

# The Impact of New Energy Vehicle Product Functions on Consumer Purchase Intention in the Backdrop of Sustainable Development Goals

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## Abstract

In this green and sustainable society, there exists a common goal among the people of the entire country: China's carbon dioxide emissions are set to peak before 2030, with carbon neutrality aimed by 2060. These objectives signify a transformation in China's economic and social development towards a greener, more environmentally protective, and low-carbon future, necessitating substantial efforts. Green and environmentally friendly electric vehicles are poised to become the primary drivers of low-carbon development within the transportation sector. Within the context of sustainable development goals, this paper examines the impact of new energy vehicle product functions on consumers' purchase intentions. The study employs a survey questionnaire method, utilizing consumers' preferences for various functions of new energy vehicles as independent variables and purchase intention as the dependent variable. The results indicate that driving range, charging convenience, intelligent driving assistance systems, safety features, and other functions significantly influence consumers' purchase intentions. Additionally, consumers' awareness of environmental protection and social responsibility also plays a role in shaping their purchase intentions. The study suggests that new energy vehicle enterprises should focus on the development and design of product functions, enhance product performance, cater to the diverse needs of consumers, and promote environmental awareness through public education, thereby facilitating the adoption and application of new energy vehicles. This approach is conducive to achieving sustainable development goals.

#### **Subject Areas**

Economics

#### **Keywords**

New Energy Vehicle Product, Sustainable Development Goals, Consumer, Purchase Intention

#### **1. Introduction**

In the context of the rapidly developing new energy vehicle market, both domestic and international experts have conducted extensive research on the factors influencing market demand. These factors primarily include the level of product technology, consumer environmental awareness, and national policy support. As product technology continues to advance, consumer environmental awareness increases, and subsidies decline, new energy vehicles encounter both new opportunities and challenges. For a country or company to thrive in an intensely competitive environment, it is essential to establish an evaluation system that identifies core competencies and accurately assesses them. Foreign research on this aspect began earlier. It mainly studied three groups of new energy vehicle purchase factors: technical aspects, consumer characteristics and their own factors. Most of the leading OEMs will re-launch their flagship models as second-generation models [1]. American Krupa and other research show that consumers are more concerned about the cost of energy consumption of new energy vehicles themselves, more concerned about the use of the cost, accounting for the proportion of the total cost. Currently, as the country actively promotes green products, public awareness of environmental protection is on the rise. In the decision-making process regarding new energy vehicles, the environmental impact of the vehicle has emerged as a crucial factor. Enhancing the sustainability of automobiles not only renders them more environmentally friendly but also attracts eco-conscious consumers, thereby boosting consumer demand. This increase in demand fosters economic growth, enabling the automotive industry to allocate more resources toward green innovation, creating a virtuous cycle. One of the most crucial challenge is the problem of the battery lifetime [2]. In the realm of economics, consumer behavior encompasses a distinctive component known as consumer preference. This refers to the ordering of various consumption options by consumers based on their individual desires, reflecting their affinity for specific products. Such preferences form the foundation of market demand and serve as a significant indicator of consumer behavior. On the one hand, consumers' preferences influence their purchasing decisions; on the other hand, their post-purchase experiences provide positive reinforcement, further shaping their preferences. It bridges the gap between fundamental laboratory research and industry [3]. In 1979, psychologists Kahneman and Tversky put forward prospect theory, which is divided into editing stage and the evaluation stage. They believe that the theory of consumer purchasing decision is to collect and sort out product information first. In 1998, he put forward the theory of preference construction based on consumer

emotion and cognitive orientation, which holds that the original goal of consumer decision making has a great impact on the process of consumer decision making, and consumers' preference expectation is satisfied. Fuel cars have outstanding shortcomings. Foremost, fuel vehicle exhaust emissions cause harm to the environment and are not environmentally friendly. Then, Gasoline prices are higher, so you need to pay more for fuel. Third, the cost of car maintenance is high, and the need to regularly replace the oil and maintain the engine and other equipment increases the economic burden of the owner. New energy vehicles are green. New energy vehicles make up for consumers' concerns about mileage and can achieve charging freedom. Traditional fuel vehicles are more dangerous to drive. On the contrary, new energy vehicles can only improve the safety performance of sensor algorithms and cloud services.

#### 2. New Energy Vehicle Product Functions

In light of the growing global awareness of environmental protection and the promotion of energy structure transformation, new energy vehicles are emerging as a significant alternative to traditional fuel vehicles, garnering attention and support from consumers and governments worldwide. As indicated by the International Energy Agency, global sales of new energy vehicles are exhibiting a gradual yet consistent upward trajectory, with projections indicating a continued expansion in the coming years. Consequently, the product features of new energy vehicles assume a pivotal role in influencing consumer purchasing intentions.

#### 2.1. Battery Technology and Range

One of the fundamental technologies driving the development of new energy vehicles is the continuous advancement of battery technology. As highlighted in the Lithium-ion Battery Technology Assessment report, recent improvements in lithium-ion battery technology have significantly enhanced both energy density and charging efficiency. These advancements have enabled electric vehicles to achieve impressive ranges, with some models exceeding 1000 kilometers on a single charge. This remarkable increase in range not only alleviates consumers' travel concerns but also eliminates the anxiety commonly associated with battery life, particularly for long-distance journeys that many families undertake.

Moreover, the enhanced efficiency of these batteries has led to faster charging times, making it more convenient for users to recharge their vehicles. For instance, advancements such as fast-charging stations and battery management systems have reduced charging durations to as little as 20 - 30 minutes for substantial re-charges, allowing drivers to resume their journeys with minimal downtime. These technological breakthroughs have sparked a surge in consumer interest and confidence in purchasing new energy vehicles. With the ability to enjoy longer driving distances without the constant need for recharging, coupled with a more user-friendly charging experience, families are increasingly inclined to consider electric vehicles as viable alternatives to traditional internal combustion engine cars.

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#### 2.2. Charging Facilities and Convenience

As the market for new energy vehicles continues to expand, consumer demand for convenient charging is also growing. In urban areas, a dense and well-distributed network of charging stations is present throughout the city, providing new energy vehicle owners with a convenient and hassle-free experience of "charging as you go." This not only alleviates consumers' concerns about mileage, but also encourages the broader adoption of new energy vehicles for daily commuting and short-distance travel. Concurrently, the advent of intelligent charging technologies, including charging reservation and automated billing, has further optimized the convenience and efficiency of the charging process, approximating the experience of using new energy vehicles to that of traditional fuel vehicles. This has reinforced consumers' willingness to purchase such vehicles.

The construction of high-standard, large-capacity service area charging stations represents a crucial step in addressing the challenge of charging new energy vehicles over extended distances. Such charging stations are not only equipped with highspeed charging capabilities, which can replenish sufficient power for vehicles in a relatively short period of time, but are also often equipped with rest areas, catering services, and other ancillary facilities to provide drivers with a comprehensive range of service experiences. The promotion of this "one-stop" service model addresses consumers' concerns about long-distance driving of new energy vehicles and facilitates the wider geographical dissemination of new energy vehicles.

#### 2.3. Driving Performance and Intelligent Technology

The incorporation of intelligent technologies has elevated new energy vehicles to a new standard of intelligent mobility. From automatic driving assistance systems to intelligent connectivity features, new energy vehicles facilitate a seamless connection between vehicles and roads, vehicles and vehicles, and vehicles and people through the integration of advanced sensors, algorithms, and cloud services. These technologies not only enhance driving safety and effectively reduce the risk of accidents through auxiliary functions such as collision prevention and lane keeping, but also greatly enrich driving pleasure and convenience. To illustrate, the intelligent navigation system is capable of modifying routes in accordance with real-time road conditions, whereas the intelligent voice assistant enables drivers to effortlessly undertake tasks such as music playback and phone dialing without distraction during the driving process.

As reported by Automotive Engineering Journal, these technologies not only enhance vehicle safety and driving comfort but also improve overall user satisfaction. This comprehensive upgrade has further accelerated the rapid development of the new energy vehicle market, making a substantial contribution to the realization of the Sustainable Development Goals. Consequently, as technology progresses and the market matures, new energy vehicles are increasingly becoming the preferred choice of an expanding consumer base, due to their distinctive attributes and benefits. New energy vehicles not only demonstrate superior driving performance but also offer consumers a novel driving experience through their advanced electric drive technology and intelligent systems.

#### 2.4. Environmental Performance and Sustainability Features

As indicated in a report published by an environmental organization, the strategic environmental assessment is conducted using the development of Xiong'an as an experimental study to demonstrate the effectiveness of proposed method [4]. These vehicles produce essentially no tailpipe emissions during operation. Environmental awareness is the concern for environmental issues and the view and willingness to maintain the relationship between people and the environment. In comparison to traditional fuel vehicles, they can markedly reduce emissions of carbon dioxide and other greenhouse gases, which is of inestimable value in mitigating global warming and improving air quality. We focused on pure electric vehicles (EVs) rather than plug-in hybrid electric vehicles (PHEVs) [5]. Moreover, the sustainable development characteristics of new energy vehicles are reflected in their full life cycle of environmental considerations. From the initial collection of raw materials through manufacturing and ultimately to recycling, the new energy vehicle industry is engaged in a continuous process of exploring and implementing greener, low-carbon production methods. For example, initiatives such as the adoption of renewable energy for charging and the promotion of battery laddering represent positive contributions made by the new energy automobile industry with the objective of achieving sustainable development. The paper concluded that electronic participation in governance is both a responsibility and a privilege [6]. The aforementioned advantages of product performance serve not only to enhance the image of new energy vehicles in the minds of consumers, but also to further promote the market acceptance of new energy vehicles and the growth of demand. An increasing number of consumers are coming to recognize that selecting new energy vehicles represents not only a personal choice but also a proactive step towards environmental stewardship and engagement in global environmental protection initiatives.

# 3. New Energy Vehicle Consumer Preference Survey Analysis3.1. Questionnaire Design

The design of an effective questionnaire is of paramount importance in the process of studying how the characteristics of new energy vehicles affect consumers' purchase intention. The specific content of the questionnaire can see appendix. This section outlines the design methods, and specific research steps.

#### **3.2. Research Methods**

In order to gain a comprehensive understanding of consumer preferences and willingness to purchase new energy vehicles, this study employs a range of research methods and instruments (See Table 1).

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Research method	The target group for this study was identified as consumers who are considering purchasing a new energy vehicle or who already own a new energy vehicle. To ensure diversity and representativeness of different regions and backgrounds, both online surveys and face-to-face interviews were employed.
Design principles	The following principles were employed in the design of the questionnaire: The questionnaire was designed in accordance with the principles of clarity, simplicity, and objectivity to ensure that respondents could comprehend the questions accurately and provide honest feedback. The survey instrument addressed consumers' needs for new energy vehicle features, the factors influencing their purchase decisions, and their environmental awareness.
Scale design	The scale design was as follows: A variety of scales were employed to ascertain the relative im- portance placed on different features by consumers, including range, charging convenience, driving performance, and environmental attributes. To facilitate the analysis and comparison of the data, Likert scales or analogous rating systems were employed.
Questionnaire Structure	The questionnaire was structured as follows: The questionnaire comprises both open-ended and closed-ended questions. Open-ended questions are employed to elicit consumer opinions and suggestions, whereas closed-ended questions are utilized to ascertain specific preferences and choices. In addition, the questionnaire includes basic demographic questions (e.g., age, gender, education, and household income) to analyze the influence of consumer characteristics on purchase intentions.
Research objective	The research methodology employed is as follows: The survey was distributed via an online plat- form, disseminated through social media and automotive forums, and supplemented with a num- ber of face-to-face interviews to gain a deeper understanding of respondents' actual thoughts and attitudes.

#### 3.3. Analysis of Survey Data

In this survey on consumers' preferences for new energy vehicles, we distributed a total of 500 questionnaires and received 432 responses, of which 410 were valid. The majority of survey respondents are adults. These questionnaires were filled out by individuals from different age groups, genders, educational backgrounds, and annual household income levels. The participants were mostly families of three and four. The survey's reliability and validity are essential. Reliability ensures consistency, while validity measures accuracy. The following **Table 2** provides information for reference. Data analysis has provided a comprehensive understanding of consumers' preferences for various functions of new energy vehicles.

#### 3.3.1. Consumer Preference Survey

The analysis commenced with an examination of consumer preferences when selecting a new energy vehicle, with a particular focus on several key aspects as identified in the questionnaire data.

The aspect of range was identified as being of particular importance to consumers when purchasing a new energy vehicle. This reflects consumers' concerns about the ability of new energy vehicles to travel long distances, as well as their high demand for reducing the number of charging times and improving the convenience of use. The convenience of charging is a significant factor in the evaluation

Table 1. Survey details.

of electric vehicles. Following the issue of range, the convenience of charging is also receiving considerable attention, with 75% of respondents indicating that this is a high priority. This illustrates the significance of the extent of charging infrastructure in influencing consumer purchasing decisions, particularly in the context of urban commuting and long-distance travel.

#### Table 2. Influence factors.

Key Factor	Description	Importance Votes
Range	The driving distance capability of new energy vehicles	336
Charging Convenience	The ease of charging and the availability of charging infrastructure	307
Driving Performance	The driving experience and handling capabilities of the vehicle	278
Intelligent Technology	The integration of autonomous driving, in-vehicle connectivity, and other smart technologies	246
Environmental Attributes	The environmental benefits, such as reduction of carbon emissions	225

Driving performance is a further factor that is considered to be of importance in the purchasing decision-making process. Although not as pivotal as range and charging convenience, driving performance is still regarded as a significant factor in the purchase decision, with 68% of respondents offering a favorable evaluation. This indicates that consumers are not solely concerned with the environmental impact and cost-effectiveness of new energy vehicles; They also prioritize the driving experience and handling performance.

The incorporation of intelligent technology (e.g., autonomous driving, in-vehicle connectivity, etc.) into new energy vehicles is becoming increasingly prevalent, garnering favor from an expanding consumer base. Approximately 60% of respondents indicated that intelligent technology plays a significant role in their purchasing decisions, indicating a positive response to the trend of automotive intelligence and internet connectivity.

Environmental attributes as a fundamental aspect of new energy vehicles, environmental attributes are also a significant consideration for consumers. Although the direct economic effect is not as immediately apparent as range and cost, 55% of respondents still consider environmental attributes important. This reflects the modern consumer's pursuit of a sustainable lifestyle and social responsibility.

#### 3.3.2. The Influence of Characteristics on Consumers' Purchase Intention

As for the dimensions of perceived value, Sheth and Newman divided it into five dimensions (functional value, conditional value, social value, emotional value and cognitive value). Sweeney and Soutar improved it and developed the classic four-dimensional scale (quality value, emotional value, price value and social value). We employed this classic classification method for research.

The term "quality value" is defined as the ratio of the quality of a product or service to its price. The enhancement of new energy vehicles in terms of range and

driving performance directly contributes to an improvement in their quality value as a means of transportation. Consumers perceive these features to guarantee the dependability and dependability of the vehicle in everyday use, thus enhancing their inclination to purchase.

The emotional value of a vehicle is determined by a number of factors, including the vehicle's design, performance, and the consumer's emotional response to it. The incorporation of intelligent technology and environmental attributes confers a heightened emotional value to new energy vehicles. The implementation of automated driving, in-vehicle interconnection, and other technological advancements streamline the driving process, enhancing convenience and comfort. Additionally, environmental protection features, such as reduced carbon emissions, instill a sense of social responsibility and fulfillment in consumers when purchasing a vehicle. Such emotional factors serve to further stimulate consumers' desire to purchase.

Price value is defined as the ratio of the cost of a product to the value that consumers ascribe to it. Although the initial purchase cost of new energy vehicles may be high, the cost of their use is gradually reduced as a result of technological advancement and the advent of large-scale production. Furthermore, government subsidies serve to mitigate the financial burden associated with vehicle acquisition. Once consumers become aware of the long-term economic benefits of new energy vehicles, their price value is enhanced, thereby strengthening their willingness to purchase.

The social value of new energy vehicles can be defined as the value they bring to society as a whole. The selection of new energy vehicles not only reflects consumers' concern and support for environmental issues, but also their sense of responsibility and foresight as members of society. The perceived social value associated with the purchase of new energy vehicles enables consumers to gain social recognition and respect, which in turn enhances their willingness to purchase.

The results of this questionnaire survey demonstrate that the perception of new energy vehicles is evolving among consumers, with their multifaceted functional attributes becoming a significant determinant of purchase intent. The range capability addresses consumer concerns about mileage, the improvement of charging convenience enhances ease of use, excellent driving performance improves the driving experience, integration of intelligent technology expands the vehicle's capabilities, and environmental attributes align with consumers' preferences for sustainable travel. Despite the benefits of PHEVs, realization ultimately falls on the consumers' willingness to purchase the new technology [6]. These features collectively contribute to the distinctive appeal of new energy vehicles, which enhances the value perception of consumers from multiple perspectives and thus facilitates the formation of purchase intention. As technology advances and the market grows, new energy vehicles will become increasingly competitive in a wider range of applications, playing a pivotal role in the evolution of the automotive industry.

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#### 4. New Energy Vehicle Development Strategy

#### 4.1. Policy Strategy

First of all, we can improve the construction of charging infrastructure, accelerate the construction of highway charging networks, encourage residential communities to install charging piles, and solve the problem of difficult charging. Secondly, we maintain and optimize the subsidy policy for car purchases, adjust the subsidy standards, focus on supporting key technological breakthroughs and industrial chain upgrades, and guide healthy market competition. In turn, farm management decisions affect agro-ecological processes such as nutrient and water supply, and thus productivity [7]. What is more, encouraging green travel, we give priority to the development of public transport, formulate differentiated parking charging policies, and guide consumers to choose new energy vehicles. Last but not least, not only can we strengthen the investment in technology research and development, support the research and development of core technologies of new energy vehicles, improve battery range, reduce production costs, and enhance product competitiveness, but we also argue to improve the legal and regulatory system, formulate laws and regulations specifically for new energy vehicles, regulate the market order, and protect the rights and interests of consumers.

#### 4.2. Business Strategy

Foremost, enterprises can actively transform and upgrade, incorporate new energy vehicles into enterprise development strategies, and seize industry development opportunities. Furthermore, they can increase investment in research and development, break through core technical bottlenecks, improve battery life, reduce production costs, and create competitive advantages. In addition, farm management decisions affect agro-ecological processes such as nutrient and water supply, and thus productivity [8]. Innovation has become a key issue at various levels for firms, institutions and governments and its importance has motivated researchers to identify its various driving forces. Subjective knowledge was found to have the highest explanatory capacity [9]. Finally, business could strengthen cooperation with core parts suppliers such as batteries and motors to ensure supply chain stability and improve product reliability.

#### **5.** Conclusion

In the article of sustainable development goals, the functions of new energy vehicles have a significant impact on consumers' purchase intentions. Outcomes of the study, should promote further research using this sampling frame for future research, especially in the area of marketing [10]. Consumers are increasingly catching attention to factors such as environmental performance, driving range, intelligent functions and safety performance. In addition, government policy support, the improvement of charging infrastructure and the improvement of social awareness have further enhanced consumers' willingness to buy new energy vehicles. However, the shortcomings of new energy vehicles mainly include: Firstly, insufficient number of charging piles, uneven distribution, and long charging time, affecting user travel experience. Secondly, limited battery range, long charging time, and high battery cost, affecting user cost and convenience. Last but not least, Battery safety issues need to further strengthen safety performance testing and supervision. We can use the following methods, such as speeding up the construction of charging piles, improving charging speed, building smart charging network, and providing users with more convenient charging services. What is more we can also improve battery energy density, extend battery range, reduce battery cost, and explore new technologies such as solid-state batteries. The most important things are that strengthen battery safety performance testing, improve battery production standards, and establish a sound safety management system.

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# **Conflicts of Interest**

The authors declare no conflicts of interest.

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# Appendix

# Questionnaire on Consumers' Willingness to Purchase New Energy Vehicles Dear Mr./Ms.

Hello! In order to help us better understand consumer demand and preferences for new energy vehicles, your participation is very important. Please answer the following questions carefully. Your answers will have an important role in guiding the development of new energy vehicles in the future. The information in this survey is for academic research only, and we guarantee that your information will be kept strictly confidential. Thank you for your participation!

Personal Information:

1) Age	2) Annual household income	3) Education level
A) Less than 18 years old	A) Less than \$100,000	A) High school
B) 18 - 25 years old	B) Less than \$100,000	B) Below high school
C) 26 - 35 years old	C) 300,000 - 500,000 yuan	C) Bachelor's Degree
D) Over 36 years old	D) More than 500,000 yuan	D) Postgraduate and above

#### Preference and willingness to buy new energy vehicles:

1) Have you ever considered purchasing a new energy vehicle?	A) Yes	B) No
2) Would you prefer to buy a new energy vehicle for environmental reasons?	A) Yes	B) No
3) If you currently own a traditional fuel vehicle, would you consider replacing it with a new energy vehicle?	A) Yes	B) No
4) Would you be willing to participate in a face-to-face interview to further share your views on new energy vehicles?	A) Yes	B) No
5) If yes, how much importance do you attach to the following features when purchasing a new energy vehicle	A) Driving performance	B) Driving performance
6) How well do you know about new energy vehicles?	A) Very well	B) Very well