



PURCHASING FUEL EFFICIENT VEHICLES IN CANADA

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Introduction

The purpose of this report is to review recent literature related to how consumers make vehicle purchasing decisions, in order to provide advice about how consumers can be convinced to purchase more fuel efficient vehicles. To enhance our understanding of consumer attitudes and choices related to fuel efficiency, this paper will also examine attitudes and behaviours toward the environment, other travel modes that reduce fuel consumption, and consumption of other natural resources. The overall objective is to gain a better understanding of consumer decision processes with regard to selecting fuel efficient vehicles.

The report will begin by reviewing the basics of consumer decision-making processes and strategies as well as consumer decision-making models, in order to provide a framework for understanding consumer decision-making in the context of the automotive market.

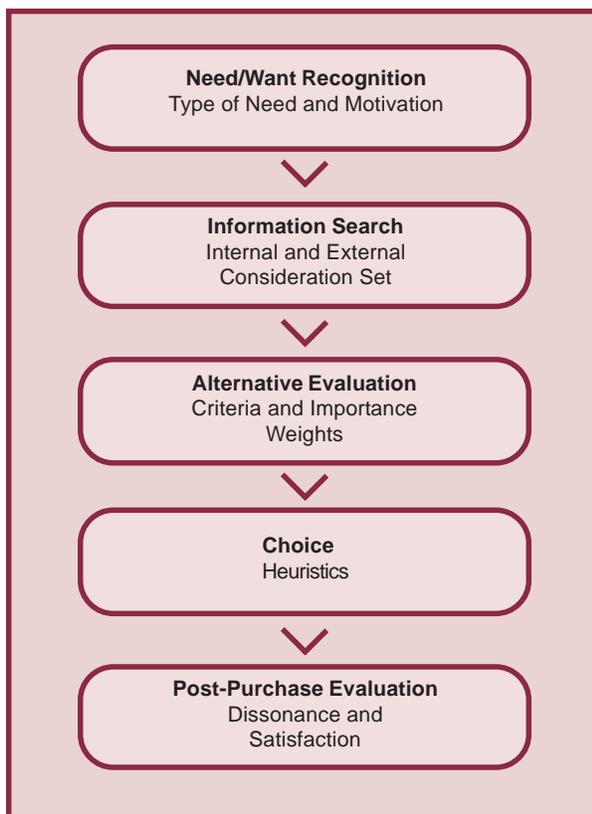
Subsequent sections of the report will review the specific literature on decision-making with regard to consumer automotive purchases, the market for highly fuel efficient vehicles (FEVs) and alternate fuel vehicles (AFVs), and vehicle purchasing market segments. The report will then examine some lessons from other environmental decision making areas (e.g., recycling, transit choices, water conservation). Finally, the foundations of social marketing theory will be outlined to provide context for conclusions regarding current consumer behaviour relating to fuel efficiency and recommendations regarding how to encourage consumers to make more fuel efficient vehicle choices.

Consumer Decision-making and Choice Models

The Decision-making Process

Regardless of the type of purchase, the consumer decision-making process generally involves five steps: need recognition, information search, alternative evaluation, choice, and post-purchase evaluation (see Figure 1). Although the diagram shows this as a linear process, it should be noted that for different types of purchases this process may be more or less thorough, some steps may be skipped, and steps may be completed in tandem or cyclically, depending on the decision being made.

Figure 1: Consumer Decision-making Process



Source: Adapted from Solomon et al.(2009); and Solomon, Zaichowsky and Polegato (2008).

Need recognition takes place when one either recognizes a decrement in one's personal comfort level or aspires to increase one's personal comfort level (Bruner and Pomazal, 1988). In the first instance, if one's car were to break down, the functional and possible social benefits derived from having a personal mode of transport are lost, thus diminishing one's personal situation. Alternatively, one may aspire to further increase one's personal situation by fulfilling a need or want that is not currently being met. For example, one who has limited resources and is forced to take public transit may aspire to own an automobile and the added personal freedom and status that goes with it. There are three main categories of need: functional, symbolic, and experiential (Park, Jaworski and McInnis, 1986). Functional needs are those which we require to solve problems and provide concrete benefits such as satiety, safety, and protection from the elements. Symbolic needs are related to status and how one desires to be seen by others, such as name brands, status symbols, and luxury items. Experiential needs involve meeting the human need for stimulation and variety, such as entertainment products and modifications to existing products. All three types of need may be met by a single product. The benefit it provides is driven by the consumer's motivation for purchasing it.

Information search may be both internal and external. Internal search involves searching one's memory for information relevant to meeting a recognized need. Recalled information may be stored in memory and processed either by brand or by product attribute. It may also be related to personal experience, experiences of others, word of mouth, or marketer driven communication. External sources of information may include the media, the

internet, word of mouth from other consumers, or marketer driven sources such as salespeople or advertising. The consumer searches for information until the value of any new information is perceived to be less than the cost of obtaining it (Simonson, Huber and Payne, 1988). Information search is often conducted in tandem with, or in a cyclical process with, alternative evaluation.

Alternative evaluation is generally said to involve comparing the attributes of all products in a consideration set against a set of weighted decision criteria. Determinant attributes are those that have the highest importance weights, and therefore the biggest impact on the purchase decision. However, relevant attributes will vary depending on the characteristics of the decision-maker. Market segmentation is a technique that allows marketers to group consumers based on similar characteristics so that marketers may better understand consumer decision-making behaviour.

Choice requires using decision heuristics and rules to ultimately choose between alternatives using one’s evaluative criteria. Heuristics are mental rules of thumb that we develop with experience. For example, we often equate quality with price, and equate small cars with fuel efficiency. These rules simplify the decision process, as do decision rules that allow for quicker elimination of possible alternatives from the consideration set. Decision rules fall into two basic categories. When employing compensatory strategies, good performance on one attribute can make up for (or compensate for) poor performance in another area. In non-compensatory strategies, failure on some aspects can not be compensated for by other attributes. Examples of some common decision rules may be found in Table 1 (Payne, Bettman and Johnson, 1993).

Table 1: Some Common Decision-making Strategies

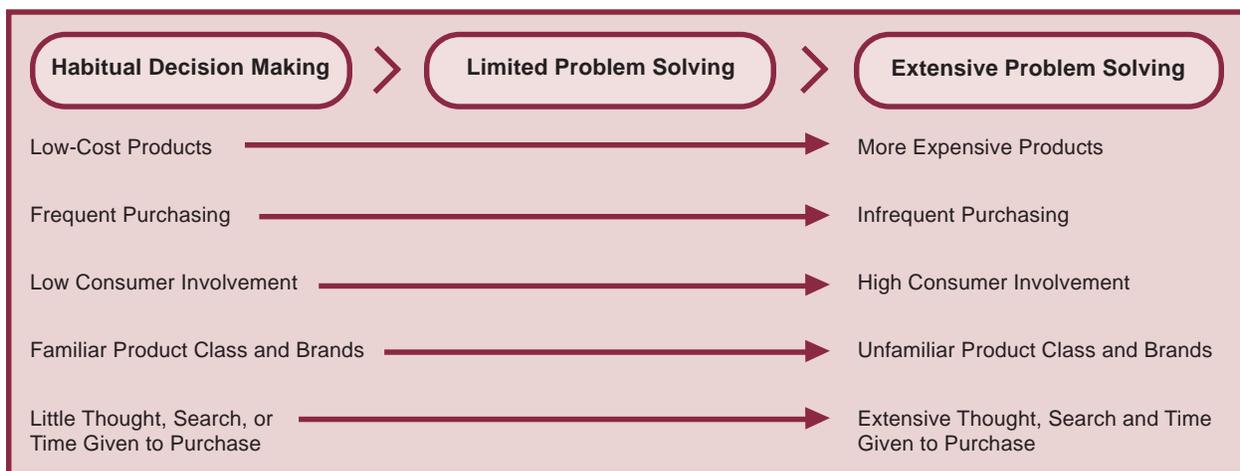
| | | |
|------------------|------------------------|---|
| Compensatory | Weighted Additive | Assign importance weights to various evaluative criteria and calculate an overall weighted score for each product based on criteria importance and evaluations. |
| | Simple Additive | Simply add the number of positive evaluative criteria each product has, without weightings. |
| Non-compensatory | Lexicographic | Choose the product with the highest evaluation on the most important attribute. In case of a tie, the same process is followed for the next important attribute on the remaining tied alternatives. |
| | Elimination by Aspects | Remove alternative products from the consideration set when they do not meet a minimum cut off for each criterion. Criteria are applied in order of importance. Eliminations continue until only one product remains. |
| | Conjunctive | The first identified brand to meet or exceed a set of minimum standards on a predetermined set of criteria is chosen. |
| | Disjunctive | The first product to score exceedingly high on at least one evaluative criterion is chosen. |

Post-purchase evaluation involves determining whether or not a product lived up to one's expectations. If expectations are met, the consumer is satisfied; if expectations are not met, the customer is dissatisfied (Oliver, 1980). If expectations are immensely exceeded, the customer may be delighted (Oliver, Rust and Varki, 1997). Dissonance occurs when the consumer second guesses or regrets their choice. Marketers in the automotive industry devote significant resources toward mitigating dissonance and solidifying longer term customer service relationships.

Decision processes fall on a continuum of time and effort expended (see Figure 2). At one end, extended problem solving involves highly complex decisions that expend high levels of time and effort. This time and effort is intended to help mitigate personal, physical, financial, social, or performance risks. These decisions tend to involve high levels of risk or personal involvement with the product category, for purchases such as automobiles, expensive electronics, and houses. In the middle of the continuum lies limited problem-solving, in which consumers are not motivated to conduct a complete and rational analysis, but will instead rely on decision rules or heuristics to simplify choices that are less

risky than their extended problem solving counterparts. These purchases generally include products such as clothing, which are lower cost, more familiar, less risky, and less involving than extended problem solving categories. Variety seeking, affect, and familiarity with the category makes these sorts of purchases more common or frequent, but the decisions still carry some degree of risk, such as the social risk associated with poor fashion choices. However, in some cases limited problem solving may include traditionally extended problem solving product categories, such as second vehicles, which may be seen as more familiar and less risky as a result of learning from previous purchases. Habitual decision-making (also called routine response behaviour) lies at the other end of the continuum. These decisions tend to be made often for commonly purchased, low risk items such as fast moving consumer goods like groceries and personal care items. In habitual decision-making, problem recognition may lead directly to automatic re-selection of a preferred brand drawn from memory, or trial and error may be seen as less costly than the time and effort required by the search and evaluation process. Some automobile purchasers do rely on brand loyalty and automatic repurchase when a vehicle requires replacing.

Figure 2: Levels of Extensiveness in Consumer Decision-making



Source: Solomon, Zaichowsky and Polegato (2008).

Relevant Choice Models

Consumer decision-making involves three fundamental elements: thinking (cognition), feeling, (affect), and doing (behaviour). The order and significance of each aspect varies according on the type of decision being made.

Rational Choice Theory

Multi-attribute models of decision-making suggest that all consumer decisions are made by maximizing utility. This process of maximizing utility includes assigning importance weights to chosen decision criteria, evaluating complete information about all relevant products and their attributes, and then selecting the product that provides the most benefit according to the consumer's weighted criteria. Clearly, consumers can not apply this lengthy process to all decisions. In fact, they rarely employ them in even the most highly complex of decisions. Instead, consumers use the simplified decision rules or heuristics discussed previously to manage the evaluative process.

Bounded Rationality

Consumer decision theorists recognized long ago that rational choice theories from the economics field were inaccurate representations of consumer choice processes (see for example, Kahneman and Tversky, 1979). Instead, the concept of bounded rationality (the assumption that decision-makers have limited processing capacity with which to make decisions) prevailed (Simon, 1955; Payne, Bettman and Johnson, 1993; Luce, Bettman and Payne, 1999).

Typical consumer decisions involve a set of alternatives and the willingness to trade off attributes. Difficulty increases with the number of alternatives, the number of attributes available for trade-off, and the level of

uncertainty involved. These more difficult decisions are associated with extended problem-solving as discussed previously. Bounded rationality assumes that people choose decision strategies depending on their willingness to compromise between making a good decision and the effort required to do so (called the accuracy/effort approach).

Decision strategies themselves are made up of six properties:

1. They are either compensatory (are based on trade-offs between attributes) or non-compensatory (existence of one attribute can not compensate for lack of another).
2. They may be consistent (use the same amount of information about each alternative) or selective (may have a varying amount of information about each alternative).
3. The total amount of processing involved may vary from cursory examination to exhaustive study of all attributes.
4. Processing may be done based on product alternatives or individual attributes.
5. Explicit evaluations may or may not be formed for each alternative.
6. The strategy may include quantitative (mathematical) or qualitative (comparative) reasoning.

Several common decision strategies are discussed at length in Payne, Bettman and Johnson (1993) and have been outlined in Table 1.

It is now becoming more recognized and accepted that most decisions that consumers make are not done in a deliberative manner as previous theories have suggested (Chartrand and Bargh, 2002; Loewenstein, 2001). Even automobile purchasing decisions may be far less logical and involved than one might assume.

Affective Choice Theories

While the previously discussed rational and bounded rationality models assume a think–feel–do response order in decision-making, not all choice models assume that cognition provides the foundation to all choices. Affective models assume that emotional and instinctive responses can lead to feel–do–think or feel– think–do decisions. In feel– think– do scenarios, emotional shopping is rationalized prior to purchase. In feel–do–think decisions, mood or “gut feel” drives choice with the intention that product usage will allow cognitive evaluation of the product. Some automobile purchasing, such as that for a sports car, may involve rationalization of an emotionally driven choice.

Personal Influences

There are various personal factors that can influence a consumer’s decision. Specifically, motivation, self-concept, lifestyle, and attitudes can all impact consumer choice.

Motivation, the Self, and Lifestyle

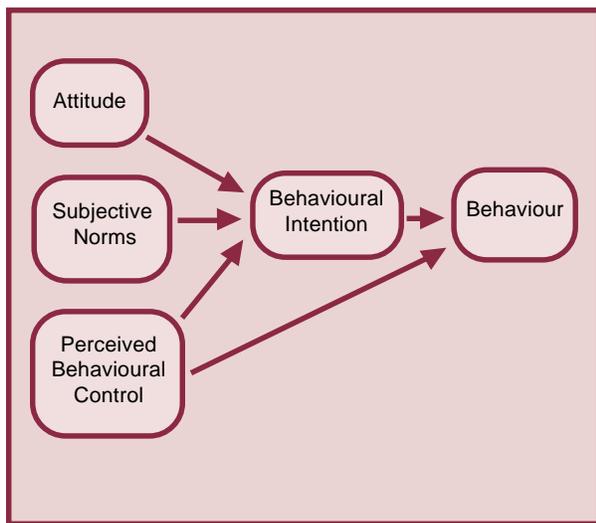
Maslow’s Hierarchy of Needs categorizes and prioritizes the various types of motives that consumers possess. They start with the most fundamental physiological needs, progress to safety needs, then on to belongingness, esteem, and self-actualization. Many symbolic needs are driven by a person’s belongingness and esteem needs, which are often linked directly to one’s self-concept. Self-concept involves many forms of the self, including the ideal self one aspires to be, and the various personal roles that make up the actual self that are a part of a consumer’s day to day life (Sirgy, 1982). Lifestyle choices, conspicuous consumption, and display of material symbols can serve to reinforce one’s self-concept, either to oneself or to others. Automobiles can serve a variety of symbolic and lifestyle needs related to one’s many roles

or selves. Some consumers may choose a vehicle to reinforce status through an expensive brand, authority or dominance through engine power, or environmental consciousness through hybrid technology or fuel efficiency. Leveraging consumers’ multiple selves and finding ways to activate more socially conscious aspects of the self during the automobile purchasing process should serve to motivate more desirable purchasing decisions.

The Attitude-behaviour Relationship

Attitudes involve both cognitive and affective components (Fishbein and Ajzen, 1975). According to the Theory of Reasoned Action, one’s beliefs about an attitude object and one’s motivation to comply with social norms related to that object work together to form a global attitude toward it. Beliefs may be cognitive (e.g., it has a good fuel efficiency rating) or affective (e.g., I like it). Attitudes have a strong impact on behaviour, both directly and indirectly through behavioural intention. Behavioural intention occurs when a consumer has made a decision but has not yet acted on it. This particular stage in the decision-making process is important because purchase intention has a relatively low correlation with actual purchase action. According to the Theory of Planned Behaviour (an extension of the Theory of Reasoned Action) a consumer’s perceived ability to act on an attitude will also directly influence behaviour (Ajzen, 1985). When purchase decisions are made in-store, salespeople are able to help persuade consumers to act on their intentions. A representation of the Theory of Reasoned Action and the extended Theory of Planned Behaviour can be found in Figure 3.

Figure 3: Theories of Reasoned Action and Planned Behaviour



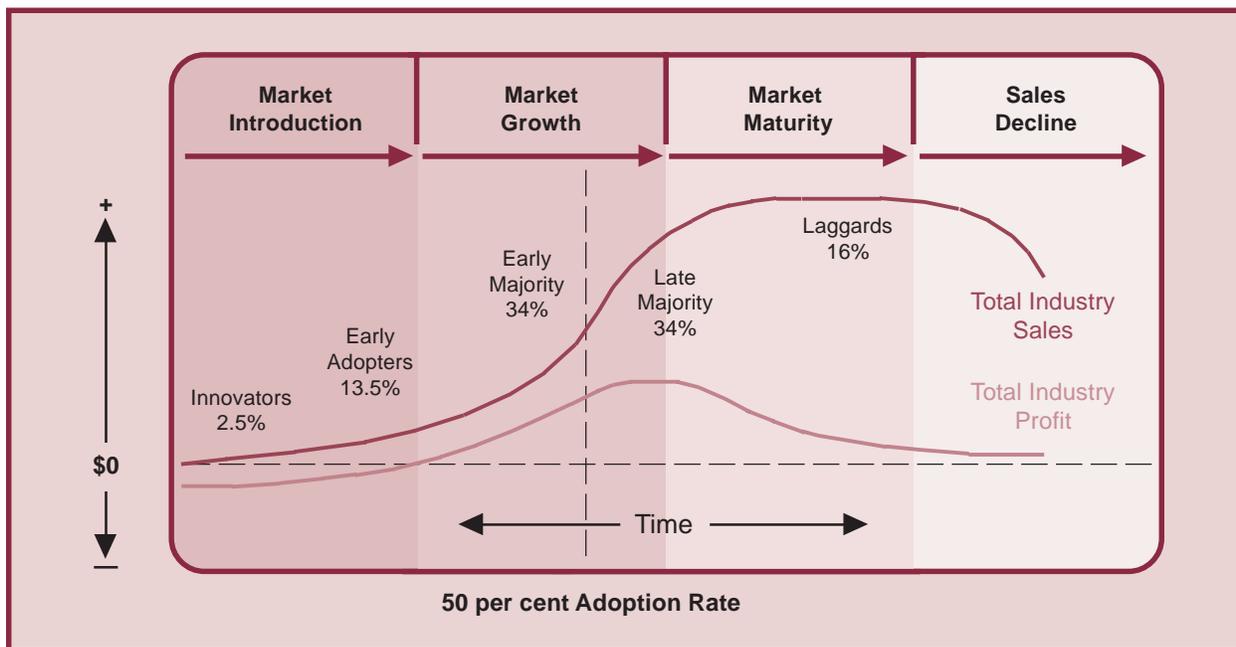
Source: Adapted from Fishbein and Ajzen (1975); and Ajzen (1985).

Note: Perceived Behavioural Control is added to the Theory of Reasoned Action to form the Theory of Planned Behaviour.

Innovation Adoption

Diffusion of innovation theory indicates a pattern by which consumers adopt new product innovations (Rogers, 1995). In correspondence with the product life cycle, as a new technology enters the market only a small number of innovators will initially purchase it (see Figure 4). As exponential early growth begins, early adopters will begin to purchase, followed by the early majority. When growth slows and a product approaches maturity, the late majority enters, followed by laggards who purchase well into the maturity phase. To speed the rate of adoption, in early stages of technology introduction, a focus must be placed on educating consumers about the product and its benefits, generating positive word of mouth and publicity through credible third party sources. Adoption rates have clear and practical importance to understanding market penetration rates of FEVs.

Figure 4: Innovation Adoption and the Product Life Cycle



Source: modified from Shapiro et al. (2002)

Social Influences

It is important to recognize that products, including vehicles, convey social meaning. Depending on the nature of a vehicle and its owner, a vehicle may hold a variety of different meanings (Fournier, 1991). For example, it may represent a social role and its associated status, or one's personal identity by representing an actual or ideal self. This is done through creating brand associations and the creation of object meaning over time (Williamson, 1978).

Reference groups, social class, culture, and marketers can all influence consumer choice. There are three general types of reference groups: aspirational, membership, and avoidance. *Aspirational groups* are those to which one wishes to belong to, but does not, such as celebrities, upper management, or the cool kids at school. Consumers often use product symbols to attempt to emulate aspirational groups. *Membership groups* are those to which a consumer currently belongs, such as family, church group, sports team or clique. While emulation is less active, there are still norms that develop within membership groups regarding things like behaviour and dress, and the opinions of one's peers are important in word of mouth information search. *Avoidance groups* are those you do not want to be associated with. These may include socially awkward or destructive colleagues whom you don't want to be seen with by other types of reference group for fear that it will slow your own career progress.

Culture and social class are higher level forms of social influence that are much more subtle than reference groups. Cultural norms are ingrained within an entire society and are very slow to change. Phrases like "throw away society" and "pedal to the metal" are examples of our acceptance of excessive waste and speeding in North America as a whole. There is also evidence that socio-economic status,

based on a combination of occupation and income, affects lifestyle, values, and shopping preferences. Thus, socio-economic status is a common basis for demographic segmentation and consumer profiling.

Market Segmentation

Market segmentation divides consumers into groups based on similar attributes. These attributes are generally categorized as geographic, behavioural, demographic, and psychographic.

Geographic segments group consumers based on issues like province, population density, or climate. Reasons for automotive manufacturers to segment by region may be due to variety in driving conditions faced by consumers (e.g., snow in winter, congestion in cities) or differing product regulations (e.g., mandatory daytime running lights). Geographic segmentation is useful as an overarching approach to understanding differing needs of rather broad market segments.

Behavioural segmentation divides consumers into groups based on product usage issues such as purchasing volume, frequency, or category. Segmenting users by usage volume or product category can help marketers to forecast market demand, but does not provide any insight into product or brand preference. Benefit sought is a useful but rarely used method of market segmentation. The benefits people look for in a product category usually loosely translate into a set of determinant product attributes for each identified market segment. In many cases, however, why those particular attributes are important may still be unclear.

Demographics include objective personal descriptors like age, gender, education level, income, and occupation. The benefit of objective indicators is that they are easily measured via surveys and are often publicly

available (e.g., via the census through Statistics Canada) and in some cases are readily visible (e.g., gender). These objective measures are often used as surrogates for psychographic and behavioural indicators. For instance, if an automobile manufacturer were to target male university students between the ages of 18–23, it would be using age, gender and occupation to predict what kind of vehicle the segment needed and could afford based on an assumed average lifestyle. The problem with this technique is that not all of these consumers will have similar lifestyles and needs from a vehicle. As such, demographics provide little insight into consumer behaviour and why particular segments of consumers make the choices that they do.

Psychographics include more qualitative personal descriptors, like lifestyle and values, which can be used to group consumers. These classification bases are much more strongly linked to consumer motivations and answering the question of “why” consumers make the choices that they do. In the car market, for example, it is more useful to know that value conscious consumers who struggle to meet the costs of basic vehicle operation are concerned about fuel economy than to know that fuel economy is of greater concern to women than men. This is because the gender demographic provides no explanation of why the difference is occurring, whereas personal values and lifestyle information helps to explain concern for fuel economy.

Consumer Automotive Purchase Decision-making

In order to understand the relevance of fuel efficiency in vehicle purchasing, one must have a broader understanding of the consumer choice process as it relates to automobiles.

Attitudes

Research suggests only moderate willingness on the part of consumers to buy more fuel efficient vehicles (DEFRA, 2008). One possible reason may be that consumers have very low awareness of how much fuel they consume or their fuel costs over time (Turrentine and Kurani, 2007) and thus don't really understand the impact that choosing a more fuel efficient vehicle would have on them. Another is that consumers seem to consistently underestimate how many miles they will drive their cars by as much as 2,000 miles per year on average (Kavalec, 1999). Some other possible reasons are convenience, self-identity, willingness to pay, and perceived personal impact.

Discrete Choice Modelling

The majority of the literature that considers how consumers choose vehicles involves discrete choice models. In fact, many studies use the same data sets to conduct different model analyses, with only about four databases being used. Most of the data analyzed was collected in California, where demand for pollution reduction strategies has made consumer willingness to adopt FEVs or AFVs an important issue. These studies are executed by either asking consumers to predict vehicle choices (stated preference) or by gathering market data on actual purchases (revealed preference). Some of the stated preference studies used experimental designs that limited the selection of vehicles to choose from, using prior survey results to tailor

options for each respondent in a phased design. The independent variables that these models use are virtually always demographic, which lends little insight into the reasons for choice. For example, knowing that women are more likely to buy more fuel efficient vehicles than men does not address the issue of why they make those choices. For example, women may buy more fuel efficient vehicles because their incomes are lower than men's and fuel efficient vehicles also tend to be smaller and less expensive. Without understanding the reasons behind these modelled associations, these models are of limited use.

With that in mind, it is useful to understand what strong and consistent associations have been found through discrete choice modelling so that we may begin to explore the underlying reasons behind these findings.

The literature on automotive decision-making divides vehicles into two categories. The first are conventional vehicles (powered by petrol or diesel). The other is labeled as AFVs, which includes such fuel options as electricity; fossil derived fuels such as liquid petroleum gas, propane and compressed natural gas (CNG), bio-fuels such as methanol and ethanol, and hybrid technologies. The literature to date provides evidence that decision-making processes for conventional vehicles and AFVs differ, thus they are addressed separately here. Because bio-fuels are not necessarily highly fuel efficient, AFVs include but are not limited to FEVs. Since several studies combine analysis of highly fuel efficient and bio-fuel options, this review is not able to entirely eliminate results relating to bio-fuels. Thus, studies that include AFVs in general (rather than FEVs exclusively) remain included in this review in the section entitled Highly Fuel Efficient and Alternate Fuel Vehicles.

Conventional Vehicles

The following section reviews literature related to automotive purchasing in general, with the intention of determining how fuel efficiency issues factor into general vehicle purchase decisions. If a study does not specify decisions relating specifically to FEVs or AFVs, the study is assumed to relate to conventional vehicles and is included here.

Discrete Choice Models

Table 2 provides a brief summary of several discrete choice models of conventional fuel vehicle purchases conducted since 1990. This review is not exhaustive, as many authors make only small modifications to their statistical models using the same data set, providing little added value to those interested in findings regarding *what* is being analyzed rather than *how* it is being done. While many other studies exist prior to the 1990s, more recent findings will be more reflective of current consumer trends. The studies in this table only consider conventional vehicles in their models, while a later section of this report reviews research on FEVs and AFVs as defined previously. The results of this review show that vehicle price, operating costs (including fuel costs and consumption), size, and acceleration are consistently significant influences on vehicle choice. A literature survey by Garcia and Balbaky (2006) reviewed consumer and vehicle attributes that were found to be important in consumer demand models and resulted in similar overall findings. These results echo the finding that 80 per cent of all Canadians believe fuel efficiency is an important attribute when making new vehicle decisions (Decima, 2004). Also consistent with these findings are reports that

annual purchasing volume in the SUV, van, and pick-up markets decreased by as much as 20 per cent in total following years that have brought significant gas price increases (West, 2007).¹ Correspondingly, sales of more fuel efficient cars rose by 20 per cent.

¹ The Congressional Budget Office (2008) calculated a very similar percentage, with purchases of light trucks in California dropping by three per cent as gasoline prices began to rise significantly.

Table 2: Discrete Choice Models Used to Predict Conventional Vehicle Purchase (1990–2008)

| Authors (Year) | Purpose | Method of Analysis | Significant Variables |
|--|--|--|--|
| Berry, Levinsohn and Pakes (BLP, 1995) | Develop a model to estimate cost and demand parameters using existing aggregate consumer-level market data | Random coefficient logit model using revealed preference (market) data | <p>Vehicle attributes that drive elasticity of demand:</p> <ul style="list-style-type: none"> ▪ Miles per dollar (MP\$) increases demand for cars with low MP\$ ratios and decreases demand for cars with high MP\$ ratios. ▪ High horsepower to weight ratio increases demand. ▪ Lower price increases demand. ▪ Vehicle size increases demand. ▪ Air conditioning (as a proxy for luxury) increases demand. |
| Berry, Levinsohn and Pakes (2004) | Builds on BLP (1995) to use both first and second choice data to predict out of sample substitution choice behaviour | Multinomial and nested logit models | <p>If the first choice model was not available, the substitute car would be chosen based on similarity on the following attributes:</p> <ul style="list-style-type: none"> ▪ Vehicle size ▪ Vehicle price |
| Choo and Mokhtarian (2002; 2004) | To model vehicle choice using not just demographics, but also personality, lifestyle, attitudinal and mobility variables | Multinomial logit model of vehicle type choice | <p><i>Demographic influences on vehicle choice:</i></p> <ul style="list-style-type: none"> ▪ Relative to other age groups, younger drivers are more likely to drive small cars and SUVs, middle aged drivers are more likely to choose minivans and pick-ups, and older drivers are more likely to choose large and luxury cars. ▪ Women are more likely than men to drive small and mid-sized cars and minivans, while men are more likely than women to choose large and luxury cars and pick-ups. ▪ Lower education levels are associate with large car, pick-up and minivan purchases, while higher education levels are associated with luxury, sports car and SUV purchases. ▪ Lower incomes are associated with small and large car purchases, middle incomes are associated with compact and large car and pick-up choice, higher incomes are associated with luxury vehicles, minivan and SUV purchases. ▪ Sales occupations lead to large and luxury vehicle purchases, professional jobs lead to smaller vehicle purchases, service jobs are associated with vans and pick-ups, and homemaking is associated with mid-sized cars and minivans. |

...continued

| Authors (Year) | Purpose | Method of Analysis | Significant Variables |
|-----------------|--|--|--|
| Goldberg (1998) | To determine how US CAFE standards affected vehicle sales, prices and fuel consumption between 1985-1990 | Nested logit model (with emphasis on 1989) | <p><i>Psychographic influences on vehicle choice:</i></p> <ul style="list-style-type: none"> ▪ Workaholics are more likely to choose pick-ups and less likely to choose small cars. ▪ Pro-environmental attitude is positively related to small car purchases and negatively related to larger vehicle purchases. ▪ Pro-high density attitude drives small car purchases. ▪ Adventure seekers are more likely to purchase sports cars than other personality types. ▪ Calm personalities are more likely to drive smaller cars. ▪ Loners are more likely to drive small cars or SUVs than minivans. ▪ Status-seeking is positively related to luxury car, sports car, pick-up and SUV choice and negatively related to smaller car and minivan choice. ▪ Frustration is positively related to pick-up purchase and negatively related to SUV purchase. ▪ Travel dislike is negatively related to vehicle purchase. ▪ Travel freedom is negatively related to smaller vehicle purchase and positively related to SUV purchase. <p><i>Behavioural influences on vehicle choice:</i></p> <ul style="list-style-type: none"> ▪ Shorter travel distances drive smaller car purchase. <ul style="list-style-type: none"> ▪ Fuel efficiency of imports was higher than CAFE standards for all years, but steadily decreased in terms of the amount by which they exceeded the standards. Domestic were unable to meet the standards. ▪ Sales of imports generally increased for both cars and trucks between 1985 and 1989, but not as strongly as originally anticipated. ▪ Estimates for CAFE penalties per domestic vehicle produced vary from a low of \$5 in 1986 to a high of \$130 in 1985 and average \$40 per vehicle in 1989. |

...continued

| Authors (Year) | Purpose | Method of Analysis | Significant Variables |
|--------------------------------|--|--|--|
| Hensher, Rose and Black (2008) | Models group vehicle choice decisions based on multiple agent preferences using unrelated male/female partners | Interactive agency choice experiment (IACE) and multiple agent discrete choice model | <p>Group decision-making process results:</p> <ul style="list-style-type: none"> ▪ Price and fuel efficiency are significant upon initial discussion. ▪ Other vehicle features (such as air conditioning, ABS brakes and manual transmission) are relevant issues later in the process. ▪ How quickly agreement is reached depends on the number of vehicles in the household, the nature of the relationship between the decision makers and expectation of agreement by the other party. |
| Kavalec (1999) | To investigate the effects of an aging baby boomer population on gas usage through vehicle choice | Stated preference experimental design and mixed logit model | <p><i>Results relate to conventional vehicles unless otherwise stated:</i></p> <ul style="list-style-type: none"> ▪ Consumers consistently underestimate their expected travel demands (by 2,000 miles per year on average). ▪ Average expected travel demand rises until age 40-49 and drops significantly after age 60. <p><i>Aging changes vehicle attribute importance:</i></p> <ul style="list-style-type: none"> ▪ The importance of fuel cost per mile fluctuates directly and positively with expected travel demands. ▪ Acceleration is more important than fuel cost per mile until age 35, at which point the importance reverses. ▪ Pick-ups, minivans and station wagons are reported as having less average utility overall than the standard car. The utility of pick-up trucks increases until the late twenties and then slowly declines until about the age of 70. Minivans and pick-ups have similar levels of utility by the late 20s and then minivans hold more utility than pick-ups. The utility of minivans and station wagons increases steadily until the early 40s and then declines exponentially thereafter. Station wagons hold less overall utility than pick-ups or minivans, despite the changes in utility for station wagons and minivans following the same pattern. ▪ Vehicle range (relating to AFVs) becomes increasingly less important until age 25 and then begins to increase again until about age 60, at which point its significance drops exponentially. |

...continued

| Authors (Year) | Purpose | Method of Analysis | Significant Variables |
|-------------------------|---|--|--|
| Kitamura et al. (2000) | To determine how ability to access activities from within an urban area affects aspects of long-term and short-term travel behaviour, including automobile use and purchase | Multinomial logit model of most recent vehicle purchased | <ul style="list-style-type: none"> ▪ Aging increases the likelihood of choosing four door and two door vehicles, wagons and vans. ▪ Men are more likely to choose pick-ups. ▪ Having a college degree increases the likelihood of purchasing a four door vehicle. ▪ Higher income is associated with SUV purchase. ▪ More household members increases the likelihood of wagon and van purchases. ▪ Accessibility of public transit is associated with four door vehicle choice. |
| Mannering et al. (2002) | To explore the motivations behind consumers' preference for leasing or buying by developing a model of vehicle acquisition decisions, including the type of vehicle choice | Nested logit of vehicle purchased | <p>Vehicle attributes and behaviours that increase choice likelihood:</p> <ul style="list-style-type: none"> ▪ Presence of passenger side airbag ▪ High horsepower ▪ High residual vehicle value ▪ Consecutive purchases <p>Vehicle attributes and demographic factors that inhibit choice:</p> <ul style="list-style-type: none"> ▪ High purchase price to income ratio |
| McCarthy (1996) | To model elasticity of demand for new vehicles using a disaggregate demand model | Stated preference design and multinomial logit model | <p>Vehicle attributes, demographics and behaviours that are positively related to choice:</p> <ul style="list-style-type: none"> ▪ vehicle size/type (length of wheelbase, van/SUV/pick-up) ▪ horsepower/acceleration ▪ manufacturer: Chrysler, Ford, GM, Honda, Toyota, Nissan, Mazda ▪ perceived quality ▪ likelihood of domestic car purchase if over the age of 45 ▪ number of dealer visits <p>Vehicle attributes and demographic factors that are negatively related to choice:</p> <ul style="list-style-type: none"> ▪ purchase price to income ratio ▪ operating cost per mile ▪ vehicle type (sports or luxury car) ▪ likelihood of domestic car purchase if living on the Pacific coast |

...continued

| Authors (Year) | Purpose | Method of Analysis | Significant Variables |
|---------------------------------------|---|--|--|
| Mohammadian and Miller (2003) | To model automobile purchase decisions in one and two vehicle households when a transaction has already taken place | Retrospective interviewing and nested logit model (Toronto, Canada) | <p>Demographics that affect purchase of new versus used vehicles:</p> <ul style="list-style-type: none"> ▪ men are more likely to buy larger vehicles ▪ higher education is positively related to new car purchases ▪ higher household education and age averages are less likely to buy pick-ups and SUVs ▪ large household size is positively related to minivan purchase <p>Vehicle attributes that affect purchase of new versus used vehicles:</p> <ul style="list-style-type: none"> ▪ a higher average market price of fleet increases likelihood of buying a new or nearly new car ▪ a higher average vehicle age in fleet reduces the likelihood of buying a brand new vehicle ▪ As average length of fleet ownership increases likelihood of buying an old or used vehicle decreases |
| Roorda, Mohammadian and Miller (2003) | To model longitudinal vehicle purchasing decisions of households over time | Retrospective interviewing and univariate analyses (Toronto, Canada) | <p>Required decision is influenced by:</p> <ul style="list-style-type: none"> ▪ Higher income increases likelihood of vehicle replacement or purchase. ▪ The more vehicles owned the less likelihood of buying another one. ▪ As the number of licensed drivers in a household increases, so do the number of transaction decisions (new buy, replacement, disposal). <p>Vehicle choice is influenced by:</p> <ul style="list-style-type: none"> ▪ Higher income leads to new and domestic vehicle purchase, while lower income is related to Japanese vehicle choice. ▪ Women are more likely to buy new cars if men are not involved in the decision. ▪ Higher education levels are related to new car purchases, while lower education levels are associated with domestic vehicle and minivan purchases. |

...continued

| Authors (Year) | Purpose | Method of Analysis | Significant Variables |
|--------------------------|--|--------------------------|---|
| Train and Winston (2007) | To study the relationship between consumer vehicle choice and the drop in market share by US automakers over the last decade | Mixed logit demand model | <ul style="list-style-type: none"> ▪ Retirees are more likely to choose new cars. ▪ Larger households are more likely to buy vans. ▪ Consumers living in single family homes are more likely to choose new and domestic vehicles, while apartment or townhouse dwellers are more likely to choose Japanese cars. ▪ Evidence suggests that consumer are more loyal to domestic vehicles, being more likely to replace an old vehicle with the latest model. <p>Loss of market share to Japanese automakers can be explained by Japanese superiority on the following vehicle attributes:</p> <ul style="list-style-type: none"> ▪ Lower retail price ▪ Higher power to weight ratio ▪ Lower fuel consumption ▪ Longer wheelbase (as a reflection of passenger compartment size) ▪ Offering automatic transmission as a standard feature ▪ Better reliability |

While results suggest strong correlations between fuel efficiency and vehicle choice, no clear correlation statistic can be derived and reported based on the combined findings of these choice models. First, few studies use a direct calculation of fuel efficiency (e.g., miles per dollar) in their studies, but instead use proxies (e.g., fuel costs, operating costs) to imply fuel efficiency. Second, discrete choice models are designed to maximize the combined predictive effects of the most relevant set of included variables on vehicle choice and not just calculate the individual effects of separate variables on vehicle choice. If one or more variables were added or removed from a given model, the weighted effects of all model variables would change. Without reporting the separate predictive effects of individual variables on choice, no valid statistic reflecting the correlation between fuel efficiency and vehicle choice can be reported.²

Vehicle attributes that are negatively associated with conventional vehicle choice include purchase price, fuel costs, other operating costs and fuel consumption. Vehicle attributes that are positively associated with conventional vehicle purchase include miles per dollar, horsepower to weight ratio, and vehicle size.

² For the more statistically literate, logit models do not use simple correlation coefficients in their calculation. Instead, these models use partial correlations to calculate beta coefficients that incorporate both direct and interaction effects for all modeled variables simultaneously in their results. Thus, results will tell us which independent variables significantly influence vehicle choice and to what extent, but the weighted influence of each variable is only accurate in tandem with the other independent variables in the model. If one or more variables were added or removed, the beta weights for the remaining variables would change.

In some cases, purchase price and income are used to calculate a purchase price to income ratio that is negatively related to vehicle choice.

Commonly reported consumer demographic attributes found to be statistically significant as reported in three or more studies were: gender, age, education, and income. Consistent with these results, Garcia and Balbaky (2006) report repetition in influence among gender, age and income on vehicle choice. Not surprisingly, age, education level, and income are all positively related to the purchase price and size/type of vehicle chosen.³ Women were consistently more likely to choose smaller cars and minivans than men, who were more likely to choose larger cars and sport models. Younger consumers were similarly more likely to drive smaller vehicles than their older counterparts, who were more likely to choose larger, more luxurious vehicles. Interestingly, lower education groups were more likely to choose large cars and minivans, while higher education levels are associated with luxury, sports car, and SUV purchases. Despite being highly correlated, education and income led to some notable vehicle choice differences. Low income earners choose small and large cars, while high income earners prefer luxury vehicles, minivans and SUVs. Pick-up purchases are associated with middle incomes. Older, more affluent consumers in an aging population are not as strongly concerned about vehicle operating costs as other demographic segments. This relationship between larger vehicles and affluence is also linked to the issue of the status and symbolism of vehicle ownership.

³ Relationships with fuel efficiency related variables were either inconsistent or not reported, making it impossible to draw any real conclusions.

These results are consistent across single and multiple car households and over time. Note that Choo and Mokhtarian (2002; 2004) do attempt to incorporate both demographic and psychographic variables into their models, providing some of the only insights into how consumer attitudes and lifestyles affect vehicle choice. They found that a variety of psychographics, namely pro-environmental and pro-high density attitudes, status-seeking, workaholism, dislike of travel, travel distance, and some personality traits are all significant predictors of vehicle choice. Pro-environmental and pro-high density attitudes are more likely to lead to smaller car choice. Conversely, status-seeking and workaholism are negatively related to small car choice, but positively related to pick-up choice. Status seekers are more likely to choose luxury vehicles, sports cars and SUVs than other vehicles. The effect of travel dislike on vehicle choice is moderated by travel distance. For those who dislike travel, higher travel demands lead to selection of larger more comfortable cars, while for others it leads to more fuel efficient choice. Further complicating interpretation of this result is the finding that consumers tend to underestimate travel demands by an average of 2,000 miles per year. Some personality traits related to vehicle purchase include calmness, introversion, and adventurousness. Calm personalities are more likely to choose small cars, introverts drive small cars or SUVs, and adventurers like sports cars. These findings help to provide some initial insight into how lifestyle and other internal consumer influences affect the vehicle decision-making process.

Highly Fuel Efficient and Alternate Fuel Vehicles

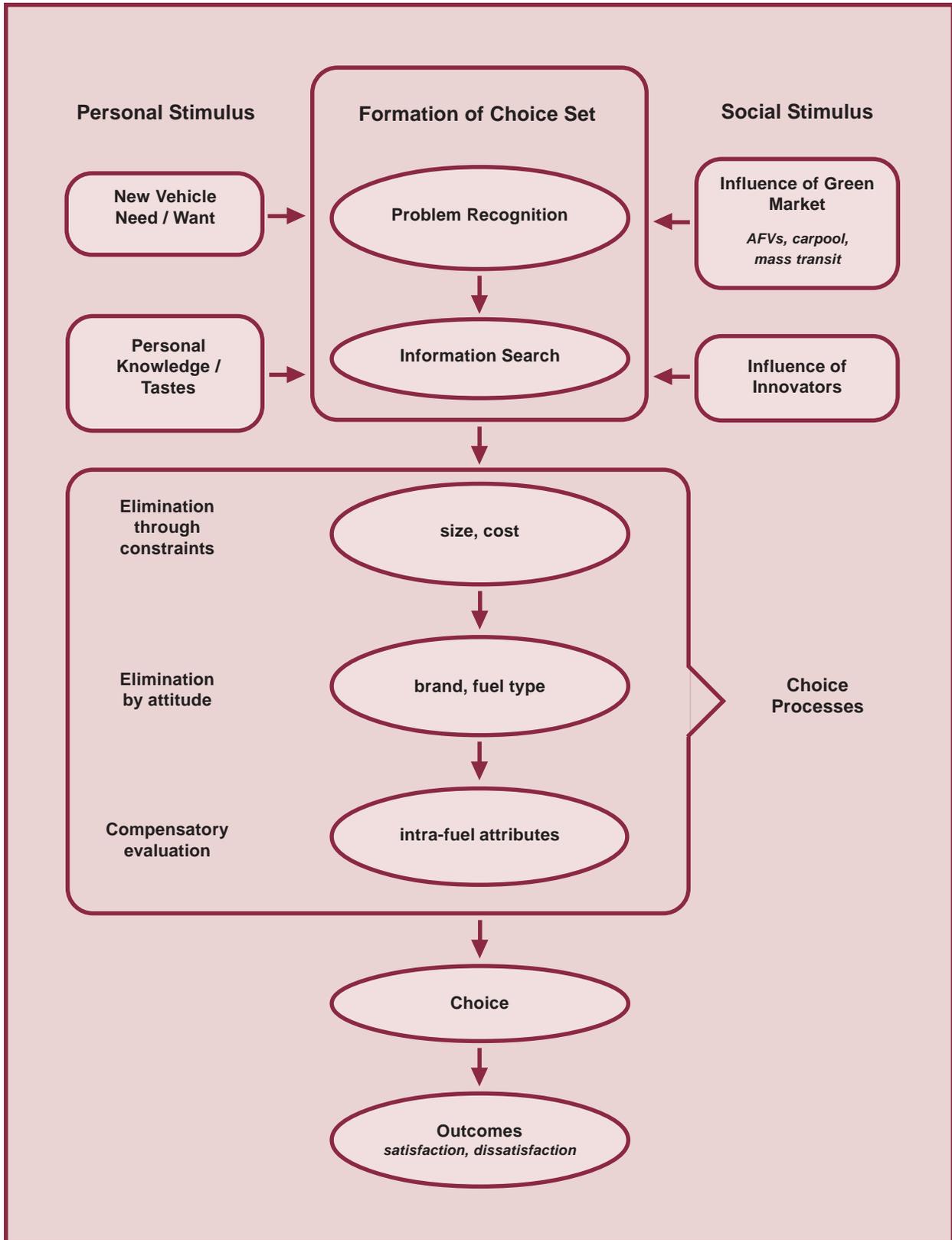
In the eyes of Canadians, the benefits of buying FEVs and AFVs include fuel efficiency and being environmentally friendly, with a higher initial purchase price being the key drawback (Decima, 2004). Even among environmentally conscious Canadians, initial purchase price is a major issue. Thirty percent would only be willing to pay a \$1,000–2,000 premium for a hybrid, while 22 per cent report being unwilling to pay anything more.

Consumer Decision-making Process for AFVs

Turrentine and Sperling (1992) recognized the limitations of discrete choice models and instead employed the consumer decision-making process to model AFV choice (Figure 5). The model acknowledges the influence of personal and social stimuli on need recognition and information search, as well as outlining the relevant evaluative criteria and decision rules for use in the AFV purchasing process. Consistent with bounded rationality, Turrentine and Sperling (1992) argue for a three stage choice process, in which the first two stages involve an 'elimination by aspects' approach, followed by a more compensatory analysis of the remaining alternatives. Like Santini and Vyas (2005), they recognized that the AFV market could be broken into two key adopter segments: (1) innovators who enter the market early, and (2) the green consumer who enters when the market is more established.

While Turrentine and Sperling (1992) also recognize social influences, this paper does not identify one key social factor that other authors have found to play a substantive role in hybrid vehicle choice. Specifically, the symbolism (Williamson, 1978) and social status (Veblen, 1899) associated with owning a hybrid vehicle play a major part in consumer motivation, particularly in the case of early adopters. Symbolic meanings associated with

Figure 5: Extended Decision Processes for the AFV Market



Source: Turrentine and Sperling (1992).

hybrid ownership include ethics, concern for others, intelligence/awareness, and independence (Heffner, Turrentine and Kurani, 2006).

Discrete Choice Models

Table 3 provides a brief summary of several discrete choice models for AFV purchase conducted since 1990. As with the previous section, this review is also not exhaustive. Not only are findings once again often repetitive, more recent findings will be more reflective of the numerous technological and consumer trends that have been made in this category within the last decade.

Results regarding significant vehicle attributes are consistent with those for conventional vehicles, with a few additions. Added to the list of relevant attributes are availability of appropriate fuel, how far away refuelling stations are (range), and pollution level of the car. Interestingly, a lower pollution level was the least recurrent attribute in this list, confirming the consumer's reluctance to be inconvenienced for the sake of the environment. The only truly consistent demographic influence on AFV choice is a high education level.

Commonly recurring vehicle attributes relevant to FEV and AFV purchase include purchase price, fuel costs, operating costs, acceleration, and vehicle size. Directions were consistent with conventional vehicle choice. Additional frequently recurring variables specific to FEVs and AFVs included pollution level, refuelling range, and fuel availability. Lower emissions levels, longer distances before refuelling is required, and easy access to fuel contribute to increased likelihood of FEV and AFV selection. These additions may be attributed both to the unique requirements of these vehicles and their lack of inclusion in conventional vehicle choice models. Additionally higher market penetration of a new vehicle technology increased its likelihood of adoption.

Table 3: Discrete Choice Models Used to Predict FEV and AFV Purchase (1990-2008)

| Authors (Year) | Purpose | Method of Analysis ⁴ | Fuel Types Under Investigation | Significant Variables |
|------------------------------------|--|---|----------------------------------|--|
| Axsen and Kurani (2008) | To exchange assumptions drawn from proxy data with direct data about potential plug-in hybrid electric vehicle (HEV) usage for the potential early US HEV market | Phased internet survey including stated preference, behavioural and structural measures with primarily descriptive analysis (NOT a logit model) | Plug-in hybrid electric only | <ul style="list-style-type: none"> ▪ The majority of drivers have access to at-home recharging, but most do not have access at work or other locations. ▪ New vehicle buyers are confused by the electric drive terminology used by HEV experts. ▪ Increased fuel economy is a high interest attribute, while faster recharging speed is of low interest. ▪ About one-third of the target population has the infrastructure and interest to purchase an HEV. ▪ While switching to HEVs could halve gasoline usage, increased electricity demands would exceed supply, thus requiring recharging management strategies such as time restrictions or tariffs to reduce overall electricity usage. |
| Brownstone and Train (1999) | To apply a mixed logit choice model that offers a good representation of substitution among AFVs | Stated preference experimental design and mixed logit model | Gas, electric, methanol, and CNG | <ul style="list-style-type: none"> ▪ Relative importance of price of vehicle will increase likelihood of switching to smaller and more fuel efficient cars. ▪ Relative importance of size of vehicle will decrease likelihood of switching to smaller and more fuel efficient cars. |
| Brownstone, Bunch and Train (2000) | To compare multinomial and mixed logit models for households' revealed and stated preference for AFVs | Revealed and stated preference design and multinomial and mixed logit models | Electric, methanol, and CNG | <p><i>Vehicle attributes that are positively related to choice:</i></p> <ul style="list-style-type: none"> ▪ Distance vehicle can travel before refuelling is required (refuelling range) ▪ Top speed ▪ Vehicle type (sports car or SUV) ▪ College education (electric only) |

⁴ Santini and Vyas. 2005. A methodological note of interest is that stated preference surveys are most appropriate for early adopters of newer technologies, while revealed preferences will be more reflective of the majority of purchasers.

...continued

| Authors (Year) | Purpose | Method of Analysis ⁴ | Fuel Types Under Investigation | Significant Variables |
|-----------------------|--|--|---|---|
| | | | | <p><i>Vehicle attributes that are negatively related to choice:</i></p> <ul style="list-style-type: none"> ▪ Vehicle price to income ratio ▪ Operating cost ▪ Acceleration ▪ Vehicle age ▪ Vehicle type (small, station wagon, minivan, pick-up) ▪ Fuel type (electric trucks and sports cars) <p><i>Differences in stated and revealed choice attributes:</i></p> <ul style="list-style-type: none"> ▪ People say they want lower pollution levels but choose higher ones |
| Bunch et al. (1992) | This study builds on Golob et al. (1991) by expanding the number of AFV options offered and conducting choice models for various demographic market segments | Phased stated preference experimental design and nested multinomial logit and multinomial probit model | Electric, methanol, ethanol, CNG, and propane | <p><i>Significant variables are generally consistent with the previous studies. The most relevant factors when choosing among alternative fuel options are:</i></p> <ul style="list-style-type: none"> ▪ Fuel cost (although lower emissions levels can compensate for higher fuel cost to an extent) ▪ Refuelling range <p><i>Added segmentation variables include fuel availability:</i></p> <ul style="list-style-type: none"> ▪ Being over 55 increases concern about limited fuel availability ▪ Commuting distances under 15 km reduce concerns about limited fuel availability |
| Dagsvik et al. (2002) | Choice model for AFVs is applied to | Stated preference experimental design and mixed multinomial logit | Electric, liquid propane gas, hybrid | <p><i>Attributes that prohibit AFV choice include:</i></p> <ul style="list-style-type: none"> ▪ Higher price ▪ Higher operating costs ▪ Limited refuelling range ▪ Taste persistence for conventional vehicles ▪ Gender (men are less likely than women to prefer AFV options) |

...continued

| Authors (Year) | Purpose | Method of Analysis ⁴ | Fuel Types Under Investigation | Significant Variables |
|----------------------------|--|---|--|--|
| Ewing and Sarigollu (1998) | willingness to pay for AFVs Choice model for AFVs by suburban commuters | Stated preference experimental design and multinomial logit model | Conventional gas with current fuel efficiency, unspecified fuel with higher levels of fuel efficiency, zero emissions electric vehicle | <p><i>Attributes that encourage FEV choice include:</i></p> <ul style="list-style-type: none"> ▪ Lower emissions level ▪ Shorter commuting time <p><i>Attributes that prohibit FEV choice include:</i></p> <ul style="list-style-type: none"> ▪ Higher price ▪ Higher operating cost ▪ Low refuelling range ▪ High refuelling time ▪ Lower acceleration |
| Golob et al. (1991) | Builds on Kitamura et al. (1991) by removing electric options for comparative purposes | Phased stated preference survey and multinomial logit | Electric, alternate fuels (methanol, ethanol, CNG, and propane), and hybrid options | <p><i>Vehicle attributes that influence choice include:</i></p> <ul style="list-style-type: none"> ▪ Purchase price (-) ▪ Fuel price (-) ▪ Fuel availability (+) ▪ Refuelling range (+) ▪ Emissions levels (-) <p>When electric options are not provided, acceleration is no longer a significant choice determinant</p> |
| Kitamura et al. (1991) | To determine the effect of attributes unique to clean fuel vehicle on vehicle choice | Stated preference survey and multinomial logit | Electric, alternate fuels (methanol, ethanol, CNG, and propane), and hybrid options | <p><i>Vehicle attributes that influence choice include:</i></p> <ul style="list-style-type: none"> ▪ Purchase price (-) ▪ Fuel price (-) ▪ Fuel availability (+) ▪ Refuelling range (+) ▪ Emissions levels (-) ▪ Quick acceleration (+) <p>AFVs and AF/gas hybrids are preferred to electric and electric/gas hybrids.</p> |

...continued

| Authors (Year) | Purpose | Method of Analysis ⁴ | Fuel Types Under Investigation | Significant Variables |
|---------------------------|--|--|--------------------------------------|--|
| Mau et al. (2008) | Builds on discrete choice models for AFVs by considering consumer preference dynamics | Dynamic preference experiment and discrete choice model (Western Canada SFU) | Hybrid electric, hydrogen fuel cells | <p>Vehicle attributes that influence choice include:</p> <ul style="list-style-type: none"> ▪ Price (-) ▪ Fuel cost (-) ▪ Refuelling frequency (-) ▪ Market penetration (+) ▪ Government subsidy (+) ▪ Warranty coverage (+) |
| McFadden and Train (2000) | To apply a mixed logit choice model that optimizes consumer utility under conditions of mild regularity | Stated preference experimental design and mixed logit model | Electric, methanol, CNG | <p>Vehicle attributes that influence choice include:</p> <ul style="list-style-type: none"> ▪ Price to income ratio (-) ▪ Operating costs (-) ▪ Quick acceleration (+) ▪ Vehicle size (+) ▪ Refuelling range (+) ▪ Fuel availability (+) ▪ Emissions levels (-) <p>Shorter commutes were associated with electric vehicle choice</p> <p>College education was associated with electric and methanol fuel choice</p> |
| Ren et al. 1994 | Builds on previous models by considering reason for new vehicle acquisition in light of current vehicle holdings | Customized stated preference experimental design and multinomial logit model | Gas, electric, methanol, CNG | <p>For all households (at least one vehicle), the following variables are significant:</p> <ul style="list-style-type: none"> ▪ Net capital and operating costs of new purchase (-) ▪ Total value (+) and operating costs (-) of resulting fleet ▪ Refuelling range of AFVs (+) ▪ Emissions level (-) |

...continued

| Authors (Year) | Purpose | Method of Analysis ⁴ | Fuel Types Under Investigation | Significant Variables |
|--------------------------------------|---|---|---|---|
| Potoglou and Kanaroglou (2006) | To examine the potential demand for cleaner vehicles in Hamilton's census metropolitan area | Stated preference experimental design and nested logit(Hamilton, Canada) | Gas, hybrid electric, alternate fuels (defined as methanol, ethanol, natural gas), and alternate fuel hybrid options | <p>Differences for households with multiple current vehicles include;</p> <ul style="list-style-type: none"> ▪ Households with luxury cars prefer higher priced (status) vehicles. ▪ Top speed and acceleration time become significant. ▪ Fuel availability for AFVs without home refuelling is significant. ▪ Multiple vehicle households show no preference for gas over AFVs. ▪ People are more likely to buy electric cars, but compressed natural gas SUVs and pick-ups. <hr/> <p>Vehicle attributes that influence choice include:</p> <ul style="list-style-type: none"> ▪ Operating cost (-) ▪ Fuel availability (+) ▪ Quick acceleration (+) ▪ Vehicle size (+) ▪ Pollution level (-) ▪ No purchase tax (+) <p>Demographic attributes that influence choice include:</p> <ul style="list-style-type: none"> ▪ Women do not value quick acceleration as highly as men. ▪ Demand for hybrids is higher if one has a university degree. ▪ Demand for AFV drops after the age of 45. ▪ After controlling for price, fuel and other operating costs, households with medium incomes are more likely to want hybrid technology than other income groups. ▪ Households with high travel distances valued fuel availability more than other groups. |

...continued

| Authors (Year) | Purpose | Method of Analysis⁴ | Fuel Types Under Investigation | Significant Variables |
|-------------------------|--|--|---|--|
| Santini and Vyas (2005) | To model the way in which consumers change their vehicle purchase decisions as new-technology vehicles move from early adoption to majority purchase | Advanced Vehicles Introduction Decisions (AVID) multinomial logit model | Hybrid electric | <ul style="list-style-type: none"> ▪ Early buyers of HEVs are less price sensitive and thus willing to pay a more premium price, and tend to have higher incomes and yearly travel distances than majority buyers. |
| Tompkins et al. (1998) | To extend previous studies of vehicle choice using a national sample | Phased stated preference experimental design and multiple multinomial logit models | Gas, alcohol, natural gas/propane, electric | Vehicle attributes that influence choice include: <ul style="list-style-type: none"> ▪ Price (-) ▪ Operating costs (-) ▪ Quick acceleration (+) ▪ Top speed (+) ▪ Vehicle size (+) ▪ Refuelling range (+) ▪ Fuel availability (+) ▪ Market penetration (+) |

Consistent with conventional vehicle findings, relevant demographic and behavioural variables include education, gender, age and travel distance. Specifically, women and those with college degrees were more likely to choose hybrid electric and electric vehicles than other segments. For women, this choice preference seems to be linked to a lower concern with quick acceleration than men. Older consumers in their forties and fifties, who tend to have longer commutes and overall travel distances, value fuel availability more highly than other age segments.

Because initial purchase prices for AFVs are higher than for gas powered vehicles, consumers often do not understand the lifetime operating costs of switching, and as a result, they demand extremely short payback on initial investment (Turrentine, Kurani, and Heffner, 2007). This suggests that other incentives for purchasing AFVs and reducing emissions need to be explored. Coninx (2004) estimates that instituting a seven per cent carbon tax on gasoline would be enough to fully fund carbon offset of the CO² emissions caused by conventional vehicles, while simultaneously providing a financial disincentive to continue driving them. However, there is no evidence to suggest that this level of tax increase would be an adequate financial incentive to effect switching toward AFVs. Tax rebates on AFV purchase and ownership have also been recommended as effective incentives for reducing CO² emissions (Coninx, 2004; de Haan et al., 2006).

Vehicle Purchasing Market Segments

Market segments are identified primarily through the use of cluster analysis, which groups survey respondents based on similarities and differences in response trends. Many vehicle purchasing studies describe consumers based on demographics; however, they do not use statistical analysis to cluster respondents. Other studies divide consumers into group for analysis based on responses to individual study questions. For example, Decima (2004) develops two segments based on their combined responses to two survey questions and then runs individual demographic statistics to develop a descriptive profile of consumers who fall into those two response groups. It is important to note the difference between using expert judgment to define a method for creating groups for the purposes of conducting analysis versus using statistical cluster analysis of sets of question responses to group consumers based on response patterns that are objectively created and representative of the marketplace.

Many descriptive studies of the automotive market segment the market by product class. DesRosiers (<http://www.desrosiers.ca/>), for example, segments the light vehicle market by product class (see, for example, *Observations*, August 15, 2007). Its four main segments include entry level, mid-sized/family, large/luxury/sport, and primarily commercial. Unfortunately, this method of segmentation has little to do with consumers, who are by definition the market, but instead focuses on the products that the manufacturer sells. This is a production-oriented approach which focuses on the products and features the manufacturer offers, rather than being a market-oriented approach which should focus on the combinations of features and underlying benefits consumers actually want. The difference between a production-oriented approach and a market-oriented approach can

lead to a gap between supply and demand wide enough to threaten customer relationships.

Several international studies have been identified that segment the vehicle purchasing market using psychographic variables. Table 4 organizes these segments according to their potential to find fuel efficiency personally relevant. In general, the majority of promotional resources should be dedicated to those segments for which fuel efficiency has been identified as having medium relevance. There is little chance of convincing low relevance consumers that any possible sacrifice in terms of a loss of convenience or product function would be personally rewarding. Conversely, those with high potential will generally make environmentally sound choices with little to no prompting. Thus, it makes more sense to devote resources toward those who need some enticing, which are those in the medium relevance range. Many consumers in the medium range are later market entrants who need reassurance that their choices will be rewarded with satisfactory post-purchase outcomes.

The set of segments that only need to have resources available to them to make fuel efficient decisions are classified as potentially high relevance segments. High relevance segments are already motivated to act. Thus, simply ensuring that they have the right types of information and infrastructure to suit their needs is all that is required. Toyota identified three possible target segments for the Prius based on personal values and self-concept. One segment valued the new technology Prius offered, meaning that the information of most value to this segment relates to how the car operates (Andidas, 2003). *Enlightened Adopters, Green Papas, Environmentally Friendly, and Transit Advocates* segments are already environmentally conscious and high relevance segments. With many already driving fuel efficient vehicles, ensuring availability of the

necessary information for making a sound fuel efficient and environmental choice should cause these segments to act in the desired manner. *Value conscious* consumers and *fleet buyers* are best served by comparative lifetime costing information for different vehicle options. Having said that, there is little evidence to support the validity of the *value conscious* segment for vehicles like the Prius at this point.

While it is possible that this may prove to be a legitimate segment in the future, other segmentation studies have failed to identify a similar consumer segment. Hybrid vehicles have a significant way to go in terms of pricing and general marketing before they will reach the point of appealing to the purchasing majority.

Medium potential segments may currently lack the motivation or perceived ability to behave fuel efficiently but show some promise for change. Segment barriers may include motivation, ability, education, comfort, and interest. The first step is to give consumers motivation to change, such as by demonstrating that their actions do make a difference, or by providing them with tools to make action easier. Removing barriers such as an inability to afford an equivalent fuel efficient vehicle is also critical to success.

Table 4: Identified Psychographic Vehicle Purchasing Market Segments

| | Environics (2005) | Shell (2004)* | Redmond (2000) | Redmond (2000) | Andidas (2003) |
|--|--|---|--|---|-------------------------------------|
| Market being segmented | Vehicle buying and usage | New fuel technology vehicle early adopters | Type of vehicle owned (attitude) | Type of vehicle owned (personality and lifestyle) | Toyota Prius |
| Country | Canada | UK | US | US | |
| Identified segments | | | | | |
| <i>Potential relevance of fuel efficiency:</i> | | | | | |
| <i>High</i> | <u><i>Enlightened adopters (31%)</i></u> Environmentally conscious, informed, already driving efficient vehicles. | <u><i>Green Papas</i></u> Environmentally conscious with high price sensitivity and functional view of vehicles. | <u><i>Transit-using Urbanites (15%)</i></u> Young, highly educated, pro-environmental urban dwellers. They are more likely to drive small cars and less likely to drive SUVs than other segments. | <u><i>Transit advocates (10%)</i></u> Highly educated, environmentally oriented and transit-oriented, this segment is more likely than others to drive smaller cars. | Early adopters/ technology pioneers |
| | | <u><i>Fleet Buyers</i></u> Business customers motivated by total cost of ownership. | <u><i>Excess travellers (19.7%)</i></u> Young, urban, adventure seekers who are pro-environment and love to travel. They tend to buy small, luxury and sports cars. | <u><i>Transit Lovin' Transit Users (7.1%)</i></u> Highly educated urban middle-income women who are environmentally sensitive and enjoy travel and are likely to use public transit or walk. They tend to own small cars and minivans. | Environmentally friendly |
| | | | <u><i>Affluent Professionals (17.5%)</i></u> This entertainment oriented affluent and mobile crowd eat out a lot and do not have large families. They tend to choose compact and mid-sized cars. | | Value conscious |

...continued

| | Environics (2005) | Shell (2004)* | Redmond (2000) | Redmond (2000) | Andidas (2003) |
|---------------|---|--|---|---|-----------------------|
| <i>Medium</i> | <p><u><i>Confused seekers (20%)</i></u> Drivers who deny personal responsibility but want to know how to be more efficient drivers.</p> | <p><u><i>Individualists</i></u> Environmentally sensitive, interested in technology, emotional view of cars and demand same refuelling experience.</p> | <p><u><i>Homemakers and older workers (20.5%)</i></u> These older, less educated drivers have large families, don't particularly like travel, and tend to drive large cars, minivans, and pick-ups.</p> | <p><u><i>Mobile yuppies (6.8%)</i></u> Young, professional, highly educated travel lovers that are more likely to own sports cars and SUVs than other segments.</p> | |
| | <p><u><i>Passive receptives (28%)</i></u> Not concerned about environmental impact but open to being a more efficient driver.</p> | <p><u><i>Long Hauler</i></u> Insensitive to environment, highly sensitive to cost and technological reliability, functional view of vehicles.</p> | <p><u><i>Travel haters (12.1%)</i></u> Work-oriented consumers who buy larger more luxurious vehicles to compensate for a dislike travel with comfort.</p> | <p><u><i>Frustrated loners (8.1%)</i></u> Moderately transit-oriented drivers with long, frustrating commutes who tend to drive either small or large cars.</p> | |
| | | <p><u><i>Ms Fast Tracker</i></u> Insensitive to environment, concerned with safety, functional view of vehicles.</p> | | <p><u><i>New family model (11.0%)</i></u> Young families that like to travel for fun but not work and are mobile. More likely than other segments to choose luxury, sports cars, pick-ups and SUVs.</p> <p><u><i>Suburban and stationary (10.8%)</i></u> Calm, older suburban women who don't travel a lot and tend to drive compacts or minivan.</p> <p><u><i>Middle-of-the-roaders (8.7%)</i></u> This strong family and community oriented segment is otherwise quite neutral and tends to drive mid-sized to large cars and minivans.</p> | |

...continued

| | Enviro-nics (2005) | Shell (2004)* | Redmond (2000) | Redmond (2000) | Andidas (2003) |
|-----|--|--|---|---|----------------|
| | | | | <u>Homebodies (8.1%)</u> A relatively neutral group, not terribly social or travel oriented, more likely than other segments to drive large cars and minivans. | |
| Low | <u>Unapologetic drivers (22%)</u> Knowledgeable drivers who refuse to compromise driving for efficiency or emissions. | <u>Stars</u> Insensitive to environment, extremely fashionable, emotional view of vehicles. | <u>Adventurous car-oriented suburbanites (15.2%)</u> Older suburban status seekers who travel excessively. Not particularly environment conscious, they tend to buy large cars, minivans, pick-ups and SUVs. | <u>Older and independent (9.4%)</u> Older, independent and entertainment focused drivers who are not family or community oriented and tend to drive luxury cars and SUVs. | |
| | | <u>Mr. Fast Tracker</u> Insensitive to environment, interested in technology, emotional view of vehicles. | | <u>Assistant VPs (10.9%)</u> These older, car-oriented suburbanites do not particularly like travel and are the least educated segment. They are more likely to choose mid-size and large cars. <u>Status-seeking workaholics (9.0%)</u> Travel most of all segments and enjoy it. These car-oriented consumers are more likely to drive luxury and sports cars. | |

Education-related segments want to learn more about fuel efficiency. *Confused Seekers* are environmentally motivated, while *Passive receptors* are more interested in fuel efficiency for its own sake. It is possible that informational campaigns may provide these relatively undereducated segments with the tools they need to make better choices. Campaign messages, however, should be tailored to demonstrate how changes will respond to their differing motives.

Comfort-driven segments with medium potential for more fuel efficient choices include avid travellers that fit demographics consistent with fuel efficient choices (e.g., *Mobile Yuppies*, *Suburban and Stationary*) or those who have long enough commutes to recognize the benefits of higher fuel efficiency even if they dislike travel (e.g., *Long Haulers*, *Travel Haters*). Emphasizing availability of vehicle choices that are more fuel efficient while still meeting other convenience related attribute requirements, such as luxury hybrid SUVs that maintain vehicle size and overall travel comfort, will see the most effective results, rather than trying to lessen the perceived importance of currently desirable product features.

Some segments seem to be disinterested in the issue of fuel efficiency or in change itself, but show promise for change through other demographic or psychographic cues, such as *Mr. FastTracker's* functional view of cars or *Middle-of-the-Roaders'* community orientation. In these cases, linking fuel efficiency directly to the segments' interests and motives may turn fuel efficiency into a relevant criterion, when it previously was not.

Finally, low potential segments include those who are disinterested in compromising vehicle performance or personal convenience for the sake of the environment, and show no other demographic or psychographic links with fuel efficient vehicle choice. There are, however, degrees of low potential. Emotionally driven segments such as *Status-Seeking Workaholics*, *Mr. Fast Tracker* and *Stars* may be motivated if fuel efficient options can be positioned as high status or fashionable options; otherwise chances of change are low. Low potential for *Assistant VPs* and *Adventurous Car-oriented Suburbanites* is simply attributed to lack of insight into cues that could be used to motivate change. Further research into psychographic segment descriptors could solve this dilemma. *Unapologetic Drivers and Older and Independents*, however, are actively unwilling to compromise vehicle function or size for fuel efficiency and should not be targeted until truly equivalent fuel efficient vehicle alternatives are proven and more widely accepted by Canadians. These consumers likely will not be persuaded to change by anything less than legislated efficiency standards and monetary penalties.

Vehicle Usage and Alternate Transit Modes as a Means of Emissions Reduction

Consumers have other options for becoming more fuel efficient than buying more fuel efficient vehicles. They may also change their driving behaviours and transit selection more generally. Recalling Kitamura et al. (2000) who found that transit accessibility affects vehicle purchase; it is possible that consumers who are not choosing fuel efficient vehicles are instead choosing alternate transit modes that may serve to even further reduce emissions. Alternatively, social marketers wishing to promote fuel efficient vehicle purchases may gain insight into ways to promote fuel efficient vehicle choice by understanding the reasons underlying not just the motives and behaviours around how consumers select vehicles, but if and how they do or do not select other fuel efficient transit modes.

Attitudes and Behaviour

Gardner and Abraham (2007) identified several major issues behind why commuters choose to travel by private vehicle rather than public transit. Misconceptions about journey times and personal space concerns relating to public transit, underestimation of car-related monetary costs, self-identity issues, effort minimization perceptions, and overall underlying control issues lead to the choice of a private vehicle over other modes of transportation. These results show clear parallels with vehicle attribute concerns in the form of fuel efficiency, other operating costs and vehicle size concerns. There are also parallels with self-identity concerns manifested in status-seeking, age and gender influences on vehicle choice, as well as travel distance related issues in terms of personal comfort, effort and control.

In general, Canadians indicate that they believe that business and government should be doing more to reduce fuel emissions and help the environment (Decima, 2004). However, they also believe that consumers should play a role in reducing emissions through using alternate means of transport (17 per cent of respondents), carpooling (nine per cent), and buying less polluting (14 per cent) and more fuel efficient (10 per cent) cars (Decima, 2004). As many as 85 per cent of Western Canadians say that they are willing to choose alternative forms of transportation such as walking, biking, carpooling, and public transit to reduce GHG emissions (Berdahl, 2008). Of those who were willing to do so, an average of about 80 per cent reported having already adopted such behaviours.

It is important to recognize that switching to public transport requires giving up the psychosocial benefits gained from having a car (Ellaway et al., 2003). Feelings of autonomy, self-esteem, and prestige can all be derived from the symbolic benefits provided by vehicle ownership. These identity issues are stripped away at the time of vehicle disposal. In order to successfully reach consumers who do not want to lose the symbolic benefits associated with having a private vehicle, social marketers should work to create positive symbolic associations with fuel efficient vehicles. Toyota's attempts to link the Prius with high status celebrities is one such example, but sustained and consistent status linkages with a complete range of FEVs would be required to make this tactic truly successful.

Golob et al. (1997) constructed a discrete choice model to describe household vehicle usage rates (measured as miles travelled) based on types and number of household vehicles,

household characteristics, and driver characteristics. Driver age, gender, and employment status influence vehicle usage rates regardless of the number of vehicles in a household. When households had multiple vehicles, the age of the vehicle also determined how far it was driven. As most consumers are unaware of the fuel consumption of their vehicles (Kurani and Turrentine, 2004), it is not surprising that fuel mileage did not significantly impact vehicle usage.

The Effects of Gas Prices

Most assume that as fuel prices increase, consumers make an effort to drive less. However, rising gasoline prices have an extremely small effect on driving behaviour through reduction of speed and frequency of trips (Congressional Budget Office, 2008). In California, for every 50 cent per gallon increase in the price of gas since 2003, average freeway speed slowed by three-quarters of a mile per hour and the average number of cars on the road decreased by 1/17th of a percent. While as many as 85 per cent of Western Canadian consumers report being willing to change travel modes and purchase hybrid vehicles, less than 50 per cent are willing to pay more for gas (Berdahl, 2008).

Travel Mode Segments

Two studies were located that segment the travel mode market (Table 5). As with vehicle purchasing, segments have been grouped with respect to behaviours consistent with fuel efficient behaviour or emission reducing behaviour, including switching to public transit. Both sets of travel mode segments contain medium relevance segments that would benefit from educational programs or incentives to move away from personal automotive usage. In particular, Anable's (2005) *malcontented motorists* provide an excellent opportunity for conversion through demonstration of the convenience benefits of public transit, since convenience is a major

factor in whether or not consumers adopt environmentally conscious behaviour. Some *car complacents* may also be swayed if convenience arguments provide strong enough motivation to alter behaviour patterns. In general, US drivers are more car-oriented than their French counterparts, but both countries have identified segments that already use a mixture of transit modes (Diana and Mokhatrian, 2008). These consumers would be best suited to being convinced to increase their frequency of alternate transit usage.

Consumers may also employ alternate driving strategies to increase fuel efficiency. Such strategies as limiting idling, regular tire pressure checks and engine maintenance, keeping windows closed and not speeding on highways, avoiding quick acceleration and stopping, and keeping air conditioners off can all work to improve fuel efficiency of a vehicle.

Table 5: Identified Travel Mode Market Segments

| | Diana & Mokhatrian (2008) | Anable (2005) |
|---|--|---|
| Market being segmented | Travel mode behaviour (use of car vs. public transit) | Travel mode behaviour and switching potential |
| Country | US and France | UK |
| Segmentation method | Behaviour | Psychographics |
| Identified segments <i>Potential relevance of fuel efficiency:</i> | | |
| <i>High</i> | <p>Neither oriented (France)</p> <p>Transit oriented (France) More transit oriented (US)</p> <p>Both oriented (France)</p> | <p><u><i>Carless crusaders (9%)</i></u> Have sacrificed car ownership and appreciate all other transportation modes</p> <p><u><i>Aspiring environmentalists (16%)</i></u> Have reduced car use for environmental and health reasons, but are reluctant to give up car ownership</p> |
| <i>Medium</i> | <p>Light travelers (US)</p> <p>Rather car oriented (US)</p> <p>Car-oriented (France)</p> | <p><u><i>Malcontented motorist (18%)</i></u> Perceive constrained by public transport, frustrated with car travel, feel morally obligated to change behaviour</p> <p><u><i>Car complacents (20%)</i></u> Recognize feasibility of other modes, but feel no need to change car use</p> <p><u><i>Car aspirers (9%)</i></u> Currently do not own a car but would like to</p> |
| <i>Low</i> | <p>Heavily car oriented (US)</p> | <p><u><i>Reluctant riders (7%)</i></u> Involuntary users of public transit for financial or health reasons</p> <p><u><i>Die hard drivers (20%)</i></u> Love their cars and see driving cheaply and freely as a right</p> |

Lessons from other Natural Resource Conservation Decision-making

Fossil fuels are natural resources, thus it is worthwhile to investigate what is known about consumers' use of other natural resources in their everyday lives. Energy (e.g., electricity, natural gas, oil) and water are both examples of natural resources that are used daily and are monitored and paid for based on metered volume usage. While they are similar to vehicle fuel in that they are used day-to-day, metres are monitored far less frequently than vehicle fuel gauges and rarely by consumers themselves. Energy and water usage costs are easier to track on a monthly basis, particularly where equal monthly payments estimated using previous annual usage are available. As such consumers most likely have a reasonable understanding of energy and water consumption costs, but have virtually no concept of their usage volume. In contrast, despite being responsible for monitoring and refilling their own gas tanks, consumers are often highly unaware of both their fuel consumption rates and how much they spend on gas over time (Turrentine and Kurani, 2007).

Energy Savings

There are two key ways to conserve natural resources. The first is through habitual behaviour and the second is through purchasing decisions. In terms of household energy savings, for example, habitual behaviour may involve opening windows and turning off lights, while purchasing behaviour may involve installing a programmable thermostat or triple glazed windows (Barr, Gilg and Ford, 2005). Interestingly, consumers who report pro-environmental behaviour do not necessarily use less energy than other consumers (Gatersleben, Sleg and Vlek, 2002).

Predictors of energy saving behaviour include the effect on personal comfort, anticipated cost savings, and internalization of the problem (Van Raaij and Verhallen, 1983). As such, cost is a more important factor than environmentalism when it comes to energy usage. These findings suggest that increasing energy costs would be a better way to encourage energy conservation than focusing on its environmental benefits.

Water Consumption

Water conservation is an ever present concern, but becomes more urgent in times of severe drought. Consumers of water appear to be even more ignorant of their consumption levels than car owners are of their own vehicles' fuel consumption. The majority of consumers underestimate their own personal water usage and have little understanding of how much water is consumed through common activities like flushing toilets (Randolph and Troy, 2008). On a day-to-day basis outside of times of crisis, Gilg and Barr (2006) recommend that water conservation policies be driven by an understanding of: 1) whether conservation occurs inside or outside of the home (habitually or consumptively); and 2) consumption activities that tend to be undertaken together (behavioural grouping). In times of crisis, water restrictions and increases in water pricing are two way to deal with shortages. Water restrictions can be seen as a legislative equivalent to legislated fuel efficiency standards. In contrast, increasing water prices only has visible impact for water that is consumed inside of the home, limiting its effectiveness. As such, there is little evidence to suggest that pricing increases alone would

be an effective incentive for reducing overall personal water usage. Instead evidence indicates that social marketing campaigns focused on education about water conservation methods are more effective for reducing water usage (Randolph and Troy, 2008). The impact of increased fuel prices is more highly visible to the majority drivers than water usage, so a combination of efficiency standards, fuel price increases and education about fuel efficiency should successfully work in tandem to promote more fuel efficient vehicle choices.

Lessons from General Environmentally Conscious Consumption Decision-making

In short, “no clear consensus regarding environmentally concerned consumers and what they want, what they will do, or how to measure them has emerged” (Kilbourne et al., 2002, p. 194). A variety of knowledge-based, attitudinal, value-driven and behavioural measures have been identified as predictors of green consumer behaviour with varying degrees of strength (Banerjee and McKeague, 1994; Chan, 1999).⁵

Environmental Attitudes and Their Effects on Behaviour

Straughn and Roberts (1999) found that concern for the environment was not strongly related to correspondingly environmentally concerned behaviour. Hines, Hungerford, and Tomera (1986), for example, found a correlation of only 0.35 in a meta-analysis of 128 studies. While it is easy to recognize a problem and express concern, changing behaviour often requires sacrifice. For example, while approximately 65 per cent of Western Canadians recognize reducing GHG emissions as a major priority, nearly 60 per cent are unwilling to do so at the expense of the economy (Berdahl, 2008).

Straughn and Roberts (1999) found that an individual’s belief that his or her own actions can have an impact on the environment was a much stronger determinant of environmentally responsible behaviour. This is consistent with Bamberg’s (2003) finding that, among highly environmentally concerned students, intention to act is predicted more strongly by perceived behavioural control than by attitudes or social norms. Further, among students with low levels of environmental concern, intention to act was most strongly driven by social norms. This suggests that other factors are more relevant to making environmentally responsible choices. Hines, Hungerford, and Tomera (1986) concluded that the following variables predict environmentally responsible behaviour: knowledge of the issues and their associated action responses, perceived individual ability and responsibility to make a difference, verbal commitment and pro-environmental attitude. However, the relationship between attitude and behaviour remained weak. This finding is consistent with the findings of many other researchers who find the attitude–behaviour relationship with respect to the environment to be weak, at best (Ungar, 1995).

The two most commonly studied attitudes regarding environmentally friendly behaviour are perceived inconvenience and perceived importance (Laroche, Bergeron, and Barbaro-Farleo, 2001). Not surprisingly, the perceived level of inconvenience of environmentally responsible behaviour has been shown to be negatively related to environmentally responsible actions. In other words, the more inconvenient it is to act responsibly, the less likely that people will do so. For many people, environmentally responsible behaviour occurs only when there is a relatively high degree of convenience attached to it (e.g., recycling

⁵ The 31-item ECOSCALE measuring environmental responsibility includes knowledge, attitude, behavioural intention and behaviour driven measures (Stone, Barnes, and Montgomery, 1995). However, a lack of face validity and directionality in reported findings makes results dubious and no evidence of its use was found in later studies.

behaviour is increased when curb side recycling is available). However, there is much weaker and mixed evidence to support a positive relationship between beliefs about the importance of acting responsibly toward the environment and actually doing so. These results suggest that inconvenience is weighted more heavily than importance when making environmental behaviour choices (Laroche, Bergeron and Barbaro-Farleo, 2001; McCarty and Shrum, 1994).

The basic self-transcendent or altruistic values of individuals also have a strong influence on their pro-environmental behavioural intentions, both directly and indirectly through their beliefs about environmental conditions (Stern et al., 1995). Those who maintain collectivist values, placing the needs of society over the needs of the individual, are also likely to place significance on environmental responsibility (McCarty and Shrum, 1994).

Several authors have identified that consumers who are willing to pay more for environmental products make up a sizeable enough portion of the market to be worth actively pursuing (Laroche, Bergeron and Barbaro-Farleo, 2001; Myburgh-Louw and O'Shaunnessey, 1994; Suchard and Polonsky, 1991). Self-report studies regarding selection of, and willingness to pay for, environmentally conscious products show overwhelming consumer concern about making environmentally sound purchases. An array of studies have indicated consumer willingness to pay anywhere from 5–40 per cent more for environmentally conscious products (Coddington 1990; Suchard and Polonsky, 1991; Myburgh-Louw and O'Shaunnessey, 1994). However, findings further suggest that we can not assume that environmentally responsible behaviour will transcend categories (Laroche, Bergeron and Barbaro-Farleo, 2001; Picket et al, 1993; Suchard and Polonsky, 1991). For example, those who recycle may not purchase products made from recycled materials. Further, there is evidence to suggest that the likelihood of

actually paying more for an environmentally sound option, after expressing a willingness to do so, is quite low (Rowlands, Parker and Scott, 2002). As such, these results must be interpreted with care.

Dwyer et al. (1993) demonstrate that social marketing campaigns that try to change attitudes in order to change behaviour are generally ineffective. Instead, one should look at the situation from the consumer's point of view to identify what limiting factors are hindering pro-environmental choices. Social marketers should then attempt to address these constraints in a way that is meaningful to consumers and stays within their tolerance for intervention (Stern, 2000).

Market Segments Relating to Environmental Issues

Attempts to profile socially conscious and environmentally concerned consumers have been on-going since the early 1970s. Pioneers found that the socially conscious consumer was likely to be a pre-middle-aged female with above average education and socioeconomic status (e.g., Berkowitz and Lutterman, 1968; Anderson and Cunningham, 1972). Decima (2004) recently provided a profile that identified the average environmentally conscious Canadian consumer as a female professional residing in Ontario or British Columbia, with a post-secondary degree, a partner and at least one child at home, and a household income of either \$30,000–\$60,000 or above \$80,000. However, this profile is not substantively different from the profile of the average Canadian driver, who has a similar household make-up, income, and education level.

As the environment has grown to be a more widely understood and politicized issue, profiling results have been highly inconsistent (Roberts, 1996; Straughn and Roberts, 1999). While a slim majority of studies still indicate that females are more environmentally

conscious than men (e.g., Banerjee and McKeague, 1994), there have been more than a few studies that show males to be more concerned (e.g., Balderjahn, 1988). Other studies found socially conscious behaviour to be consistent across income groups (Laroche, Bergeron and Barbaro-Farleo, 2001) or higher among lower socioeconomic groups (Samdahl and Robertson, 1989). Finally, studies seem to indicate a possible age reversal among the environmentally conscious, with the average age sitting above middle age (Roberts, 1996; Samdahl and Robertson, 1989). This inconsistency and the lack of explanatory power discussed earlier have led to the conclusion that demographics are not useful predictors of environmental consciousness (e.g., Straughan and Roberts, 1999).

Due to an inability to identify one key type of environmentally conscious consumer, psychographic segmentation methods have been used instead to identify multiple types of consumers who are motivated to be environmentally conscious. Table 6 provides a selection of such segmentation results. As in previous sections, studies that use a single study variable to segment respondents rather than a more thorough cluster analyzing techniques have not been included in the forthcoming discussion of segmentation study findings.

Three notable parallels can be drawn across vehicle purchasing, travel mode, and environmental segments. At the most highly committed end are consumers who are currently actively committed to the environment, such as *activists*, *committed environmentalists*, *LOHAS*, and *positive greens*, which parallel the *enlightened adopters* in the vehicle market and *carless crusaders* in the travel mode market. At the low relevance or uncommitted end of the spectrum, we find both actively hostile (e.g., *hostiles*, *non-believers*, *enriched sceptics*) and apathetic segments (e.g., *fatalistic bystanders*, *unconcerned*, *honestly disengaged*). These segments would most closely correspond to *unapologetic drivers* and

stars in the vehicle purchasing market, and *die hard drivers* and *car complacents* in the travel mode market, respectively. Other comparisons are sporadic, with inconsistency across categories for those who express concern for change but make excuses for their own behaviour, and those who don't care about the environment but will act because everyone else does.

Table 6: Market Segments for other Environmental Issues Markets

| | Angus Reid (1994)* | Energy Savings Trust (2008) | Rose et al. (2005) | EKOS (2003)* | Brown & Wahlers (1998) | Gilg, Barr & Ford (2005) | Natural Marketing Institute (2008)** | DEFRAS (2008) |
|---------------------------------------|---|--|---|--|---|--|---|---|
| Market being segmented | Environmental mindset | Energy consumption | | Kyoto Protocol | Environmental efforts and motivational barriers | Environmental behaviours | Health, wellness and sustainability | |
| Country | Canada | United Kingdom | United Kingdom | Canada | United State Midwest | United Kingdom | United States | United Kingdom |
| Segmentation method | Psychographic | Attitudes and behaviour | Motivation | Values and attitudes | Attitudes and behaviour | Behaviour | Attitudes and behaviour | Psychographics socio-demographics |
| Identified segments | | | | | | | | |
| <i>Likelihood to act responsibly:</i> | | | | | | | | |
| High | <u>Activists (20%)</u> Informed and empowered environmentalists with little government trust or media susceptibility | <u>Driving Dependency (10%)</u> Younger couples with new houses and lowest emissions | <u>Pioneers (35%)</u> Will act because it is right | <u>Hard core supporters (33%)</u> Affluent, well informed, values aligned with and strongest supporters of protocol | <u>Product seekers</u> Seek out more environmentally safe products | <u>Committed environmentalists</u> The most enthusiastic in all activities and most likely to compost waste | <u>LOHAS (17%)</u> Dedicated to personal and planetary health in purchasing, actions and advocacy Further divided into <u>leaders</u> (early adopters) and <u>followers</u> (moderated behaviour) | <u>Positive Greens (18%)</u> I do as much as I can to limit my impact on the environment |
| | <u>Boosters (17%)</u> Informed and empowered environmentalists who trust government and are media friendly | <u>Educated advocates (9%)</u> Young and aware, moving into life stage where energy consumption usually increases | | | <u>Recyclers</u> Consumers who actively recycle | <u>Mainstream environmentalists</u> Like the committed, but much less likely to compost waste | <u>Naturalites (17%)</u> Strong health focus with emphasis on organics, not politically committed or environmentally driven in the durables market | <u>Concerned consumers (14%)</u> Do more than most people but won't give up some things so support other options like carbon off-setting |

* From Kindra (2004).

**Note that NMI's (2008) LOHAS segments are proprietary

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| | Angus Reid (1994)* | Energy Savings Trust (2008) | Rose et al. (2005) | EKOS (2003)* | Brown & Wahlers (1998) | Gilg, Barr & Ford (2005) | Natural Marketing Institute (2008)** | DEFRAS (2008) |
|--------|---|--|---|--|---|---|---|--|
| High | | <u>Restful Retirement (6%)</u> Those interested in independence also want to save money and possibly energy | | | <u>Political watchdogs</u> Actively support environmental causes | | | |
| Medium | <u>Anxious (18%)</u> Informed environmentalists who feel guilty and helpless, support government action but are unlikely to take personal action | <u>Comfortable conservatives (9%)</u> Above average emissions with scope to reduce | <u>Settlers (21%)</u> Will change if everyone else does | <u>Middle of the road (31%)</u> Strong supporter but rest quietly in the middle of the pack | <u>Buck passers</u> Shift responsibility for change | <u>Occasional environmentalists</u> Carry out only the most commonplace activities and rarely buy sustainable products | <u>Drifters (24%)</u> Good intentions are often overridden by other factors, price sensitive, trendy and full of excuses | <u>Sideline Supporters (14%)</u> Believe climate change is important but aren't vigilant in all areas and know they could do more |
| | <u>Apathetic mainstream (18%)</u> Disengaged cynics who are unfamiliar with the issues and minorly concerned but not alarmed about the environment | <u>Environmentally mature (9%)</u> High household and vehicle emissions but have resources to change | <u>Prospectors (44%)</u> Will change if it is fashionable or implies success | <u>Conditional supporters (35%)</u> Concerned supporters open to arguments of critics | <u>Excuse makers</u> Postponing involvement | | <u>Conventionals (26%)</u> Practical segment lacking in green attitudes but with common "municipal" environmental behaviours | <u>Cautious participant (14%)</u> Take minimal action, only willing to do what they believe other people do |
| | | <u>Environmentally indifferent (28%)</u> Emissions below average with low car ownership | | | | | | <u>Waste watchers (12%)</u> Conscious of environmental footprint but don't necessarily do anything about it |

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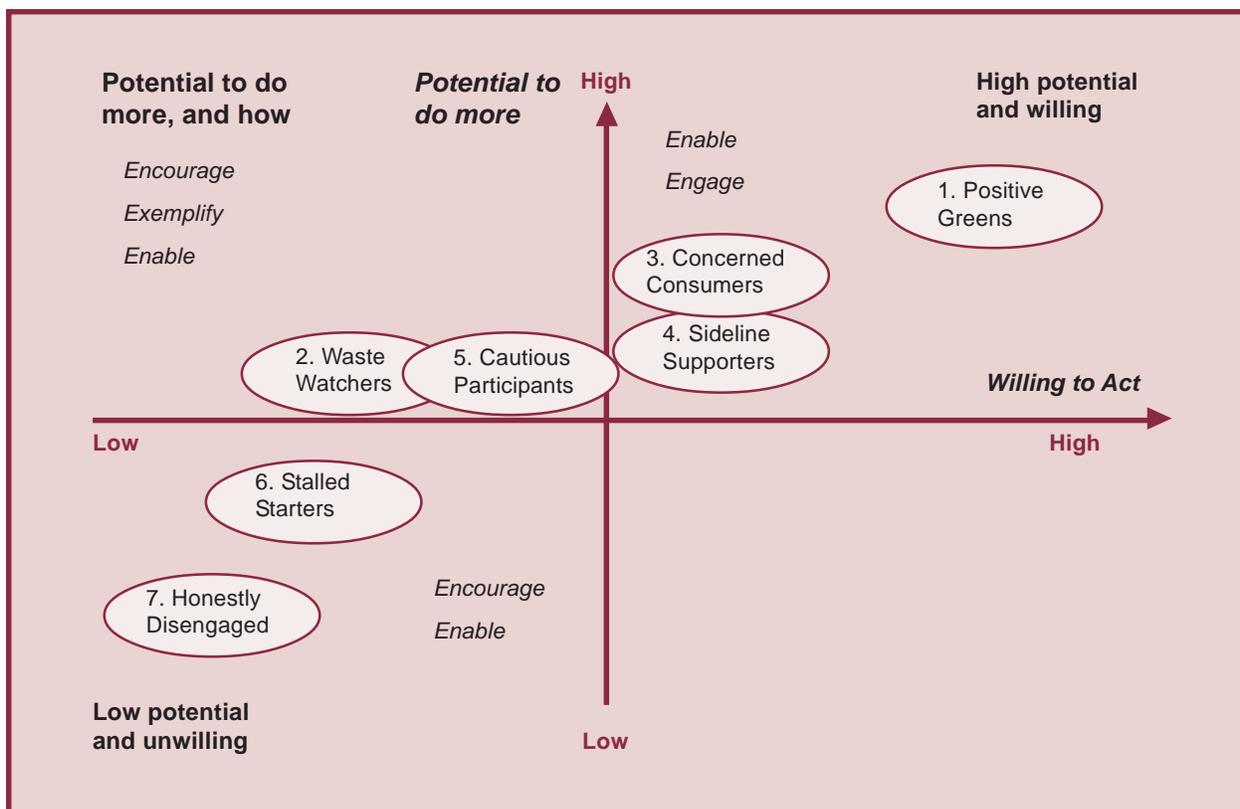
| | Angus Reid (1994)* | Energy Savings Trust (2008) | Rose et al. (2005) | EKOS (2003)* | Brown & Wahlers (1998) | Gilg, Barr & Ford (2005) | Natural Marketing Institute (2008)** | DEFRAS (2008) |
|--------|---|--|-----------------------|---|---|--|--|---|
| Medium | | <u>Discerning Elders (5%)</u> Energy bills are still quite high with moderate vehicle ownership | | | | | | <u>Stalled starters (10%)</u> Take public transport out of necessity and would like a car |
| | | <u>Britain Today(9%)</u> Emissions not high but below average attitude toward the environment | | | | | | |
| Low | <u>Fatalistic Bystanders (14%)</u> Cynical survivalists who don't believe the environment is their problem | <u>Financially Burdened (11%)</u> Large families make household energy consumption high | | <u>Enriched critics (11%)</u> Sceptical government critics with plenty to lose | <u>Non-believers / sceptics</u> Self-servers | <u>Non-environmentalists</u> Rarely participate in environmental activities | <u>Unconcerned (16%)</u> Environment and society are not priorities and show no environmentally responsible behaviour | <u>Honestly disengaged (18%)</u> Don't care about environment and make no effort to change behaviour |
| | <u>Hostiles (13%)</u> Prosperous cynical critics who deny the problem and argue a leftist conspiracy | <u>Ethnic tradition (4%)</u> Extended families make household energy consumption high | | | | | | |

Facilitating Environmental Behaviour Change

Effectively facilitating change in environmental behaviour requires an understanding of consumer motivation, ability and opportunity (Olander and Thøgersen, 1995). Recommended tools often include information provision, moral argument, and financial incentives. DEFRA (2008) offers strategies for engaging various categories of environmental segments (Figure 6). For those segments that are highly willing and able to act, they recommend providing tools that enable action and actively engaging consumers

through two-way communications and community action. For those with moderate willingness and ability to do more, providing encouragement such as financial incentives, leading by example, and providing enabling tools like information and infrastructure to increase ease of action are again recommended. Finally, for low potential segments, encouragement and enabling activities are recommended in the form of regulation and limiting product choices. These strategies can be adapted to suit the vehicle purchasing market and are highly reminiscent of recommendations made earlier in this report.

Figure 6: Strategies for Engaging Environmental Segments



Source: DEFRA (2008).

Social Marketing and Behaviour Change

The tragedy of the commons recognizes that individuals will act with rational self-interest to the detriment of the commons, or shared public resources (Lloyd, 1833). Social marketing attempts to change consumer behaviour by creating exchanges that will both satisfy personal self-interest and benefit the greater good (Rothschild, 1999). However, social marketers often lose sight of the fact that behaviour change, which lies at the centre of all social marketing activity, lies ultimately in the hands of the individual (Andreasen, 2002). As such, if behaviour change is not affected, it may not always be the fault of the marketer, but may lie with the will of the consumer.

The three key tools available to social marketers to achieve behaviour change are education, law, and marketing (Rothschild, 1999). *Education* uses a combination of informative and persuasive messages that tell a consumer how to behave, and why it is in their best interest to do so. This allows the receiver to accept or reject a message, and does not necessarily cause behaviour change. Responses may include selective perception in which only parts of the message that are consistent with current views are retained, and counter arguments to message elements that are inconsistent with currently held views. *Laws* are designed to force behaviour change through the coercive use of legitimate power. In this case, unless the punishment is extremely onerous, there is still free choice based on the costs and benefits associated with the available choices (Rothschild, 2002). *Marketing*, however, is intended to provide incentives or disincentives consistent with consumer self-interest, in order to motivate voluntary behaviour change.

Successful social marketing programs begin with an understanding of the consumer. Issues that must be centrally understood and incorporated into the campaign include

consumer exchange, relationship power, market competition, and self-interest (Rothschild, 1999). Successful social marketing campaigns also require application of a full range of marketing strategies and tactics, including segmentation, competitive positioning, and a variety of tactics drawn from all 4Ps of the marketing mix: product, price, place, and promotion (Andreasen, 2002).

Exchange

Mutually beneficial exchanges are those that provide satisfaction to both parties. This requires that both the social marketer and the consumer see benefit in the exchange. For the marketer, this means that the desired behavioural change is made and maintained. For the consumer, this generally means that the behavioural change, at minimum, either does not reduce his or her current level of personal comfort, or promises to increase long term comfort at the expense of a short term comfort decrement. If one or both of the parties does not believe that their needs will be successfully met, the exchange will not be successful. In such cases, it is advised that the social marketer determine what will improve the likelihood of a successful exchange to the point that risk is reduced to a level where a campaign is worth pursuing.

Commercial marketers understand that it is far easier and cheaper to repeat successful exchanges than to create new ones. However, social marketers rarely want to rely on continued exchanges for the purposes of behaviour maintenance. Ideally, they would like a new behaviour to be adopted and continued without further exchange being required. As such, marketing strategies involving loyalty are not always congruent with repurchase, and interpretation must be modified accordingly.

Relationship Power

Equally important to understanding the requirements of a successful exchange are the nuances of power within the exchange relationship (Andreasen, 2002). Mutual benefit does not always mean equal benefit, and it is possible for one party to want an exchange to occur more than the other. In this case the more powerful party tends to be the more apathetic one. In a social marketing context, the consumer is often apathetic and requires active recruitment to participate in an exchange, despite its mutual benefits, because the value received is usually intangible and long term and comes with a short term cost (Rothschild, 2002). This scenario usually results in either the eager party giving up more in the exchange or accepting less. In a social marketing context, the social marketer often settles for less satisfying results than they want because they don't know how, or are fiscally unable, to provide the necessary level of incentive to tempt the consumer to act in the desired fashion.

Market Competition

Many government, not-for-profit, and community based organizations like to argue that they operate in an environment that lacks competition. It is critical that social marketers realize that the behaviours they are trying to discourage are considered to be their direct competitors (Andreasen, 2002). Indirect competitors could include equally undesirable or only moderately acceptable substitute behaviours that may replace the original behaviour, but are not the desired behaviour being advocated.

Self-interest

Consumers weigh behaviour choices based on short term and long term costs and benefits. Not surprisingly, consumers tend to prefer options that have short term benefits and long term costs over those with short term costs and long run benefits, despite the fact that it is usually the latter which is better for us (Rothschild, 2002). For example, many young men choose to drive extremely expensive foreign sports cars over less prestigious and more economical options, in order to achieve the short term status that such a vehicle affords. Reasons for such behaviour may include risk perceptions, value comparisons, and intangibility associated with short and long term benefits. Education, law, and marketing (dis)incentives can be used to respond to these concerns. Consumers that perceive risk in achieving long term benefit from a choice may want added short term service or other incentive benefits that complement the longer term benefit in order to reduce the perceived risk associated with their choice.

Dealing with the perceived value of short and long term alternatives may involve four different tactics. First, lowering the perceived benefit of a short term competitor can be achieved through law or education. Making the future benefit of the desired behaviour seem closer to the present (and thus increasing its perceived short term benefit) through the addition of added short term incentives is a second option. Thirdly, one may increase the perceived long term cost of a competitor through education. Lastly, lowering the short term cost of the desired behaviour may require removal of barriers or addition of incentives. Intangibility of future costs of competitor short term benefits can be made more tangible through the use of fear appeals in educational campaigns. Intangible future benefits associated with desired behaviour may seem more tangible in the face of educational campaigns, used in combination with either

short term incentive benefits or laws. Acknowledging that consumers are short term focused, and seek to maximize benefits while minimizing costs, is fundamental to choosing social marketing tools and achieving campaign success.

Segmentation

Cause-related marketing involves partnerships between for-profit and not-for-profit organizations (NPOs), whereby for-profit companies make donations to NPOs in direct relation to customer purchasing action. For example, a fast food chain might donate one dollar to charity for every hamburger sold on a particular day. Webb and Mohr (1998) identified four customer segments relating to cause-related marketing. They included sceptics, balancers, attribution-oriented, and socially concerned. *Sceptics* reacted to programs with distrust or disbelief about their legitimacy. *Balancers* had positive attitudes toward the programs, but these attitudes rarely translated into changes in purchasing habits. The *attribution-oriented* segment also showed signs of scepticism, perceiving cause-related marketing to act like a form of advertising on the part of the for-profit firm, and thus became more actively involved in understanding the sponsor's motives and the program before deciding whether or not to participate. If the program was other-oriented, rather than firm-oriented, the attribution-oriented segment reacted positively to the program. The *socially concerned* segment believed that firms participated in these programs for self-centered reasons, but remained most likely to change behaviour and actively participate if the cause being supported was one that they believed in.

It is likely that these segments are reflective of psychographic segments relating to social marketing programs in general, and show parallels with the various car purchase, travel, and environmental segments discussed in this document. Sceptics generally distrust social

marketing programs and are unlikely to voluntarily change behaviour based on such programs; instead, laws are required to force behaviour change through the use of coercive power. The socially concerned only require education to act in a manner that satisfies the greater good, and thus are the most easily behaviourally influenced by social marketing programs. Balancers and attribution-oriented segments are where social marketers can effect the most change by better understanding their clientele. Assuming that each of these segments has been educated about the social issue at hand, the marketing tactics required to reach the balancer and attribution-oriented segments differs slightly. Balancers have positive attitudes toward social marketing programs, but they are not personally relevant enough to be used as key evaluative decision making criteria. Instead, they continue to rely on traditional criteria when making choices. Thus, product offerings and incentives must meet all of the consumer's self-interested demands as well as meet the pro-social result desired by the marketer. For example, if a balancer wants a car that is symbolic of power and the government wants to encourage consumers to purchase lower emissions vehicles, these vehicles must be able to provide balancers with both benefits in a single product offering. Only then will educational advertising and other marketing incentives or disincentives be successful in changing this segment's voluntary purchase choices. Attribution-oriented consumers are only slightly more likely to change behaviour than balancers, and they will only do so if they believe that a program is truly useful. Unfortunately, the sort of convincing and often short term evidence that they want is usually difficult to provide. As such, the educational component of the campaign is of more importance than incentives toward achieving voluntary behavioural modification in this segment. In both cases, change will only occur if the cause is one that the consumer believes to be important and achievable.

Of course, segmentation for specific social marketing campaigns should be based on context specific market research that segments the specific market in question, just as would be done by commercial marketers. The above framework merely provides a foundation for some general categories of segments that one may expect to encounter, and where emphasis should be placed. The car buying segmentation data in this document, when combined with data currently being collected, will, in combination, be invaluable to developing a campaign specifically targeting fuel efficient car purchasing decisions.

Competitive Positioning

As with commercial firms, social marketing campaigns will be more successful if they are able to identify a differentiating factor that makes them a superior choice than their competitors on some dimension. The chosen dimension should ideally include an attribute that the desired behaviour has that competitive behaviour does not, and which is also of significant relevance and/or value to the consumer. Toyota, for example, had success in positioning the Prius as trendy by having celebrities drive them to the Academy Awards rather than arriving in limousines. The Smart car drew attention away from limited interior space by focusing on ease of parking instead. These strategies were also matched to appropriate target segments; in both cases, the target was young urban professionals.

The Marketing Mix

The marketing mix is comprised of what is commonly known as the 4Ps (product, price, place, and promotion).

Product

Products comprise goods, service, ideas and experiences. Social marketing campaigns are traditionally associated with selling ideas, but this is a very limited and limiting view. Social marketing campaigns can, and should, include within them other forms of product. First, satisfactory goods and services, that include all desired attribute combinations so as to satisfy various target segments, must exist so as to allow consumers to act in the desired fashion. This could include providing hybrid or otherwise fuel efficient automobiles in a range of classes and price points, and providing adequate support services to customers who need further assistance in order to make behaviour change feasible.

Branding is also an element of product strategy that should not be under-rated in importance. Any organization with a corporate reputation is nurturing a brand image, and that brand has value. Social marketers should find ways to develop brands for the products they provide in order to encourage behaviour change, such as the ecoAuto label, in order to increase the value of such tools in the eyes of consumers over time. As with the product life cycle, brands gain recognition and acceptance over time, thus patience is required before firm associations between brands and desired behaviours will be seen.

It is also important to recall that the product life cycle and innovation adoption start very slowly before exponential growth is reached. Many social marketing campaigns have very short-term timelines and benchmarks for measuring success. While commercial ventures traditionally see results quickly, they usually offer immediate gratification with short term

benefits, whereas social marketing campaigns often require not just personal, but cultural, change before acceptance is reached. This sort of long term effect can take decades, not years, to achieve.

Price

Price is usually associated with the exchange of money for goods and services; however, time, barter, hedonic experience, and anything else of value can be thought of as the price paid in an exchange. A price can not only include value that is gained, but also value that is foregone. In the case of social marketing, price is often associated with short term costs in the form of benefits that are foregone in exchange for long term intangible gains. In many cases, these gains are of public benefit, as opposed to personal benefit. The immediate perceived value of an altruistic long term benefit is significantly less than a short term hedonic benefit. Thus, the social marketer's task requires adding short term value for the consumer in such ways as have been discussed previously.

Place

Place is often used interchangeably with promotion in the social marketing context. However, it is important to distinguish between the two. Distribution, also thought of as convenience, is a term associated with the P that is 'place.' This involves getting the social marketing products and services out to the consumer. Cause-related marketing, for example, can be associated with the traditional distribution agreement called licensing, while large charitable organizations can be seen as working in a franchise format (Andreasen, 2002), where local branches follow the rules and regulations outlined by an overarching international body. Even if consumers want to behave as a campaign advocates, they will not do so if barriers to action are too great. Keys to

successful distribution include making products and services conveniently available where, when, and how consumer want to have them delivered. Issues such as dealer location, opening hours, staffing, and inventory are critical success factors to both commercial and social marketing efforts.

Promotion

Promotion involves all tools used in a campaign to communicate with the target audience. Because so many social marketing campaigns are limited to ideas delivered through media, this method is generally understood the most readily. Integrated marketing communication is intended to move the consumer from attention, to information/understanding, to desire, to intention, and finally action (reflective of the cognition-affect-behaviour order of decision making), and is most effective when all tools work together to convey a single unified message. Tools include advertising, public relations, direct marketing, sales promotion, and word-of-mouth media. All informational/educational communication should be targeted at all identified consumer segments, since education is foundational to all other campaign elements as it is the major contributing factor to informed free choice. Other persuasive aspects of the campaign should be tailored to specific segments based on their unique needs. Advertising and direct marketing both offer ways to deliver messages to target consumers, either directly or through mass media. Direct marketing and print media are able to deliver a high level of information, while broadcast media are better suited to simple messages. When direct marketing achieves response from the consumer and two-way communication ensues, persuasion and behaviour change can result. Public relations can also provide information indirectly through third party media sources. Sponsorships and product placements are used

primarily as affective tools for making associations between your brand and an event or brand that the target consumer likes, in order to elicit positive attitudes toward the product. Short term incentives are provided through sales promotion techniques, through either monetary or non-monetary means. Monetary incentives are most suited to well known brands that provide functional benefits, while non-monetary incentives are more appropriate for relatively unknown brands or well known brands that provide more hedonic benefits. Sales promotion techniques are most commonly associated with motivating behaviour change through brand switching or increased purchasing volume.

By achieving a better understanding of social marketing techniques, campaign success in terms of behaviour change can increase. By putting continued campaigns in place over the course of the entire product life cycle and continually monitoring how the needs of consumers change over time, as commercial marketers do, maintenance of such change is much more likely to occur, adding to overall success for the initiative.

Conclusions and Recommendations

The above review has examined relevant consumer decision-making theories, as well as providing a review of the recent literature on fuel efficiency, AFVs, alternate transportation modes, and other types of environmentally conscious behaviour. We have concluded with a review of social marketing methods as they might apply to the automotive market. The objective has been to provide greater insight into consumer decision-making, in order to be able to convince consumers to make more transportation choices that are more fuel efficient and contribute less to greenhouse gases. This section will summarize some of the key insights.

- **Automotive purchasing is not always rational.** Although an automotive purchase involves a major investment that should be characterized by high consumer involvement, it is not necessarily a rational purchase. Self-concept, attitudes, and lifestyle can influence automotive choice, allowing emotional factors to take precedence over the practical.
- **Many consumers are slow to adopt new products.** AFVs represent a relatively new product category, and it will be some time before the majority of consumers feel comfortable enough with this new concept to become product adopters in this new category.
- **Social influences are important in transportation decisions.** Automotive purchase decisions are often driven by social influences, since cars are often a sign of status and social standing. Similarly, taking public transit can be driven by social influences, making it an unacceptable choice in some socio-economic brackets.
- **Consumer attitudes and behaviour don't always line up.** What consumers say they will do, and what they actually do, are often two different things. For this reason, measures of purchase intention are often poor predictors of actual purchasing behaviour. People may say they believe in being environmentally responsible, but a close examination of their actual behaviour often demonstrates relatively poor adherence to their lofty ideals.
- **Research has shown only a moderate consumer willingness to buy more fuel efficient vehicles.**
 - Consumers insist on comfort and convenience, and therefore few are willing to trade down from a van or SUV to a smaller vehicle that would be less comfortable or convenient.
 - Consumers are generally relatively unwilling to pay more for improved fuel efficiency, so few are willing to pay significantly more for an AFV version of their current van or SUV model. Consumers do not understand the lifetime operating costs of operating AFVs, and demand a short payback on their initial investment.
 - Self-identity is a key factor, so few consumers are willing to downsize for greater fuel efficiency, since that would impact their personal image.
 - Consumers who currently switch to a highly fuel efficient or alternate fuel vehicle are likely to see this as part of their environmentally conscious self-identity, or are early adopters who enjoy having novelty products.

- **Demographic variables can be predictors of fuel efficient automotive purchases.**
 - Younger and less affluent consumers are more concerned about fuel costs.
 - Those who drive more miles are more concerned about fuel costs (but would prefer not to sacrifice comfort).
 - Women tend to be more concerned about fuel costs (likely because they also often have lower incomes) and less concerned about power.
- **Consumers are more likely to conserve when natural resource consumption levels are visible and understood.**
 - Automotive fuel consumption is highly visible. While consumers lack a full understanding of how much fuel they consume on a long term basis, purchase price, fuel costs and operating costs all consistently work to reduce the likelihood of selecting more expensive vehicle options. Recent gas price increases have demonstrated a notable impact on the market for the larger vehicles.
 - Household power and gas usage is understood at a monthly payment level. Consumers only visibly pay for private household consumption, not out-of-home use. Energy conservation within the home is motivated by reducing monthly bill payments.
 - Water conservation, like power and gas, is understood at a monthly payment level for household use. However, consumers lack an overall understanding of the amount of water that is used in various household activities. Thus, education is required on top of potential cost savings to achieve substantive water conservation.
- **Fuel efficient private vehicles seem to have fewer negatives than alternate transit modes.** Alternate transit usage is viewed as having many negatives, including longer journey times, less convenience, lack of personal space, and reduced personal status. Car-related costs are also often under-estimated, making public transit seem like an unattractive alternative relative to private vehicles.
- **No clear consensus has emerged regarding environmentally concerned consumers.** This may be due to the large gap between consumer attitudes and behaviours, making it difficult to predict consumer behaviour based on what people say they believe. However, the inconvenience associated with environmentally responsible behaviour appears to be the greatest barrier.
- **Social marketing can be used to motivate changes in consumer behaviour.** Social marketers typically target specific markets and manipulate the 4Ps (product, price, place, promotion) in order to motivate behaviour change.

Recommendations

In order to encourage more consumers to make more environmentally friendly choices, several things will need to be done:

- If gasoline prices are to be increased through taxes in order to make it more attractive to switch to more fuel efficient vehicles, such price increases need to be of the significant 50 per cent magnitude of increases seen during 2008 which had an impact on reducing SUV purchases. There is no evidence to suggest that smaller gasoline price increases of 5–15 per cent will have the desired impact. Substantially higher gas prices at a sustained level have the demonstrated effect of changing buying patterns for automobiles by encouraging the purchase of more fuel-efficient vehicles.
- Greater financial incentives should be offered for purchasing FEVs (through income tax incentives, or preferably through immediate cash discounts), in order to make fuel efficient vehicles more attractive. This reduces the risks for consumers, and encourages them to make innovative choices that they would otherwise fear making.
- FEVs need to be offered in a wide range of model choices. Consumers want vehicles that fit as many of their purchase criteria as possible, so comfortable and affordable FEVs need to be available in as many product classes as possible. Where options are available, they need to be promoted to overcome awareness barriers.
- FEVs need to be offered in sufficient numbers to avoid delivery delays. Consumers tend to want rapid availability, so FEVs need to be available in sufficient quantities to satisfy consumer demand.

- Manufacturers should be offered incentives for selling more FEVs (e.g., tie bail-outs to sales of FEVs). Alternatively, manufacturers could face legislated goals for selling FEVs that would include financial penalties for failing to meet the goals. Such legislated goals would force automotive manufacturers to price FEVs at more attractive levels, and would also force automotive manufacturers to heavily promote FEVs.

In addition to the above policy initiatives, a social marketing campaign should be developed to encourage consumers to adopt FEVs. Such a campaign would focus on manipulating the 4Ps of social marketing, in order to create a persuasive argument for consumers to purchase FEVs:

- **Product.** In the automotive sector, the product needs to be made more desirable, which would include creating an aura of prestige surrounding the ownership of FEVs. The FEV product itself also needs to be perceived as being at least as reliable, if not more reliable, than traditional automobiles. Consumers have little understanding of hybrid vehicles, and may have misperceptions about high maintenance costs.
- **Price.** The price of FEVs needs to be made more attractive, preferably on par with traditional vehicles. Consumers tend to focus on the current price rather than the long-term operating cost, so prices of FEVs need to be on par with traditional vehicles. Alternatively, or as a supplement, if gas prices are increased substantially (50 per cent+) through taxes, this can also have an impact on making the operating costs more salient, and encouraging consumers to look beyond the initial purchase price of FEVs.

- **Place.** Smaller cities or towns tend to not carry or service more exotic types of vehicles such as FEVs. For example, in smaller towns that service rural areas, availability of parts may be an issue for FEVs. Therefore, distribution of FEVs and their parts needs to ensure that they are readily available in smaller centres as well as in major cities. Furthermore, a heavy reliance on traditional trucks and 4-wheel drive vehicles for farming and rural enterprises needs to be overcome by educating the consumer about the comparability, performance, and availability of Highly FEV choices.
- **Promotion.** Consumers in general need more education about FEVs and the benefits of switching to FEVs. Consumers are generally unaware of the benefits of FEVs, and are unwilling to switch if there is not a significant cost benefit to offset the perceived risk of choosing a novel FEV product. Therefore, promotional materials need to educate the consumer about FEVs, and motivate the consumer to desire FEVs in preference to conventional automotive products.

By combining policy levers and an effective social marketing campaign, it is possible to change consumer purchasing habits away from gas-guzzling vehicles toward more environmentally-friendly choices. However, these are long-term initiatives that require a dedicated effort now, in order to achieve results for the future.

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