Non-Cost Barriers to Consumer Adoption of Advanced-Technology Vehicles

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Vehicle Purchase Decisions are Influenced by Factors Other than Price

- Vehicle Attributes
  - "Newness" of technology
  - Availability in multiple makes and models
  - Driving range, refueling time
- Consumer knowledge, attitudes and predispositions
  - Level of awareness of or familiarity with technology
  - Uncertainty in costs and benefits of new technology
  - Attitude/predispositions toward new technology
    - Perceived differences
    - Message/associations/values

"Non-Cost Barriers to Consumer Adoption of New Light-Duty Vehicle Technologies," Transportation Energy Futures Series. Prepared for the U.S. Department of Energy by Argonne National Laboratory, Argonne, IL. DOE/GO-102012-3709. 47 pp, to appear.

Proposed Ranking of Non-Cost Barriers

Non-cost Barrier	Effective Cost	Governing Factors	Possible Policies	Potential Policy Effectiveness	Policy challenges
Limited driving range	$1000 - $10,000	Range, driver mobility needs	Pilot programs, information	Probably somewhat effective	Tailoring policies to consumers
Limited fueling/charging stations	$1000 - $10,000	Range, driver mobility needs. Local conditions	Building stations	Effective	High cost
			Pilot programs, information	Probably somewhat effective	Tailoring policies to consumers
Long fueling/charging times	Negligible except for BEVs	Availability, driver's value of time	Building stations	Effective	High cost
			Pilot programs, information	Probably somewhat effective	Tailoring policies to consumers

Proposed Ranking of Non-Cost Barriers, Cont'd

Non-cost Barrier	Effective Cost	Governing Factors	Possible Policies	Potential Policy Effectiveness	Policy challenges
Unfamiliarity, uncertain of benefits	$100 - $10,000	Prevalence, early adopters	Labeling, info, outreach	Effective	Tailoring policies to early adopters, sustainment
Predisposition or perceived differences	$100 - $10,000	Social and behavioral factors	Labeling, info, outreach	Effective	Tailoring policies to early adopters, sustainment
Lack of standards	>$1,000	Technology maturity	Testing, standard-ization	Effective	Complexity of future technology and business models
Limited availability of models/makes	$100 - $10,000	Consumer preferences, modularization	R&D	Limited	Limited role

Consumer Awareness

- Consumer will not purchase a vehicle with a new technology if they are unaware of or unfamiliar with it
- Factors
  - Length of time the technology has been on the market
  - Marketing/advertising
  - Limited availability
  - Market share
  - Consumer social networks
  - Fleet turnover rate (vehicle survival)
- Severity
  - Difficult to quantify, but probably important in early- to mid-term market
  - Theoretical models describe how awareness increases with marketing and via feedbacks through social networks and general exposure

Uncertainty in Costs and Benefits

- Consumers will tend not to buy a vehicle with a new technology if its benefits/costs are uncertain
- Factors
  - Increase in fuel economy
  - Incremental cost of new-technology vehicle
  - Future fuel prices and volatility
  - Miles the new vehicle will be driven and driving aggressiveness
  - Years vehicle will be owned and maintenance
  - Potential resale value of vehicle
  - Future availability and interoperabilty of charging stations
- Severity
  - Difficult to quantify, but probably significant
  - Delaying or foregoing purchase of a new-technology vehicle may be rational if uncertainty is high, and consumers may be risk-averse

Limited Driving Range and Fueling/Charging Availability

- Consumers will tend not to buy a vehicle with a limited range and/or that is not convenient to refuel/recharge
- Factors
  - Driving range
  - Fueling/charging time
  - Fueling/charging station availability
  - Consumer driving patterns
  - Household travel options
- Severity
  - Very severe for short-range vehicles or alt fuel vehicles having few fuel stations

Limited Driving Range and Fueling/Charging Availability

- For restricted range vehicles, limited range may limit the size of the potential market to those drivers who drive mostly moderate distances
  - Try to identify the potential market segments rather than an implied value
- Market depends strongly on assumptions about
  - Adaptability of drivers, e.g. do they have alternate vehicles or modes available?
  - Availability and convenience of fueling/charging stations
- BEV and FCV markets will differ from other vehicle markets and adoption will probably be spatially heterogeneous initially, e.g., “lighthouse” concept, clustering of hydrogen fueling stations and hydrogen fuel cell vehicle adoption
- Difficult to predict future market for range-limited vehicles

Limited Availability of New Technologies or Diversity of Models Offering a Technology

- Consumers want bundles of features in vehicles. If technologies that increase fuel economy are not offered in a desired package, consumers may forgo the technology
- Some consumers are loyal to their favorite brands, or need a certain vehicle type or class and will tend not buy a new-technology vehicle if it is not offered by their preferred brand or class
- Factors
  - Range of makes and models that the technology is offered in
- Severity
  - Can be significant

Some Preferences in Vehicle Choice are Difficult to Quantify or Model

- Consumer predispositions or associations
  - Vehicle size ⇔ safety
  - Fuel economy ⇔ poor performance
  - Diesel ⇔ odor, noise
- Consumers purchase vehicles not only for transportation, but as symbols
- Purchasing a car is significant economically, but much of its significance also comes from how it produces meanings that support the owner's self-image and allow expression of that image to others
- Purchase decisions depend on the consumer's frame of reference
- Symbolism and frames are not easily quantified, but are important when communicating with consumers

Heffner R, KS Kurani, TS Turrentine, (2007) "Symbolism in early markets for hybrid electric vehicles", UCD-ITS-RR-07-01.

Conclusions

- Non-cost barriers to new vehicle technologies are significant
- Many are difficult to quantify, but relevant factors can be identified
- Marketing to consumers and projecting future adoption should respect market segmentation
  - Can we identify segments of the consumer population who are likely adopters?
  - How best to inform these consumers about advanced vehicles so they can make informed decisions?