), there is no strong theoretical reason why liminality would relate to citizen acceptance of fossil fuel projects.

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) find that the NEP scale is better described as a scale of general awareness of environmental impacts or consequences from human behavior. Thus, I presently use the NEP scale as a measure of general awareness and concern regarding environmental impacts.

The survey also elicits engagement in different lifestyles by asking respondents about their frequency of engagement in 47 different activities. Axsen et al. (2012) demonstrated that lifestyle is linked to consumer identify and values, and is a measure that can predict interest in pro-environmental technology—in particular, engagement in pro-environmental and technology-oriented lifestyles were important explanatory variables. In the present case of citizen acceptance, I focus on the measure of pro-environmental lifestyle, whereas a technology-oriented lifestyle does not relate to the present conceptual framework.

2.2. Data analysis

The survey data are analyzed through several statistical methods. NGP acceptance and beliefs are compared between Canadian regions, then compared according to value-based "clusters." 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. The lifestyle responses are examined using exploratory factor analysis to identify one (or more) scales relating to pro-environmental activities. Standardized data from the above six scales (four value scales, the NEP scale, and the pro-environmental lifestyle scale), are then used to perform a K-means cluster analysis in SPSS. The clusters are intended to categorize respondents by values and lifestyle that are expected to relate to NGP acceptance. I then compare the clusters, by region, according to demographic variables, NGP acceptance and beliefs, and other variables that may lend insight into the present research objectives—assessing the relationship between citizen values, the framing of NGP beliefs, and overall acceptance of the NGP.

3. Results

3.1 Canada survey sample

The web-based survey collected respondent data from February to May of 2013. A total of 2,628 useable responses were collected, including intentional oversamples of BC (n = 813) and Alberta (n = 508). For an initial Canada-wide comparison, I group respondents from Saskatchewan, Manitoba and Ontario in to 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.

Because the survey was conducted as part of a larger project targeting new-vehicle buying households, the realized sample was expected to be biased relative to the general Canada population. Indeed, these regional samples are of generally higher income and education than the general population as indicated by Canadian 2006 and 2011 census data. These regional samples are also slightly younger than the Canada census data, with slightly more respondents aged 25-34 year olds and less respondents aged 65 or older. However, these demographic differences are not severe, and are not expected to substantially impact the present exploration of how values relate to NGP acceptance. As noted above, the focus of these results is on causal links between variables, not on attaining representative distributions of individual variables (e.g. NGP acceptance or a given core value). Sample responses are highly diverse on all scales relating to demographics, values, attitudes, beliefs and NGP acceptance, indicating that causal relationships can be explored.

3.2. Regional comparison

Figure 1 depicts respondent support for the NGP across the four sampled regions. BC is the only region to have more respondents that disagree with the statement of NGP support (34%) than agree with it (28%). Alberta respondents are most likely to indicate support for the NGP (49%) and least likely to indicate disagreement (12%). These general regional differences in NGP acceptance are fairly similar to the findings of the Insights West poll conducted at about the same time, though the latter poll elicited slightly more extreme views in both provinces (Insights West, 2013). The Central and Atlantic regions of Canada are likely to have less familiarity with the NGP, and are less likely to have formulated opinions and beliefs regarding the NGP—49 and 57 percent, respectively, indicated that they are neutral or "don't know" about the NGP. The remainder of this analysis excludes these two regions.

Figure 1: Regional acceptance of the Northern Gateway pipeline. (Agreement with the statement: "I support the Northern Gateway Project.")

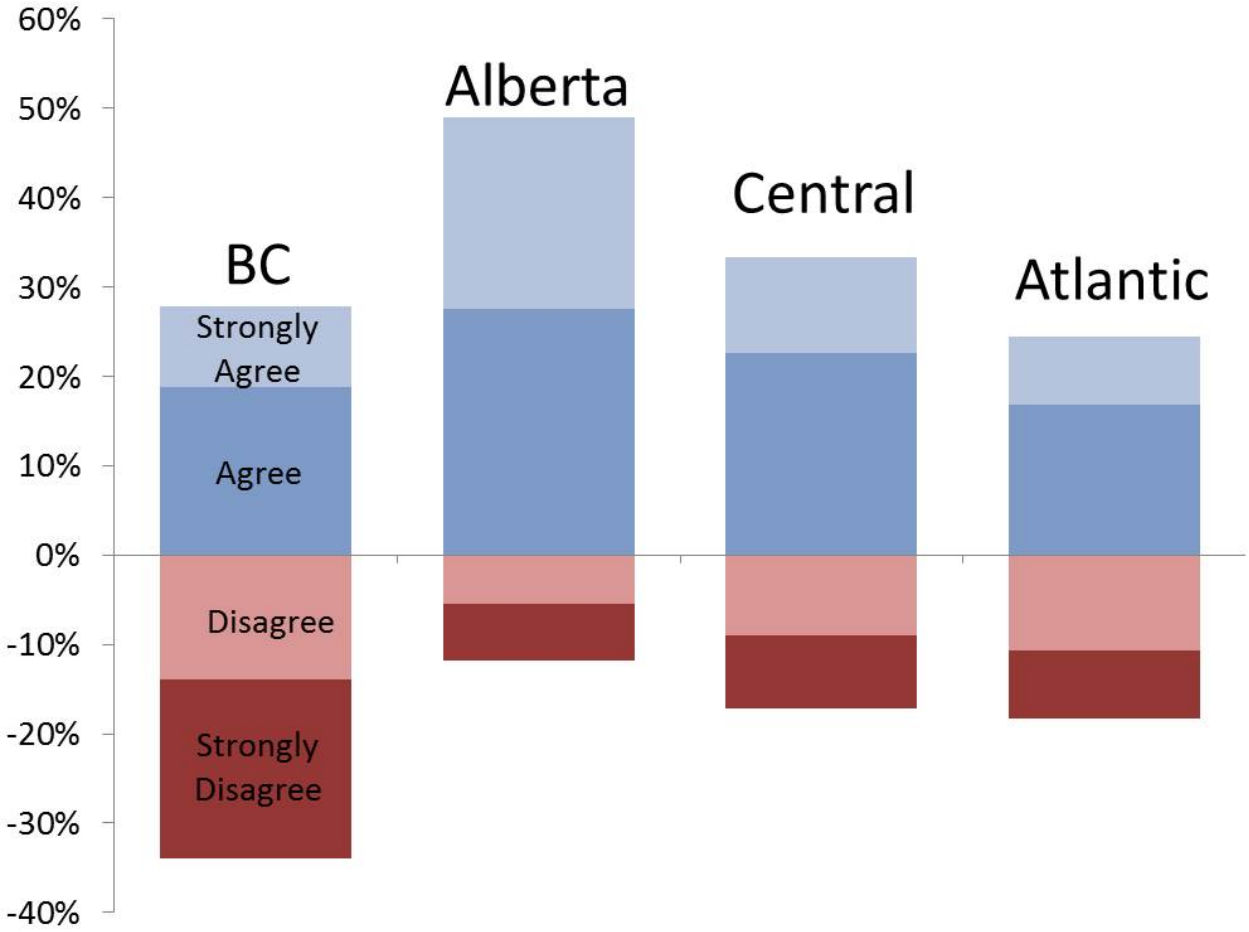
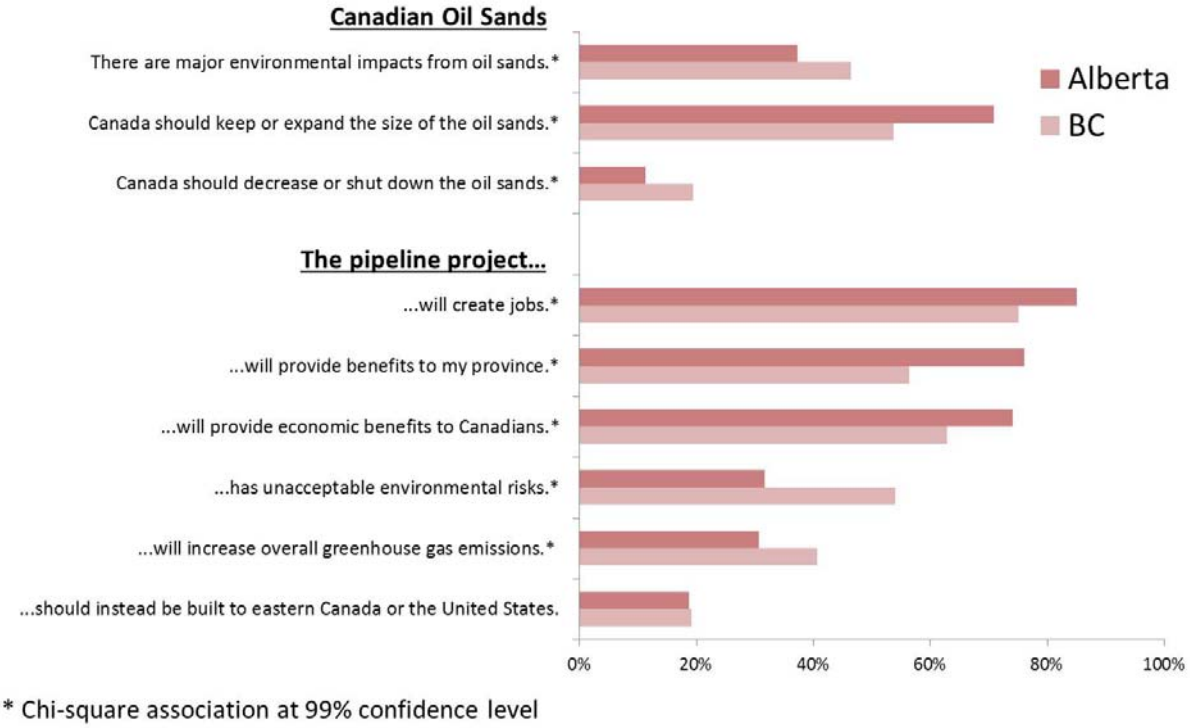


Figure 2 portrays sample differences (BC versus Alberta) in respondent beliefs regarding the NGP. Alberta respondents are less likely to believe that Alberta oil sands cause "major environmental impacts," and are more likely to believe that oil sands operations should be maintained or expanded in Alberta. Alberta respondents are also more likely to believe that the NGP will create jobs, provide general benefits to the province, and provide economic benefits to Canada, and are less likely to belief that the NGP will have unacceptable environmental risks, or will result in an overall increase in greenhouse gas emissions. Thus, Alberta respondents' beliefs are slightly more consistent with the economic benefit frame (though a majority of BC respondents still "agree" with each response), while BC respondents' beliefs correspond more with the environmental risk frame. Note that BC respondents are more likely to believe in general "environmental risks" than in the specific global impact of increasing greenhouse gas emission.

Figure 2: Regional comparison of beliefs relating to Alberta oil sands and NGP.



3.3 Identifying citizen segments

The primary objective of this study is to explore and explain these variations in NGP acceptance and beliefs. 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 lifestyle scale. Each of the four value scales has a reasonable degree of internal reliability for this survey data (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 (and as found by Stern et al. the two scales could be combined into a single biospheric-altruistic scale, with a 0.88 alpha). 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 has an alpha of 0.82 (once negative statements are reverse coded).

To establish a lifestyle scale for "pro-environmental" activities, I conducted a factor analysis on respondent engagement in 47 activities (principal axis factoring with varimax rotation in SPSS). The most interpretable solution including a total of 10 factors, with one "pro-environmental activities" 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 activity variables have a Cronbach's alpha of 0.85.

The BC and Alberta samples show no significant differences in scoring 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 these

differences are only slight, I have constructed value-based clusters based on the entire Canada sample, rather than specifying different clusters within each regional sample—I do not suspect that that clustering solutions will substantially differ by regional sample, so I prefer to use the largest, pooled sample to construct value-based clusters.

Table 1 depicts the six-cluster solution from the full Canada sample (K-means clustering of the six standardized variables, using SPSS). In my judgment, this solution is the most interpretable, and also has between-cluster variability greater than within-cluster variability as indicated by SPSS outputs (which is a desirable trait, indicating a reasonable degree of homogeneity within each cluster so that clustering accounts for a substantial portion of overall sample variation). This solution is also fairly balanced in distributing the samples (Table 1), with substantial sample sizes in each of the six clusters (the smallest cluster includes 246 respondents from the full Canada sample, or 52 in the Alberta sample).

I split the six clusters into two general categories, where the first three clusters exhibit some degree of pro-environmental orientation. The "strong environmental" cluster is the most dedicated to environmental issues, with relatively high cluster centers (average standardized scores) for biospheric and altruistic values, pro-environmental lifestyle, and NEP. The "mildly aware" cluster exhibits no such strong pro-environmental value or lifestyle centers, but does have a relatively high NEP center. The "multi-valued" cluster is perhaps most interesting, where there are high biospheric and altruistic values centers, but also a high traditional value center, and no strong pro-environmental lifestyle centers. The non-environmental clusters include respondents that score highly only on egoistic values ("self-oriented"), and on traditional values ("tradition-oriented"), and finally an "unengaged" cluster with negative centers for all tested variables. The proportion of respondents within each cluster are not significantly different between regions, e.g. BC has about the same proportion of "strong environmental" respondents as does Alberta.

TABLE 1 Value-based Cluster descriptions and center values.

	Some environmental orientation			No environmental orientation		
	Strong enviro.	Mildly aware	Multi-valued	Self-oriented	Tradition-oriented	Unengaged
Values						
Traditional (conservative)	0.44		0.79	-0.79	0.33	-1.64
Self-enhancement (egoistic)	-0.38	-0.88	0.16	0.46		-0.52
Biospheric	0.95	-0.29	0.85	-0.27	-0.83	-1.49
Altruistic	0.66	-0.15	0.80	-0.52		-1.81
Pro-environmental lifestyle	0.97			0.16	-1.07	-0.71
Belief in consequences (NEP)	1.07	0.29		-0.33	-1.00	-1.00
Number of respondents	515	546	538	416	368	246
% of total Canada sample (2,628)	19.6%	20.8%	20.5%	15.8%	14.0%	9.4%
% of BC sample (813)*	21.4%	21.7%	18.1%	17.3%	13.2%	8.4%
% of AB sample (508)*	17.5%	21.9%	20.9%	15.4%	14.2%	10.2%

*No significant differences in cluster proportions between regions

Note: 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. There are no statistically significant differences in cluster proportions between Alberta and British Columbia (at a 95% confidence level).

Table 2 compares the six clusters according to a variety of 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 (other than gender)–indicating that the main differences between clusters are the value, attitudinal and lifestyle variables used to construct the clusters.

Table 2: Comparing value-based clusters by socio-demographic factors (percentage, total Canada sample, n = 2268)

	Some environmental orientation			No environmental orientation		
	Strong enviro.	Mildly aware	Multi-valued	Self-oriented	Tradition-oriented	Ungengaged
Respondent gender**						
Female	**66.5**	**63.2**	**59.5**	44.5	49.5	35.4
Respondent age**						
<35 years old	25.7	24.2	32.2	**47.4**	32.1	**43.9**
35-54 years old	40.7	41.0	41.9	32.2	36.1	37.8
55 years and older	**33.5**	**34.8**	25.9	20.4	31.8	18.3
Respondent education level (ns)						
College diploma or trade degree	35.4	32.0	33.8	28.5	31.9	26.3
Bachelor's degree	20.6	26.7	22.3	25.5	23.9	30.0
Graduate degree	10.7	10.7	9.2	12.9	9.3	11.7
Household income (ns)						
<$70k/year	44.9	38.6	45.9	39.4	36.7	41.5
$70-99k/year	25.7	26.2	25.7	25.7	24.5	21.1
$100k/year or more	20.6	25.8	20.8	25.2	28.5	26.0
Not reported	8.8	9.3	7.6	9.6	10.3	11.4
Household size*						
1 person	14.0	13.0	11.5	14.4	10.3	18.3
2 people	38.7	43.2	35.6	35.1	41.6	35.0
3 or more	47.3	43.8	52.9	50.5	48.1	46.7

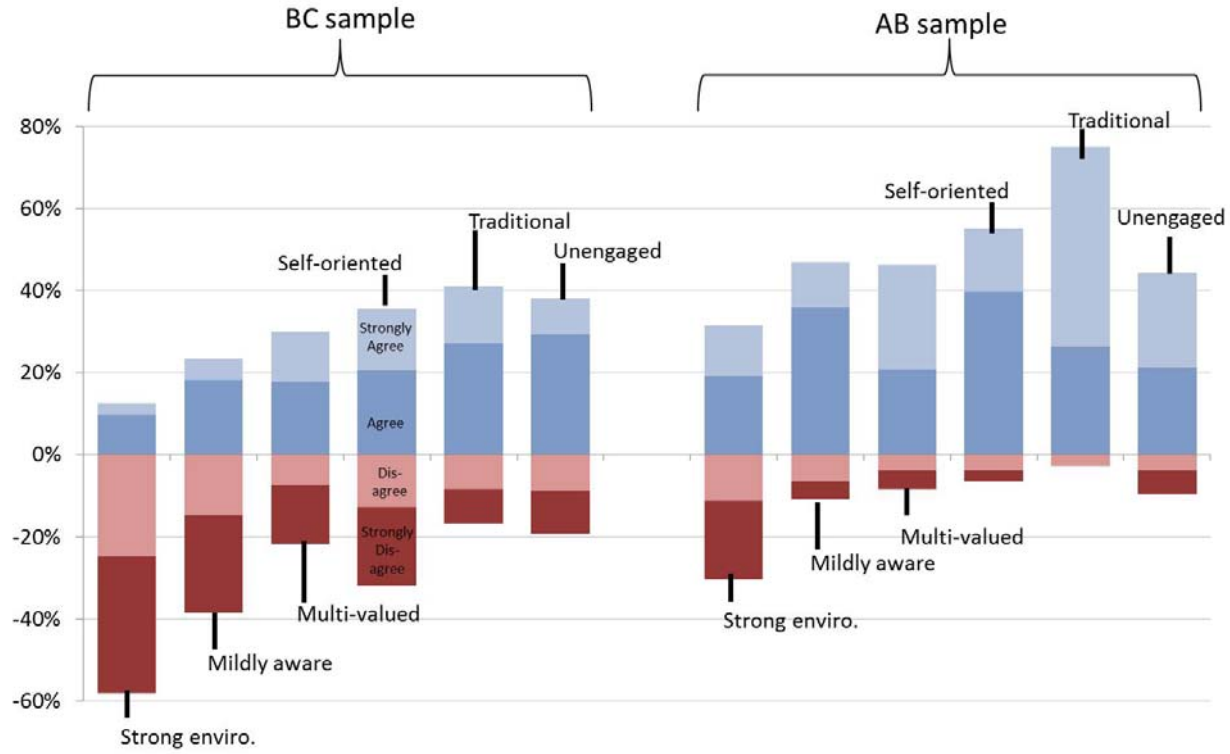
(ns) = no significant association with value cluster
*Significant association at 95% confidence level (chi-square)
**Significant association at 99% confidence level (chi-square)

3.4 Linking support to consumer values

Figure 3 depicts how NGP acceptance varies among these value-based clusters within each region (BC and Alberta). Within-region comparisons of value-based clusters are largely consistent with the conceptual framework. The highest levels of "resistance" (as indicated by disagreement with the statement of support), and lowest levels of "support" are observed in the strong-environmental cluster. The mildly aware clusters exhibit higher acceptance, and the multi-valued clusters have even higher acceptance. The highest proportion of NGP support is observed in the traditional-oriented clusters, followed by the self-oriented and unengaged clusters. The highest level of extreme resistance ("strongly disagree") is in BC's strong environmental cluster,

while the highest level of extreme support ("strongly agree") is in Alberta's tradition-oriented cluster.

Figure 3: Acceptance of the Northern Gateway pipeline by value-based cluster. (Agreement with the statement: "I support the Northern Gateway Project.")



The between-region comparison of value-based clusters is striking in its consistency in differences. In the Alberta sample, every single value-based cluster has higher levels of NGP support, and lower levels of NGP resistance. In particular, there is a consistent absence of resistance among all of the Alberta clusters (less than 11 percent) except the strong-environmental cluster (30.3 percent).

To further explore the perceptions and motivations of respondents by value-based cluster and by region, Table 3 compares responses to a number of NGP-related beliefs. There are statistically significant variations among clusters for nearly every belief, for both regions. Again, these belief differences match frames that are consistent with each cluster's values. The strong-environmental cluster is the mostly likely to perceive that the NGP presents 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, the tradition-oriented cluster is 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.

TABLE 3 Comparing value-based clusters by respondent beliefs relating to NGP (percentage, BC and AB regions only)

	Region	Some environmental orientation			No environmental orientation		
		Strong enviro.	Mildly aware	Multi-valued	Self-oriented	Tradition-oriented	Un-engaged
Beliefs about NGP: The pipeline project…							
(% "agree" or "very agree")							
…will create jobs.	BC*	73.6	76.7	76.9	75.2	**83.2**	57.4
	AB**	85.4	89.2	81.1	85.9	**94.4**	69.2
…will provide benefits to my province.	BC (ns)	49.4	53.4	59.9	56.0	67.3	57.4
	AB**	68.5	81.1	73.6	75.6	**93.1**	59.6
…will provide economic benefits to Canadians.	BC (ns)	58.6	64.2	65.3	58.9	72.9	55.9
	AB**	64.0	78.4	72.6	73.1	**88.9**	65.4
…has unacceptable environmental risks.	BC**	**72.4**	56.3	51.0	53.9	34.6	38.2
	AB**	**56.2**	29.7	30.2	37.2	15.3	11.5
…will increase overall greenhouse gas emissions.	BC**	**55.7**	40.9	41.5	46.1	20.6	20.6
	AB**	**47.2**	28.8	31.1	39.7	18.1	9.6
…should instead be built to eastern Canada or US.	BC*	15.5	18.2	19.7	**29.1**	11.2	22.1
	AB (ns)	18.0	14.4	24.5	23.1	15.3	15.4
Beliefs about Alberta Oil Sands							
(% selecting a given response)							
There are major environmental impacts from oil sands.	BC**	**69.0**	48.3	45.6	48.2	19.6	25.0
	AB**	**65.2**	37.8	37.7	38.5	12.5	19.2
Canada should decrease or shut down the oil sands.	BC**	**37.4**	18.2	17.7	19.9	2.8	5.9
	AB**	**28.1**	10.8	10.4	10.3	0.0	1.9
Canada should keep or expand the size of the oil sands.	BC**	36.8	55.1	51.7	55.3	**67.3**	**73.5**
	AB**	49.4	73.9	66.0	75.6	**87.5**	**80.8**
Beliefs about Climate Change							
(% selecting 1 of the 5 responses)							
A serious problem, immediate action is necessary.	BC**	**60.9**	29.0	**42.9**	26.2	5.6	13.2
	AB**	**51.7**	17.1	**33.0**	11.5	4.2	5.8
Could be a serious problem, should take some action.	BC**	29.9	**41.5**	**30.6**	**50.4**	40.2	35.3
	AB**	32.6	**56.8**	**34.9**	**56.4**	30.6	28.8
More research is needed before deciding.	BC**	5.7	21.0	19.0	18.4	**36.4**	**29.4**
	AB**	9.0	17.1	17.0	24.4	**37.5**	**34.6**
It is not a problem and does not require any action.	BC**	1.7	3.4	1.4	0.0	8.4	**10.3**
	AB**	1.1	3.6	1.9	2.6	15.3	**17.3**
I don't know enough about the issue.	BC**	1.7	5.1	6.1	5.0	9.3	**11.8**
	AB**	5.6	5.4	13.2	5.1	12.5	**13.5**
Self-assessment: I see my overall lifestyle as…							
(% selecting 1 of the 4 responses)							
Dark green = environ. activities a main priority	BC**	**9.8**	0.6	5.4	3.5	0.0	2.9
	AB**	**7.9**	0.0	4.7	1.3	0.0	1.9
Medium green = environ. activities general priority	BC**	**67.2**	39.8	**51.7**	35.5	9.3	19.1
	AB**	**56.2**	32.4	**43.4**	32.1	6.9	5.8
Light green = environ. activities sometimes a priority	BC**	23.0	**58.5**	**42.2**	**57.4**	**72.0**	**60.3**
	AB**	32.6	**63.1**	**48.1**	**62.8**	**76.4**	**57.7**
Not green = environ. activities not a priority.	BC**	0.0	1.1	0.7	3.5	**18.7**	**17.6**
	AB**	3.4	4.5	3.8	3.8	**16.7**	**34.6**

(ns) = no significant association with value cluster

*Significant association at 95% confidence level (chi-square)

**Significant association at 99% confidence level (chi-square)

4. Discussion and conclusions

4.1 Value-based clusters

I explore the role of citizen values in citizen acceptance of large-scale fossil fuel infrastructure proposals, using the case of the Northern Gateway Project (NGP) proposed to transport bitumen across western Canada. I develop a conceptual framework based on value theory, and compare citizen acceptance and beliefs using a web-based survey of 2,628 Canadians. Although the present sample is of slightly higher income and education and lower age than Canadian census data, the general patterns of NGP acceptance by region (BC and Alberta) are similar to marketing poll results conducted around the same time (Insights West, 2013). Regional comparisons reveal different beliefs by region, where BC respondents are more likely to believe in environmental risks associated with the NGP, and Alberta respondents are more likely to believe in economic benefits.

The primary objective of this study is to explore how citizens' core values relate to acceptance of the NGP. By clustering respondents based on values, awareness and lifestyle, I find general support for the conceptual framework I detail in the introduction. Within both regions (Alberta and BC), the "strong environmental" value cluster exhibits the least NGP acceptance, and is more likely to associate the NGP with environmental risks. Higher NGP acceptance is observed among clusters with strong egoistic (self-enhancement) or traditional (conservative) values—such clusters are also more likely to perceive economic benefits from the NGP. The differences in beliefs by cluster support the idea that citizens tend to subscribe to different "frames" and construct beliefs that are consistent with their values. Stern et al. (1995a) suggest that citizens tend to receive, filter and process information from sources (media, institutions, and social interactions) that frame issues to align with their existing values, which is consistent with qualitative research exploring how citizens' formulate opinions on renewable energy related to their larger worldview (West et al., 2010). My findings further support this notion—but a more media-focused research project is required to explore the details of how information is perceived by citizens with different core values.

A second insight involves conflict in a citizen's core values—which seems to affect citizen support. Two of the value-based clusters have nearly identical levels of biospheric-altruistic values: the strong-environmental and multi-valued clusters. However, the strong-environmental cluster exhibits much lower acceptance of the NGP. A major difference is that the multi-valued cluster also has stronger traditional values—a core value that is highly consistent with NGP support. Thus, respondents in the multi-value cluster may be more likely to experience value conflict—subscribing to core values consistent with opposing frames of the NGP. Seemingly, this conflict results in NGP acceptance levels that are less extreme than clusters with only strong traditional values or only strong biospheric-altruistic values.

Third, awareness and concern regarding general environmental impacts (as indicated by the New Environmental Paradigm scale) does not translate into strong NGP resistance in the absence of strong altruistic-biospheric values, as seen in the mildly aware cluster (particularly in Alberta). One explanation is that if environmental concern exists but does not resonate with a citizen's core values, then the concern is not likely to translate into negative evaluation of the NGP (or to focus on the environmental frame).

Somewhat surprising is that NGP acceptance was highest among the tradition-oriented cluster in both regions, particularly in the Alberta sample (with 75 percent supporting, and less than 3 percent resisting). The traditional values scale is based on statements relating to family security, respecting elders, and self-discipline. On the other hand, Schwartz (1994) and Stern et

al. (1995a) consider egoistic values as aligned with self-enhancement and thus diametrically opposed to self-transcendence values (e.g. biospheric-altruistic values). Indeed, egoistic values were associated with NGP support and with beliefs in the economic benefit frame. However, the tradition-oriented clusters yielded even higher NGP support. One explanation may be that the specific values of family security and respecting elders are more consistent with maintaining the status quo of a society, which in this case translates into supporting an energy project that expands the present fossil-fuel based economy (as opposed to a renewable energy project that would disrupt the status quo).

4.2 Regional differences in support

The regional differences in citizen support for the NGP are substantial and strikingly consistent across value-based clusters. Every single cluster from the Alberta sample exhibits higher NGP support and less resistance than its counterpart cluster in BC. Otherwise, Alberta and BC sample are not very different: there were no statistically significant differences in any of the four core values or the proportions of respondents in each value-based cluster; there were differences in environmental awareness and lifestyle but these were slight. Clearly, there are important regional or contextual factors that are not directly measured in this study.

Two potential explanations for these regional differences are consistent with my conceptual framework. First, the NGP has likely been framed very differently in each region by media, institutions and stakeholders—with Alberta media more likely to focus on the economic benefit frame, and BC media 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, the respondent may be constrained by the extent of their regional pool of information. Thus, for example, strong-environmental respondents in AB end up constructing beliefs that are more supportive of the NGP than their BC counterparts. Further exploration of this explanation could utilize a comparative media analysis.

A second explanation (which does not necessarily contradict the first) is that NGP beliefs differ because benefits and risks actually do vary by region, and that respondents tend to think about these benefits and risks from a regional perspective (rather than a national or global perspective). Any economic benefits are likely to be greater in Alberta due to the provincial economy's reliance on the fossil fuel industry. Incremental environmental risks are greater in BC because the region would contain most of the pipeline, the marine terminal, and all of the increased oil tanker traffic. Thus, if respondents are identifying with their region, then BC respondents would tend to emphasize the environmental risk frame of the NGP, and Alberta respondents would emphasize the economic benefits frame. This explanation could be confirmed through qualitative interviews with citizens in both regions.

There may be additional explanations for regional differences that are beyond the scope of this study. Perhaps there are differences in values, attitudes, culture, worldview or other factors that were not tested here

4.3 Policy insights regarding citizen acceptance

Citizen acceptance of large fossil fuel projects can shape political decisions. Clearly, citizen acceptance and resistance to proposed fossil fuel energy projects is not just a matter of NIMBYism—such projects can resonate with a variety of citizen values in ways that can differ substantially by context, such as region and distribution of benefits and risks. The competition

between frames of economic benefits and environmental risks (and how those frames resonate with values) is a particularly strong theme in this and other energy project proposals. Governments seeking to navigate public opinion will need to carefully frame political decisions to propose, accept or reject such large-scale energy projects. Potentially, such controversy can be alleviated by the provision of a strong, consistent vision by political leaders—where integrated national energy development plans (including fossil fuel development) could be actively framed in a way that aligns with stated environmental and climate goals.

This study also suggests that citizen values are not necessarily a "hard constraint" to acceptance (or resistance) of new fossil fuel infrastructure proposals. Clearly, the subgroup of citizens with strong biospheric-altruistic values and commitments to pro-environmental lifestyles are most likely to actively resist such projects. But within all identified clusters, resistance is higher for citizens that perceive negative local impacts (in their own region). Potentially, framing the broader climate change impacts of such fossil fuel projects to emphasize specific local impacts (rather than more general, global impacts) could better connect with a broader set of values. Also, the strong support exhibited by citizens with traditional values may be subject to change—if the negative impacts of climate change are perceived as disrupting to the economy, or threatening with family security, then traditional values could more clearly align with the environmental risks frame. Such possibilities should be further explored in future research. When considering citizens' stated acceptance of such energy projects, policymakers should also consider how well this stated acceptance reflects citizen's core values versus reflecting the frames put forth and propagated by media and stakeholders.

4.4. Limitations and directions for future research

There are several limitations of this study that can be explored in future research on citizen acceptance of the NGP and other large fossil fuel infrastructure proposals. Specifically, this study did not explore:

- Beliefs and frames relating to fairness of the NGP to First Nations (aboriginal) communities that would be affected by the pipeline (or oil sands expansion), including revenue sharing, and land impacts.
- The potential frame of energy security benefits, which is likely to be important in cases where the infrastructure would increase domestic access as with the Keystone XL pipeline proposed for the U.S. (whereas the NGP would export oil.)
- Citizen trust in NGP-related actors, including federal and provincial governments, Enbridge (the proposed builder and operator), oil companies, and oil spill clean-up agencies. Perceptions of trust may affect acceptance (Huijts et al., 2012; Kamishiro and Sato, 2009; Midden and Huijts, 2009; Terwel et al., 2009), though core values may also shape perceptions of trust.
- Citizen perceptions of and trust in technology, including the potential to substantially reduce the probability of land- or marine-based oil spills through improved pipeline and oil tanker technology.
- Citizen perceptions of their regions' dependence on different industries that would be affect by the NGP, say the oil industry, fisheries or eco-tourism.
- Regional and sub-regional differences in NGP framing by media, advertising, governments, organizations and NGOs (as noted above).
- The relative influence of different stakeholders and information sources in the formation of citizen beliefs and acceptance.

- The potential influence of environmental risk frames that emphasize global impacts (increasing greenhouse gas emission) rather than local impacts (pipeline construction and oil spill risks).

Drawing from the present findings, I suspect that beliefs regarding First Nations are consistent with the environmental risk frame (aligning with the altruistic-biospheric dimension), while energy security beliefs might align with the economic benefits frame. I also suspect that citizens' perceived trust in actors and technology is likely to be constructed based on core values—as with the other beliefs explored in the present study.

Also, there are likely to be important differences in citizen concerns regarding fossil fuel energy projects versus renewable energy projects—the latter of which is often perceived to have tradeoffs within the general category of environmental benefits, such as disrupting local river flows (for run-of-river hydro) or impacting local landscape visual (for wind turbines) for the sake of reducing carbon emission from electricity generation. The present NGP case study does not seem to invoke such environmental tradeoffs—instead, reducing local oil spill risks and carbon emissions from oil sands growth, for example, seem to be complementary pro-environmental outcomes.

As noted above, confirmation of this study's findings and exploration of many of these omitted factors could be accomplished through complementary qualitative research methods, such as semi-structured interviews and focus groups with citizens and stakeholders, media analysis and stakeholder analysis, and even time-series analysis of media, beliefs and acceptance over time.

References

Aaron, W. (1987) Choosing Preferences by Constructing Institutions: A Cultural Theory of Preference Formation. The American Political Science Review 81, 4-21.

Ajzen, I. (1991) The theory of planned behavior. Organizational Behavior and Human Decision Processes 50, 179-211.

Aklin, M., Urpelainen, J. (In Press) Debating clean energy: Frames, counter frames, and audiences. Global Environmental Change.

Axsen, J., Kurani, K.S. (2013a) Connecting plug-in vehicles with green electricity through consumer demand. Environmental Research Letters 8, 1-8.

Axsen, J., Kurani, K.S. (2013b) Developing sustainability-oriented values: Insights from households in a trial of plug-in hybrid electric vehicles. Global Environmental Change 23, 70-80.

Axsen, J., TyreeHageman, J., Lentz, A. (2012) Lifestyle practices and pro-environmental technology. Ecological Economics 82, 64-74.

Bradbury, J., Ray, I., Peterson, T., Wade, S., Wong-Parodi, G., Feldpausch, A. (2009) The Role of Social Factors in Shaping Public Perceptions of CCS: Results of Multi-State Focus Group Interviews in the U.S. Energy Procedia 1, 4665-4672.

Chan, G., Reilly, J.M., Paltsev, S., Chen, Y.H.H. (2012) The Canadian oil sands industry under carbon constraints. Energy Policy 50, 540-550.

Cordano, M., Welcomer, S., Scherer, R. (2003) An analysis of the predictive validity of the New Ecological Paradigm. The Journal of Environmental Education 34, 22-28.

Druckman, J.N. (2004) Political Preference Formation: Competition, Deliberation, and the (Ir)relevance of Framing Effects. The American Political Science Review 98, 671-686.

Dunlap, R., Van Liere, K., Mertig, A., Jones, R. (2000) Measuing endorsement of the New Ecological Paradigm: A revised NEP scale. Journal of Social Issues 56, 425-442.

Eglington, P., Mansell, R., Ruitenbeek, J., Schlenker, R., (2012) Public Interest Benefit Evaluation of the Enbridge Northern Gateway Pipeline Project: Update and Reply Evidence. Wright Mansell Research Ltd. .

Gunton, T., Broadbent, S., (2012) A Public Interest Assessment of the Enbridge Northern Gateway Project. Prepared for: Coastal First Nations.

Hitlin, S. (2003) Values as the core of personal identity: Drawing links between two theories of self. Social Psychology Quarterly 66, 118-137.

Huijts, N., Molin, E., Steg, L. (2012) Psychological factors influencing sustainable energy technology acceptance: A review-based comprehensive framework. Renewable and Sustainable Energy Reviews 16, 525-531.

Insights West, (2013) Your Insights on the Northern Gateway Pipeline, Insights West Press Release.

Kamishiro, N., Sato, T. (2009) Public acceptance of the oceanic carbon sequestration. Marine Policy 33, 466-471.

Luhmann, N. (1989) Ecological communication. University of Chicago Press, Chicago, IL, U.S.A.

Mercer, A., Keith, D.W., Sharp, J.D. (2011) Public understanding of solar radiation management. Environmental Research Letters 6.

Midden, C.J.H., Huijts, N.M.A. (2009) The Role of Trust in the Affective Evaluation of Novel Risks: The Case of CO₂ Storage. Risk Analysis: An International Journal 29, 743-751.

Poumadère, M., Bertoldo, R., Samadi, J. (2011) Public perceptions and governance of controversial technologies to tackle climate change: nuclear power, carbon capture and storage, wind, and geoengineering. Wiley Interdisciplinary Reviews: Climate Change 2, 712-727.

Schwartz, S.H., (1977) Advances in Experimental Social Psychology, in: Berkowitz, L. (Ed.), Normative influences on altruism. Academic Press, New York, NY, pp. 221-279.

Schwartz, S.H. (1992) Universals in the context and structure of values: Theoretical advances and empircal tests in 20 countries. Advances in Experimental Social Psychology 25, 1-65.

Schwartz, S.H. (1994) Are there universal aspects in the structure and content of human values? Journal of Social Issues 50, 19-45.

Schwartz, S.H., Bilsky, W. (1987) Toward a universal psychological structure of human values. Journal of Personality and Social Psychology 53, 550-562.

Sharp, J.D., Jaccard, M.K., Keith, D.W. (2009) Anticipating public attitudes toward underground CO2 storage. International Journal of Greenhouse Gas Control 3, 641-651.

Shelby, L.B. (2011) Beyond Cronbach's Alpha: Considering Confirmatory Factor Analysis and Segmentation. Human Dimensions of Wildlife 16, 142-148.

Shum, R.Y. (2013) Social construction and physical nihilation of the Keystone XL pipeline: Lessons from international relations theory. Energy Policy 59, 82-85.

Steg, L., de Groot, J. (2010) Explaining prosocial intentions: Testing causal relationships in the norm activation model. British Journal of Social Psychology 49, 725-743.

Stephens, J.C., Bielicki, J., Rand, G.M. (2009a) Learning about carbon capture and storage: Changing stakeholder perceptions with expert information. Energy Procedia 1, 4655-4663.

Stephens, J.C., Rand, G.M., Melnick, L.L. (2009b) Wind Energy in US Media: A Comparative State-Level Analysis of a Critical Climate Change Mitigation Technology. Environmental Communication 3, 168-190.

Stephens, J.C., Wilson, E.J., Peterson, T.R. (2008) Socio-Political Evaluation of Energy Deployment (SPEED): An integrated research framework analyzing energy technology deployment. Technological Forecasting and Social Change 75, 1224-1246.

Stern, P., Dietz, T., Kalof, L., Guagnano, G. (1995a) Values, beliefs, and proenvironmental action: Attitude formation toward emergent attitude objects. Journal of Applied Social Psychology 25, 1611-1636.

Stern, P.C., Dietz, T., Guagnano, G.A. (1995b) The New Ecological Paradigm in Social-Psychological Context. Environment and Behavior 27, 723-743.

Stern, P.C., Dietz, T., Guagnano, G.A. (1998) A Brief Inventory of Values. Educational and Psychological Measurement 58, 984-1001.

Terwel, B.W., Harinck, F., Ellemers, N., Daamen, D.D.L. (2009) Competence-Based and Integrity-Based Trust as Predictors of Acceptance of Carbon Dioxide Capture and Storage (CCS). Risk Analysis: An International Journal 29, 1129-1140.

Terwel, B.W., Harinck, F., Ellemers, N., Daamen, D.D.L. (2010) Voice in political decision-making: The effect of group voice on perceived trustworthiness of decision makers and subsequent acceptance of decisions. Journal of Experimental Psychology: Applied 16, 173-186.

Tversky, A., Kahneman, D. (1981) The Framing of Decisions and the Psychology of Choice. Science 211, 453-458.

Wallquist, L., Visschers, V., Siegrist, M. (2010) Impact of knowledge and misconceptions on benefit and risk perception of CCS. Environmental Science & Technology 44, 6557-6562.
West, J., Bailey, I., Winter, M. (2010) Renewable energy policy and public perceptions of renewable energy: A cultural theory approach. Energy Policy 38, 5739-5748.