

Article

Understanding the Acceptance of Vehicle-to-Grid (V2G) Services: Evidence from Chongqing, China

Qi Chen ^{1,*} , Wenli Fan ², Jian Chen ³ and Yin Pan ¹¹ College of Architecture and Urban Planning, Chongqing Jiaotong University, Chongqing 400074, China² College of Traffic & Transportation, Chongqing Jiaotong University, Chongqing 400074, China³ School of Smart City, Chongqing Jiaotong University, Chongqing 400074, China

* Correspondence: chenqi@cqjtu.edu.cn

Abstract

Amid global energy demand escalation, renewable energy intermittency, and electric vehicle (EV) charging demand concentration exacerbating power grid supply–demand contradictions, Vehicle-to-Grid (V2G) emerges as a solution, yet EV users' V2G acceptance and participation willingness lack in-depth exploration. This study aims to fill this research gap by investigating Chongqing EV users' V2G acceptance, behavioral intention, and influencing mechanisms to provide support for V2G promotion. It targets EV owners in Chongqing's downtown areas, collecting 295 valid questionnaires, covering users' demographics, travel-charging habits, and subjective attitudes. Based on technology acceptance and usage theories, it constructs a structural equation model (SEM) with perceived usefulness, ease of use, economic viability, and technological risk as latent variables to analyze their impacts on behavioral intention. Results show that perceived usefulness, perceived ease of use, and economic benefits positively affect behavioral intention, while technology risk perception exerts a negative effect; users with fixed commutes, low-range anxiety, and home charging piles are more receptive, and 70% support V2G but worry about battery wear and plug-in duration. Its innovation lies in integrating EV charging–discharging and travel patterns into the analysis, and its findings enrich new energy technology acceptance theory and provide a theoretical basis for transportation-energy system coordinated planning and V2G development.

Keywords: V2G; EV user acceptance; behavioral intention; structural equation model

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1. Introduction

Under the guidance of achieving the global “carbon peaking and carbon neutrality” goals, energy transition has become an inevitable trend and a crucial path to achieve sustainable development. As the share of renewable energy keeps rising, its inherent intermittency and instability impose higher demands on both the stability and accommodation capacity of the power grid. Meanwhile, as the concept of green travel takes firm root among the public, new-energy electric vehicles (EVs) have been promoted and used more extensively in practice. The global stock of EVs has experienced explosive growth. As their charging demand becomes concentrated, the supply–demand contradiction in the power grid has been further aggravated. In response, the significance of energy storage technology has become more prominent, and Vehicle-to-Grid (V2G) technology has thus emerged to meet the needs of the era. V2G technology regards EVs as mobile energy storage units. By enabling bidirectional energy conversion between electric vehicles and the power grid, it

provides a new solution for the accommodation of renewable energy and the regulation of power grid load.

Among the existing implementation forms of V2G, the distributed V2G for the public has the greatest peak-shaving potential. It is no longer restricted to social service vehicles such as buses and ride-hailing cars that need to cooperate with power grid dispatching. Instead, the scope of application is expanded to all electric vehicles. Vehicle owners can charge their cars during the low-load periods of the power grid, and discharge electricity to the grid during peak-load periods. This not only reduces the electricity cost but also enables them to obtain additional income through energy trading. The distributed V2G for the public provides vehicle owners with more flexible charging options. Meanwhile, it can effectively integrate renewable resources, reduce the impact of their intermittency and volatility on the power grid, and improve the stability of the power grid.

In-depth tests and evaluations have shown that V2G can effectively integrate the energy storage capacity of electric vehicles with power grid regulation requirements, enhance the accommodation of renewable energy, reduce dependence on traditional fossil energy, and lower power grid operating costs. Similar initiatives have been implemented in other regions. Wuxi (China) e-Park Vehicle Network Interactive Center uses advanced V2G technology and an intelligent management system to achieve efficient vehicle-grid interaction [1]. By charging vehicles during low-load periods and discharging during peak-load periods, it eases the power supply–demand contradiction in the grid, improves the economic efficiency and reliability of grid operation, and offers vehicle owners convenient charging services and economic compensation. Furthermore, the first integrated demonstration station for photovoltaic, energy storage, charging, and discharging energy management of Chongqing buses combines photovoltaic power generation, energy storage systems, and V2G technology [2]. This achieves multi-level energy utilization and optimal allocation. On top of meeting the charging needs of buses, it combines vehicle energy storage with grid regulation via V2G technology, boosts energy utilization efficiency, and cuts down bus operating costs. These pilot projects, across diverse application scenarios, fully demonstrate that V2G technology significantly contributes to regulating the power grid supply–demand balance, improving energy utilization efficiency, and promoting renewable energy accommodation. This lays a solid foundation for its widespread adoption.

Though V2G technology has been validated by global pilots for its value in grid balance and energy efficiency, the large-scale promotion and application of public-focused distributed V2G still hinge on public acceptance and active participation. Currently, the public's understanding of V2G technology is still insufficient, and there exists wide variation in their acceptance of this emerging vehicle-grid interaction model. Additionally, quantifying and predicting users' psychology and behavioral decisions related to V2G participation presents certain challenges, which in turn makes the feasibility of user involvement and the widespread popularization of the technology remain unclear. Unlike prior V2G acceptance studies that focus narrowly on attitudinal determinants in isolation, this study makes a novel contribution by systematically integrating EV users' travel behavior patterns, charging–discharging characteristics, and infrastructure conditions into the Technology Acceptance Model (TAM) framework, thereby providing a more contextualized understanding of V2G behavioral intention. Furthermore, by situating the empirical analysis in Chongqing—a rapidly urbanizing megacity in southwestern China with unique topographical and infrastructure constraints—this study extends the geographical scope of V2G acceptance research beyond the predominantly studied contexts of developed countries and eastern Chinese cities. Therefore, investigating EV users' V2G participation willingness and behavioral decision making is of profound significance. The findings of this study may serve as a theoretical basis for the government to advance the promotion

and development of V2G, aligning with the practical needs of public-oriented distributed V2G popularization discussed earlier.

2. Literature Review

2.1. Characteristics of EV Charging Behavior

With the popularization of EVs, understanding the spatiotemporal characteristics of users' charging, discharging, and travel behaviors has become crucial for the optimization of smart grids and the coordinated planning of transportation-energy systems. Regarding charging behavior, Fang et al. have analyzed vehicle travel record datasets and found that charging behavior on weekdays shows a “double-peak” pattern, occurring at 9 am and 5 pm [3]. Sun et al. have discovered that most EV drivers charge their vehicles at night [4]. Yang has explored the charging and discharging potential of EVs in different functional areas [5]. It has been found that the discharging response potential peaks between 14:00 and 16:00 in work areas and reaches its lowest level between 0:00 and 3:00. In residential and commercial areas, the discharging response potential is relatively high from 18:00 to 22:00.

Compared with fuel-powered vehicles, EV users also exhibit certain differences in travel patterns. Yang X. et al. have used trajectory data to describe the mobility patterns of EV users and found that EV users, possibly limited by driving range and energy replenishment, tend to be more active in a relatively small geographical area [6]. In addition, charging demand shows a certain aggregation in spatial distribution. Zheng et al. identified that charging demand is higher in residential and commercial areas but lower in the work area [7]. Notable differences also emerge in the temporal distribution of charging demand across various functional areas. Specifically, charging demand in work areas is concentrated before noon, while in shopping and entertainment areas, it clusters from afternoon to evening [8]. In terms of vehicle usage patterns, Harris, C. B. and Webber, M. E. identified notable differences in day–night driving patterns between weekdays and weekends [9]. Furthermore, the charging demand of electric vehicles (EVs) tends to be higher during the power grid's peak consumption periods—aligning with the earlier noted “double-peak” charging pattern (e.g., 5 p.m.) that overlaps with grid peaks.

2.2. Influencing Factors of Users' Participation in V2G

As efforts to promote vehicle-grid integration progress, the technical dimensions of V2G charging and discharging have reached a relatively mature stage. Yet, challenges remain on the front of user acceptance—consistent with the earlier noted gaps in public awareness and participation willingness. The level of awareness of V2G technology among the public EV users, as well as the resulting transformation of travel habits, are becoming obstacles to the further popularization of V2G. Users' habitual preferences, attitudes and perceptions towards V2G play a crucial role. They affect users' acceptance and participation in V2G.

Studies have found that users exhibit high sensitivity to V2G-related limitations. On one hand, positive attitudes toward V2G services and recognition of its value boost users' V2G usage intention; on the other hand, the potential risks posed by V2G technology undermine their willingness to participate in V2G [10]. Additionally, EV users take multiple factors into account, which fall into two distinct categories: one is the inherent attributes of EVs themselves—including environmental sustainability, driving range, charging convenience, and charging costs; the other is their subjective perceptions of V2G technology, such as its social recognition, influence, and development pace [11].

Case studies conducted in the Nordic region indicate that users' willingness to adopt V2G is influenced by factors such as personal income level, political inclination, urbanization degree, and geographical location [12]. Separately, other studies note that familiarity with EVs and social influence also shape users' relevant choices [13]. For EV users deciding

whether to engage in V2G, economic value is another important factor—they typically expect two key elements: optimized V2G charging and discharging strategies and appropriate economic compensation [14,15]. Also, users voice concerns regarding two key issues: the high costs of V2G technology, and uncertainties stemming from new technologies (e.g., the ambiguous internal rate of return related to V2G) [16]. Furthermore, several factors can influence users' willingness to pay for V2G participation including the amount of battery energy owners consent to share [17], the number of monthly mandatory plug-in hours, the guaranteed minimum battery level, and street-level V2G availability [18].

2.3. Analysis Methods of User Participation Intention

EV users' participation in V2G—a new energy interaction model—largely depends on their acceptance of this model within a specific technical and social context. This could fall under the research scope of behavioral psychology. Proposed by Davis et al. in 1989, the Technology Acceptance Model (TAM) is a user behavior theoretical model that focuses on explaining and predicting users' acceptance and adoption of new technologies [19]. Later, Venkatesh et al. expanded on the TAM by integrating several key theoretical models: the Theory of Planned Behavior (TPB), the Task-Technology Fit model (TTF), the Innovation Diffusion Theory (IDT), and the Theory of Reasoned Action (TRA). On this basis, they further proposed the Unified Theory of Acceptance and Use of Technology (UTAUT) [20]. To align with varied organizational environments, usage stages, and user groups, the TAM has introduced more research variables over time, with these variables explicitly addressing how user characteristics, environmental factors, and time-related factors influence technology acceptance. Such refinements have subsequently resulted in the formation of extended TAMs [21].

These studies noted above have established a research basis for understanding new technology acceptance behavior. In response to the unique attributes of V2G technology and the socioeconomic backgrounds of the regions hosting empirical cases, scholars have further sought to incorporate additional influencing factors into models, thereby improving the models' accuracy and targeted applicability. To explain the acceptance of autonomous vehicles more comprehensively, Zhang et al. applied the UTAUT model and supplemented it with two key variables which are risk expectation and consumer innovativeness [22]. Their research employed a hybrid method combining Structural Equation Modeling (SEM) and the Artificial Neural Network (ANN) to validate the model. To validate the feasibility of factors with potential impacts on smart charging acceptance, Will and Schuller adopted Structural Equation Modeling (SEM) and applied the Partial Least Squares (PLS) method for analysis [23]. To explore how V2G capabilities and broader potential energy benefits influence consumers' preferences for electric vehicles, Philip et al. adopted a mixed logit model to analyze the stated preferences of 500 Australian consumers [24].

2.4. Summary

As EVs gain rapid popularity, research on EV charging behavior has achieved substantial accumulation. Existing studies have revealed distinct peak charging patterns across urban functional areas and identified key determinants of V2G participation willingness, including user attitudes, economic incentives, and perceived technological risks. However, two important limitations persist. First, despite the centrality of discharging behavior to V2G's operational logic, few studies have analyzed how EV users' discharging patterns interact with their travel routines to shape V2G acceptance. Second, most existing Technology Acceptance Models applied to V2G rely on conventional TAM or UTAUT frameworks without integrating transportation-specific variables such as commuting patterns, parking availability, and charging infrastructure access, which are critical contextual factors for V2G feasibility. This study addresses these gaps by constructing a V2G-specific Technology

Acceptance Model that incorporates both subjective attitudinal dimensions and objective travel-charging behavioral patterns.

Building on the above, this study integrates EV users' charging and discharging behavior patterns, their daily travel patterns and charging–discharging needs, and V2G-related infrastructure and social environmental factors into a unified analytical framework. It assesses EV users' acceptance of V2G technology and explores their future participation willingness, thereby providing a more comprehensive theoretical foundation for the coordinated planning of transportation-energy systems and the advancement of V2G adoption.

3. Research Methods

3.1. Key Hypothesis

Based on existing theories, latent variables including perceived usefulness, perceived ease of use, economic viability, and perceived technological risk have a significant impact on users' behavioral intentions. Specifically, the Technology Acceptance Model (TAM) identifies perceived usefulness—defined as users' perception of the extent to which a technology improves efficiency—and perceived ease of use, which refers to users' judgment of how convenient a technology is to operate, as the core factors influencing technology acceptance behavior. Judging from the research results of the acceptance behavior of new technologies, economic viability (i.e., cost–benefit trade-off) and perceived technological risk (users' concerns about the potential negative consequences of a technology) also shape users' decisions. Accordingly, the following hypotheses are proposed. It should be noted that this study adopts a parsimonious model focusing on four core constructs (PU, PEU, EB, and TRP) to test direct effects on behavioral intention as a first-stage investigation of V2G acceptance. While additional constructs such as trust, social influence, environmental concern, and policy support may also influence V2G adoption, their inclusion would substantially increase model complexity. The current four-construct model provides a focused and theoretically grounded baseline; the examination of mediation and moderation effects involving these additional variables is reserved for future research.

H1. *Perceived Usefulness (PU) has a significant positive impact on behavioral intention (BI). Specifically, the more useful users perceive V2G technology to be, such as its ability to improve energy utilization efficiency or bring daily convenience, the stronger their intention to participate in V2G.*

H2. *Perceived Ease of Use (PEU) has a significant positive impact on behavioral intention (BI). That is, the simpler and more user-friendly the operation of V2G technology (e.g., charging–discharging control, platform interaction), the higher the users' willingness to participate.*

H3. *Economic Benefit (EB) has a significant positive impact on behavioral intention (BI). When users perceive more obvious economic benefits from V2G technology (such as reduced charging fees) and additional revenue (e.g., discharging compensation), they will be more inclined to participate in V2G.*

H4. *Technology Risk Perception (TRP) has a significant negative impact on behavioral intention (BI). The stronger the users' perception of the risks associated with V2G technology (e.g., concerns about battery reliability, data security, or charging–discharging safety), the lower their intention to participate in V2G.*

3.2. Model and Indicator Construction

The indicator system of this study is constructed based on existing research theories and the hypotheses proposed above. It integrates objective information and subjective scale information to systematically collect users' acceptance of and willingness to participate in V2G.

In the dimension of objective information, users' basic characteristics are included, such as age, gender, educational level, and income level. This is because cognitive and receptive abilities to new technologies vary across groups with different demographic characteristics, making these variables fundamental influencing factors for technology acceptance. Meanwhile, this study also collects information related to users' EV usage, including daily average driving distance, commuting mode, driving range, charging frequency, and charging location. Such information directly reflects users' daily usage scenarios and habits, which are relevant to the adaptability and application feasibility of V2G technology.

In the dimension of the subjective scale, based on existing research and the hypotheses proposed previously, investigations are conducted across five aspects: perceived usefulness (PU), perceived ease of use (PEU), economic benefit (EB), technology risk perception (TRP), and behavioral intention (BI). The purpose of this research design is threefold: first, to collect users' perception of the practical utility of V2G technology and their subjective experiences regarding the difficulty of technical operations; second, to understand users' judgment on the economic rationality of V2G-derived benefits and measure their psychological perception of V2G's potential risks; third, to determine users' subjective participation tendencies through the expression of behavioral intention. Integrating objective behavioral backgrounds with subjective psychological cognition, this subjective indicator system explores the mechanism by which various factors influence users' acceptance of and participation in V2G from a multi-dimensional perspective. Drawing on the hypotheses proposed earlier, the influencing path of variables on V2G user behavioral intention is constructed as Figure 1.

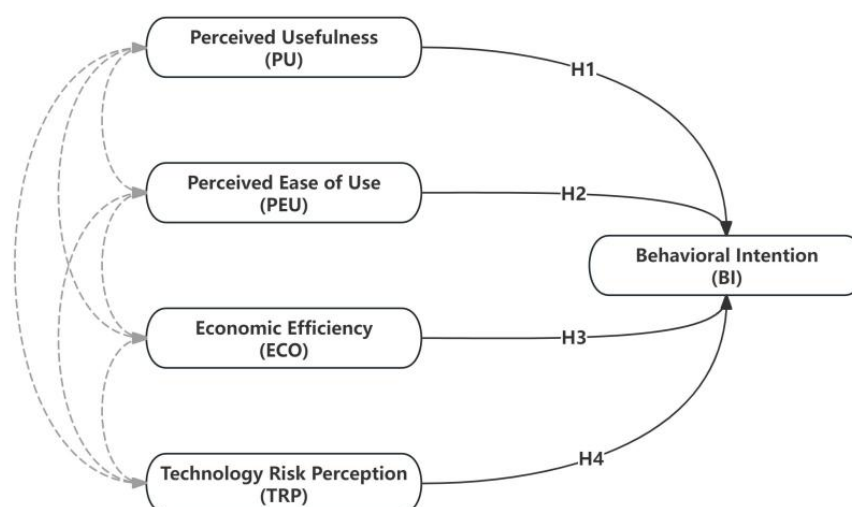


Figure 1. Influence path construction.

Since users' subjective attitudes are unobservable latent variables, they need to be derived from observable indicators. Guided by the path-hypothesis analysis above, the study designs measurement items as follows: perceived ease of use [25], economic benefits [15], and technology risk perception [26], and 4 items were set to evaluate behavioral intention. All items adopted a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), with higher scores reflecting stronger user acceptance and participation willingness toward V2G. Details of these items are shown in Table 1. The measurement items for perceived usefulness (PU) and perceived ease of use (PEU) were adapted from Rahman et al. [25]. Items for economic benefit (EB) were adapted from van Heuveln et al. [15], and items for technology risk perception (TRP) were adapted from Im et al. [26]. Behavioral intention (BI) items were developed by the authors based on the TAM framework. A pilot test was

conducted with a small group of EV users ($N = 30$) to assess item clarity and face validity, and minor wording adjustments were made accordingly before the main survey.

Table 1. Subjective attitude measurement items.

Latent Variables	Observed Variables	Code	Explanation
Perceived Usefulness (PU)	Think that V2G is useful	PU1	The cognitive ability to reflect the perceived usefulness of the overall value of V2G.
	Think that V2G can shave peaks and fill valleys	PU2	
	Think that V2G can utilize surplus electric energy	PU3	
Perceived Ease of Use (PEU)	Think that V2G is very easy to use	PEU1	The perception of the operational simplicity of V2G can enhance the perceived ease of use.
	Think that V2G easily brings benefits	PEU2	
	Think that V2G easily brings convenience to life	PEU3	
Economic Benefits (EB)	Think that the benefits can meet expectations	EB1	Good economic performance reflects positive recognition in terms of economy.
	Think that the fluctuation of electricity prices is within an acceptable range	EB2	
	Think that the battery cost and wear are within an acceptable range	EB3	
Technology risk perception (TRP)	Think that the technology is not safe and reliable enough	TRP1	The lower the trust in the safety of the technology, the higher the perceived technical risk.
	Think that the information protection measures are not sound	TRP2	
	Think that the reputation of the operator is not relatively high enough	TRP3	
Behavioral Intention (BI)	Assuming that V2G is put into use, I will plan to use it	BI1	The degree of willingness to accept and participate after V2G is put into use.
	Assuming that V2G is put into use, I want to use it frequently	BI2	
	Assuming that V2G is put into use, I will recommend others to use it	BI3	
	Assuming that V2G is put into use, I want to buy an electric vehicle with reverse charging function	BI4	

3.3. Model Selection

These latent variables cannot be directly observed and need to be measured indirectly through observed indicators. Structural Equation Modeling (SEM) can handle both latent and observed variables simultaneously, clearly defining the measurement relationships between them, which meets the requirements of this study. In addition, SEM can integrate factor analysis and path analysis to test the complex causal paths among multiple variables in one go. For example, it can simultaneously explore the positive impacts of PU, PEU, and EB on behavioral intention (BI), as well as the negative impact of TRP, avoiding the limitations of traditional methods that require splitting the model. Meanwhile, SEM can assess the overall goodness-of-fit of the model, examining the degree of fit between theoretical hypotheses and the data. It provides a scientific and rigorous framework for verifying the relationships among variables, ensuring the reliability and validity of research conclusions. Therefore, this study selects SEM for subsequent research and analysis. In terms of the specific SEM approach, this study adopts covariance-based SEM (CB-SEM) rather than partial least squares SEM (PLS-SEM). This choice is motivated by the confirmatory nature of this research: the hypotheses are derived from established theories (TAM and UTAUT), and CB-SEM is better suited for theory

testing and confirmation, whereas PLS-SEM is more appropriate for exploratory research and prediction-oriented objectives.

4. Empirical Analysis

This case study adopted a questionnaire-based data collection approach. Following preprocessing and screening of the collected data, an SEM was built to examine the influence paths between latent variables, with the core goal of verifying the hypotheses. More precisely, the study sought to validate two key sets of relationships: first, the positive impacts of PU, PEU, and EB on BI; second, the negative impact of TRP on BI. Through this analysis, the inherent mechanism driving users' V2G acceptance and participation willingness could be revealed.

Questionnaire surveys are a commonly used method for researching users' participation behaviors and willingness. They offer flexible design, enabling questions to be formulated from multiple dimensions such as participation frequency, depth, and motivation, thus ensuring comprehensive information collection. In terms of operation, compared with interviews and observations, questionnaire surveys are more economical and convenient. They can quickly cover many EV users through both online channels and offline touchpoints, which not only enhances the representativeness and persuasiveness of the results, but also facilitates the discovery of general patterns in user behavior and potential individual differences across different user groups. The standardized process ensures that respondents face consistent questions and response methods, reducing biases caused by investigators or the environment, guaranteeing data objectivity, and facilitating statistical analysis as well as the understanding of the relationship between users' behaviors and influencing factors. Anonymity can alleviate respondents' concerns about privacy, improving the credibility of the data. In summary, due to their flexible design, wide coverage, standardized process, and good anonymity, questionnaire surveys have become an ideal choice for researching users' participation behaviors and willingness.

4.1. Data Description

In this study, data were collected via online questionnaires, with the target area set as the main urban area of Chongqing. Chongqing features a dense distribution of EV charging stations, sufficient on-street and underground parking facilities, and most local EV users follow fixed commuting patterns. All these characteristics facilitate targeted questionnaire distribution and help ensure the validity of the collected data. Survey respondents were strictly restricted to current EV owners, and the questionnaire was structured into three sequential sections.

Chongqing was chosen as the study area for several reasons. As one of China's four municipalities directly under the central government and a major economic hub in southwest China, Chongqing has vigorously promoted electric vehicle adoption and charging infrastructure development, rendering it a representative case for investigating V2G acceptance in inland megacities. Moreover, its mountainous topography and high population density generate unique travel and parking behaviors that differ notably from those in coastal cities, where most existing V2G acceptance research has been concentrated.

The survey was distributed through Wenjuanxing (www.wjx.cn), a leading professional online survey platform in China. Participants were recruited from EV owner groups on WeChat and charging stations located in Chongqing's main urban districts. To improve data quality, the questionnaire incorporated attention-check questions, and duplicate responses were filtered out via IP address and device fingerprint verification. Finally, only current EV owners living in the main urban area of Chongqing were included in the valid sample.

The questionnaire was administered in three sequential parts. First, respondents filled out sections on personal basic information, including gender, educational background, daily travel patterns (e.g., commute distance, frequency), and charging habits (e.g., weekly charging times, preferred charging locations).

Second, a brief introduction to V2G technology was provided to ensure respondents had a basic understanding. After that, respondents were asked to select their vehicle's driving range and their own "range anxiety threshold" (i.e., the minimum remaining power they would reserve for daily use), and the questionnaire would automatically calculate their expected income from V2G discharging based on predefined parameters. For reference, a V2G charging station in Hefei, Anhui Province, can feed 30 kWh of electricity back to the grid within 1.5 h, generating approximately 30 yuan in income [27]. To help users intuitively grasp V2G-related earnings, this study simplified the calculation standard to 1 yuan per kWh. In the ideal scenario assumed for the calculation, after reserving power to meet the range anxiety threshold, all remaining power (after the vehicle was fully charged) was considered to be fed back to the grid to derive the expected income.

Third, after gaining a basic understanding of V2G technology and potential earnings, respondents completed a self-designed subjective scale. This scale aimed to capture their attitudes toward V2G, identify any concerns they had (e.g., about battery life or data security), and clarify the key factors influencing their willingness to participate in V2G. On average, the entire questionnaire took 5–8 min to complete.

A total of 295 valid questionnaires were collected in the survey, and the statistical results of objective information are shown in Figure 2. From the initial data collected, most respondents have fixed commuting routes and dedicated parking spaces. Nearly half of the respondents have home charging piles, and 96% of them charge their vehicles immediately after parking. These habits indicate a high degree of regularity in their EV usage, which provides favorable conditions for potential V2G participation (e.g., fixed time windows for discharging). In terms of vehicle and range-related attributes, 82% of respondents' EVs have a driving range of 300–600 km, and 90% report feeling range anxiety when the remaining range drops below 100–150 km.

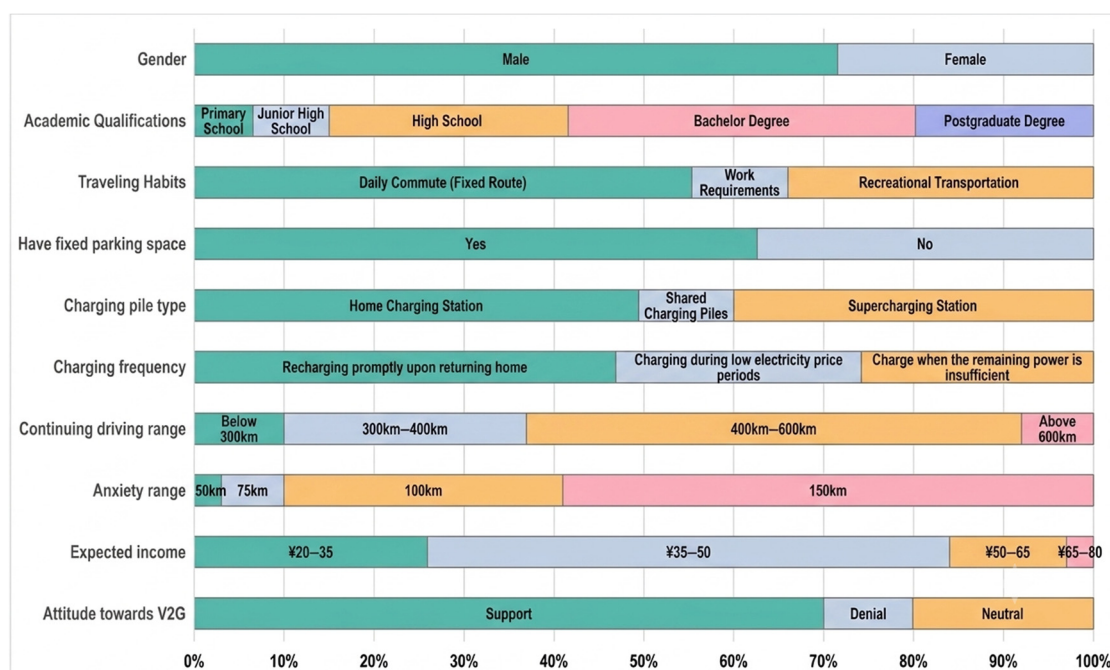


Figure 2. Statistical results of questionnaire objective information.

The questionnaire further estimated the expected income each user could obtain from participating in V2G. The results show that 58% of users would potentially earn 35–50 yuan per V2G discharging cycle. Notably, after receiving a brief introduction to V2G from the research team and going through the questionnaire-filling process (which included income estimation), respondents gained a preliminary understanding of V2G technology and its benefits. Subsequently, 70% of them expressed a supportive attitude toward V2G participation; this positive response ratio provides an initial indication of the market acceptance potential for V2G in the Chongqing main urban area.

After filling out the objective information, the respondents proceeded to complete the 7-point Likert scale added to the questionnaire, and the specific results of this scale are presented in Table 2. According to the data, two key findings emerge from the data. First, over 70% of the respondents indicated that once V2G technology is officially put into use, they are not only willing to participate in V2G services themselves but also intend to recommend V2G to other EV users (reflecting a relatively high level of initial participation intention). Second, approximately 80% of the respondents recognized the multi-dimensional value of V2G. They believed the technology can help smooth power loads and alleviate grid pressure (from a social energy perspective), while also bringing personal benefits such as convenience to daily life and additional income. Notably, after learning about the specific expected income from V2G participation, most users expressed relative satisfaction with this economic incentive.

Table 2. Statistical results of the scale.

Measurement Variable	AVG	SEM	S.D	Var	Median	Mode	Mode Proportion	"Agree" Proportion *
PU1	5.39	0.072	1.241	1.541	6	6	33.4%	78.0%
PU2	5.21	0.070	1.202	1.446	5	6	33.4%	74.7%
PU3	5.46	0.066	1.128	1.273	6	6	34.8%	81.4%
PEU1	5.17	0.073	1.253	1.569	5	6	32.1%	72.6%
PEU2	5.26	0.068	1.175	1.381	5	6	33.1%	76.7%
PEU3	5.30	0.063	1.086	1.180	5	6	37.2%	78.7%
EB1	5.57	0.069	1.183	1.398	6	6	32.8%	83.8%
EB2	5.73	0.069	1.180	1.393	6	6	35.1%	84.1%
EB3	5.65	0.069	1.190	1.415	6	6	38.5%	84.8%
TRP1	2.88	0.056	0.968	0.937	3	3	44.6%	81.4%
TRP2	3.09	0.058	0.994	0.989	3	3	41.9%	70.6%
TRP3	2.90	0.061	1.050	1.102	3	3	37.8%	75.3%
BI1	5.47	0.066	1.129	1.274	6	6	36.8%	84.1%
BI2	5.36	0.064	1.102	1.214	6	6	41.2%	79.4%
BI3	5.19	0.066	1.142	1.304	5	6	35.8%	73.6%
BI4	5.41	0.066	1.128	1.272	6	6	40.2%	81.1%

* "Agree" proportion refers to the cumulative percentage of scores of "5", "6" and "7" in the statistical results of the seven-level scale. Specifically, the "Agree" proportion of TRP is the cumulative percentage of scores "1", "2" and "3".

However, the scale results also revealed lingering concerns among users toward this emerging technology. About 20% of users perceived V2G operations as rather complex, indicating a relatively low level of perceived ease of use. For this phenomenon, a preliminary hypothesis is proposed that such low acceptance of V2G complexity may be associated with two factors. One is respondents' educational background (which may influence their ability to understand and operate new technologies) and the other is their willingness to participate in social public affairs (which may affect their motivation to engage with energy-related public services like V2G). This hypothesis will be further verified and analyzed in depth in subsequent sections of the study.

In addition, the scale results further highlight that most users harbor heightened concerns about four critical issues directly related to V2G participation: battery wear-and-tear (a top worry, as frequent charging–discharging may increase long-term vehicle maintenance costs), plug-in time requirements (which could clash with their fixed daily commuting or parking schedules, disrupting routine usage), residual driving range after discharging (directly tied to their existing range anxiety, as insufficient remaining mileage

may risk commute disruptions), and income stability (specifically regarding the consistency of V2G compensation and timeliness of payment). The specific distribution of these concerns across the surveyed user group is detailed in Figure 3, and these factors are far from trivial; they are likely to be key determinants that exert a direct influence on users' attitudes toward V2G, potentially overriding positive perceptions (e.g., of expected income) and becoming barriers to participation.

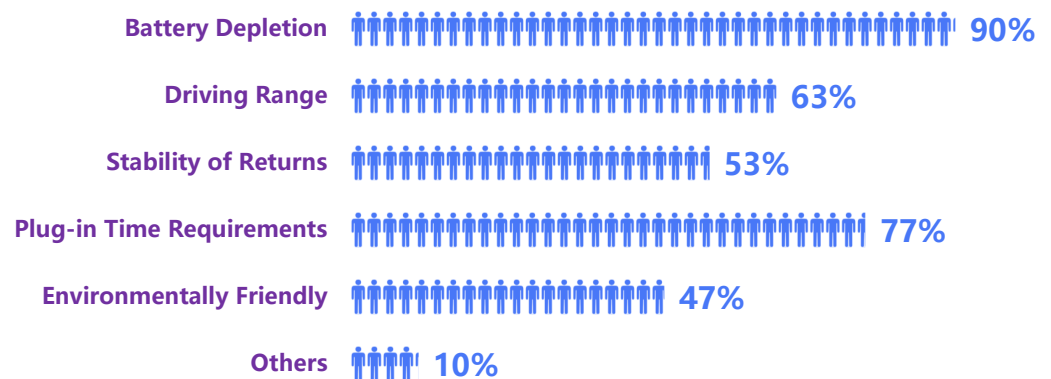


Figure 3. Other factors of greater concern to the interviewees.

4.2. Model Verification

To ensure data appropriateness, this study performed data cleaning and screening prior to conducting validity analysis. Specifically, invalid questionnaires where respondents selected identical options for all scale items were excluded, and subjective scale scores were organized systematically. Ultimately, 295 valid datasets were retained for further analysis.

Internal reliability was first evaluated using Cronbach's α coefficient and Composite Reliability (CR). Cronbach's α ranges from 0 to 1, with values above 0.7 indicating acceptable internal consistency [28]. Similarly, CR values greater than 0.7 suggest satisfactory reliability. Convergent validity was assessed using Average Variance Extracted (AVE), where values above 0.5 imply that latent variables possess adequate explanatory power over their indicators.

As shown in Table 3, Cronbach's α coefficients for all constructs range from 0.827 to 0.895, well above the 0.7 threshold. All CR values exceed 0.7, and AVE values range from 0.503 to 0.672, meeting the criteria for good convergent validity.

Table 3. The results of measurement model, reliability and convergent validity.

Latent Variable	Measurement Variable	Mean	Standard Deviation	Factoring Loading	Cronbach's α	Composite Reliability	AVE
PU	PU1	5.39	1.241	0.774	0.862	0.803	0.576
	PU2	5.21	1.202	0.742			
	PU3	5.46	1.128	0.760			
PEU	PEU1	5.17	1.253	0.733	0.875	0.777	0.537
	PEU2	5.26	1.175	0.749			
	PEU3	5.30	1.086	0.717			
EB	EB1	5.57	1.183	0.727	0.849	0.752	0.503
	EB2	5.73	1.180	0.754			
	EB3	5.65	1.190	0.779			
TRP	TRP1	2.88	0.968	−0.784	0.828	0.790	0.557
	TRP2	3.09	0.994	−0.752			
	TRP3	2.90	1.050	−0.700			
BI	BI1	5.47	1.129	0.864	0.895	0.891	0.672
	BI2	5.36	1.102	0.820			
	BI3	5.19	1.142	0.781			
	BI4	5.41	1.128	0.812			

Discriminant validity was examined using the Fornell–Larcker criterion, which requires that the square root of AVE for each construct be greater than its pairwise correlation

coefficients with other constructs [29]. As presented in Table 4, this condition is satisfied across all latent variables, confirming satisfactory discriminant validity. For instance, the square root of AVE for perceived usefulness (PU) is 0.759, which is higher than its correlation with behavioral intention (BI, 0.628). Although the Heterotrait–Monotrait (HTMT) ratio is increasingly recommended as a stricter criterion, this study relied on the widely adopted Fornell–Larcker method. Future research may adopt both approaches for more robust validation.

Table 4. Analytical results for discriminant validity.

Latent Variable	AVE	BI	PU	PEU	EB	TRP
BI	0.672	0.820				
PU	0.576	0.628	0.759			
PEU	0.537	0.648	0.523	0.733		
EB	0.503	0.651	0.615	0.517	0.709	
TRP	0.557	−0.709	−0.549	−0.530	−0.556	0.746

Since all data were collected through a single self-reported questionnaire at one time point, the potential threat of Common Method Bias (CMB) was acknowledged. Procedural remedies were applied, including respondent anonymity and separate sections for independent and dependent variables. However, formal statistical tests such as Harman’s Single-Factor Test were not conducted. Despite the satisfactory discriminant validity that alleviates concerns about severe common method variance, the potential influence of CMB is recognized as a limitation. Future studies are suggested to implement both procedural and statistical controls for CMB.

4.3. Result Analysis

The structural model was employed to test the hypotheses proposed earlier, and the results revealed a good model fit. Specifically, the key fit indicators yielded the following: $\chi^2/df = 1.018$, $GFI = 0.961$, $AGFI = 0.943$, $NFI = 0.972$, $RMSEA = 0.008$. All coefficients were found to be significant at the level of $p < 0.001$. Detailed model fitting results are presented in Table 5. Although the reported fit indices (CMIN/DF, GFI, AGFI, NFI, RMSEA) all meet established thresholds for excellent model fit, additional commonly reported indices such as CFI, TLI, and SRMR were not computed in this analysis. This is acknowledged as a limitation, and future research should report a more comprehensive set of fit indices for fuller model evaluation. Furthermore, the R^2 value for the endogenous construct (BI) is not separately reported; given the model’s focus on path-level hypothesis testing, the squared multiple correlations are embedded in the path coefficient estimates.

Table 5. Fitness of SEM.

Indicator	Reference Value Range			Values in This Study
	Excellent Fit	Acceptable Fit	Poor Fit	
CMIN/DF	<2.0	2.0–3.0	>3.0	1.018
GFI	>0.95	0.90–0.95	<0.90	0.961
AGFI	>0.95	0.90–0.95	<0.90	0.943
NFI	>0.95	0.90–0.95	<0.90	0.972
RMSEA	<0.05	0.05–0.8	>0.08	0.008

Per statistical test criteria, a Critical Ratio (CR) exceeding 1.96 indicates that the parameter estimate is statistically significant ($p < 0.05$), while a p -value below 0.001 confirms the passing of the significance test [30]. Table 6 presents the path coefficient estimation results for the relationships between each latent variable including PU, PEU,

EB, TRP, and BI. The standardized path coefficients of all these variables with respect to the latent variable BI are positive, indicating a positive correlation between each of the variables and BI. Furthermore, the CR of all the paths in the model is greater than 1.96, and the p -value for each significance test is less than 0.001. These results confirmed that all hypotheses proposed in this study passed the significance test. The final structure of the model verification is illustrated in Figure 4.

Table 6. Path coefficient estimation results.

Effect Path	Estimate	SE	CR*	Hypothesis Verification
PU→BI	0.856	0.092	9.345	H1 is valid
PEU→BI	0.844	0.091	9.221	H2 is valid
EB→BI	0.850	0.089	9.518	H3 is valid
TRP→BI	−0.747	0.075	9.949	H4 is valid
PU1→PU	0.833	-	-	-
PU2→PU	0.802	-	-	-
PU3→PU	0.829	-	-	-
PEU1→PEU	0.843	-	-	-
PEU2→PEU	0.856	-	-	-
PEU3→PEU	0.813	-	-	-
EB1→EB	0.774	-	-	-
EB2→EB	0.812	-	-	-
EB3→EB	0.837	-	-	-
TRP1→TRP	0.827	-	-	-
TRP2→TRP	0.792	-	-	-
TRP3→TRP	0.737	-	-	-
BI1→BI	0.872	-	-	-
BI2→BI	0.826	-	-	-
BI3→BI	0.784	-	-	-
BI4→BI	0.810	-	-	-

* |CR| > 3.29 indicates statistical significant at $p < 0.001$.

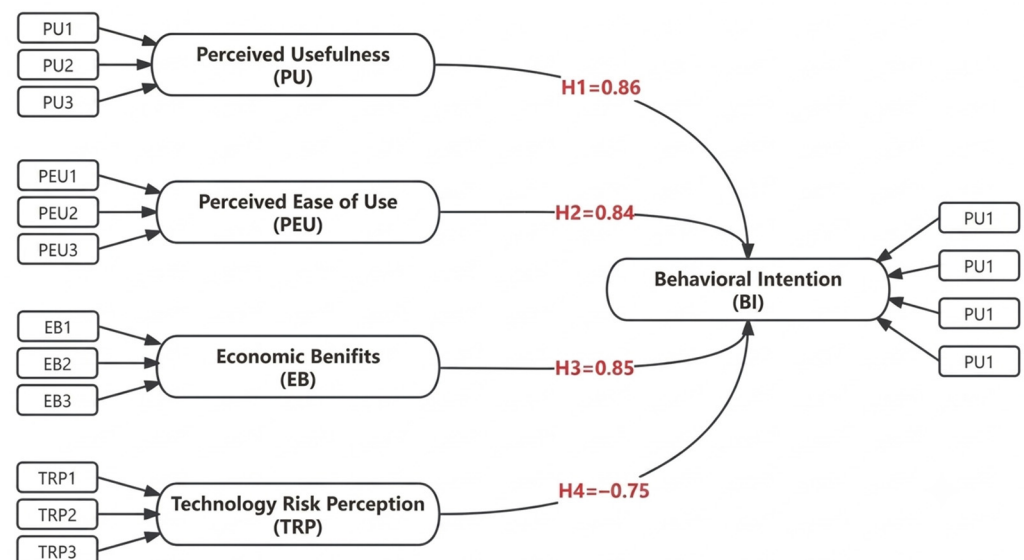


Figure 4. Verification of the research model.

As evident from the verification results in Table 6 and Figure 4, the impact path coefficients of PU and PEU on BI are 0.86 and 0.84, respectively. This implies that a one standard deviation increase in PU or PEU is associated with a 0.86 and 0.84 standard deviation increase in BI, respectively. This indicates a strong and significantly positive relationship between these variables and BI. Similarly, the impact path coefficient of EB on BI is 0.85, also reflecting a significantly positive relationship. This result confirms that

users' consideration of the economic benefits brought by V2G directly influences their intention to participate. Regarding TRP, its impact path coefficient on BI is -0.75 , which is significantly negative. Although the coefficient of TRP is slightly lower than those of PU, PEU, and EB, it still clearly demonstrates that higher users' trust in V2G technology corresponds to a stronger intention to engage in V2G services. It is worth noting that the standardized path coefficients (0.84 – 0.86 for positive paths and -0.75 for the negative path) are relatively high by conventional behavioral research standards. Several factors may contribute to this observation. First, TAM-based studies frequently report strong associations between core attitudinal constructs and behavioral intention, particularly when constructs share a common theoretical foundation and are measured within the same survey instrument. Second, the potential influence of common method variance, as discussed in Section 4.2, may partially inflate the observed correlations. Third, the relative homogeneity of the respondent sample (all EV owners in a single city) may reduce error variance and yield stronger path estimates. Therefore, while the statistical significance and direction of these paths are robust, the absolute magnitudes of the coefficients should be interpreted as indicators of relative importance among the predictors rather than precise effect-size estimates.

5. Discussion

This study employed Structural Equation Modeling (SEM) to verify the impact paths of subjective attitudes. The results showed that perceived usefulness (PU), perceived ease of use (PEU), and economic benefit (EB) exert positive effects on behavioral intention (BI), while technology risk perception (TRP) exerts a negative effect on behavioral intention (BI). Among them, the impacts of PU and PEU are more prominent. Thus, hypotheses H1, H2, H3, and H4 are all validated. Drawing on the empirical analysis results, the subsequent discussion is organized around three dimensions: (1) the influence paths of subjective attitudes on V2G participation willingness, (2) the objective factors influencing subjective attitudes, and (3) the group preference characteristics related to V2G adoption.

(1) The influence path of subjective attitudes

Users' subjective willingness exerts a positive influence on their intention to accept and participate in V2G services. Specifically, users who perceive V2G as useful, easy to use, and capable of bringing convenience to daily life are more inclined to accept this emerging technology. The stronger users' perception of V2G's usefulness and ease of use, the higher their willingness to engage in V2G services. Notably, prior studies have also identified PU and PEU as key factors shaping users' technology adoption intention, a finding that aligns with the results of this study [31].

These findings are broadly consistent with V2G acceptance studies conducted in other regions. For example, Chen and Lai [10] found that perceived usefulness and ease of use were significant predictors of V2G acceptance among Taiwanese EV users, and van Heuveln et al. [15] reported similar patterns in the Netherlands, where economic benefits emerged as a key driver. However, the present study extends these findings by demonstrating that in the Chongqing context, the relative importance of economic benefits (EB, $\beta = 0.85$) is comparable to that of PU and PEU, suggesting that financial incentives may play a more central role in inland Chinese cities than in more developed coastal or international settings. This observation carries practical implications for the design of region-specific V2G incentive policies.

After users learned about the expected income from V2G participation, a higher level of economic recognition toward V2G corresponds to a stronger willingness to accept and engage in V2G services. Notably, EVs with a longer driving range and owners with a lower level of anxiety threshold can secure a higher income from V2G. Excluding other interfering

factors, the higher the income users stand to gain, the greater their interest in V2G. When V2G offers more advantages in terms of economic benefits, users are more inclined to adopt it. This conclusion aligns with the findings of previous studies cited earlier [15].

From a practical standpoint, these findings suggest several actionable strategies for V2G promotion. First, public awareness campaigns should emphasize not only the environmental benefits of V2G but also its concrete economic returns, as EB exerts a comparably strong influence on behavioral intention. Second, charging infrastructure deployment should prioritize residential areas and workplaces where users with fixed commuting routes can conveniently plug in their vehicles, thereby lowering the perceived operational complexity (PEU). Third, technology demonstrations and transparent safety certifications can mitigate technology risk perceptions (TRPs), which, despite being ranked lower in absolute coefficient magnitude, remain a statistically significant barrier to participation. These practical implications contribute to the broader discourse on how behavioral insights can inform infrastructure planning and energy policy.

Similarly, the maturity and safety of V2G technology, as well as the reputation of its operators, collectively influence users' trust in this technology. The higher users' level of trust in V2G technology, the greater their acceptance of V2G services. This conclusion is consistent with the findings of existing studies [32].

(2) Objective Factors Affecting Subjective Attitude

Users' PU of V2G (defined as the belief that V2G can create value and meet needs) and PEU (referring to convenient operation) form the core logic underlying technology acceptance. In terms of the mechanism of action, PU is directly tied to users' pre-judgment of "technology-driven value creation". For instance, if V2G can deliver practical value to users, such as convenience of off-peak electricity usage and ability to utilize excess electric energy, it will reinforce the perception that "participating in V2G is beneficial". By contrast, PEU reduces users' psychological resistance to new technology; it helps users recognize that engaging in V2G reverse charging requires only a simple process, allowing them to gain benefits and daily convenience without incurring excessive learning or operational costs.

Notably, the Technology Acceptance Model (TAM) proposed by Davis has long confirmed that PU and PEU are core antecedent variables shaping users' technology adoption intentions [19]. This finding is also supported by research on Advanced Driver-Assistance Systems (ADAS). Kaye S.-A. et al. found that consumers' perceptions of ADAS's PU and PEU significantly and positively influence their willingness to use the system [33]. In this study, as a branch of smart grid interaction technology, V2G similarly sees users' PU and PEU positively driving their participation intention, which aligns with the logical assumptions of the classic TAM and its derivative studies.

When users are aware that V2G can generate benefits, their economic recognition influences V2G acceptance through a "benefit-cost and trade-off" mechanism. Specifically, EVs with long driving ranges paired with owners who have low-range anxiety create a "high-benefit-potential scenario", and ample range frees owners from concerns about electricity price fluctuations, battery costs, and wear, allowing them to more easily perceive the economic returns from discharging. Meanwhile, low-range anxiety lowers users' "demand for risk compensation," enabling them to focus more on whether the positive benefits of V2G align with their expectations.

Compared with previous research on V2G economics, which often focuses on macro-level costs (e.g., peak-shaving cost savings on the power grid side) or automakers' profit models (e.g., benefits from cascaded battery utilization), this study centers on users' micro-level decision making, highlighting the chain of "individual benefit perception, economic recognition, participation willingness". For example, when Sioshansi F.P. studied the V2G business model, the focus was on value distribution between the power grid and

automakers [34]. By contrast, this study supplements the micro-mechanism of “benefit perception driving participation” at the user end. The distinction represents a shift from an industrial-ecosystem perspective to user-behavior segmentation, bringing the research closer to addressing a core question in real-world V2G promotion, that is, how economic incentives effectively activate user participation decisions.

The maturity of V2G technology, its safety performance, and the reputation of its operators jointly shape users’ perception of “technology trust”. Specifically, technological maturity dictates users’ expectations of “technical risks”, for example, whether frequent charging and discharging will damage the battery or cause system malfunctions. Safety, on the other hand, encompasses the protection of users’ private data and prevention of property loss or personal harm from electrical accidents. Operator reputation, meanwhile, is closely tied to the guarantee of long-term economic returns from V2G participation. These three dimensions together form a “trust pool” for users regarding V2G technology. The higher the level of trust in this pool, the easier it is for users to overcome “unfamiliarity with the technology” and “concerns about risk”, thereby strengthening their acceptance of and participation in V2G.

In cross-field research, Mayer’s trust integration model proposes that trust comprises three components, which are competence trust (technological maturity), benevolence trust (operator reputation), and integrity trust (safety commitment) [35]. The impact path of V2G technology trust identified in this study highly corresponds to this model, with all three components jointly driving users to accept and participate in V2G.

This study replicates the logic of “technology trust to behavioral intention” in the context of energy interaction. It not only verified the cross-scenario universality of the trust mechanism but also supplements research details on cross-border technology trust in the energy-transportation field due to the specificity of V2G involving “bidirectional power flow and integration of transportation and travel needs”.

(3) Group Preferences Related to V2G Adoption

Further analysis of EV user group characteristics reveals that V2G technology is more appealing to EV owners with fixed commuting routes and low-range anxiety. In an ideal scenario, these two traits (fixed commuting patterns and low-range anxiety) enable this user group to maximize the benefits of V2G applications.

Moreover, for EV users with access to battery-replacement service, who can enjoy free battery replacement within a specified service life and when the mileage does not exceed a certain threshold, their perception of battery-wear cost is significantly reduced. This weakening of cost concerns exerts a positive influence on their decision to participate in V2G. EV users equipped with home charging piles benefit from a more favorable electricity-cost structure. They are less sensitive to electricity price fluctuations and can secure higher returns through V2G reverse power supply, leading to a significantly higher willingness to participate compared to users without home charging piles.

During the survey, it is notable that educational level exerts a positive moderating effect on the public’s ability to understand V2G technical principles. Specifically, the highly educated group not only demonstrates stronger cognitive competence in grasping the operational logic of V2G systems but also exhibits a higher sense of responsibility when participating in social public affairs. Additionally, this group tends to pay more attention to the actual effectiveness of V2G technology in power grid load peak shaving and valley filling.

6. Conclusions

Drawing on theoretical frameworks including TAM and the UTAUT, this research incorporates factors such as users’ attitudes, habitual preferences, economic compensation, and perceived technological risks to construct a targeted structural equation model. By

adopting quantitative analysis and statistical methods, this study not only validated the model's effectiveness but also offered in-depth insights into EV users' discharge behavior patterns. Furthermore, this study integrates users' daily travel patterns, charging and discharging needs, as well as V2G-related infrastructure and social environmental factors, forming a comprehensive theoretical foundation. Ultimately, this work aims to provide scientific support for the coordinated planning of the transportation-energy system and the promotion and development of V2G technology.

This study has confirmed the potential for public acceptance of V2G technology. However, several limitations should be acknowledged. First, the study was conducted in a single city (Chongqing), and the infrastructural, economic, and social conditions of this inland megacity may not fully represent other regions of China or other countries. The generalizability of the findings to coastal cities, rural areas, or international contexts should therefore be approached with caution. Second, the survey design included a brief introduction to V2G technology and an income estimation prior to the subjective attitude scale, which may have introduced a positive anchoring effect on respondents' attitudes. This potential response bias should be considered when interpreting the high levels of reported acceptance. Third, although rich demographic and behavioral data were collected (e.g., education level, charging habits, driving range, parking availability), these variables were analyzed only descriptively and were not incorporated into the SEM framework through multi-group analysis or moderation testing. The current model tests only direct effects of four latent variables, and the examination of mediation and moderation mechanisms involving these additional variables represents an important direction for future research. Despite these limitations, the study provides valuable empirical evidence on V2G acceptance and lays a foundation for more comprehensive investigations.

- (1) Raise public awareness: Launch targeted publicity and educational initiatives to improve the public's understanding of V2G technology, thereby strengthening their perception of its usefulness and ease of use.
- (2) Optimize economic incentive mechanism: Design rational economic incentive schemes to ensure users can secure expected benefits, thereby increasing their willingness to participate.
- (3) Strengthen technological trust: Showcase the maturity and safety of V2G technology through technology demonstrations and pilot projects to alleviate public concerns and enhance trust in the technology.
- (4) Upgrade infrastructure: Expand and optimize the charging infrastructure network to alleviate users' concerns about plug-in duration and driving range, thereby improving the overall user experience.

Building on the present findings, future research should pursue several directions. First, an intermediate effect analysis model can be introduced to examine the indirect influence paths of objective factors, such as expected benefits and travel patterns, mediated by subjective perception variables, thereby constructing a more comprehensive mechanism model for behavioral intention. Second, multi-group SEM or moderation analysis should be employed to explore how demographic characteristics (e.g., education, income) and behavioral patterns (e.g., charging habits, commuting mode) moderate the relationships identified in this study. Third, subjective acceptance can be integrated with objective infrastructure conditions and travel trajectories to conduct a holistic evaluation of V2G implementation effectiveness. Geographic Information System (GIS) technology can be utilized to identify urban areas suitable for prioritizing V2G implementation. Based on the infrastructure status and user travel patterns of these areas, more targeted promotion strategies can then be formulated. By combining research findings with practical application, we

can better facilitate vehicle energy integration, improve energy utilization efficiency, and contribute to the development of a sustainable energy system.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The raw questionnaire data involves personal travel and usage information of electric vehicle users. To protect respondents' privacy, the data are not publicly available, but can be obtained from the corresponding author upon reasonable request.

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References

1. Jiangsu Provincial Government State-Owned Assets Supervision and Administration Commission. The Largest in the Country! Wuxi e-Park Vehicle Network Interaction Center Officially Launched. 8 October 2023. Available online: http://jsgzw.jiangsu.gov.cn/art/2023/10/8/art_11703_11033608.html (accessed on 15 June 2026).
2. Upstream News. Chongqing Public Transportation's First Comprehensive Demonstration Station for Optical Storage, Charging and Discharge Energy Management Completed. *Upstream News*, 4 November 2022. Available online: <https://baijiahao.baidu.com/s?id=1748536321637598723&wfr=spider&for=pc> (accessed on 15 June 2026).
3. Fang, X.; Wang, B.B.; Cao, W.J. A Day-Ahead Peak Shaving Strategy Using Data-Driven Prediction of EV Charging Behavior. *J. Electr. Eng. Technol.* **2025**, *20*, 2901–2928. [\[CrossRef\]](#)
4. Sun, M.; Shao, C.; Zhuge, C.; Wang, P.; Yang, X.; Wang, S. Uncovering travel and charging patterns of private electric vehicles with trajectory data: Evidence and policy implications. *Transportation* **2022**, *49*, 1409–1439. [\[CrossRef\]](#)
5. Yang, X.Y. Collaborative Optimization Model for Electric Vehicle-Power Grid-Electric Source Considering the Spatial and Temporal Charging and Discharging Characteristics of Electric Vehicle. Ph.D. Thesis, North China Electric Power University, Beijing, China, 2023. [\[CrossRef\]](#)
6. Yang, X.; Zhuge, C.; Shao, C.; Huang, Y.; Tang, J.H.C.G.; Sun, M.; Wang, P.; Wang, S. Characterizing mobility patterns of private electric vehicle users with trajectory data. *Appl. Energy* **2022**, *321*, 119417. [\[CrossRef\]](#)
7. Zheng, L.; Hou, D.; Wu, G.; Zeng, Q.; Dong, C. Spatial-temporal distribution prediction of electric vehicle charging load based on charging models. In Proceedings of the 2024 5th International Symposium on New Energy and Electrical Technology (ISNEET), Hangzhou, China, 27–29 December 2024; pp. 587–591.
8. Yi, T.; Zhang, C.; Lin, T.; Liu, J. Research on the spatial-temporal distribution of electric vehicle charging load demand: A case study in China. *J. Clean. Prod.* **2020**, *242*, 118457. [\[CrossRef\]](#)
9. Harris, C.B.; Webber, M.E. A temporal assessment of vehicle use patterns and their impact on the provision of vehicle-to-grid services. *Environ. Res. Lett.* **2012**, *7*, 034033. [\[CrossRef\]](#)
10. Chen, C.-F.; Lai, C.-M. Understanding the acceptance of vehicle-to-grid (V2G) services: Evidence from Taiwan. *Transp. Policy* **2024**, *159*, 230–240. [\[CrossRef\]](#)
11. Kester, J.; de Rubens, G.Z.; Sovacool, B.K.; Noel, L. Public perceptions of electric vehicles and vehicle-to-grid (V2G): Insights from a Nordic focus group study. *Transp. Res. Part D Transp. Environ.* **2019**, *74*, 277–293. [\[CrossRef\]](#)
12. Sovacool, B.K.; Kester, J.; Noel, L.; de Rubens, G.Z. Income, political affiliation, urbanism and geography in stated preferences for electric vehicles (EVs) and vehicle-to-grid (V2G) technologies in Northern Europe. *J. Transp. Geogr.* **2019**, *78*, 214–229. [\[CrossRef\]](#)
13. Liu, J.; Zhuge, C.; Tang, J.H.C.G.; Meng, M.; Zhang, J. A spatial agent-based joint model of electric vehicle and vehicle-to-grid adoption: A case of Beijing. *Appl. Energy* **2022**, *310*, 118581. [\[CrossRef\]](#)

14. Baumgartner, N.; Kellerer, F.; Ruppert, M.; Hirsch, S.; Mang, S.; Fichtner, W. Does experience matter? Assessing user motivations to accept a vehicle-to-grid charging tariff. *Transp. Res. Part D Transp. Environ.* **2022**, *113*, 103528. [CrossRef]
15. van Heuveln, K.; Ghotge, R.; Annema, J.A.; van Bergen, E.; van Wee, B.; Pesch, U. Factors influencing consumer acceptance of vehicle-to-grid by electric vehicle drivers in the Netherlands. *Travel Behav. Soc.* **2021**, *24*, 34–45. [CrossRef]
16. Gong, S.; Cheng, V.H.S.; Ardeshiri, A.; Rashidi, T.H. Incentives and concerns on vehicle-to-grid technology expressed by Australian employees and employers. *Transp. Res. Part D Transp. Environ.* **2021**, *98*, 102986. [CrossRef]
17. Maeng, K.; Ko, S.; Shin, J.; Cho, Y. How much electricity sharing will electric vehicle owners allow from their battery? Incorporating vehicle-to-grid technology and electricity generation mix. *Energies* **2020**, *13*, 4248. [CrossRef]
18. Zhang, L.; Ross, T.; Cain, R. Designing a New Electric Vehicle Charging System: People's Preference and Willingness-To-Pay. In *International Conference on Human-Computer Interaction*; Springer International Publishing: Cham, Switzerland, 2021.
19. Davis, F.D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* **1989**, *13*, 319–340. [CrossRef] [PubMed]
20. Venkatesh, V.; Morris, M.G.; Davis, G.B.; Davis, F.D. User acceptance of information technology: Toward a unified view1. *MIS Q.* **2003**, *27*, 425–478. [CrossRef]
21. Venkatesh, V.; Bala, H. Technology acceptance model 3 and a research agenda on interventions. *Decis. Sci.* **2008**, *39*, 273–315. [CrossRef]
22. Zhang, S.; Jing, P.; Xu, G. The acceptance of independent autonomous vehicles and cooperative vehicle-highway autonomous vehicles. *Information* **2021**, *12*, 346. [CrossRef]
23. Will, C.; Schuller, A. Understanding user acceptance factors of electric vehicle smart charging. *Transp. Res. Part C Emerg. Technol.* **2016**, *71*, 198–214. [CrossRef]
24. Philip, T.; Whitehead, J.; Prato, C.G. Adoption of electric vehicles in a laggard, car-dependent nation: Investigating the potential influence of V2G and broader energy benefits on adoption. *Transp. Res. Part A Policy Pract.* **2023**, *167*, 103555. [CrossRef]
25. Rahman, M.M.; Lesch, M.F.; Horrey, W.J.; Strawderman, L. Assessing the utility of TAM, TPB, and UTAUT for advanced driver assistance systems. *Accid. Anal. Prev.* **2017**, *108*, 361–373. [CrossRef] [PubMed]
26. Im, I.; Kim, Y.; Han, H.-J. The effects of perceived risk and technology type on users' acceptance of technology. *Inf. Manag.* **2008**, *45*, 1–9. [CrossRef]
27. Li, H. As Vehicle-Grid Integration Gathers Momentum, V2G Commercialization Still Faces Multiple Challenges. *China Business News*, 12 January 2024. Available online: <https://www.yicai.com/news/101955634.html> (accessed on 29 July 2026).
28. Nunnally, J.C. *Psychometric Theory*, 2nd ed.; McGraw-Hill: New York, NY, USA, 1978.
29. Wynne, C.W. Issues and opinion on structural equation modelling. *Manag. Inf. Syst. Q.* **1998**, *22*, 1–8. [CrossRef] [PubMed]
30. Byrne, B.M. *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*; Routledge: New York, NY, USA, 2016. [CrossRef]
31. Wu, J.; Liao, H.; Wang, J.; Chen, T. The role of environmental concern in the public acceptance of autonomous electric vehicles: A survey from China. *Transp. Res. Part F Psychol. Behav.* **2019**, *60*, 37–46. [CrossRef]
32. Xie, K.; Xie, Y.Q.; Xiao, J.H. Antecedents and Moderation of Consumers' Technological Trust in Sharing Economy Platforms. *J. Inf. Syst.* **2017**, *2*, 1–14.
33. Kaye, S.-A.; Nandavar, S.; Yasmin, S.; Lewis, I.; Oviedo-Trespalacios, O. Consumer knowledge and acceptance of advanced driver assistance systems. *Transp. Res. Part F Psychol. Behav.* **2022**, *90*, 300–311. [CrossRef]
34. Sioshansi, F.P. *Evolution of Global Electricity Markets: New Paradigms, New Challenges, New Approaches*; Academic Press: London, UK, 2013.
35. Mayer, R.C.; Davis, J.H.; Schoorman, F.D. An integrative model of organizational trust. *Acad. Manag. Rev.* **1995**, *20*, 709–734. [CrossRef]

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