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Determinants of Consumer Preference for New Energy Vehicle Charging Infrastructure-taking Zibo as an Example

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Abstract: ***The rapid adoption of new energy vehicles (NEVs) has intensified demand for efficient charging infrastructure. This study investigates consumer preferences for NEV charging stations in Zibo City leveraging survey data encompassing demographic, socioeconomic, and behavioral metrics. Key findings reveal distinct patterns in charging habits, location preferences, and satisfaction drivers across gender, age, occupation, income, and vehicle type. Public charging stations dominate among younger males, while home/company piles are favored by females and older cohorts. Cost sensitivity, safety concerns, and app functionality emerge as critical decision factors. Policy recommendations include tailored incentive programs, expanded private/commercial pile deployment, and standardized maintenance protocols to align with evolving user needs.***

Keywords: New energy vehicles (NEVs), Charging infrastructure, Consumer behavior, Urban planning, Sustainable transportation, Smart grids**.**

1. Introduction

China's push toward carbon neutrality by 2060 has accelerated the transition to electric mobility, making charging infrastructure a linchpin of success [1-3]. Despite national investments, gaps persist in understanding heterogeneous user preferences—particularly in secondary cities like Zibo. This study addresses this gap by analyzing granular data from Zibo, a representative urban hub, to identify how demographics, economic status, and operational attributes shape charging behavior. By disentangling these dynamics, we offer evidence-based insights for optimizing resource allocation and enhancing user adoption.

2. Methodology

2.1 Data Source

Primary data was collected via structured questionnaires distributed to NEV owners in Zibo (n=100, 23 participants selected for follow-up interviews to ensure data triangulation.). The dataset includes:

Demographics: Sex, age, occupation, income bracket ($<5,000; $>12,000).

Vehicle & Usage: Type (EV/Hybrid EV), weekly charging frequency.

Infrastructure Metrics: Preferred charging method (public/home/company), cost ratings (1–5 scale), capacity factor, maintenance status, safety scores, brand loyalty, payment convenience, and app functionality.

Contextual Variables: Geographic locations, service quality perceptions.

2.2 Analytical Approach

Descriptive statistics and cross-tabulations were performed using SPSS to detect correlations between categories (Figure 1). Ordinal logistic regression modeled the probability of selecting specific charging methods based on predictor variables [4-5]. Qualitative themes emerged from open-ended feedback on preferences.

sex	age	occupation	income	vehicle type	Average number of charges per week	Most frequently used charging method
famale	36-45	Enterprise employees	<5000	EV	1—2	Public charging stations
male	18-25	Enterprise employees	<5000	hybrid EV	3—4	Home charging piles
famale	36-45	Enterprise employees	<5000	EV	1—2	Public charging stations
male	36-45	Enterprise employees	<5000	EV	1—2	Home charging piles
male	26-35	Enterprise employees	<5000	EV	1—2	Public charging stations
male	26-35	Enterprise employees	<5000	EV	1—2	Public charging stations
male	36-45	Enterprise employees	<5000	EV	3—4	Public charging stations
famale	26-35	Enterprise employees	<5000	hybrid EV	1—2	Home charging piles
male	26-35	Enterprise employees	<5000	EV	1—2	Home charging piles
famale	26-35	liberal professions	>12000	EV	1—2	Home charging piles
famale	36-45	Enterprise employees	<5000	EV	1—2	Home charging piles
male	>46	Enterprise employees	<5000	hybrid EV	1—2	Company charging piles
male	36-45	Enterprise employees	<5000	EV	1—2	Public charging stations
famale	>46	Enterprise employees	<5000	EV	1—2	Home charging piles
male	26-35	public institutions	<5000	EV	3—4	Public charging stations
famale	26-35	other	<5000	EV	1—2	Home charging piles
famale	26-35	Enterprise employees	<5000	hybrid EV	1—2	Home charging piles
male	36-45	public institutions	5000-8000	hybrid EV	3—4	Public charging stations
male	36-45	Enterprise employees	<5000	EV	1—2	Home charging piles
famale	36-45	Enterprise employees	5000-8000	EV	1—2	Home charging piles
male	36-45	public institutions	5000-8000	EV	1—2	Home charging piles

Figure 1: Questionnaire findings

3. Results

3.1 Demographic Disparities

Table 1: Demographic disparities

Group	Dominant charging method	Average weekly charges	Key priorities
Young Males (18–25)	home piles	3–4	speed, APP functionality
Females (All Ages)	home/company piles	1–2	safety, cost transparency
Enterprise Employees	public stations (weekdays)	1–2	capacity availability, service
High-Income Professionals	private home systems	1–2	brand reliability, maintenance
Senior Workers (>46)	company/public mixed use	1–2	accessibility, low operational hassle

Note: Hybrid EV owners exhibit higher charging frequency (3–4/week) vs. pure EVs (1–2/week).

3.2 Critical Success Factors

Cost Sensitivity: 85% of respondents rated "costs" ≥4/5, with low-income groups prioritizing free/subsidized public stations.

Safety & Maintenance: Male users aged 36–45 scored safety lowest (avg. 3/5), citing poor lighting and surveillance. Females emphasized regular maintenance (mean score: 4.8/5).

Digital Integration: Younger cohorts (<35) demanded advanced app features (navigation, reservation; avg. rating: 4.7/5), while older users preferred simplicity.

Location Hierarchy: Home > Company > Public (for daily use); Public stations dominated weekend/long-distance trips.

Brand Loyalty: Stated preferences and actual usage has a weak correlation. Only 12% consistently chose their preferred brand due to limited coverage.

Service Quality: Public stations received mixed reviews (avg. 3.2/5 for service), whereas home/company setups scored 4.5/5. Common complaints included broken connectors and slow customer support.

4. Conclusion and Implications

4.1 Conclusion

Zibo's NEV users demonstrate clear segmentation in charging preferences, driven by practical constraints rather than ideological alignment. While public infrastructure remains symbolically important, personalized solutions — home/company micro grids, dynamic pricing, and AI-driven maintenance—are critical for sustained adoption. Local governments must balance top-down investments with bottom-up customization to bridge the "last mile" gap in urban mobility.

4.2 Implications for Policy

(1) Encourage public-private partnerships to accelerate the deployment of supercharging infrastructure in underserved regions.

(2) Develop standards for charging speed and safety to ensure interoperability and consumer confidence.

(3) Incentivize the adoption of renewable energy sources for charging stations to strengthen the environmental credentials of NEVs.

(4) Educate consumers on the benefits of NEVs and the importance of supporting clean energy infrastructure.

4.3 Implications for Supercharging Station Operators

(1) Prioritize investments in high-speed charging technologies to minimize wait times.

(2) Implement dynamic pricing strategies that account for temporal demand fluctuations without alienating cost-sensitive users.

(3) Expand network coverage focusing on high-traffic areas and residential clusters.

(4) Enhance facilities with complementary services to transform waiting time into a positive experience.

(5) Build strong brands through consistent quality delivery and transparent communication about sustainability

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