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SPECIAL ISSUE — COMMUNITY ENERGY PLANNING IN CANADA:
INSIGHTS AT THE NEXUS OF RESEARCH AND PRACTICE

SPECIAL ISSUE EDITOR

Kirby Calvert

Co-Mapping Solutions Inc.

CPP-APC ASSOCIATE EDITOR

Thomas Gunton

Simon Fraser University

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SOCIAL AND MUNICIPAL INFLUENCES ON INTENTION TO PURCHASE ELECTRIC AND HYBRID ELECTRIC VEHICLES IN LONDON ONTARIO, CA

Jordan Fuller^a , Jamie Baxter^a, and Jamie Skimming^b

^a Department of Geography, Western University

^b City of London, Ontario

Résumé

Nous avons mené une étude de cas à London, Ontario, pour identifier les facteurs qui influencent les décisions d'achat des véhicules à faible émission de carbone, y compris le rôle que les administrations municipales pourraient jouer pour encourager les décisions d'achat des véhicules à faible émission de carbone. Dans le cadre d'un partenariat entre la ville et l'université, cette étude a rapporté (n = 257) les résultats d'un sondage par la poste auprès des résidents. Notre sondage est principalement pour savoir si les influences sociales et les mécanismes sous contrôle municipal prédisent l'intention d'acheter des véhicules électriques (VE) et des véhicules électriques hybrides (HEV). Les influenceurs sociaux proximaux (famille et amis) (.179 *, .393 *) et les influenceurs sociaux distaux (.219 *, .142 *) prédisent respectivement l'intention d'acheter EV et HEV. Les séances d'information par la ville (.161 * EV) et la promotion de la ville (.141 * HEV) influencent considérablement les intentions, alors que le stationnement et la recharge des véhicules électriques fournis par la ville ne le sont pas. Alors que les municipalités peuvent trouver d'autres domaines ayant un plus grand impact sur la réduction des GES, les résultats soutiennent la promotion des aspects sociaux de l'achat de VE et HEV et la fourniture d'événements de promotion à un coût relativement faible.

Mots-clés: influences sociales, infrastructure municipale, véhicules électriques, véhicule électrique hybride, planification énergétique Communautaire, théorie du comportement planifié

Abstract

We conducted a case study in London, Ontario to identify factors that influence decisions to purchase low carbon vehicles including what role municipal governments might play in encouraging low carbon vehicle purchase decisions. As part of a city-university partnership, this study reports (n = 257) results from a mail-out survey. We test mainly whether social influences and mechanisms under municipal control predict intent to purchase electric vehicles (EV) and hybrid electric vehicles (HEV). Both proximal social influencers (family and friends) (.179**, .393**) and distal social influencers (.219**, .142*) predict intent to purchase EV and HEV respectively. City information sessions (.161** EV) and City promotion (.141* HEV) significantly influence intentions, while City-provided EV parking and charging are not. While municipalities may find other areas with greater impact on GHG reductions, the findings support promoting the social aspects of EV and HEV purchasing and providing relatively low-cost promotion/events.

Keywords: social influences, municipal infrastructure, electric vehicles, hybrid electric vehicle, community energy planning, theory of planned behaviour

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INTRODUCTION

The impact of the transportation sector on greenhouse gas (GHG) emissions in Canada is substantial and has worsened over time. According to Statistics Canada 2018 data, the national transportation sector was responsible for approximately 217 Mt or 30% of all of Canada's 730 Mt of greenhouse gas (GHG) emissions measured as CO₂ eq.¹ Transportation is second only to the energy supply sector at 319 Mt (44%), while the subcategory of road transportation alone emitted 153 (21%) of those 730 Mt in 2019. While Canadian GHG emissions overall have decreased modestly from 739 Mt in 2005 to 730 Mt in 2019 (-1.1%), the transportation sector is the only sector that has seen an increase in emissions - from 190 Mt to 217 Mt (14%) - over this time span with road transportation increasing (18%) from 130 Mt to 153 Mt (Environment and Climate Change Canada, 2021b). In Ontario, where GHG emissions dramatically decreased from 206 Mt to 163 Mt (-21%) between 2005 and 2019 the transportation emission numbers also stand out. In 2019 the transportation sector accounted for 63 of those 163 Mt (38%) of Ontario's GHG emissions while road transportation alone accounted for 49 of the 163 Mt (30%). Further, while overall emissions have decreased in the province between 2005 and 2019, the emissions from the road transportation sector increased from 48 to 49 Mt (2.6%) despite the growing availability of more efficient modes of transportation including hybrid electronic vehicles (HEV) and electronic vehicles (EVs) (Environment and Climate Change Canada, 2021a).

The IPCC calls for more research on the social aspects of transportation decision making, including consumer vehicle purchases, to better understand why people do or do not purchase EVs and HEVs (IPCC, 2014). There is a significant opportunity for GHG reduction if households switch to HEVs and particularly EVs. This study addresses this issue by focusing on two main topics. First, how do potential consumers view the influence of social networks on

their intention to purchase HEV and EV vehicles. Second, how do consumers view municipal interventions to encourage HEV and EV purchase intentions. While much research on transportation decisions is at the macro-level to assess aggregate level changes e.g., fuel switching to electricity (Jaccard & Dennis, 2006), research at the more micro-level of consumer intentions and behaviour may more readily provide policy insights for all levels of government (Liao et al., 2017). In some of these macro-level studies social phenomena are labelled the "neighbor effect," which has a specific connotation (i.e., the vehicle market share held by EVs and/or HEVs). At the microscale, social influences on purchasing (intentions) can be measured more directly as the impact of specific social networks like family, friends, and neighbours (Mau et al., 2008).

Our study emphasizes attitudes and intentions to purchase EVs and HEVs at the household scale. Axsen et al. (2013) underscore the importance of social interactions for changing attitudes as they are potentially malleable in a dynamic market, "Many of these perceptions are uncertain, especially the frequently mentioned controversy as to whether BEVs have the ability to reduce lifecycle environmental impacts. We find evidence that these perceptions are subject to change, particularly through social interactions" (p. 106). The research comes at a significant time, as the Ontario government removed their incentives program in 2018 to encourage plug-in hybrid EV (PHEV) and EV sales with thousands of dollars in potential rebates (Jones, 2019). Working with the City of London as a partner, and within a broader network of Canadian university-municipality partnerships on community energy planning and GHG reduction, the goal of our study is to assess the factors affecting decisions to purchase EVs. We used a survey that is scalable and transportable to other municipalities to inform long-term community energy planning and vehicle marketing on a broader scale. We draw on two frameworks commonly used

¹ CO₂ eq means all greenhouse gases converted to a CO₂ equivalent.

in the alternative fuel vehicle purchase intentions literature.

BACKGROUND LITERATURE

Rezvani et al. (2015) encourage drawing on multiple theoretical perspectives at different scales for EV research. Thus, our research is informed by two frameworks: community energy planning (CEP) also known as local energy planning (LEP)², and the theory of planned behaviour (TPB). CEP helps establish the context while TPB is often used to measure attitudes in the type of survey-based methodology we used. That is, we use CEP as inspiration to identify variables that might not otherwise be included in a TPB study. CEP is particularly relevant as it focuses on exploring the importance of policy levers under municipal control. CEP is also the framework that brought together our community-university partnership, providing a language familiar to both that bridged municipal energy planning and academic work on environmental planning (e.g., see QUEST, 2021).

Community energy planning

Community energy planning is a relatively new dimension of municipal planning processes in Canada, and generally involves any aspect of low-carbon energy production, consumption, and conservation that falls within municipal jurisdiction (St. Denis & Parker, 2009; Wyse & Hoicka, 2019). Such planning relates to everything from district energy production, rooftop solar, and energy conservation programs to public transportation design and investment. Increasingly, communities are looking at long-term integrated energy systems that will involve a movement away from fossil fuels towards electrification (Koirala et al., 2016; Mendes et al., 2011). The framework recognizes the crucial role of municipalities in carbon reduction efforts with local municipalities having influence over half of

Canada's greenhouse gas emissions (Hill & Perun, 2017). This literature has generally focused on such issues as local (renewable) energy production, energy conservation, and transportation modal switches rather than consumer vehicle choices (Koirala et al., 2016).

While much of the municipal transportation planning relating to GHG emissions reductions tend to centre on public transit, there is some suggestion in the transportation planning literature that municipalities can have an influence on alternative fuel vehicle purchases (Tran et al., 2012), such that planning for them may contribute to sustainable local energy planning. Yet, there is limited research in this area. Yu and Li (2019) use modelling of secondary data to demonstrate the positive impacts that local government can have on increasing EV use in high traffic areas of Beijing, but note that more research on the impacts of such policies is required. For example, they find that while designated parking and free/subsidized charging stations are currently being used as policies to encourage battery-powered electronic vehicles (BEV) and PHEV vehicles (Hagman et al., 2016), there is modest empirical research into the effect of such policies (Noel et al., 2019). Liao et al. (2017) and Lin and Wu (2018) find such interventions are low on the list of consumer concerns. Nevertheless, in a 2017 review of predictors of EV adoption, Coffman et al. (2016) found at least eight studies showing that availability of charging infrastructure is among the most significant concerns for uptake of EVs (e.g., Egbue & Long, 2012; Graham-Rowe et al., 2012).

Researchers often conclude that more education about EV is required, but they are vague about the role of municipalities (Cecere et al., 2018; Chen et al., 2016; Egbue & Long, 2012; Klöckner, 2014). While municipalities have the power to promote,

² These two terms do not entirely intersect in the sense that community energy planning is largely about community participation in decision-making about local energy. For our purposes the significant overlap between the two in terms of local sovereignty and management of energy and greenhouse gas emissions is sufficient to treat them as synonymous here; see Wyse and Hoicka 2019 for a more nuanced treatment.

educate, and expand EV infrastructure, they lack empirical evidence justifying such actions. Meanwhile, many of those who study EV purchases/intentions recommend that policies at the municipal level like education, charging stations, and preferred parking are likely to have among the most important impacts (Coffman et al., 2016; de Rubens, 2019; Egbue & Long, 2012; Graham-Rowe et al., 2012; Koirala et al., 2016; Liao et al., 2017; Rezvani et al., 2015). Thus, while community energy planning has traditionally focused on things like building efficiencies and conservation, the move to renewables and electrification opens opportunities for local government to support electric vehicle use.

Theory of planned behaviour (TPB)

The central concepts in the TPB are normative beliefs (attitude towards what we think society expects of us), subjective norms (attitude towards a behaviour or technology), and behavioural control or self-efficacy (attitude towards the ease of adopting a technology or engaging in a behaviour) (Ajzen, 1991). All of these are presumed to influence intention to engage in a behaviour (e.g., purchase an EV) and intention is assumed to be highly predictive of actual behaviour. This theory is inherently social, perhaps most directly through the normative belief concept.

The TPB has been used in a number of studies designed to predict the determinants of intention to purchase an alternative fuel vehicle (e.g., Chen et al., 2016; Egbue & Long, 2012; Lane & Potter, 2007; Lin & Wu, 2018; Klöckner, 2014; Moons & De Pelsmacker, 2012; Rezvani et al., 2015). For example, attitudes towards the environmental impact of EVs has been shown to be fairly consistent and significant predictor of intention to purchase an EV across a range of studies (Chen et al., 2016; de Rubens, 2019; Heffner et al., 2007; Klöckner, 2014; Lin & Wu, 2018; Plötz et al., 2014; Rezvani et al., 2015). That said, Egbue and Long (2012) find that cost and performance attitudes are more important than attitudes about positive environmental impacts.

Among the more studied attitudes are those related to the vehicle itself, including performance factors like *driving range* and *range anxiety* which prove to be significant in most studies (e.g., Cecere et al., 2018; de Rubens, 2019; Egbue & Long, 2012; Lin & Wu, 2018; Rezvani et al., 2015). Rezvani et al. (2015) and Lin and Wu (2018) show a significant impact of *willingness to pay a premium* for EVs, while Cecere et al. (2018) show that a *reduction in the price of EVs* has a more important effect on the intention to purchase EVs than an improvement in performance (see also Coffman et al. 2016). Relatedly, there is also consistent support for the notion that subsidies have a significant positive effect on purchasing intention, but that subsidies on their own are not sufficient (Chen et al., 2016; Coffman et al., 2016; Lin & Wu, 2018). Aspects such as *performance* and *total costs* may have a greater impact on adoption (Egbue & Long, 2012; Hagman et al., 2016; Helveston et al., 2015).

Liao et al. (2017), Chen et al. (2016), Klöckner (2014), and Axsen et al. (2013) all demonstrate social influence to be a significant predictor of intention to purchase EVs. Likewise, Chen et al. (2016) show that perceived behavioural control and perceived knowledge about renewable energy significantly predict intention to use EVs in the future. In a review on the factors influencing adoption of EVs, Coffman, et al. (2016) found evidence to suggest social networks are more important than individual influencers when it comes to EV uptake. Further, Axsen et al. (2013) conclude, “Neglect of social influence processes will ignore or underestimate the potential for consumer perceptions and preference to develop and shift. Assumptions of static, exogenous consumer preferences can strongly bias results of market potential for new, pro-environmental technologies” (p. 106) (see also Rezvani et al., 2015 regarding neighbourhood effect). While they identify three social processes - diffusion, translation and reflexivity; we hypothesize that social influence might usefully be divided into spheres of influence based on social location/social ties - where those closest to us that have the most influence.

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Sociodemographic predictors of intention to purchase alternative fuel vehicles are also important. De Rubens' (2019) review of empirical research on sociodemographic predictors of "early adopters" highlights the following have a greater likelihood of owning EVs: men, individuals who earn higher incomes, technical professionals, and individuals residing in multi-car households. The next section shows how we organized this long list of potential predictors into our TPB-based attitudes questionnaire.

RESEARCH DESIGN

We use 257 survey responses from a random selection of London, Ontario residents to test three hypotheses about the social (e.g., Coffman et al., 2016; Hsu et al., 2013) and municipal (de Rubens, 2019; Rezvani et al., 2015) influences on intentions to purchase HEVs and EVs:

H1a: Attitudes towards social network influencers predicts intention to purchase an EV or HEV.

H1b: Proximal social networks (family and friends) will have more impact than distal social networks (neighbours and coworkers).

That is we take up the call of researchers such as Axsen et al. (2013) and Rezvani et al. (2015) to add nuance to the social influences on attitudes to EV and HEV purchases (Figure 1). Further, drawing on sociology and management literatures, Hsu et al., (2013) provide inspiration for our proximal/distal distinction by suggesting that closer social ties (strong ties) have a more powerful influence on EV/HEV purchasing intention than more distant ones (weak ties). Their research focuses on internet word of mouth whereas ours is focused on consumer perceptions of their own social networks.

H2: Attitudes towards municipal EV and HEV policy interventions (e.g., promotion, infrastructure) predicts intention to purchase an EV or HEV vehicle.

This hypothesis is very practically oriented and amounts to a recategorization of predictors (e.g.,

parking, charging, promotion/information sharing) across a range of different studies that our municipal partner agreed might be a potential policy lever to encourage EV/HEV uptake locally.

The three hypotheses are tested analytically in regression models that include variables reviewed above, common variables known in the literature to predict EV and PHEV vehicle purchases, attitudes towards financial incentives, range anxiety, environmental benefits, status, and sociodemographic variables.

Figure 1. Hypothesized increasing social influence on intentions to purchase EV or HEV moving from distal to proximal social spheres.

Site Selection

London, Ontario is a mid-sized Canadian city with a vehicle purchasing profile that likely more closely resembles places outside the largest cities in Canada (Hill & Perun, 2017). Whereas vehicle ownership is declining in big cities, the number of registered vehicles has grown 40% from 2010 to 2019, about four times faster than the population growth. Further, the average annual vehicle registration growth rate (3.9%) is higher than the provincial

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growth rate (0.4%) (Statistics Canada Government of Canada, 2018). Additionally, diesel-only and gas-only light-duty vehicles make up 98.6% of the total vehicles in London, with combined ownership of HEV and EV being just under 0.3% (City of London, 2020).

Measurement & Analysis

We defined HEV and EV as follows at the beginning of the questionnaire:

Hybrid-Electric Vehicle (HEV): vehicles that combine BOTH the use of an electric motor AND the use of gasoline or diesel powered engines. This includes all Plug-In Hybrids. e.g., Toyota Prius, Ford Fusion ENERGY, Chevrolet Volt.

Plug-In Electric Vehicle (EV) vehicles that ONLY use an electric motor and battery and do NOT use an internal combustion engine. These vehicles are commonly known as Battery Electric Vehicles (BEVs). e.g., Nissan Leaf, Tesla Model 3, Chevrolet Bolt.

Since we asked a large number of questions about each vehicle type in our questionnaire, we had to limit the number of vehicle types to keep the time our City of London partners suggested (10 minutes). Our vehicle typology captures the most important differentiation between vehicles powered at least partially with an electric motor and those only powered by an internal combustion engine. Pragmatically, if our findings support installing infrastructure (designated parking, charging stations) for EV, PHEV owners would be covered. Though the literature is focused on EV and contains many examples which distinguish plug-in (PHEV) from non-plug-in (HEV), we do not. That said, the examples in our description of HEV provided in the questionnaire identified above, are all of the PHEV rather than the non-plug-in variety.

The items used from the questionnaire to test the hypotheses consisted of 53 items in eight categories: the three dependent variables (3 indexes from 6 items) relating to vehicle purchasing intentions for EV, HEV, and EV or HEV (pooled), two indexes

measuring proximal and distal social influences on vehicle purchase intentions (2 indexes from 18 items), and several other categories of attitudinal variables consistent with a TPB model, i.e., attitudes towards: municipal policies and outreach (7 items), range anxiety (1 item), financial influences (6 items), status (2 items), environmental impacts (1 items), vehicle purchase purchasing influences (5 items), as well as typical socio-demographic control variables (7 Items). All of the questions were closed-ended, and most were measured with seven-point ordinal Likert scales (e.g., strongly agree 7, agree 6, somewhat agree 5, neither agree nor disagree 4, somewhat disagree 3, disagree 2, strongly disagree 1).

The three dependent variables are indexes - *intention to purchase HEV*, *intention to purchase EV* (each comprising three items) and the pooled *intention to purchase HEV or EV* (six items). For example, the *intention to purchase a HEV* dependent variable included the following questions: “If you had to purchase a vehicle in the next month, what is the likelihood of purchasing a hybrid vehicle”; “What is the closest you have come to purchasing a hybrid vehicle” (response set includes actual purchase); and “Have you actively attempted to convince someone else to purchase a hybrid vehicle.” The first was measured on a four-point likelihood Likert scale, while the other two were on a seven-point agree scale. With scores being additive, the index scores ranged from three (least likely to purchase an HEV), to 18 (most likely to purchase an HEV). We used the exact same format to create the intention to purchase an EV index, while the pooled version of the dependent variable (either an EV or HEV) simply added both indexes together to create an index that ranged from six to 36. The Cronbach’s Alpha scores of reliability or internal consistency of these indexes are .844, .695, .83 for the EV, HEV, and EV or HEV respectively, with scores above .7 considered “good” (Cho & Kim, 2015) for inaugural measures such as these.

The two social influence indexes are identified in Figure 1 and are detailed in Table 2 with the *proximal social influence index* consisting of items

relating to family and friends and the *distal social influence index* consisting of items relating to neighbours and coworkers. The following questions were asked for each of the four social groups: “In the last year, how often have you had conversations about EVs with (family, friends, neighbours, coworkers)”; “In the last year, how often have you had conversations about hybrids with (family, friends, neighbours, coworkers)”; “The majority of my conversations with (family, friends, neighbours, coworkers) regarding EV and hybrid vehicles focus on the positive aspects of these vehicles.”; “My (family, friends, neighbours, coworkers) have influence over my vehicle purchasing decisions” (see Table 2). These questions were all measured on Likert Scales ranging from 5-8 points, with scores ranging from a low of 0 to a high of 27 for each of the two social influence indexes. The Cronbach Alpha internal reliability score for the proximal social network influence was 0.879 and 0.836 for the distal social network influence, suggesting that this index has high internal consistency.

The following questions were asked about various municipal interventions: *City promotion* “My municipality should take a more active role in promoting EV/HEV”; *City chargers* “I would be more inclined to buy an EV if my municipality had more charging stations”; *City designated parking EV/HEV* “I would be more inclined to buy an EV/HEV if my municipality had more designated parking spots”; *City info sessions* “If my municipality was to run an EV/HEV information session in my community, I would attend”; *City test drive* “If my municipality held an information session with test rides, I would attend”; and *City information centre* “If there was a local EV/HEV information centre where I could learn more and test drive EVs, I would visit” (see Table 2).

In terms of attitudes towards financial characteristics (costs and incentives) we drew items from the ranking question, “When making a vehicle purchase, rank these from most important to least important: purchase price, environmental impact, long-term cost savings, mileage, functionality, overall look and feel, safety, brand loyalty, quality/

reliability, and prestige.” The variable labels for these include the word “importance” (e.g., *importance of purchase price*) in Tables 2 and 3 and each variable is reverse coded such that 1 is least important and 10 is most important. The attitudes to financial characteristics section of Tables 2 and 3 include two such variables from this group - *importance of purchase price*, and *importance of long-term cost savings*. The attitudes to financial characteristics section also includes two questions about subsidies and a hypothetical money-is-no-object question, specifically, *provincial subsidies* “The Ontario government should subsidize EV/HEV”; *federal subsidies* “The Canadian government should subsidize EV/HEV”; *would purchase if no financial constraints* “If money were no issue, I would purchase an EV/HEV.”

As for measures within the status block, we used four measures including two from the ranking question identified above, that is, importance of *vehicle look and feel* and *vehicle prestige*. The other two measures come from the seven-point Likert agree scale questions: *EV/HEV are now mainstream*, “Do you consider EVs/HEVs to now be mainstream?”, and *EV/HEV cool to own* “Is it ‘cool’ to own an EV?”. The *environmental impact* item is likewise from the ranking question already identified above.

We also included other characteristics of vehicles that have been shown to be significantly associated with intention to purchase an EV or HEV in at least one study and these come from the ranking question above, importance of: *quality, functionality, brand loyalty, safety, and mileage*. Like the others from this list these ranged from one to 10 in that we asked them to rank 10 criteria for selecting their next vehicle purchase.

The analysis consists of bivariate correlation and stepwise multivariate linear regression in a two-stage process. First, we ran bivariate Pearson correlations between all the predictor variables and each of the three dependent variables. All variables were then inserted into three regression models, one for each of the EV and HEV dependent variables and one for the pooled EV or HEV variable. The

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analytical purpose is to determine if social influence and municipal intervention variables remain significant in the models that include other known predictors of (alternative fuel) vehicle purchases.

Sampling

To maximize variation in the sample on a limited budget we used a random cluster design. We divided London, Canada into four roughly equal spatial quadrants from which we randomly selected one mail route each for a total of 2,311 mail outs. Areas to the east and northeast are modest with smaller homes and lower car ownership while those in the north and southwest are wealthier with larger homes and higher vehicle ownership. To address Rezvani et al.'s (2015) lament that surveys tend to focus on those with little EV experience, we captured some EV owners by pushing the survey to all members of the London Electric Vehicle Association (LEVA - membership is less than 50). Households were mailed a recruitment letter and asked to fill out the survey online using a shortened URL. After approximately 50 days, we received only 65 responses, so we sent out a second mailing to the same 2,311 households as per Dillman, et al. (2014) and included the option to fill out a paper copy of the survey with a pre-paid mail-back envelope. The questionnaire included screener questions to prevent duplicate responses and targeted adults over the age of 18 based on the presupposition that younger licenced drivers - people 16 to 17 - are less likely to purchase a vehicle.

RESULTS

Response Rates

The overall response rate is a modest 11%, which is typical for a social science study of this type in Canada. The first mailing (online-only) yielded a response rate of 3.9%, while the second mailing (online and paper) yielded a response of 6.9% but, given that these mailings went to the same people the overall response rate is additive totalling 11% (257/2311).

Sample Characteristics

We compare the sample to the populations of London, Ontario and Canada in Table 1. Overall, the sample is skewed in the following ways relative to these Statistics Canada data; a higher proportion male, middle-aged, higher income, larger households, married, more educated, and retired. These characteristics closely match the

Table 1. Socio-Demographic Comparisons between the survey sample, and the populations of London and Canada

Variable	Categories	EV STUDY DATA	2016 LONDON CENSUS	2016 CANADA CENSUS
Gender	Male	59.4%	48.3%	49.1%
	Female	39.3%	51.6%	50.8%
Age	18-34	9.9%	28.4%	25.1%
	35-54	33.6%	25.1%	35.1%
	55-74	48.1%	28.7%	30.4%
	75+	8.3%	9.4%	9.3%
Income	Under 30K	5.7%	21.4%	17.7%
	30K-49K	13.2%	18.5%	16.8%
	50-69K	15.2%	15.6%	14.8%
	70-100K	19.6%	18.2%	17.6%
	Over 100K	37.3%	26.7%	32.3%
Household Size	1	13.1%	31.9%	28.2%
	2	46.3%	33.8%	34.3%
	3	13.1%	14.6%	15.2%
	4	19.7%	12.4%	13.8%
	5+	7.4%	6.9%	8.3%
Marital Status	Married	71.7%	53.4%	61.9%
	Widowed	5.3%	5.6%	5.9%
	Divorced	6.1%	6.7%	6.6%
	Separated	3.7%	3.4%	2.6%
Education	Never Married	11.9%	30.5%	30.2%
	Less than HS	1.6%	17.3%	11.6%
	Some HS Post-	12.3%	N/A	N/A
	Secondary	25%	24.2%	22.4%
	College	26.6%	18.6%	20.8%
	University	19.7%	5.3%	5.9%
	Post Grad	3.3%	1.6%	0.9%
Employment	Employed Full	48.4%	59%	66%

characteristics of early adopters of alternative fuel vehicles de Rubens’ (2019), thus suggesting a skew towards EV and HEV adoption.

Dependent variables - intention to purchase EV and HEV indexes

Figures 2 and 3 shows the box plots (median and quartile values) for each of the three dependent variables. The pooled index of intention to purchase either EV or HEV has a respondent minimum of 6, maximum of 31, mean of 14, and median of 13 meaning that the sample is skewed rather strongly towards intending not to purchase one or the other vehicle type. Both other indexes are likewise skewed to the *not intending to purchase* end of the scores with the intention to purchase EV responses ranging from 3 to 18 with a mean of 7.2 and median of 7.0 and the hybrid index ranging from 3 to 17 with a mean of 7.2 and median of 7.0. Nevertheless, these values indicate purchasing intention that well exceeds the level of ownership of EVs and HEVs currently in London. This is likely due to two factors - the oversampling of London Electric Vehicle Association members and self-selection bias. Those who are already leaning towards an EV or HEV purchase are more inclined to fill out this type of survey.

Figure 2. Median and quartiles for the three intention to purchase indexes.

Results by hypothesis

The results are organized according to the two main hypotheses to determine if social group interactions and municipal intervention variables are associated with our intention to purchase indexes in both bivariate analysis multivariate linear regression models.

H1a: Attitudes towards social network influencers predicts intention to purchase an EV or HEV.

Table 2 shows the bivariate Pearson correlations between each predictor variable and each dependent variable while Table 3 shows the same relationship after a stepwise linear regression procedure which had the variables entered the model in blocks in the order listed in Table 2.

There is considerable support for hypothesis 1a in the sense that not only are the proximal and distal social influence indexes significantly correlated with each of the three dependent variables, but they are also significant predictors in the final regression models for all three. That is, in Table 2 the proximal social influence index is significantly associated with the intention to purchase either an EV or HEV (.768**) EV (.716**) and HEV (.655**) variables and so is the distal social influence index: either an EV or HEV (.672**), EV (.660**) and HEV (.545**). Table 2 also shows that each item within each of these indexes is significantly associated with these dependent variables with Pearson correlation scores ranging from .229** to .736** for the measures that make up the proximal influence index and from .162** to .630** for the measures comprising the distal influence index. This is not surprising, given the high Cronbach alpha scores for each of these indexes. Ironically though, the lowest correlations are for the items within the indexes directly relating to influence (PSII4, PSII8, DSII4, DSII8), “my [family/friends/neighbours/coworkers] has influence over my vehicle purchasing behaviour” with correlations all below .35; nevertheless, they are all significant at the 0.01 level. The highest correlations are for the measure, “How often do you have conversations

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with [family/friends/neighbours/coworkers] about [HEV/EV]", (PSII2, PSII3, PSII6, PSII7, DSII2, DSII3, DSII6, DSII7) with all Pearson scores significant and above .35.

Only the indexes are included in the three regression models (Table 3) and both social influence indexes are significant in all models. That is, the proximal social influence index is a significant predictor of the intention to purchase an EV or HEV (.405**) an EV (.179**) or a HEV (.393**); while the distal influence index is a significant predictor of the intention to purchase an EV or HEV (.241**) an EV (.219**) or a HEV (.142*). It is important to note that these two indexes are among only a handful of significant variables remaining in the models with the EV or HEV model having only three other predictors importance of *long-term cost savings* (.113*), "EV and HEV prices should be *provincially subsidized* (.324**) and importance of *environmental impact* (.176**).

The EV intentions model has the most with eight predictors total, the six other predictors being attitudes towards: *range anxiety* (-.170**), importance of *long-term cost savings* (.207**), EV should be *provincially subsidized* (.276*), importance of *look and feel* (.112**), importance of *environmental impact* (.193**), and would attend *City information session* on plug in vehicles (.161**). The intention to purchase a HEV has five significant predictors only, the other three being: importance of *environmental impact* (.126*), *City promotion* of EV and HEV (.141*), and *City designated hybrid parking* (-.167**). All these models perform rather well, with adjusted R^2 values of .687 (EV or HEV purchase intentions), .741 (EV purchase intentions) and .521 (HEV purchase intentions) with the least variance explained for the HEV model. The reason likely has something to do with the fact that items like *range anxiety* and *designated parking for charging* do not necessarily relate to HEVs since most sold in London, Canada are not yet plug-in hybrids (PHEV).

For H1a, regarding attitudes towards social influences the point of the modelling is to determine

if the social influence indexes remain significant in these models when "the usual suspects" predictor variables are also included, and indeed that is the case.

H1b: Proximal social networks (family and friends) will have more impact than distal social networks (neighbours and coworkers).

There is little support for hypothesis 1b. The proximal social network influence index has a minimum of 8 and maximum of 47 with a mean of 28.2 and a median of 29, while the distal social network influence index has a wider range - minimum 10 and maximum 54 with a mean of 24.4 and median of 22. The box plots show that the proximal index has greater skew towards high influence over intention to purchase either an EV or HEV as we would expect for hypothesis 1b, but the interquartile range still overlaps considerably indicating that the difference is not significant.

Boxplots for Social Influence Indexes

Figure 3. Median and quartiles for the proximal and distal social network influence indexes.

What is most telling though is the role played by these variables in the three models: all cells in Table 3 show statistically significant results and no clear pattern of difference between the standardized regression coefficients. That is, while for the pooled

Table 2. Bivariate Correlations for Intention to Purchase Alternative Fuel Vehicles

Variables	POOLED Intention to Purchase EV or Hybrid Index	Intention to Purchase EV Index	Intention to Purchase HEV Index	Mean (Median)
Attitude to SOCIAL influence groups				
PROXIMAL Social Influence Index (PSII)	.768**	.716**	.655**	28.1 (29.0)
PSII1 How often conversations with family about EV ¹	.712**	.7299**	.532**	2.9 (3.0)
PSII2 How often conversations with family about HEV	.699**	.613**	.639**	2.9 (3.0)
PSII3 How often are those conversations with family positive	.653**	.606**	.561**	4.7 (5.0)
PSII4 My family influence over vehicle purchase behaviour	.253**	.229**	.239**	3.8 (4.0)
PSII5 How often conversations with friends about EV	.721**	.736**	.542**	3.0 (3.0)
PSII6 How often conversations with friends about HEV	.714**	.653**	.618**	3.0 (3.0)
PSII7 How often are those conversations with friends positive	.630**	.555**	.570**	4.9 (6.0)
PSII8 My friends influence over vehicle purchase behaviour	.341**	.300**	.318**	2.7 (2.0)
DISTAL Social Influence Index (DSII)	.672**	.660**	.545**	24.4 (22.0)
DSII1 How often conversations with neighbours about EV	.551**	.604**	.369**	1.9 (1.0)
DSII2 How often conversations with neighbours about HEV	.504**	.482**	.415**	1.8 (1.0)
DSII3 How often are those conversations with neighbours positive	.516**	.515**	.399**	2.8 (1.0)
DSII4 My neighbours influence over vehicle purchase behaviour	.215**	.182**	.216**	1.6 (1.0)
DSII5 If my neighbour owned an EV/HEV I would engage them about it	.394**	.383**	.325**	5.0 (5.0)
DSII6 How often conversations with coworkers about EV	.618**	.630**	.462**	2.3 (2.0)
DSII7 How often conversations with coworkers about HEV	.572**	.507**	.512**	2.1 (1.0)
DSII8 How often are those conversations with coworkers positive	.535**	.500**	.458**	3.3 (1.0)
DSII9 My coworkers influence over vehicle purchase behaviour	.162*	.141*	.169*	1.83 (1.0)
DSII10 My supervisors influence if they owned an EV/HEV	.312**	.256**	.312**	2.19 (1.5)
Attitude to DETERRENTS				
Influence of Range Anxiety	-.348**	-.516**	-.059	5.16 (6.0)
Attitude to FINANCIAL characteristics				
Importance of Purchase Price	-.137*	-.136*	-.098	8.1 (9.0)
Importance of Long Term Cost Savings	.382**	.449**	.227**	5.5 (5.0)
Would purchase an EV if no financial constraints	.516**	.583**	.323**	4.4 (5.0)
Would purchase an HEV if no financial constraints	.347**	.178**	.461**	4.6 (5.0)
Provincial Subsidies	.560**	.584**	.418**	4.5 (5.0)
Federal Subsidies	.443**	.481**	.310**	4.6 (5.0)

Table 2 Continued

Variables	POOLED Intention to Purchase EV or Hybrid Index	Intention to Purchase EV Index	Intention to Purchase HEV Index	Mean (Median)
Attitude to STATUS				
EV/HEV are now Mainstream	.344**	.318**	.291**	3.5 (3.0)
EV/HEV are Cool to Own	.445**	.452**	.332**	3.9 (4.0)
Importance of Vehicle Look & Feel	-.208**	-.180**	-.193**	5.0 (4.0)
Importance of Vehicle Prestige	-.159*	-.122	-.162*	1.7 (1.0)
Attitude to ENVIRONMENTAL impacts				
Importance of Environmental Impact	.530**	.561**	.386**	4.5 (4.0)
Attitude to Other Vehicle Characteristics				
Importance of Vehicle Quality	-.045	-.086	-.003	7.7 (8.0)
Importance of Vehicle Functionality	-.184**	-.227**	-.095	6.8 (7.0)
Importance of Vehicle Brand Loyalty	-.253**	-.231**	-.227**	3.1 (2.0)
Importance of Vehicle Safety	-.066	-.113	-.004	6.8 (7.0)
Importance of Vehicle Mileage/Fuel volume	.024	-.038	.086	6.0 (6.0)
Attitude to MUNICIPAL policies/outreach				
City Promotion	.613**	.605**	.491**	4.5 (5.0)
City Chargers	.355**	.356**	.274**	4.4 (5.0)
City Designated Parking EV	.556**	.576**	.428**	4.1 (4.0)
City Designated Parking Hybrid	.364**	.369**	.276**	4.3 (4.0)
City Info Session	.598**	.647**	.424**	3.9 (4.0)
City Test Drive	.411**	.393**	.341**	4.3 (5.0)
City Information Centre	.452**	.426**	.382**	4.4 (5.0)
Sociodemographic				
Gender	-.010	-.028	.015	N/A ²
Age	-.181**	-.182**	-.141**	N/A
Income	.128	.134*	.088	N/A
Education	.104	.062	.120	N/A
Employment	-.107	-.140*	-.051	N/A
People Living in Household	.159*	.118*	.173**	N/A
Number of Vehicles Owned	.006	.012	.014	N/A

* significant at the 0.05 level, ** significant at the 0.01 level

¹ - these individual items comprising each of the social influence indexes were not entered into the models

² - N/A - cannot be calculated as they are ordinal or categorical, see Table 1

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Table 3. Final Regression Coefficients for Likelihood to Purchase Alternative Fuel Vehicles¹

Variables	POOLED Intention to Purchase EV or Hybrid Index	Intention to Purchase EV Index	Intention Purchase Hybrid Index
Attitude to SOCIAL influence groups			
PROXIMAL Social Influence Index (PSII)	.405**	.179**	.393**
DISTAL Social Influence Index (DSII)	.241**	.219**	.142*
Attitude to DETERRENTS			
Influence of Range Anxiety	REM ¹	-.170**	DNI
Attitude to FINANCIAL characteristics			
Long Term Cost Savings Importance	.113*	.207**	REM
Provincial Subsidies	.324**	.276*	REM
Federal Subsidies	-.205 ^{ns}	-.204 ^{ns}	REM
Would purchase an EV if no financial constraints	REM	.087 ^{ns}	DNI
Would purchase an HEV if no financial constraints	REM	DNI	REM
Attitude to STATUS			
Importance of Look & Feel of Vehicle	REM	.112**	REM
Attitude to ENVIRONMENTAL impacts			
Importance of Environmental Impact	.176**	.193**	.126*
Attitude to MUNICIPAL policies/outreach			
City Promotion	REM	REM	.141*
City Information Sessions	REM	.161**	REM
City Designated Parking Hybrid	REM	DNI	-.167**
ADJUSTED R ²	.687	.741	.521

^{ns} = not significant, DNI = did not include, not conceptually relevant, * p< 0.05, ** p< 0.0

¹REM = variable removed from model during the stepwise procedure - p>0.05 removal threshold

² = Although all but the DNI variables were entered in the regression model, this table only shows the variables that remained in the final model of the stepwise regression procedure

EV or HEV model the proximal social influence index has a higher standardized regression coefficient (as expected from Figure 1) .405** proximal compared to .241** distal and there is a similar ordering for the HEV model .393** proximal compared to .142* distal; for the EV index the relationship flips with a lower value .179** for proximal compared to .219** distal. Thus, there does not appear to be a consistent effect of closer social networks having greater influence over intention to purchase EV or HEV.

H2: Attitudes towards municipal EV and HEV policy interventions (e.g., promotion, infrastructure) predicts intention to purchase an EV or HEV vehicle.

There is modest support for the municipal policy interventions hypothesis. While the bivariate correlations show that there seems to be overwhelming support for the range of policies (Table 2), the modelling sifts out most of those variables (Table 3). That is, all seven of the municipal policy measures in Table 1 are significantly correlated with the intention to purchase EV, HEV, and EV or HEV dependent variables with correlations ranging from .274** (City chargers X HEV) to .647** (City info session X EV).

What is more telling is the models which show that none of the seven municipal policy variables is predictive in the pooled model, whereas for the EV model only interest in attending *City information sessions* about EV (.161**) is statistically significant and for the HEV model only two municipal variables are significant, preference for more *City promotion* of EV (.141*) and *City designated parking for hybrids* (-.167**). However, the one concerning parking is in the opposite direction from hypothesized, suggesting that those inclined towards HEV purchases feel that special parking is a counter-incentive. Thus, while there is some support in these findings that information and promotion may have a positive influence on pushing those intending to purchase an EV or HEV to follow through, the other forms of policy support do not significantly distinguish those who intend to

purchase EVs or HEVs from those who do not. The lack of predictive power for *City chargers* and hands-on *City test driving events* is conspicuous for the fact that other studies have shown such factors to be important.

The purpose of this paper is to specifically test the roles played by different social networks and municipal policy on intention to purchase EV or HEV. Thus, all of the other variables in the analysis are there mainly as controls. We have already noted above the significant variables in the three regression models, and the list is relatively modest with only two from the attitudes to financial characteristics block being significant in any model - specifically, *long-term cost savings* and *provincial subsidies*; *range anxiety* as a deterrent for the EV model, one measure of status for the EV model - *importance of look and feel*, and the *importance of environmental impacts* for all models. All these relationships are in the direction expected in relation to the typical findings in the literature. Interestingly, none of the sociodemographic predictors like *age*, *gender*, *education*, and *income* were significant predictors, suggesting that these may not be as important as their attitudes.

DISCUSSION

Despite oversampling for EV ownership and the usual self-selection bias for survey research, the intention to purchase EVs or HEVs in London, Canada is relatively low. As with many places without adequate subsidies, London is still in the early adopter stage and will likely remain there without such incentives (Jones, 2019).

Hypothesis 1a – Social Influence

The social influence hypothesis addresses the call from researchers like Axsen et al. (2009, 2019) and Rezvani et al. (2015) to further tease out the nuances of the effects of social networks processes on intention to purchase EV and HEV. Our local scale survey findings contribute to a growing list of studies which show the very strong effect of social networks on intention to purchase EVs and HEVs (Axsen et al., 2013; Chen et al., 2016; Coffman et

al., 2016; Klöckner, 2014; Liao et al., 2017; Rezvani et al., 2015). We add to this body of work by dividing social influence in terms of their social location making the conceptual distinction between proximal social influence (family and friends) on the one hand and distal social influence (neighbours and coworkers) on the other (Figure 1).

The core of our design involves the well-known and used TPB, but measures of social influence in those studies can be somewhat indirect whereby, for example, Chen et al. (2016) measure subjective norms (e.g., “most of my friends think I should save electricity”) and descriptive norms (e.g., “my close friends save electricity”) while Klöckner (2014) similarly measures social norms as “people around me (family, friends, work, school) expect of me that I buy an electric car.” We measure social influence in a robust and slightly more direct way asking about three dimensions - the *frequency of conversations*, whether those *conversations were positive* and perhaps most importantly, whether the social group is *perceived to “have influence over my vehicle purchasing decisions.”* Our findings suggest that social influences are among the strongest and most consistent predictors of EV/HEV purchasing intentions in the sense that they are the only variables besides *importance of environmental impact* that are statistically significant in all three models - models that include many attitude measures shown to be significant in other studies: range anxiety, financial characteristics of the vehicles, status, and various sociodemographic factors.

Beyond what our hypotheses test, these findings generally suggest that government subsidies, range anxiety, environmental impacts, the look and feel of the vehicle, are among the most important predictors. Lin and Wu (2018) likewise find subsidies are important and while in other contexts the role of subsidies seems slightly more ambiguous (e.g., Chen et al., 2016; Coffman et al., 2016; Helveston et al., 2015), our findings suggest a strong role in the Canadian context in a population that recently had provincial subsidies for EV/HEV removed (Jones, 2019). We were somewhat

surprised that the other status/identify measures relating to “cool,” “prestige,” and “mainstream” did not figure more heavily in the models - suggesting that beyond costs there is a *je ne sais quoi* that buyers look for, and they only know it when they experience it. We come back to this “experiencing” in relation to test driving, in the next section.

Hypothesis 1b – Proximal is more important than distal social Influence

We found little evidence to support the notion that social networks closer to an individual have more influence on EV and HEV purchase intentions (Hsu et al., 2013). The lack of proximal and distal social influence conceptual distinction may be real or may be more nuanced and interact with other dimensions. For example, those who are concerned about environmental impacts may be more influenced by wider/distal groups while those concerned about status may be more influenced by closer/proximal groups. Our case centres on positive influence only while there may be interaction between positive/negative influence and proximal/distal or some other form of social network grouping. That the social influence indexes are strongly significant suggests teasing out social influence is worth exploring further.

Social *processes* should likely be at the heart of this exploration, as per Axsen et al. (2013): “*diffusion*, the sharing of BEV-related information; *translation*, the discussion of uncertain BEV benefits and drawbacks; and *reflexivity*, the relating of BEV technology to self-concept” (p. 96) [emphasis added]. This will likely require more dialogical methods than surveys. With such methods in mind, what is not common in the literature is a characterization of the moment that current EV/HEV owners made the decision to buy an EV in particular. While Klöckner (2014) encourages longitudinal research and Liao et al. (2017) and Rezvani et al. (2015) remind us that attitudes should not be treated as static, there still seems to be little to no research that recounts the decision-making moment along with the events and personalities leading up to it. Such research could be key for understanding how EVs and HEVs innovations

reach fuller stages of adoption (Hagman et al., 2016; Noel et al., 2019).

Hypothesis 2 – Municipal Influence

The municipal influence hypothesis draws from all three of our theoretical frameworks. The broad community energy planning framework sets a context for categorizing variables that have appeared in TPB and other studies - specifically by parsing out those which may be influenced by municipal policy levers. In the most practical sense, our partner, the City of London, wanted to know what city investments might increase EV and HEV purchases at a time when ownership in these categories is extremely low and pressures to act on carbon reduction are increasing.

Consistent with Liao et al. (2017), our regression analysis provides limited support for the idea that municipal policies, particularly charging stations and designated parking, have significant impacts when considered alongside our other variables. The only significant predictors relate to knowledge and information sharing with the *City promote* “My municipality should take a more active role in promoting EV/HEV” significant in the HEV model and the *City information sessions* “If my municipality was to run an EV/HEV information session in my community, I would attend” significant in the EV model. This is consistent with a range of empirical studies and reviews that suggest potential buyers want information and further that they want to be continually updated on innovations (Bakker & Trip, 2013; Coffman et al., 2016; Rezvani et al., 2015; van Rijnsoever, 2009).

Hagman et al. (2016) and Lane and Potter (2007) argue that incorrect knowledge is a barrier to EV and HEV adoption (e.g., fuel usage and long-term costs - total costs of operation), while Coffman et al. (2016) and Bakker and Trip (2013) suggest that municipalities could play a key role informing the public about EV and HEV benefits. Thus, our finding supports this from the other side, that indeed consumers desire up-to-date vehicle information and further, that their municipalities are trusted to play a role in providing/facilitating it. The idea of

holding events in particular is consistent with the Axsen et al., (2013) *diffusion* and *translation* of information processes - that discussion with trained experts can help potential consumers reflexively decide if/how a vehicle fits with their self-image. Whereas we only asked if e.g., test drive events are desired, future research should explore the actual effects of test drive events and that they have important trickle-down effects on purchases within social networks.

While the *designated parking HEV* “I would be more inclined to buy an HEV if my municipality had more designated parking spots” was statistically significant the sign is unexpected such that those who have a greater intention to purchase an HEV, do not feel the need for special parking. Indeed, there would be potential practical advantages for PHEV in particular if combined with charging. This reinforces the needs to tease out PHEV from other hybrids in future research. While being conspicuous may be one of the factors influencing HEV ownership (Noel et al., 2019), our data suggest that privilege parking spots is not one of them - but that may depend on the need for plug-in and access to charging in such parking spots.

LIMITATIONS

We review five limitations to this study. First, like many studies in this literature our dependent variables focus on intentions rather than actual purchasing behaviour, a key difference being that we oversampled for EV ownership as by sending the survey specifically to the local EV enthusiast organization.

Second, as with all surveys, the sample is prone to self-selection bias - those who are already most interested in EV or HEV would be the most likely to complete our questionnaire. The fact that our intention to purchase EV and HEV indexes are both skewed to the lower end of the scale (low intention to purchase) suggests that this may not entirely be the case.

Third, the sample is relatively small (only from London, Canada), and has a higher proportion of

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respondents who are male, middle-aged, higher income, larger households, married, better educated, and retired than both the City and National populations. Our sample is thus skewed towards higher intentions to purchase EVs and HEVs (de Rubens, 2019), while our city-wide study adds a new dimension to studies in the literature which understandably focus in other ways e.g., on younger university and college-aged students (e.g., Chen et al., 2016; Egbue & Long, 2012) - i.e., the next generation of adopters - and those who work in the technology sectors (e.g., Axsen et al., 2013).

Fourth, at 11% our response rate is low, and though such rates have become commonplace, we want to highlight that our mail back (paper) response rate was much higher than our online one - we suspect partially because respondents had to type in the short link to the questionnaire.

Fifth, we chose not to separate out HEV into those that plug in (PHEV) and those that do not. Blending PHEV with non-plug-in hybrids likely impacted the performance of HEV model - e.g., issues like range anxiety and charge infrastructure.

Our questionnaire is designed to include several control variables so adding another category of vehicle would have made it too long (response rate). That said, we are certainly not suggesting that our HEV findings here apply to PHEV. In fact, the differences in predictors that emerge in our EV compared to HEV models suggest otherwise if we assume PHEV will take on some of the characteristics of EV in the minds of consumers. Future research into social and municipal factors would do well to distinguish PHEV from HEV and EV (Hardman et al., 2017).

CONCLUSIONS

There are at least three key policy implications to this work. First, our social influence findings suggest that those interested in promoting EVs and HEVs should consider messaging that centres on current owners of EVs and HEVs interacting within their social networks. Of course these promoters need not be just municipalities; in fact the

manufacturers, industry organizations and higher levels of government are perhaps best positioned for such promotion.

Second, and dovetailing with the first, municipalities in Canada should consider the small roles they might play in providing up-to-date information about these vehicles, including demonstration through tangible action like municipal EV fleet purchases. The information they provide might include real-world owner data (testimonials) to ensure consumers are not stuck on old thinking about constantly evolving technology (e.g., battery range and charge time). Future research might include piggybacking on direct municipal interventions, such as information sessions and test drive events, which are meant to increase EV/HEV uptake along with measurement of the impacts on those attending using, for example before and after questionnaires/interviews.

Third, the strongly positive effect of subsidy programs on EV purchasing intention is worth noting, as it supports the fact that higher levels of government who can better afford subsidy programs, will likely move the needle most on EV purchasing. This suggests that while municipalities may be able to help move EV and HEV adoption into the “mainstream” by highlighting the performance and environmental advantages of EV and HEV that this study shows are appealing, they cannot likely do it in the short term without sizable provincial/federal financial incentives to ensure the total costs of these vehicles makes economic sense to consumers.

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NOTES ON CONTRIBUTORS

Jordan Fuller is a Western University alumnus where he works as GIS Technical Specialist, primarily focused on the Northern Tornadoes Project. He previously completed a BA in Environment and Human Health and a MA in geography, and graduate certification in GIS.

Jamie Baxter is a social environmental geographer and professor interested in attitudes towards technologies. His studies interrogate the social construction of risk and the interplay of environmental policies and social practice in everyday life.

Jamie Skimming is the Manager of Energy & Climate Change at the City of London, Ontario. His position is responsible for the municipally-led climate change mitigation programs for London, Ontario.

CORRESPONDING AUTHOR

Jordan Fuller
Department of Geography and Environment
University of Western Ontario
Email: jfulle32@uwo.ca

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