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## **The Canadian Zero Emissions Vehicle Survey: Insights into potential mainstream ZEV buyers**

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### **Summary**

Zero emissions vehicles (ZEVs), which we define as plug-in electric and hydrogen fuel cell vehicles, have the potential to reduce greenhouse gas emissions. Successful deployment of these vehicles will depend on the readiness of mainstream consumers to purchase and use them. Much remains unknown about Canadian consumers' "readiness" to integrate ZEVs into their lives. Therefore, we design a comprehensive survey of over 2000 new vehicle buyers in Canada, and assess consumers' awareness of and interest in ZEVs. In this paper we explore consumer preferences for ZEVs and characterize groups of consumers according to their preferences for ZEVs. Data from the survey could provide important information for the design of policy and product strategy, and outreach and marketing activity.

*Keywords: Plug-in electric vehicles, hydrogen fuel cell vehicles, market research, consumer preference, Canada*

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### **1 Introduction**

Zero Emissions Vehicles (ZEVs), including pure battery electric vehicles (BEVs) that run on only electricity, plug-in hybrids that run on both electricity and gasoline (PHEVs), and hydrogen fuel cell vehicles that run on only hydrogen (HFCV) have the potential to reduce gasoline consumption, greenhouse gas emissions and air pollutants. For example, in Canada, BEVs and PHEVs can reduce GHG emissions 45-98% relative to a conventional vehicles [1]. Given that emissions from transportation represent close to a quarter of Canada's GHG emissions [2], any effort to achieve deep GHG emissions in the country will likely require significant reductions from the transportation sector. Past research suggests that significant adoption of ZEVs could be essential to meeting longer-term climate targets. The International Energy Agency indicated that 40% of new passenger vehicle sales will need to be electric by 2040 to limit global warming to 2 degrees Celsius [3]. Canada research suggests adoptions rates will likely need to be higher to achieve similar GHG reduction goals, possibly up to 80-90% of passenger vehicles sales by 2050 [4, 5].

Successful deployment of ZEVs will depend on the readiness of the mainstream consumer market to adopt these vehicles. Research indicates that consumers' awareness, attitudes, values, lifestyles and access to charging/fueling infrastructure are all likely to be important factors shaping a transition to ZEVs [6-8]. However, much remains unknown about Canadian consumers' "readiness" to integrate these vehicles into their daily lives, and given the novelty of such technologies, it can be difficult to elicit a reliable responses from survey respondents. Building on our 2013 and 2014 Canadian Plug-in Electric Vehicle Surveys [1] and the earlier 1990s work on BEVs in California [9, 10], we follow a "reflexive participant" approach to survey

design, collected extensive data from survey respondents' awareness, values and vehicle interests, using a reflexive format that allows respondents to construct preferences for novel technology. Here we present results from our survey of over 2000 new vehicle buyers in Canada. In addition to this novel survey approach, another particular novelty of the present survey is its discrete choice experiment that included conventional vehicles, hybrid vehicles, PHEVs, BEVs and HFCVs, with varying contexts and attribute levels. Analyses of these data through latent-class choice modelling allows researchers to characterize different consumer segments based on a number of factors, including: (1) preferences for different drivetrains and vehicle attributes, (2) preferences for charging and fueling infrastructure, (3) respondent demographics and characteristics such as attitudes, values and lifestyle.

We utilize latent-class choice modeling to explore heterogeneity in mainstream consumer ZEV valuation, focusing on two research questions:

- How do consumers differ in their valuation of different ZEV types (PHEV, BEV and HFCV)?
- How does ZEV interest and valuation relate to consumer values and demographics?

Here we focus specifically on individual purchases of light-duty passenger vehicles, where individual (rather than fleet) vehicle purchases make up the vast majority of sales in Canada. We focus on what we call "Mainstream" consumers that have not yet purchased a ZEV vehicle, as research shows that the first buyers of ZEVs (or "Pioneers") are significantly different than Mainstream buyers in terms of demographics, values and lifestyles [11].

## 2 Method: Survey design

### 2.1 Survey design

The Canadian Zero Emissions Vehicle Survey (CZEVS) follows a reflexive respondent (or reflexive lifestyle) approach, which assumes that consumers construct their interests and preferences as they learn about ZEV technologies [10]. ZEVs are fairly novel technologies for mainstream consumers and they are persistently confused about basic differences between PHEVs, BEVs and HFCVs and how they are operated [1, 12]. Further, operation and refueling (charging) of these vehicles can affect consumers' lifestyles, so consumer valuation and interest in ZEVs will likely require them to reflect on their travel patterns, charging access and overall motivation to adapt. The reflexive participant survey design involves a three part process, with the following layout:

**Part 1:** a 25-35 minutes web-based survey, which includes several sections designed to assess background information related to interest in ZEVs:

1. **Household vehicle information:** includes questions that evaluate the household's current fleet of vehicles (e.g. make/model, use, and purchase history) and fuel costs.
2. **Vehicle use and driving habits:** includes questions designed to assess the complexity, variability, and intensity of travel use patterns for the vehicles currently in the household fleet.
3. **Awareness of, and interest in, ZEVs:** includes questions that measure awareness of, familiarity with, and interest in purchasing various vehicle technologies and specific models.
4. **Home/work recharge access:** includes questions that evaluate each participant's potential to install a Level 2 charger at home (e.g. do they have a plug in their garage), as well as their access to and awareness of non-home charging infrastructure.
5. **Awareness of automated vehicle technologies:** includes questions to assess familiarity with, and opinions about, various levels of vehicle automation.
6. **Lifestyle, values, and attitudes scales:** includes questions on individual values and lifestyle, as well as environmental concern, variables which have been found to relate to interest in pro-environmental technologies.
7. **Demographic questions:** includes questions on key demographics (e.g. education, income, and home type).

**Part 2:** was an 11-page Buyers' Guide designed to familiarize respondents with ZEV technologies and attributes. A PDF of the ZEV Buyers' Guide was emailed to each participant following Part 1 of the survey to serve as an introduction to the technologies and concepts included in Part 3. The Guide provided a primer on what various ZEV technologies and charging/fueling infrastructure were and how they were used or operated. The Guide also includes several "infographics" to assist respondents in understanding the trade-offs among drivetrain technologies, driving range, refueling/recharging time, and charging level (see example below).

**Part 3:** includes exercises and additional questions designed to explore and quantify consumer preferences and interest regarding ZEVs, as follows:

1. **Design space exercises:** a series of design space exercises elicit consumer vehicle preferences based on the respondent's next intended vehicle purchase and ZEV interest.
2. **Stated choice experiments:** a series of stated choice experiments elicit vehicle preferences and public recharging/hydrogen refueling preferences, and investigate the trade-offs involved in purchasing and charging/fueling ZEVs.
3. **Perceptions of ZEVs:** includes questions to assess perceptions and beliefs about BEVs, PHEVs, and HFCV (e.g. related to vehicle costs, ease of use, symbolism, and impact), as well as questions related to policy that could increase ZEV interest (e.g. HOV lane access, free parking, and home charging incentives).
4. **Perceptions of vehicle brands:** includes questions to evaluate perceptions about vehicle brands, with a specific focus on perceptions, awareness, influence, and beliefs about the Tesla brand.
5. **Repeat of ZEV interest questions:** questions related to respondent awareness of and interest in ZEVs, repeated from Part 1 to assess any potential change to these variables as a result of participating in the study (e.g. from doing independent research about ZEVs during the intervening period between Part 1 and Part 2, etc.).

## 2.2 Stated choice experiment

This paper focuses on results from the stated choice experiment in Part 3 of the survey. Data from the choice experiment is used to create models of consumers' ZEV preferences and the trade-offs they make among vehicle attributes. Choice experiments are frequently used in transportation research to model consumer demand for alternative-fuel vehicles [13, 14]). The choice experiment method is based on rational choice theory, which has been critiqued as an oversimplification of consumer behaviour; however, it can enrich analyses when combined with other statistical data, such as that from our survey questions and design exercises.

Before the choice experiment, the questionnaire elicited information from each respondent about the anticipated price, make, and model of the next vehicle their household plans to buy or lease, which we initially restricted to conventional gasoline models. This information was used to customize the choice experiment based on each respondents' selected conventional vehicle (CV) Respondent data was then used to create six vehicle choice sets containing customized versions of the following five drivetrains: conventional vehicle (CV, their reported next anticipated vehicle purchase), a hybrid (HEV), plug-in hybrid (PHEV), battery electric (BEV), and hydrogen fuel cell version (HFCV) of their next anticipated vehicle purchase/lease.

The experimental design for these choice sets is summarized in Table 1, where eight attributes were varied across choice sets, including vehicle attributes such as incremental vehicle purchase prices, weekly fuel costs, electric- and hydrogen-powered driving ranges, point-of-sale purchase incentives (varying from \$0 to \$10,000). The choice sets also specified the availability of slower (Level 1) or faster (Level 2) vehicle charging at respondents' home and work locations as contextual variables. Public Level 2 charging infrastructure was represented as a varying percentage of respondent's destinations covered, and hydrogen refueling was represented as a varying percentage of potential gas stations. Public access to DC fast charging was reflected as a binary (i.e. 'all' or 'none') variable, where "all" indicated that all highways in the respondent's regions would have DC Fast chargers at least every 50km (at "rest stops"). Figure 1 shows an example of the choice experiment, along with instructions to respondents.

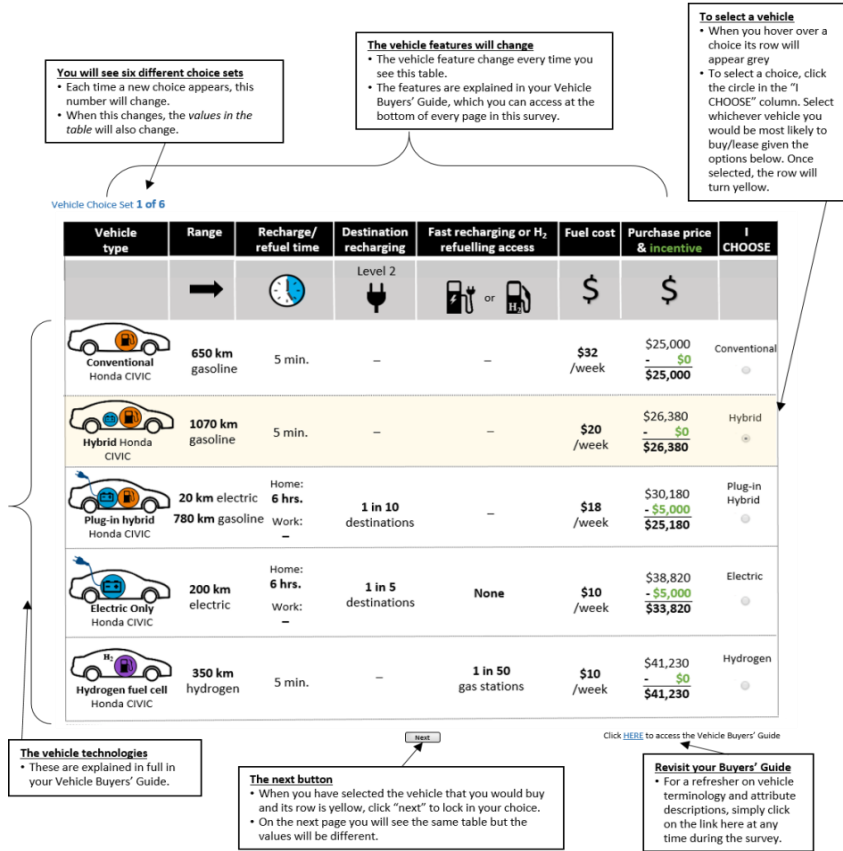


Figure 1: Example of the choice experiment

Table 1: Attribute levels for choice experiment

		Next anticipated CV	HEV	PHEV	BEV	FCEV
Range		Fixed: Selected by respondent (based on average range of class of their next anticipated vehicle)	Fixed: Selected by respondent (based on average range of class of their next anticipated vehicle)	First 20 km electric/ 780 km gasoline	100 km electric	300 km hydrogen
		Compact - 650 km	Compact - 850 km	First 50 km electric/ 750 km gasoline	140 km electric	400 km hydrogen
		Sedan - 650 km	Sedan - 850 km	First 80 km electric/ 720 km gasoline	220 km electric	500 km hydrogen
		Mid-SUV - 650 km	Mid-SUV - 850 km	First 110 km electric/ 690 km gasoline	300 km electric	600 km hydrogen
		Full-SUV/minivan - 750 km	Full-SUV/minivan - 1000 km			
	Truck - 750 km	Truck - 750 km				
Recharge/refuel time	Home recharging time	Fixed: 5 min.	Fixed: 5 min.	Not available X <sup>a</sup> hrs. (Level 1) X <sup>a</sup> hrs. (Level 2)		Fixed: 5 min.
	Work recharging time			Not available X <sup>a</sup> hrs. (Level 1) X <sup>a</sup> hrs. (Level 2)		
Destination recharging	Level 2 access	n/a	n/a	1 in 3 destinations 1 in 10 destinations 1 in 20 destinations 1 in 50 destinations		n/a
	1) Highway-based fast chargers 2) Fuel station- based H <sub>2</sub> fueling	n/a	n/a	No access along major highways At rest stops (every 50 km) on all major highways		1 in 2 gas stations 1 in 4 gas stations 1 in 10 gas stations 1 in 25 gas stations
Fuel cost		Stated by respondent: \$/week	\$(40% less) / week \$(30% less) / week \$(20% less) / week \$(10% less) / week	\$(90% less) / week \$(70% less) / week \$(50% less) / week \$(30% less) / week	\$(90% less) / week \$(70% less) / week \$(50% less) / week \$(30% less) / week	\$(30% less) / week \$(15% less) / week Stated fuel cost \$(15% more) / week
Purchase price		Stated by respondent: \$	Stated CV purchase price \$[5% more] \$[15% more] \$[25% more]	\$(10% more) \$(20% more) \$(30% more) \$(40% more)	\$(10% more) \$(20% more) \$(30% more) \$(40% more)	\$(10% more) \$(20% more) \$(30% more) \$(40% more)
Incentive		Fixed: \$0	Fixed: \$0	\$0 \$5,000 \$10,000	\$0 \$5,000 \$10,000	\$0 \$5,000 \$10,000

## 2.3 Estimation of latent-class choice models

In basic terms, a latent class model allows us to segment respondents into classes based on their stated interest in different vehicle drivetrains and attributes, as well as respondent characteristics. We estimated the latent-class choice model with Latent Gold version 5.0 [15]. Although there are statistical diagnostics that are commonly used to determine the optimal number of classes, we emphasize that our present focus is on improving our understanding of heterogeneity in consumer preferences and motivations—not just maximizing the predictive performance of the model. Thus, we consider several criteria when selecting the number of classes to include in our model, ordered here from most important to the least: 1) maximizing the interpretability of the solution, 2) avoiding solutions with proportionally large classes (e.g. greater than 50% of sample) or very small classes (e.g. less than 5% of sample), and 3) avoiding solutions where two or more classes are essentially identical. We calculate WTP values for each class using coefficient estimates that are statistically significant at a 90% confidence level.

## 3 Results

In this section we describe the survey sample, and present and interpret the latent-class choice model according to our research objectives.

### 3.1 Data collection

Our sample of new vehicle buyers (i.e. individuals who plan to buy or lease a vehicle in the next 12 months) was recruited by the panel company Research Now between January and June 2017. In total 2124 respondents completed both Part 1 and Part 2 of the survey, with 3525 completing Part 1. We oversampled the provinces of British Columbia, Ontario and Quebec to provide a useful comparison of regions with varying approaches to ZEV support. Demographic data on the target population (new vehicle buyers in Canada) is not accessible, so we compare our sample to Canadian Census data (Table 2). As is typical of new vehicle buying households, our sample is slightly older, and has higher education and income than the general population.

### 3.2 Latent class models and consumer valuation of ZEVs

To segment respondents and quantify heterogeneity in consumer preferences we estimate a latent class model which divides the sample into a pre-defined number of classes (or segments) and estimates separate sets of coefficients for each class [16-18]. These coefficients can be interpreted as a measure or quantification of consumer interest or disinterest in particular attribute. The latent class model assumes that individual preferences can be discretely grouped according to different patterns of preferences. This approach allows the researcher to describe respondents in each class (or segment) according to their valuation of vehicle attributes (via the choice model for that class) as well as individual characteristics (via the membership model, on the second page of the model) [19].

Table 3 shows our latent class model, where the first page depicts the choice model, including alternative specific constants, attribute coefficient estimates and willingness-to-pay calculations, and the second page depicts the membership model, that is, the role that demographic and lifestyle characteristics play in assigning respondents to each class. We have chosen the five-class model because we have judged that it reveals the clearest differences in alternative specific constants, attribute coefficients, and respondent characteristics across classes—as well as providing the most “interpretable” solution.

Across the five classes, the majority of alternative specific constants (ASCs or constants) that represent overall interest in HEV, PHEV, BEV, HFCV vehicle types are statistically significant at a 90% confidence level. Note that these ASCs must be interpreted with caution, as they represent valuation of a drivetrain in relation to a conventional vehicle, all else held constant (including range, fuel price, price and charging/fueling access)—for this reason Table 3 provides willingness-to-pay (WTP) calculations for ZEV drivetrains with particular ranges and charging access levels set.

Table 2: Demographic data for Canadian survey respondents and Canadian Census

	Canadian Sample	Canadian Census
<b>Sample Size</b>	2124	
<b>Population size</b>		33476688
<b>Age (of person filling out the survey)</b>		
15-34	24%	31%
35-44	18%	16%
45-54	20%	19%
55-64	22%	16%
65+	15%	18%
<b>Household income (pre-tax)</b>		
<\$40,000	16%	25%
\$40,000-\$59,999	19%	19%
\$60,000-\$89,000	25%	24%
\$90,000-\$124,999	21%	17%
\$125,000+	20%	15%
<b>Highest level of education completed (of person filling out the survey)</b>		
Other	17%	60%
College, CEGEP, or other non-university diploma	33%	22%
University degree (Bachelor)	31%	14%
Graduate or professional degree	19%	5%
<b>Residence type</b>		
Detached House	63%	62%
Attached House (e.g. townhouse, duplex, triplex, etc.)	12%	17%
Apartment	24%	20%
Mobile Home	1%	1%
<b>Residence ownership</b>		
Own	77%	69%
Rent	23%	31%
<b>Number of people per household</b>		
1	20%	28%
2	41%	34%
3	19%	16%
4	20%	23%

We use 2011 Census data here as the complete set of 2016 Census data are not available. Census data are from Statistics Canada: <http://www12.statcan.gc.ca/census-recensement/2011/rt-td/index-eng.cfm>.

In addition, across all five classes, vehicle purchase price and ZEV incentive coefficient estimates are significant and of the expected sign (i.e. lower vehicle prices and higher incentives are seen as valuable by all respondents, regardless of segment). Coefficients for BEV range, HFCV and fuel prices (where lower fuel prices are valued) are significant for only two classes. In addition, home and DC fast charging are significant for only one class (the “PHEV-oriented class, which we describe next), where interest in a BEV or PHEV is significantly higher if respondents have access to home charging and DC fast charging along major highways in their region.

One starting point to describe the differences among the five classes is to stated respondent interest in vehicle technologies in each class. Here we discuss differences in segments that are statistically significant at a 90% level of confidence or greater. We name each class according to overall drivetrain choice, where:

1. The “**CV-oriented**” class (representing 23% of the Canada-wide sample) demonstrates a disutility, as indicated by negative ASCs, for all non-conventional vehicle types, particularly ZEVs but also HEVs. Respondents in this class are not influenced by added PEV driving range or increased access to charging or refueling infrastructure. Thus the CV- oriented classes does not have positive WTP values for any ZEVs.
2. The “**HEV-oriented**” class (21% of the Canada-wide sample) expresses significant and positive value for HEVs, preferring HEVs over all other vehicle types, with a higher ASC for HEVs. Respondents in this segment also exhibit the second-highest valuation of fuel savings, though we note that their positive preference for HEVs (as indicated by ASC) is independent of this fuel savings valuation. Like the “CV-oriented” class”, respondents in this class are not influenced by added PEV driving range or increased access to charging or fueling infrastructure. Although this class does not have positive WTP values for ZEV, its WTP for PHEVs is not as negative as the CV-oriented class, where a significant incentive might sway some respondents to purchase one.
3. The “**PHEV-oriented**” class (representing 22% of the Canada-wide) are the most sensitive to fuel saving, and express positive WTP values for HEVs and PHEVs, relative to CVs. Respondents in this class also express substantially higher willingness to pay for PHEVs when they have access to home charging and DC fast charging. While these respondents express negative valuation of BEVs, they show a potential for interest in HFCVs, where WTP becomes positive (but small) when hydrogen fuel availability is high (i.e. at 100% of gas stations) and the vehicle range is 500km or higher. The PHEV-oriented class is, on average, willing to pay just over an extra \$5,000 for PHEVs (with home charging and DC fast charging access) and \$4,000 of HEVs.
4. The “**ZEV-curious**” class (representing 21% of the Canada-wide sample) is characterized more by their ambivalence towards ZEVs (relative to other classes) rather than positive valuation of ZEVs— though they also positively value HEVs over CVs. Respondents in this segment express a negative WTP for PHEVs, though are sensitive to PHEV range. However, despite this, they appear to be somewhat curious about BEVs and HFCVs. Although they express neither utility nor disutility in BEVs and HFCVs, relative to CVs (i.e. equivalent valuation of BEVs, HFCVs and CVs), 70% of respondents who chose a HFCV, and almost 40% of those who chose a BEV in the choice exercises belonged to this class. We therefore call this class the ZEV-curious class, as they state a degree of interest in BEVs and HFCVs.
5. The “**PEV-enthusiast**” class (representing 13% of the Canada-wide sample) expresses a high value for PHEVs and BEVs (the highest of all classes) relative to CVs, and to a lesser extent HEVs. However, individuals in this class are ambivalent towards HFCVs, which have an overall valuation that is not statistically different from CVs (like the “ZEV-curious” class). Members of this class also see ZEV incentives as highly valuable, substantially more than any other class. Surprisingly vehicle range and charging access did not emerge as significant attributes. The PEV-enthusiast class has the highest willingness-to-pay values for HEVs, PHEVs and BEVs, indicating that even if fuel costs are equivalent to that of a CV and regardless of range, the average respondent in this class would pay over \$90,000 extra (relative to a CV) for an HEV, or pay more than \$150,000 extra for a BEV and over \$200,000 for a PHEV. These willingness-to-pay values seem inflated and should not be interpreted in a literal sense, but they do indicate a strong level of enthusiasm for PEVs (hence the “PEV-enthusiast” label). It should be noted that these values are similar to the willingness-to-pay values for the PEV-enthusiast class in our 2015 study [1].

The class membership model (lower half of Table 3) provides further description of the respondents in terms of the characteristics that statistically define membership in a class. The CV-oriented class is used as the “base,” or reference point, for the other classes. While the classes do not generally differ from the CV-oriented group in terms of income, dwelling type or household number, we do note some statistically significant differences. Specifically, we observed that, relative to the CV-oriented class, respondents in the:

1. Members of the **HEV-oriented class** are more likely to be engaged in an environmental lifestyle, express environmental concern, and express altruistic values, but less likely to express biospheric values. They are also more likely to have higher levels of education, specifically a university degree.
2. Members of the **PHEV-oriented class** are more likely to express environmental concern, and they are also more likely to be younger and have higher levels of education, especially university and graduate degrees.
3. Members of the **ZEV-curious class** are more likely to be engaged in an environmental lifestyle and express environmental concern. They are also more likely to be younger and have higher levels of education.
4. Members of the **PEV-enthusiast class** are more likely to be engaged in an environmental lifestyle and express environmental concern, despite expressing lower biospheric values. They are also more likely to be younger, and have higher levels of education.

## 4 Conclusion

As noted, the successful deployment of ZEVs will depend on the perceptions and preference of the mainstream consumer market. In this paper we use empirical survey data, specifically a stated choice experiment, to segment consumers according to their preferences for ZEVs, as well as their personal characteristics. We selected a latent class model with five-classes as the most meaningful and interpretable. Of the five class, two (making up 44% of the sample) expressed disutility or negative valuations of ZEVs, instead expressing high WTP values for CVs (CV-oriented class) and HEVs (HEV-oriented class); with the HEV-oriented class also placing significant value on fuel cost savings. The other three classes expressed varying levels of interest in ZEVs. The PEV-enthusiast (representing 13% of the sample) expressed an extremely high willingness to pay for both BEVs and PHEVs regardless of access to charging or electric range. Respondents in the PHEV-oriented class (representing 22% of the sample) were sensitive to fuel costs and expressed preferences for both HEVs and PHEVs, and placed a higher willingness to pay for PHEVs when combined with home and DC fast charging access. Respondents in the ZEV-curious class (representing 21% of the sample) indicate more of a neutral perception of ZEVs relative to CVs, perhaps indicating a potential for openness under future conditions—while currently preferring HEVs. Although they are indifferent about ZEVs currently, they appear to be sensitive to electric range. Members of these three classes were also more likely to be younger and more educated, and have higher environmental orientation or concern. Results from this analysis could provide important insights to government who wish to target policy efforts towards more ZEV interested consumers.

Table 3: Latent-segment results 5-segment solutions (Canadian-wide sample, n=2124)

Segment name	CV-oriented	HEV-oriented	PHEV-oriented	ZEV-curious	PEV-enthusiast
<b>Percentage of respondents in segment Canada-wide</b>	<b>23%</b>	<b>21%</b>	<b>22%</b>	<b>21%</b>	<b>13%</b>
<b>Choice model</b>					
Measure of vehicle interest (s)					
HEV	-2.8424 *	1.4845 *	1.2799 *	0.6512 *	1.1644 *
PHEV	-4.8964 *	-1.4798 *	0.5683 *	-0.6223 *	2.708 *
BEV	-8.865 *	-5.6417 *	-2.8657 *	0.058	1.9836 *
HFCV	-4.9464 *	-4.2875 *	-2.4106 *	0.0955	-0.9605
Measure of preferences (coefficients)					
PHEV range (km)	0.0015	-0.0006	0.0026	0.0035 *	0.0006
BEV range (km)	0.0059	0.0064	0.0025	-0.0027 *	0.001
HFCV range (km)	0.0003	0.0024	0.0022 *	0.0003	0.0015
Vehicle price (CAD\$)	-0.0002 *	-0.0003 *	-0.0003 *	0	0 *
Fuel cost (CAD\$/week)	-0.0001	-0.0133 *	-0.0163 *	0.0001	0
Incentive value (CAD\$)	0.0001 *	0.0001 *	0.0003 *	0.0001 *	0.0001 *
Home charging (Level 1 or 2)	-0.1087	-0.252	0.6582 *	-0.0145	-0.071
Workplace charging (Level 1 or 2)	-0.2934	0.1833	0.0452	0.1078	0.2011
Public charging (% of destinations)	0.0121	0.0057	0.0019	0.0048	0.0019
DC fast charging (access on major highways)	0.8032	0.1586	0.3137 *	0.1675	-0.2452
Hydrogen station availability (% of gas stations)	0.0173	0.0212	0.0155 *	0.0011	0.0106
Implied willingness-to-pay (CDN) <sup>a</sup>					
Fuel cost savings(CAD\$/year)		\$ 2,368 *	\$ 2,913 *		
Incentive value (CAD\$)	\$ 0.81 *	\$ 0.46 *	\$ 1.02 *	\$ 2.48 *	\$ 7.71
Home charging (Level 1 or 2)			\$ 2,269 *		
DC fast charging (access on major highways)			\$ 1,081 *		
Hydrogen station availability (% of gas stations)			\$ 53 *		
Vehicle Type					
HEV (all else held constant) <sup>b</sup>	\$ (18,143)	\$ 5,086	\$ 4,411	\$ 20,622	\$ 92,256
PHEV-60km (all else held constant) <sup>b</sup>	\$ (31,254)	\$ (5,070)	\$ 1,959	\$ (12,968)	\$ 214,556
+ home charging & DC fast charging			\$ 5,309		
BEV-220km (all else held constant) <sup>b</sup>	\$ (56,586)	\$ (19,328)	\$ (9,877)		\$ 157,161
+ home charging & DC fast charging			\$ (6,527)		
HFCV-500km (all else held constant) <sup>b</sup>	\$ (31,573)	\$ (14,689)	\$ (4,434)		
10% gas stations			\$ (3,900)		
50% gas stations			\$ (1,764)		
100% gas stations			\$ 906		

Segment name	CV-oriented	HEV-oriented	PHEV-oriented	ZEV-curious	PEV-enthusiast
<b>Percentage of responds in segment</b>					
<b>Canada-wide</b>	<b>23%</b>	<b>21%</b>	<b>22%</b>	<b>21%</b>	<b>13%</b>
<b>Class membership model</b> [relative to base = CV-oriented]					
Lives in Metro Vancouver		0.9655 *	-0.2437	0.3163	1.292 *
Lives in BC	[Base]	-0.5898	0.1089	0.5003	-0.7298
Lives in ON		0.193	-0.1986	0.6192 *	-0.2157
Lives in QC		-0.2634	-0.1806	0.552 *	0.37
Technology-oriented lifestyle score		-0.111	0.0344	-0.0627	0.1023
Environment-oriented lifestyle score		0.2258 *	-0.0755	0.3534 *	0.5254 *
Liminality score		0.089	0.3878	0.1984	-0.1266
Environmental concern (NEP score)		0.4834 *	0.4891 *	0.284 *	0.5815 *
Biospheric value score		-0.5023 *	0.0376	-0.212	-0.3953 *
Altruistic value score		0.383 *	-0.0088	-0.0751	0.0756
Age	[Base]				
15-34		0	0 *	0 *	0 *
35-44		0.0629	-0.5205	-0.5318	-0.3054
45-54		-0.1204	-0.6403	-1.0705	-0.8359
55-64		-0.1244	-0.6448	-0.8265	-1.1509
65+		-0.05	-0.612	-1.0765	-0.8112
Income					
<\$40,000	[Base]	0	0	0	0
\$40,000-\$59,999		0.4219	0.4958	-0.3553	-0.0182
\$60,000-\$89,000		0.2226	0.2492	-0.5703	0.225
\$90,000-\$124,999		0.4137	0.3986	-0.131	0.4418
\$125,000+		0.4126	0.4662	-0.2014	0.5858
Education					
Other		0 *	0 *	0 *	0 *
College, CEGEP, or other non-university diploma	[Base]	0.367	0.274	0.4572	0.5688
University degree (Bachelor)		0.7566	0.9074	0.4622	0.9538
Graduate or professional degree		0.4574	0.9276	0.5345	0.5525
Housing type					
Detached House		0	0	0	0
Attached House (e.g. townhouse, duplex, triplex, etc.)		0.1305	-0.0744	-0.0371	-0.4152
Apartment	[Base]	0.2191	0.069	-0.0042	0.1004
Mobile Home		0.0566	0.3736	-1.0629	-0.1215
Number of people per household		-0.0489	0.1332	0.0694	0.0472

\*significant at a 90% confidence level or greater

<sup>a</sup> We only depict willingness-to-pay calculations where the coefficient estimates are significant at a 90% confidence level or greater.

<sup>b</sup> Willingness-to-pay values for vehicle types reflect the estimated value of a vehicle type all other attributes held constant, unless otherwise specified. Note: Because the coefficient estimate for ZEV range are not statistically significant in many cases, our willingness-to-pay calculations for ZEV do not include the value of electric range. Range was only significant for the PHEV-oriented and ZEV-curious segments.

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