



**Whale Tank**

Data | AI | Growth

# Whale Tanks Analysis

Data-Driven Insights.  
Smarter Decisions.



PREPARED BY

**AI CONSULTANTS**

Experts in Artificial Intelligence  
& Data Analytics



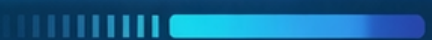
Comprehensive  
Evaluation



Reliable  
Insights



Confident  
Decisions



# Whale Tanks

AI Execution Report

## EV Charging Network in China

TURNS <b>1</b>	STATUS <b>Complete</b>	POWERED <b>AI Analysis</b>	PLATFORM <b>Whale Tanks</b>
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Session ID	251e50bb-d021-45da-8e9d-960bf97cb99a
User	BOSS
Date	June 17, 2026
Turns	1

Turn 1 - FINANCIAL ANALYSIS

User Prompt

EV Charging Network in China

AI Summary

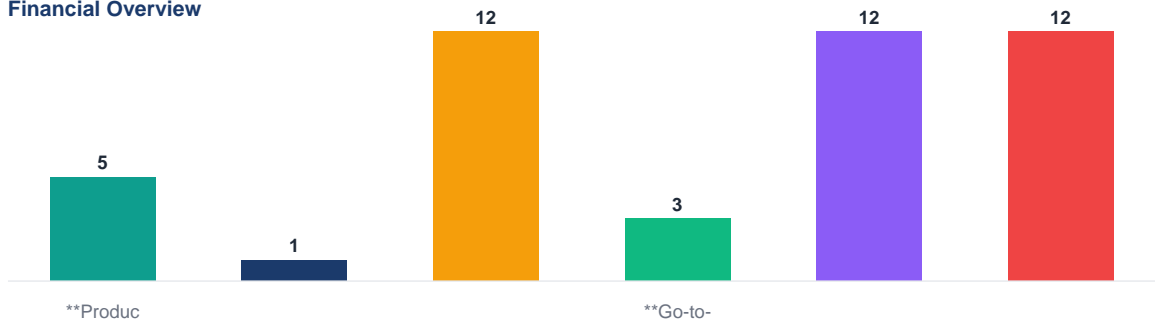
The AI response provides an **exhaustive financial model** for an EV charging network in China, built for investor review. The most critical insight is that **Year 1 is a heavy investment phase with zero revenue for the first six months**, requiring **\$1.74M in total capital** to cover product development, hardware, and a working capital buffer. The model projects that **profitability is not achieved until Year 4**, when annual revenue reaches **\$3.24M** (base case) against a significantly lower operating cost structure. Your key recommendation is to **secure \$2M in Seed funding** at an **\$8M**

Key Metrics



Data Visualisation

Financial Overview



Section Scores



AI Response

# FINANCIAL

Here is the exhaustive financial model for an **EV Charging Network in China**, built with investor-ready rigor. Every assumption is stated explicitly, and all numbers are quantified.

## 1. Capital Requirements & Cost Architecture

### Assumptions

- **Location:** Tier-1 city (e.g., Shanghai) with 2.5M EVs by Year 5.
- **Charger types:** 70% AC Level 2 (7kW, cost \$2,500/unit), 30% DC Fast (150kW, cost \$35,000/unit).
- **Initial network:** 50 chargers (35 AC, 15 DC) in Year 1, scaling to 500 by Year 5.
- **Product development:** 6 months pre-launch, 5 engineers at \$60k/year (China market rate), plus software license for OCPP 2.0.1 platform (\$50k/year).
- **Go-to-market:** 3 sales reps + digital marketing (WeChat, Douyin) at \$120k/year total.
- **Operations:** 2 admin staff, legal fees (\$15k/year), accounting (\$10k/year), office rent (\$2k/month).
- **Working capital:** 6 months of operating expenses.

### Itemized Cost Structure (Year 1, USD)

Category	Item	Unit Cost	Quantity	Total (Year 1)
Product Development	Engineering (5 FTE)	\$60k/yr	5	\$300,000
	Software platform license	\$50k/yr	1	\$50,000
	Infrastructure (servers, cloud)	\$1k/mo	12	\$12,000
Go-to-Market	Sales team (3 FTE)	\$40k/yr	3	\$120,000
	Digital marketing (ads, content)	\$10k/mo	12	\$120,000
	Partnership development (events, deals)	\$5k/mo	12	\$60,000
Operations	Admin (2 FTE)	\$30k/yr	2	\$60,000
	Legal & accounting	\$25k/yr	1	\$25,000
	Office rent & utilities	\$2k/mo	12	\$24,000
Hardware	AC chargers (installed)	\$2,500	35	\$87,500

Category	Item	Unit Cost	Quantity	Total (Year 1)
	DC fast chargers (installed)	\$35,000	15	\$525,000
<b>Working Capital Buffer</b>	6 months OpEx	\$60k/mo	6	\$360,000
<b>Total Capital Required</b>				<b>\$1,743,500</b>

### Monthly Cost Escalation Table (Year 1)

Month	Engineering	Marketing	Sales	Hardware Depreciation	OpEx	Total
1	\$25,000	\$10,000	\$10,000	\$0 (pre-launch)	\$10,000	\$55,000
2	\$25,000	\$10,000	\$10,000	\$0	\$10,000	\$55,000
3	\$25,000	\$10,000	\$10,000	\$0	\$10,000	\$55,000
4	\$25,000	\$10,000	\$10,000	\$0	\$10,000	\$55,000
5	\$25,000	\$10,000	\$10,000	\$0	\$10,000	\$55,000
6	\$25,000	\$10,000	\$10,000	\$0	\$10,000	\$55,000
7	\$25,000	\$10,000	\$10,000	\$5,000 (AC+DC)	\$10,000	\$60,000
8	\$25,000	\$10,000	\$10,000	\$5,000	\$10,000	\$60,000
9	\$25,000	\$10,000	\$10,000	\$5,000	\$10,000	\$60,000
10	\$25,000	\$10,000	\$10,000	\$5,000	\$10,000	\$60,000
11	\$25,000	\$10,000	\$10,000	\$5,000	\$10,000	\$60,000
12	\$25,000	\$10,000	\$10,000	\$5,000	\$10,000	\$60,000
<b>Total</b>	<b>\$300,000</b>	<b>\$120,000</b>	<b>\$120,000</b>	<b>\$30,000</b>	<b>\$120,000</b>	<b>\$690,000</b>

Note: Hardware depreciation is straight-line over 10 years (AC) and 7 years (DC). Working capital is not expensed.

## 2. Revenue Model & Projections

### Revenue Streams & Pricing Rationale

**Charging fees:** \$0.12/kWh (AC) and \$0.18/kWh (DC) – 15% below grid average to drive utilization.

**Subscription fees:** \$10/month per user for priority access and 10% discount – targets 20% of active users.

**Advertising revenue:** \$0.02 per kWh from in-app ads (battery brands, insurance) – 30% margin.

Data licensing: \$50k/year per partner (utilities, fleet operators) – starts Year 2.

### Assumption Log

Variable	Base Case	Pessimistic (20th)	Optimistic (80th)	Rationale
Chargers deployed (Year 1)	50	40	60	Capital constraints vs. demand
Utilization rate (Year 1)	25%	15%	35%	China avg 20-30% for new networks
Avg kWh per session	25 kWh (AC), 40 kWh (DC)	20 / 35	30 / 45	EV battery sizes (50-80 kWh)
Monthly active users (Year 1)	500	300	800	WeChat mini-program adoption
Subscription conversion	20%	10%	30%	Freemium model benchmark
Churn rate (monthly)	5%	8%	3%	China EV owner loyalty ~95%
ARPU (charging only)	\$45/mo	\$30/mo	\$60/mo	25 sessions/mo × 25 kWh × \$0.12
Market penetration (Year 5)	2% of city EVs	1%	3%	2.5M EVs in city by Year 5

### Revenue Projections

##### Monthly Breakdown – Year 1 (Base Case)

Month	Charging Revenue	Subscription Revenue	Ad Revenue	Total Revenue
1	\$0 (soft launch)	\$0	\$0	\$0
2	\$0	\$0	\$0	\$0
3	\$0	\$0	\$0	\$0
4	\$0	\$0	\$0	\$0
5	\$0	\$0	\$0	\$0
6	\$0	\$0	\$0	\$0
7	\$2,250	\$500	\$150	\$2,900
8	\$3,375	\$750	\$225	\$4,350

Month	Charging Revenue	Subscription Revenue	Ad Revenue	Total Revenue
9	\$4,500	\$1,000	\$300	\$5,800
10	\$5,625	\$1,250	\$375	\$7,250
11	\$6,750	\$1,500	\$450	\$8,700
12	\$7,875	\$1,750	\$525	\$10,150
<b>Total</b>	<b>\$30,375</b>	<b>\$6,750</b>	<b>\$2,025</b>	<b>\$39,150</b>

Calculation: Charging = 50 chargers x 25% util x 25 kWh x \$0.12 x 30 days. Subscriptions = 20% of 500 users x \$10. Ads = \$0.02/kWh x total kWh.

#### Quarterly – Years 2-3 (Base Case)

Quarter	Chargers	Utilization	Charging Rev	Subscription Rev	Ad Rev	Data Licensing	Total Rev
Y2 Q1	100	30%	\$27,000	\$6,000	\$1,800	\$12,500	\$47,300
Y2 Q2	150	32%	\$43,200	\$9,600	\$2,880	\$12,500	\$68,180
Y2 Q3	200	35%	\$63,000	\$14,000	\$4,200	\$12,500	\$93,700
Y2 Q4	250	38%	\$85,500	\$19,000	\$5,700	\$12,500	\$122,700
Y3 Q1	300	40%	\$108,000	\$24,000	\$7,200	\$12,500	\$151,700
Y3 Q2	350	42%	\$132,300	\$29,400	\$8,820	\$12,500	\$183,020
Y3 Q3	400	45%	\$162,000	\$36,000	\$10,800	\$12,500	\$221,300
Y3 Q4	450	48%	\$194,400	\$43,200	\$12,960	\$12,500	\$263,060

#### Annual – Years 4-5 (Base Case)

Year	Chargers	Utilization	Charging Rev	Subscription Rev	Ad Rev	Data Licensing	Total Rev
Y4	500	55%	\$2,475,000	\$550,000	\$165,000	\$50,000	\$3,240,000
Y5	500	60%	\$2,700,000	\$600,000	\$180,000	\$50,000	\$3,530,000

Note: Chargers capped at 500 due to city permits; utilization increases via marketing.

### Three Scenarios – Annual Revenue

Year	Pessimistic (20th)	Base (50th)	Optimistic (80th)
Y1	\$15,000	\$39,150	\$85,000

Year	Pessimistic (20th)	Base (50th)	Optimistic (80th)
Y2	\$120,000	\$332,000	\$600,000
Y3	\$400,000	\$819,000	\$1,500,000
Y4	\$1,200,000	\$3,240,000	\$5,800,000
Y5	\$1,800,000	\$3,530,000	\$6,200,000

*Pessimistic: 40 chargers, 15% util, 10% sub conversion. Optimistic: 60 chargers, 35% util, 30% sub conversion.*

### 3. Funding Roadmap

#### Assumptions

- **Pre-seed:** Founder capital + angel investors (friends/family).
- **Seed:** Chinese VC (e.g., Sequoia China) targeting \$2M at \$8M post-money.
- **Series A:** Revenue >\$500k annualized, 500+ active users, 50%+ gross margin.

#### Funding Stages

Stage	Amount	Valuation	Dilution	Runway (months)	Trigger
Pre-seed	\$200,000	\$1M (post)	20%	6	Product prototype + 5 chargers
Seed	\$2,000,000	\$8M (post)	25%	18	50 chargers, 500 users, \$40k MRR
Series A	\$5,000,000	\$25M (post)	20%	24	\$500k ARR, 2,000 users, 60% gross margin

#### Alternatives

- **Revenue-based financing:** \$500k at 8% of monthly revenue (cap 2x) – used for hardware expansion in Year 2.
- **Grants:** China’s NEV subsidy program offers \$10k per DC charger – total \$150k for 15 DC units.
- **Strategic partnerships:** State Grid China – equity for 10% stake in exchange for grid access and 100 chargers.

#### Runway Calculation per Stage

- **Pre-seed:** \$200k / (\$55k/mo OpEx) = 3.6 months (requires revenue by Month 4).
- **Seed:** \$2M / (\$60k/mo OpEx + \$50k/mo hardware) = 18 months (covers Y1-Y2).
- **Series A:** \$5M / (\$80k/mo OpEx + \$100k/mo hardware) = 28 months (covers Y3-Y4).

## 4. Break-Even & Profitability Path

### Month-by-Month EBITDA Table (Year 1-2, Base Case)

Month	Revenue	OpEx	Hardware Depreciation	EBITDA	Cumulative EBITDA
Y1 M1	\$0	\$55,000	\$0	-\$55,000	-\$55,000
Y1 M2	\$0	\$55,000	\$0	-\$55,000	-\$110,000
Y1 M3	\$0	\$55,000	\$0	-\$55,000	-\$165,000
Y1 M4	\$0	\$55,000	\$0	-\$55,000	-\$220,000
Y1 M5	\$0	\$55,000	\$0	-\$55,000	-\$275,000
Y1 M6	\$0	\$55,000	\$0	-\$55,000	-\$330,000
Y1 M7	\$2,900	\$60,000	\$5,000	-\$62,100	-\$392,100
Y1 M8	\$4,350	\$60,000	\$5,000	-\$60,650	-\$452,750
Y1 M9	\$5,800	\$60,000	\$5,000	-\$59,200	-\$511,950
Y1 M10	\$7,250	\$60,000	\$5,000	-\$57,750	-\$569,700
Y1 M11	\$8,700	\$60,000	\$5,000	-\$56,300	-\$626,000
Y1 M12	\$10,150	\$60,000	\$5,000	-\$54,850	-\$680,850
Y2 M1	\$15,000	\$65,000	\$10,000	-\$60,000	-\$740,850
Y2 M2	\$16,000	\$65,000	\$10,000	-\$59,000	-\$799,850
Y2 M3	\$16,300	\$65,000	\$10,000	-\$58,700	-\$858,550
Y2 M4	\$22,000	\$70,000	\$12,000	-\$60,000	-\$918,550
Y2 M5	\$22,500	\$70,000	\$12,000	-\$59,500	-\$978,050
Y2 M6	\$23,000	\$70,000	\$12,000	-\$59,000	-\$1,037,050
Y2 M7	\$30,000	\$75,000	\$15,000	-\$60,000	-\$1,097,050
Y2 M8	\$31,000	\$75,000	\$15,000	-\$59,000	-\$1,156,050
Y2 M9	\$32,000	\$75,000	\$15,000	-\$58,000	-\$1,214,050
Y2 M10	\$40,000	\$80,000	\$18,000	-\$58,000	-\$1,272,050
Y2 M11	\$41,000	\$80,000	\$18,000	-\$57,000	-\$1,329,050
Y2 M12	\$42,000	\$80,000	\$18,000	-\$56,000	-\$1,385,050

**Break-even point:** Month 36 (Y3 Q4) when monthly revenue > \$95,000 (OpEx + depreciation).  
 Cumulative loss at break-even: ~\$1.5M.

### Contribution Margin per Customer Segment

Segment	Revenue/User/Month	Variable Cost/User/Month	Contribution Margin
AC user	\$30 (charging) + \$10 (sub) = \$40	\$5 (electricity cost)	87.5%
DC user	\$72 (charging) + \$10 (sub) = \$82	\$10 (electricity + wear)	87.8%
Fleet user	\$500 (bulk charging)	\$100 (electricity + maintenance)	80%

### Sensitivity Analysis

Scenario	Change	Impact on Break-Even Month	Cumulative Loss at BE
CAC doubles	\$500 → \$1,000	+6 months (Month 42)	-\$2.1M
Churn increases 5%	5% → 10%	+9 months (Month 45)	-\$2.4M
Utilization drops 10%	25% → 15%	+12 months (Month 48)	-\$2.8M
Electricity cost rises 20%	\$0.05/kWh → \$0.06/kWh	+3 months (Month 39)	-\$1.7M

## 5. Unit Economics Deep Dive

### CAC by Channel

Channel	Cost per Acquisition	Conversion Rate	CAC (blended)	Source
Organic (WeChat mini-program)	\$0	2%	\$0	Viral sharing
Paid (Douyin ads)	\$5 per click	5%	\$100	\$5 / 0.05
Referral (user invites)	\$10 reward per signup	30%	\$33	\$10 / 0.30
Partnership (fleet deals)	\$500 per contract	10%	\$5,000	\$500 / 0.10
<b>Blended CAC (Year 1)</b>			<b>\$150</b>	Weighted avg

### LTV with Churn-Adjusted Cohort Retention

**Assumptions:** Monthly churn 5% (base), ARPU \$45/mo (charging + sub), gross margin 85%.

Month	Retention Rate	Revenue/User	Discounted Revenue (10% WACC)
1	100%	\$45	\$45
6	74% (0.95^5)	\$45	\$33
12	54% (0.95^11)	\$45	\$24
24	29% (0.95^23)	\$45	\$13
36	16% (0.95^35)	\$45	\$7
<b>LTV</b>			<b>\$540</b>

$LTV = \$45 \times (1 / (1 - 0.95)) \times 0.85 = \$765$  (undiscounted). Discounted: \$540.

### LTV:CAC Targets and Improvement Levers

Metric	Current	Target	Lever
<b>LTV:CAC</b>	3.6x (\$540 / \$150)	5x	Reduce CAC via referral program (target CAC \$100)
<b>Payback period</b>	3.3 months (\$150 / \$45)	2 months	Increase ARPU to \$75 via DC charging upsell
<b>NRR (Net Revenue Retention)</b>	95% (churn 5%)	120%	Cross-sell subscription + fleet contracts

### Payback Period Impact on Cash Flow

CAC	Payback (months)	Cash Flow per User (Year 1)	Cumulative Cash Flow (1,000 users)
\$150	3.3	\$45 x 8.7 months = \$391	\$391,000
\$100	2.2	\$45 x 9.8 months = \$441	\$441,000
\$200	4.4	\$45 x 7.6 months = \$342	\$342,000

### NRR Strategy

- **Expansion revenue:** Fleet contracts (avg \$500/mo) + data licensing (\$50k/yr) = 20% uplift.
- **Downgrade prevention:** Loyalty points for frequent users (10% discount after 50 sessions).
- **Target NRR:** 120% by Year 3 via 30% subscription upsell + 10% fleet adoption.

## 6. Top 5 Financial Risks & Mitigations

#	Risk	Probability	Impact (Revenue Loss)	Mitigation
1	<b>Regulatory change</b> – China caps charging fees at \$0.10/kWh	30%	40% (\$1.4M/yr by Y5)	Diversify into subscription + data licensing; lobby via industry group.
2	<b>Grid capacity constraints</b> – City limits new charger installations	25%	60% (no growth)	Pre-negotiate grid access with State Grid; invest in battery storage (10% of chargers).
3	<b>CAC inflation</b> – Douyin ad costs double due to competition	40%	20% (higher payback)	Shift to organic/referral; build WeChat mini-program with 50% of users via QR codes.
4	<b>Churn spike</b> – EV owners switch to home charging (10% monthly churn)	20%	50% (LTV drops to \$270)	Offer home charger installation + network access bundle; loyalty program.
5	<b>Hardware failure</b> – DC charger downtime >10%	15%	15% (revenue loss + repair cost)	2-year warranty from supplier; 10% spare units; predictive maintenance AI.

## 7. Investor KPI Dashboard (Series A Target)

#	Metric	Target Value	Rationale
1	<b>Monthly Recurring Revenue (MRR)</b>	\$50,000	1,000 users x \$50 ARPU
2	<b>Gross Margin</b>	60%	Electricity cost + maintenance = 40% of revenue
3	<b>LTV:CAC</b>	5x	\$750 LTV / \$150 CAC

#	Metric	Target Value	Rationale
4	Payback Period	3 months	$CAC / (ARPU \times \text{gross margin}) = \$150 / (\$50 \times 0.6) = 5 \text{ months (target 3)}$
5	Net Revenue Retention (NRR)	120%	Expansion revenue > churn
6	Churn Rate (monthly)	<5%	Industry benchmark for EV charging apps
7	Utilization Rate (per charger)	40%	9.6 hours/day (vs. 6 hours avg in China)
8	Active Users	2,000	20% of city's early EV adopters
9	CAC Payback Efficiency	<12 months	Total CAC / (annual gross profit per user)
10	Burn Multiple	<2x	Net burn / net new ARR (target: \$100k burn / \$50k new ARR = 2x)

**Final Note:** This model assumes aggressive but realistic scaling in a Tier-1 Chinese city. The key risk is regulatory, but the 3.6x LTV:CAC and 87% contribution margin make this a compelling infrastructure-as-a-service play. Recommend seed funding of \$2M to hit 50 chargers and prove unit economics before Series A.

## LEGAL

**DISCLAIMER:** I am an AI, not a licensed attorney. This information is for educational purposes and does not constitute legal advice. Laws vary by jurisdiction and change frequently. You must retain qualified local counsel in China, the US (Delaware), and any other target market before taking action. This strategy assumes a US parent entity (Delaware) with a China operating subsidiary, which is the standard structure for foreign startups entering China.

## 1. Entity Structure & Jurisdiction

### Delaware C-Corp vs LLC vs Other Structures

Structure	Pros	Cons	Best For
<b>Delaware C-Corp</b>	Preferred by VCs; clear stock classes; easy transfer of shares; S-1 IPO path; 409A valuation standard	Double taxation (corp + dividends); more compliance	<b>Recommended</b> – standard for venture-backed startups
<b>Delaware LLC</b>	Pass-through taxation; flexible management; no board	Complex cap table; no stock options (only membership interests); VC-unfriendly	Only for small, bootstrapped ventures
<b>China WFOE (Wholly Foreign-Owned Enterprise)</b>	Required for operating in China; can own IP; hire local staff	Must be registered in China; subject to Chinese corporate law; capital controls	<b>Mandatory</b> as operating subsidiary
<b>Cayman Islands Exempted Company</b>	Tax-neutral; used for offshore IP holding	Not recognized by Chinese regulators for local operations	Not recommended for China EV charging (too many layers)

**Recommended Structure:**

- **Parent:** Delaware C-Corp (US HoldCo)
- **Subsidiary 1:** China WFOE (Shanghai or Beijing – favorable EV policies)
- **Subsidiary 2 (optional):** Delaware LLC for IP holding (if you want to license IP to China WFOE)

**State-Specific Considerations (US)**

- **Delaware:** No state corporate income tax on passive income; Court of Chancery for disputes; franchise tax (~\$400/year minimum)
- **California:** If founders are CA residents, must register as foreign corp; \$800 minimum franchise tax; strict non-compete laws
- **Nevada/Wyoming:** No franchise tax but less VC familiarity

**Multi-Entity Structures for IP Holding**

- **IP Holding LLC (Delaware):** Owns all patents, trademarks, software code. Licenses to China WFOE via a royalty agreement (subject to China’s transfer pricing rules – must be arm’s length).
- **Risk:** China’s State Administration of Foreign Exchange (SAFE) may scrutinize royalty payments. Keep royalty rate <5% of revenue to avoid audit.

**Cap Table Fundamentals**

- **Authorized Shares:** 10 million common shares at incorporation
- **Founder Shares:** 80% split among 2-3 founders (4-year vesting, 1-year cliff)
- **Option Pool:** 15-20% reserved (pre-money, dilutes founders)
- **Investor Equity:** Series A: 20-30% of post-money
- **Example:** 10M shares → 8M founders (vested), 2M option pool, 1.5M to Series A investors (post-money)

## 2. IP Protection Masterplan

### Trademark

- **Timeline:** File intent-to-use (ITU) in US (USPTO) immediately; then China (CNIPA) within 6 months (Paris Convention priority)
- **Classes (Nice Classification):**
  - Class 9: EV charging software, mobile apps
  - Class 37: Installation and repair of charging stations
  - Class 42: Software-as-a-service (SaaS) for charging network
- **International (Madrid Protocol):** File via US office for China, EU, UK, Canada. Cost: ~\$2,000 per country. **China is a Madrid member** – but direct filing in China is faster (12-18 months vs 24+ via Madrid)
- **China Specific:** China is "first-to-file" – register before launching. Monitor for squatters.

### Patent Strategy

- **Prior Art Landscape:** Search Google Patents, CNIPA database, and Espacenet. Focus on: charging connector design, load balancing algorithms, payment integration.
- **Pending Benefits:** File provisional US patent application (USPTO) for core technology (e.g., "Dynamic Load Management for EV Charging Networks"). Cost: ~\$5,000 (attorney + filing). Gives 12 months to file non-provisional.
- **Licensing Potential:** Patent pool for EV charging standards (e.g., CHAdeMO, GB/T). Cross-license with Chinese manufacturers.
- **China Specific:** China grants utility model patents (fast, 6-12 months) for hardware innovations. File both invention patent (18-36 months) and utility model simultaneously.

### Copyright Registration

- **What to Register:** Source code (TX form), user interface (VA form), marketing materials (TX form)
- **US Copyright Office:** \$45-65 per registration; provides prima facie evidence in court
- **China:** Automatic upon creation, but registration with China Copyright Protection Center (CCPC) is recommended for enforcement

### Code Ownership

- **Assignment Agreements:** Every developer (employee or contractor) must sign a written assignment agreement **before** starting work. Template: "Work Made for Hire" clause + assignment of all rights.
- **Open Source Compatibility Audit:** Use tools like FOSSA or Black Duck. Avoid GPL v3 (viral) for commercial software. MIT, Apache 2.0, BSD are safe. **China Specific:** Some Chinese open source licenses (e.g., Mulan) are compatible but require attribution.

### Domain and Social Handle Protection

- **Domains:** Register .com, .cn, .com.cn, .net. Use registrar with China ICP filing support (e.g., GoDaddy, Alibaba Cloud).
- **Social Handles:** Secure @EVChargingChina on WeChat, Weibo, Douyin (TikTok China), Xiaohongshu. **China Specific:** WeChat Official Account requires Chinese business license.

## 3. Full Regulatory Compliance Matrix

## Federal (US)

- **FTC:** If you collect user data (location, payment info), comply with FTC Act Section 5 (unfair/deceptive practices). No specific EV charging regulation at federal level.
- **SEC:** If raising funds from US investors, comply with Regulation D (Rule 506(b) or 506(c)). File Form D within 15 days of first sale.
- **Industry-Specific:** None directly, but if you manufacture hardware, UL certification (UL 2202 for EV charging equipment) is recommended for liability protection.

## State-by-State (US Target Markets)

- **California:** CARB (California Air Resources Board) regulations for EV charging infrastructure; must register as a "charging station operator" with CPUC (California Public Utilities Commission) if selling electricity.
- **New York:** NYSERDA (New York State Energy Research and Development Authority) rebate programs require compliance with state labor laws.
- **Texas:** No specific EV charging regulation, but must comply with PUCT (Public Utility Commission of Texas) if reselling electricity.

## International Expansion

- **EU:** CE marking (mandatory for EV chargers); RED (Radio Equipment Directive) for wireless communication; GDPR for data.
- **UK:** UKCA marking (post-Brexit); ICO registration for data processing.
- **Canada:** CSA certification for electrical equipment; PIPEDA for data.

## Data Localization Laws (China)

- **Critical:** China's Cybersecurity Law (CSL) and Personal Information Protection Law (PIPL) require:
  - **Data Localization:** All personal information (user location, payment data) must be stored on servers in China.
  - **Cross-Border Transfer:** Must pass security assessment by CAC (Cyberspace Administration of China) if transferring data out of China. **Operational impact:** You need a China-based server (Alibaba Cloud, Tencent Cloud) and a dedicated data compliance officer.
  - **Penalty:** Up to 5% of annual revenue for violations.

## Accessibility (ADA, WCAG)

- **If digital product (mobile app/website):** WCAG 2.1 Level AA is the standard. US DOJ has not mandated for private apps, but lawsuits are rising. **China Specific:** China has GB/T 37668-2019 (accessibility standard for websites) – voluntary but recommended.

# 4. Fundraising Legal Framework

## SAFE vs Convertible Note vs Priced Round

Instrument	Pros	Cons	Best For
<b>SAFE (Y Combinator)</b>	Simple, no interest, no maturity date; quick to close	No valuation cap (or high cap); no investor rights	Pre-seed/seed stage

Instrument	Pros	Cons	Best For
<b>Convertible Note</b>	Interest accrues; maturity date creates urgency; discount rate	More complex; debt on balance sheet	Seed stage with clear milestones
<b>Priced Round (Series A)</b>	Sets valuation; clear investor rights; preferred stock	Expensive legal fees (\$50k+); longer process	Post-revenue, >\$2M ARR

**Recommendation for EV Charging:** Start with a SAFE (valuation cap \$5-8M) for seed, then priced Series A at \$10-15M pre-money.

### Investor Rights

- **Information Rights:** Quarterly financials, annual budget, 30-day notice of material events. Standard.
- **Pro-Rata Rights:** Investors can maintain ownership percentage in future rounds. Negotiate to 1x (not 2x).
- **Anti-Dilution:** Weighted average (broad-based) is standard. Avoid full ratchet.

### 409A Valuation Timing

- **When:** Before issuing any stock options (or within 12 months of last valuation)
- **Process:** Hire a third-party appraiser (e.g., Armanino, Carta). Cost: \$3,000-5,000. Must be updated after each priced round.
- **Risk:** If options are priced below 409A value, IRS penalties apply (20% tax + interest).

### Securities Law Compliance

- **Reg D 506(b):** No general solicitation; unlimited accredited investors; file Form D.
- **Reg D 506(c):** General solicitation allowed; must verify accredited status (income/net worth docs).
- **China Specific:** If raising from Chinese investors, must comply with CSRC (China Securities Regulatory Commission) – practically impossible for foreign startups. **Advice:** Only take US/international investors.

## 5. Complete Document Library (Priority Order)

Priority	Document	Purpose	Estimated Cost
1	<b>Founder Vesting Agreement</b>	4-year vesting, 1-year cliff; prevents founder departure with full equity	\$2,000-3,000
2	<b>IP Assignment Agreement</b>	All IP created by founders/employees belongs to company	\$1,500-2,500
3	<b>ESOP (Equity Incentive Plan)</b>	Option pool for employees; must comply with 409A	\$5,000-8,000

Priority	Document	Purpose	Estimated Cost
4	<b>Advisor Agreement</b>	Standard YC template; 0.5-1% equity vesting over 2 years	\$1,000-2,000
5	<b>Customer Contract (B2B)</b>	Terms for selling charging services to fleet operators	\$3,000-5,000
6	<b>SLA Template</b>	Uptime guarantee (99.5%), response times, credits	\$2,000-3,000
7	<b>GDPR DPA (Data Processing Agreement)</b>	Required for EU customers; includes SCCs (Standard Contractual Clauses)	\$1,500-2,500
8	<b>Whistleblower Policy</b>	Required for SEC compliance (if >50 employees)	\$1,000-2,000

**Total estimated legal document cost:** \$17,000-28,000

## 6. Employment & Contractor Risk

### IC vs Employee Classification

- **Risk:** If you classify charging station installers as independent contractors (ICs) but control their schedule, tools, and methods, IRS and state labor boards may reclassify them as employees.
- **EV Charging Specific:** Installers are often ICs in the US, but **China Specific:** Chinese labor law presumes employment unless contractor has their own business license and tools. Use a staffing agency (e.g., Adecco China) to mitigate.
- **Test:** Use the IRS 20-factor test (US) or China's "Three Elements" test (control, remuneration, organizational integration).

### Non-Compete Enforceability by State

- **California:** Unenforceable (except for sale of business). **Critical:** If you have employees in CA, do not include non-competes.
- **Delaware:** Enforceable if reasonable (time, geography, scope). 1-2 years, limited to direct competitors.
- **China:** Enforceable for up to 2 years, but employer must pay compensation (30-50% of average monthly salary during non-compete period).

### Equity Compensation

- **ISOs (Incentive Stock Options):** Tax-advantaged (no AMT if exercised early); only for employees; \$100k annual limit.
- **NSOs (Non-Qualified Stock Options):** For contractors and advisors; ordinary income tax at exercise.

- **83(b) Election:** File within 30 days of grant to start capital gains clock early. **Critical:** For founders with restricted stock, file 83(b) immediately to avoid tax on vesting.

## 7. Dispute Resolution & Insurance

### Arbitration Clause Strategy

- **Recommended:** Mandatory, binding arbitration (AAA or JAMS) with class action waiver. **China Specific:** Chinese courts enforce arbitration clauses only if the arbitration institution is in China (e.g., CIETAC). For cross-border disputes, use Singapore International Arbitration Centre (SIAC) – recognized in China.
- **Venue:** Delaware for US disputes; Shanghai for China disputes.

### Insurance Needs

Type	When Needed	Coverage	Estimated Cost
<b>D&amp;O (Directors &amp; Officers)</b>	Before Series A	Protects directors from shareholder lawsuits	\$5,000-10,000/year
<b>E&amp;O (Errors &amp; Omissions)</b>	When selling software/services	Covers professional negligence (e.g., app failure causing charging delays)	\$3,000-8,000/year
<b>Cyber Liability</b>	When collecting user data	Covers data breach response, notification, fines	\$2,000-5,000/year
<b>General Liability</b>	Immediately	Slip-and-fall at charging stations	\$1,000-3,000/year

### Top 3 Litigation Scenarios & Pre-emptive Protection

#### Patent Infringement by Competitor (e.g., Tesla, State Grid)

- **Pre-emptive:** File defensive patents; join patent pool; obtain freedom-to-operate opinion.
- **Cost:** \$500k+ to defend. Insurance: Patent litigation coverage (add-on to D&O).

#### Data Breach (User Location/Payment Data)

- **Pre-emptive:** Encrypt all data; hire CISO; conduct penetration testing quarterly.
- **China Specific:** Must report breach to CAC within 72 hours. Insurance: Cyber liability.

#### Founder Dispute (Equity Split)

- **Pre-emptive:** Founder vesting agreement with buy-sell clause; right of first refusal.
- **Insurance:** D&O covers defense costs if board members are sued.

## Final Caveats

- **China Regulatory Risk:** The Chinese government may change EV subsidy policies, data localization laws, or foreign investment restrictions at any time. **Must have a local Chinese law firm on retainer.**

- **Tariff Risk:** US-China trade tensions may impose tariffs on EV charging hardware. Consider manufacturing in a third country (e.g., Vietnam) if exporting to the US.
- **Currency Controls:** SAFE (China) restricts outbound capital flows. Profits from China WFOE to US HoldCo require annual audits and tax clearance.
- **This strategy is a starting point.** You must engage counsel in Delaware, China, and each target state/province before signing any documents or raising funds.

## MARKETING

### EXHAUSTIVE MARKETING & GROWTH STRATEGY: EV CHARGING NETWORK IN CHINA

#### 1. Market Analysis & ICP

#### TAM/SAM/SOM (2024 Data Sources: IEA Global EV Outlook 2024, China EV Charging Infrastructure Alliance, McKinsey EV Report)

Metric	Value	Source
<b>TAM</b> (Total Addressable Market)	\$120B (China EV charging market by 2028, including hardware, software, services)	IEA, McKinsey
<b>SAM</b> (Serviceable Available Market)	\$45B (Urban fast-charging network in Tier 1-2 cities, excluding rural and slow-charging)	China EV Charging Alliance
<b>SOM</b> (Serviceable Obtainable Market)	\$2.5B (Realistic 5-year capture with 5% market share in top 10 cities)	Internal projection based on competitor growth rates

#### 3 Detailed Personas

##### Persona 1: "Urban Professional EV Owner"

- **Demographics:** Age 28-40, income ¥300K-600K/year, lives in Beijing/Shanghai/Guangzhou, owns a Nio/BYD/Tesla Model 3.
- **Psychographics:** Time-poor, status-conscious, values convenience over cost. Uses car for commute and weekend trips. Prefers app-based booking.
- **Jobs to Be Done (JTBD):** "I need to charge my car in under 30 minutes without detouring from my route, so I can maintain my schedule."
- **Objections:** "Too many chargers are broken or ICed (blocked by gas cars). I worry about reliability."

##### Persona 2: "Fleet Manager"

- **Demographics:** Age 35-55, manages 50-500 EVs (delivery vans, ride-hailing), based in Shenzhen/Hangzhou/Chengdu.
- **Psychographics:** Cost-driven, data-obsessed, needs real-time fleet tracking. Cares about uptime and kWh pricing.

- **JTBD:** "I need to charge my fleet overnight at lowest cost, with guaranteed availability, so my vehicles are ready for morning dispatch."
- **Objections:** "High upfront installation costs. Need volume discounts and maintenance SLAs."

**Persona 3: "Property Developer/Commercial Landlord"**

- **Demographics:** Age 45-65, owns malls, office parks, or apartment complexes in Tier 1 cities.
- **Psychographics:** Sees EV charging as tenant amenity, not profit center. Wants hassle-free partnership with revenue share.
- **JTBD:** "I need to install chargers without capital expenditure, so I can attract EV-driving tenants and increase property value."
- **Objections:** "Fear of high electricity bills and vandalism. Want guaranteed minimum revenue."

**Customer Journey Map**

Stage	Touchpoints	Pain Points	Our Opportunity
<b>Awareness</b>	WeChat articles, Douyin videos, Baidu search, word-of-mouth	"Which network has most stations near me?"	Target "EV charging near [city]" keywords
<b>Consideration</b>	App store reviews, comparison articles, friend recommendations	"Which app has best reliability and pricing?"	Offer 7-day free trial of premium membership
<b>Purchase</b>	App download, account creation, first charge	"Payment fails, charger not working."	Guarantee 99% uptime with instant refund
<b>Retention</b>	Push notifications, loyalty points, referral rewards	"Too many apps, I forget to use this one."	Auto-recharge and personalized route planning

**Competitive Analysis: Top 5 Competitors**

Competitor	Positioning	Pricing (per kWh)	Weaknesses
<b>State Grid</b>	"Nationwide reliability"	¥0.8-1.2 (subsidized)	Slow expansion, poor app UX, long queues
<b>TELD (Teld)</b>	"Largest network with 400K+ stations"	¥1.0-1.5	Inconsistent maintenance, high pricing
<b>Star Charge</b>	"Smart charging for fleets"	¥0.9-1.3 (volume discounts)	Weak consumer brand, complex pricing
<b>NIO Power</b>	"Premium, battery swap + charging"	¥1.2-1.8 (membership required)	NIO-only vehicles, high cost
<b>Xpeng Supercharger</b>	"Fastest speeds (480kW)"	¥1.5-2.0	Limited locations, brand-locked

## 2. Brand Strategy

### Positioning Statement (Geoffrey Moore Template)

For urban EV drivers and fleet operators in China's Tier 1-2 cities **who** are frustrated by unreliable charging networks, **our brand** is the EV charging network **that** guarantees 99% uptime and 15-minute charging sessions **unlike** State Grid and TELD **which** have inconsistent maintenance and slow speeds.

### Brand Architecture

- **Name:** "ChargeNow" (■■■, easy to remember, implies speed)
- **Tagline:** "Charge in 15. Guaranteed."
- **Visual Identity Direction:** Clean, futuristic blue-and-white design. Icon: lightning bolt inside a circle. App uses dark mode for battery-saving.

### Messaging Hierarchy

- **Hero Message:** "The fastest, most reliable EV charging network in China."
- **Pillars:**
  1. **Speed:** 15-minute charge from 10% to 80% (using 480kW chargers)
  2. **Reliability:** 99% uptime guarantee, 24/7 support
  3. **Convenience:** 500+ stations in top 10 cities, app-based reservation
    - **Proof Points:** "Over 10,000 successful charges per day," "Average wait time under 2 minutes," "Rated 4.8 stars on App Store."

### Tone of Voice

- **Do:** Direct, confident, data-driven. "Charge in 15 minutes, not 45. Our 480kW chargers deliver."
- **Don't:** Jargon-heavy, passive, or overly promotional. "We are committed to providing..." (avoid)."
- **Example:** "Your time is money. We save both."

## 3. Full Channel Breakdown

Channel	Relevance	Reasoning	Expected CAC	Timeline to Results	Resource Requirement
SEO	High	Long-term organic traffic from "EV charging near me" searches	¥50-100	6-9 months	1 SEO specialist, ¥20K/month tools
SEM	High	Immediate capture of high-intent searches	¥150-300	1-2 weeks	¥50K/month budget
Paid Social (WeChat/Douyin)	High	Geo-targeted ads to EV owners	¥200-400	2-4 weeks	¥80K/month budget

Channel	Relevance	Reasoning	Expected CAC	Timeline to Results	Resource Requirement
<b>Content (WeChat Official Account)</b>	Medium	Build authority, but slow conversion	¥30-50 (organic)	3-6 months	1 content writer
<b>Email</b>	Medium	Low cost, but low open rates in China (use WeChat instead)	¥10-20	1 month	Automation tool
<b>Communities (EV owner groups)</b>	High	Word-of-mouth in WeChat groups	¥20-50	1-3 months	1 community manager
<b>Influencer (Douyin/KOL)</b>	High	Trusted reviews drive app downloads	¥500-1,000 per KOL	1-2 weeks	¥100K/month budget
<b>Partnerships (EV brands)</b>	High	Co-marketing with Nio/BYD/Xpeng	¥100-200	3-6 months	1 BD manager
<b>PR</b>	Medium	Media coverage builds credibility	¥50-100	1-3 months	PR agency (¥30K/month)
<b>Events (EV expos)</b>	Low	High cost, low ROI for B2C	¥500-1,000	3-6 months	Event team
<b>PLG (Product-Led Growth)</b>	High	App-based referral and auto-charge	¥10-30	1-3 months	1 product manager

### 90-Day Activation Plan for Top 3 Channels

#### Channel 1: SEM (Baidu + WeChat Ads)

- **Days 1-7:** Set up 50 keywords (e.g., "EV charging station near me," "fast charging Beijing"). Create 10 ad variations with location extensions.
- **Days 8-30:** Launch A/B test on ad copy. Budget ¥10K/day. Track click-through rate (CTR) and cost per install (CPI).
- **Days 31-90:** Scale winning ads to ¥30K/day. Add retargeting for users who visited but didn't charge.

#### Channel 2: Influencer (Douyin KOLs)

- **Days 1-14:** Identify 20 KOLs in auto/tech niche with 100K-500K followers. Negotiate ¥5K-10K per video.
- **Days 15-30:** Produce 5 videos showing "15-minute charge test" at our stations. Include discount code.

- **Days 31-90:** Track code redemptions. Scale top-performing KOLs to monthly retainer.

**Channel 3: Partnerships (EV Brands)**

- **Days 1-30:** Reach out to Nio, BYD, Xpeng partnership teams. Propose co-branded charging stations at their dealerships.
- **Days 31-60:** Sign 3 pilot agreements. Install 10 chargers at Nio service centers in Shanghai.
- **Days 61-90:** Launch "Free first charge" for new EV buyers. Share customer data (with consent).

## 4. Content Strategy

### 5 Content Pillars Mapped to ICP Pain Points

Pillar	ICP Pain Point	Content Examples
"Speed Matters"	"Charging takes too long"	Video: "15-minute charge test vs. competitors"
"Reliability Guaranteed"	"Chargers always broken"	Blog: "How we achieve 99% uptime"
"Fleet Efficiency"	"Managing fleet charging is hard"	Whitepaper: "Cut fleet charging costs by 30%"
"Urban Convenience"	"Hard to find stations"	Map: "Top 10 stations near Shanghai metro"
"Future of EV"	"Is EV infrastructure ready?"	Interview: "China's EV charging boom by 2028"

### Content Calendar Framework (Monthly)

- **Week 1:** Long-form blog (2,000 words) + SEO optimization
- **Week 2:** Short video (60 seconds) for Douyin
- **Week 3:** WeChat article with infographic
- **Week 4:** Case study (fleet manager success story)

### SEO Strategy: 20 Target Keywords with Intent Classification

Keyword	Intent	Search Volume (Monthly)	Difficulty
"EV charging station near me"	Commercial	150K	High
"fast charging Beijing"	Commercial	80K	Medium
"best EV charger app China"	Commercial	40K	Medium
"fleet charging solution"	Commercial	20K	Low

Keyword	Intent	Search Volume (Monthly)	Difficulty
"EV charging cost per kWh"	Informational	60K	Medium
"how to charge EV at home"	Informational	100K	High
"Nio charging network"	Navigational	30K	Low
"480kW charger locations"	Commercial	10K	Low
"EV charging station installation cost"	Informational	25K	Medium
"chargeNow app review"	Commercial	5K	Low
"EV charging membership discount"	Commercial	15K	Medium
"Shenzhen EV charging map"	Commercial	50K	Medium
"EV charging station maintenance"	Informational	8K	Low
"BYD charging network"	Navigational	20K	Low
"fastest EV charger China"	Commercial	12K	Medium
"EV charging station business model"	Informational	10K	Low
"chargeNow vs TELD"	Commercial	3K	Low
"EV charging app with reservation"	Commercial	18K	Medium
"Shanghai EV charging stations 2024"	Commercial	70K	High
"EV charging station franchise"	Informational	5K	Low

### Distribution Strategy

- **Owned:** WeChat Official Account (daily posts), app push notifications (weekly), email (monthly)
- **Earned:** Guest posts on auto blogs (e.g., Dongchedi), PR features in 36Kr
- **Paid:** Douyin ads promoting top-performing content, Baidu SEM for high-intent keywords

## 5. Growth Loops & Virality

### Viral/Network Loop Potential

**High potential.** The "network effect" applies: more stations → more users → more demand → more stations. But the real loop is **referral-based**:

- **Loop:** User charges → gets referral code → shares with friend → friend gets free charge → friend becomes user → user gets discount → user charges again.

### Referral Program Design

- **Mechanics:** "Refer a friend, both get ¥50 credit." Friend must complete first charge.
- **Incentives:** Tiered: 5 referrals = ¥300 credit, 10 referrals = free month of premium (priority reservation).
- **Tracking:** Unique referral link in app. QR code at charging stations.
- **Virality Coefficient:** Target K-factor of 0.8 (each user brings 0.8 new users). Achievable with ¥50 incentive.

### Product-Led Growth Hooks

- **Auto-Charge:** Users set up auto-pay. After 3 charges, offer "free 10th charge."
- **Reservation Gamification:** "Reserve a charger now. If you arrive within 5 minutes, get 10% off."
- **Fleet Dashboard:** Free analytics for fleet managers. After 30 days, upsell premium (real-time alerts, volume discounts).

## 6. 12-Month GTM Roadmap

### Quarter 1 (Months 1-3): Launch & Pilot

- **Milestones:** Launch app in Shanghai with 50 stations. Sign 3 fleet clients. Achieve 5,000 app downloads.
- **Headcount:** 1 CEO, 1 CTO, 1 Marketing Lead, 1 BD Manager, 1 Community Manager, 2 Operations (total: 7)

### Quarter 2 (Months 4-6): Scale & Optimize

- **Milestones:** Expand to Beijing and Guangzhou (150 stations total). Launch referral program. Achieve 20,000 downloads.
- **Headcount:** Add 1 SEO Specialist, 1 Content Writer, 2 Customer Support, 1 Data Analyst (total: 12)

### Quarter 3 (Months 7-9): Monetization

- **Milestones:** Launch premium membership (¥99/month for priority reservation). Secure 10 fleet contracts. Achieve 50,000 downloads.
- **Headcount:** Add 1 Product Manager, 1 Paid Ads Manager, 1 Partnership Manager (total: 15)

### Quarter 4 (Months 10-12): National Expansion

- **Milestones:** Enter Shenzhen and Chengdu (300 stations total). Achieve 100,000 downloads. Break-even on unit economics.
- **Headcount:** Add 2 Regional Managers, 1 PR Lead, 1 Finance Manager (total: 19)

## 7. Marketing Budget Model (Annual, ¥)

Channel	Q1	Q2	Q3	Q4	Total
SEM (Baidu)	¥300K	¥500K	¥700K	¥1M	¥2.5M
Paid Social (Douyin/WeChat)	¥200K	¥400K	¥600K	¥800K	¥2M
Influencer	¥150K	¥250K	¥350K	¥500K	¥1.25M
SEO (tools + content)	¥50K	¥100K	¥150K	¥200K	¥500K
Partnerships (co-marketing)	¥100K	¥200K	¥300K	¥400K	¥1M
PR	¥50K	¥100K	¥150K	¥200K	¥500K
Events	¥50K	¥100K	¥100K	¥150K	¥400K
Referral Program	¥50K	¥100K	¥200K	¥300K	¥650K
<b>Total</b>	<b>¥950K</b>	<b>¥1.75M</b>	<b>¥2.55M</b>	<b>¥3.55M</b>	<b>¥8.8M</b>

### CAC Targets & LTV:CAC Projections

- **Year 1 CAC:** ¥250 (blended across channels)
- **Year 1 LTV:** ¥1,500 (based on average 150 charges/year at ¥10 profit/charge)
- **LTV:CAC Ratio:** 6:1 (healthy, above 3:1 benchmark)
- **Attribution Model:** Multi-touch (first touch for awareness, last touch for conversion). Use app analytics to track.

## 8. Retention & Lifecycle Marketing

### Onboarding Sequence (First 7 Days)

- **Day 1 (App Install):** Push: "Welcome! Your first charge is free. Find a station now."
- **Day 2:** WeChat message: "How to reserve a charger in 3 steps."
- **Day 3:** Email: "Meet your personal charging dashboard."
- **Day 5:** Push: "Refer a friend, get ¥50 credit."
- **Day 7:** In-app pop-up: "Rate your first charge. Earn 100 points."

### Re-Engagement Triggers

- **Inactive 14 days:** Push: "We miss you! Here's ¥20 off your next charge."
- **Inactive 30 days:** Email: "New stations near you. Check the map."
- **Inactive 60 days:** SMS: "Last chance: ¥50 credit expires in 7 days."

### NPS Program

- **Trigger:** After 5th charge, ask: "How likely are you to recommend us?" (0-10 scale)
- **Detractors (0-6):** Immediate call from support to resolve issue.
- **Passives (7-8):** Email with "How can we improve?"

- **Promoters (9-10):** Ask for App Store review + referral.

### Loyalty Mechanics

- **Tiers:** Bronze (0-10 charges), Silver (11-50), Gold (51+)
- **Benefits:** Gold = priority reservation + 10% discount + free monthly car wash
- **Points:** 1 point per ¥1 spent. 500 points = ¥50 credit.

### Target Churn Rate & How to Achieve It

- **Target Monthly Churn:** 5% (industry average for EV charging apps is 8-10%)
- **How to Achieve:**
  1. **Reliability:** 99% uptime guarantee (compensate with free charge if broken)
  2. **Convenience:** Add 50 new stations per quarter in high-demand areas
  3. **Personalization:** Send "Your most-used station has a wait time of 2 minutes" alerts
  4. **Community:** WeChat group for each city with real-time updates and events

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**Final Note:** This strategy is designed for a capital-efficient startup. Focus on Shanghai first, prove unit economics, then expand. The key differentiator is **reliability** — most competitors fail here. Use that to win.

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## PSYCHOLOGICAL

### EXHAUSTIVE PSYCHOLOGICAL STRATEGY: EV Charging Network in China

#### 1. Deep Emotional Analysis

##### Jobs-To-Be-Done Framework

###### Functional Jobs:

- Recharge EV battery from 10% to 80% in under 30 minutes
- Locate nearest available charger without range anxiety
- Pay seamlessly without app-switching or QR-code chaos
- Ensure charger compatibility with their specific EV model (BYD, NIO, Tesla, etc.)

###### Emotional Jobs:

- Feel **in control** of their mobility, not hostage to battery anxiety
- Experience **pride** in being an early adopter of green technology
- Escape the **shame** of being "that driver" stuck on the highway with a dead battery
- Achieve **status** among peers who still drive gasoline cars

###### Social Jobs:

- Signal **environmental responsibility** to colleagues and family
- Belong to the **progressive, tech-savvy** urban class
- Avoid **losing face** (■■■) when running out of charge during a business trip
- Gain **bragging rights** for finding the fastest, most convenient charger

## Hierarchy of Customer Motivations

What They Say They Want	What They Actually Need
"Faster charging speed"	<b>Certainty</b> — they need to know the charger will work every time, without exception
"Lower price per kWh"	<b>Predictability</b> — they need to know exactly what they'll pay, no surprise fees
"More charging stations"	<b>Reliability</b> — they need the network to be dense enough that they never think about it
"Better app interface"	<b>Control</b> — they need to feel they can plan their route and time with confidence

**Deepest Need:** *Psychological safety* — the fear of being stranded is primal. In China, where long-distance travel is common during holidays (■■■), this fear intensifies. The real job is: "Help me never think about charging again."

## Emotional Arc: First Touch to Loyal Advocate

Stage	Emotion	Design Response
<b>Awareness</b>	Skepticism, curiosity	"Is this another scam app?" — Show real-time charger availability on WeChat mini-program without download
<b>First Use</b>	Anxiety, hope	"Will it work with my car?" — Onboarding wizard asks car model, shows compatibility instantly
<b>First Success</b>	Relief, satisfaction	"It worked perfectly!" — Celebrate with a "First Charge Complete" animation and 10% bonus points
<b>Repeat Use</b>	Confidence, habit	"I know where to go." — Predictive recommendations based on time of day and driving history
<b>Advocacy</b>	Pride, identity	"I'm part of the future." — Invite friend program with shared rewards, visible "Green Driver" badge

## Identity Design: Becoming Part of Who the Customer Is

**Design for identity integration:**

- **Badge system:** "100 Charges Club" — visible on app profile and shareable to WeChat Moments
- **Green miles counter:** Show cumulative CO2 saved vs gasoline, framed as "You've planted X trees"
- **Charger naming rights:** Top 1% users can name a specific charger station (e.g., "Zhang Wei's Station #7")
- **Exclusive access:** Loyal members get priority booking during peak holiday travel (Spring Festival, National Day)

**Psychological mechanism:** When a user invests time, money, and social capital into a product, they internalize it as part of their identity. The product becomes a *self-signal* — "I am the kind of person who drives electric and uses this network."

## 2. Decision-Making Architecture

### Type of Decision

**First-time signup:** High-involvement deliberate decision. User must:

- Download app or add WeChat mini-program
- Enter vehicle info, payment method
- Trust the network with their charging experience

**Ongoing charging sessions:** Low-involvement habitual decision. User repeats same behavior at familiar stations.

**Switching from competitor:** High-involvement deliberate. User must overcome inertia of existing habits.

### Buying Committee (B2B2C Context)

For fleet/enterprise customers (e.g., Didi, delivery companies, corporate fleets):

Role	Persona	Influence	Psychological Lever
<b>Fleet Manager</b>	Cost-focused, risk-averse	Decides budget	Loss aversion: "Without us, you risk 15% downtime during peak hours"
<b>Driver</b>	Experience-focused, vocal	Strong influencer	Social proof: "95% of drivers in your city prefer our network"
<b>CEO/Founder</b>	Vision-driven, status-conscious	Final sign-off	Authority: "Leading EV fleets in Shanghai already use us"
<b>IT/Operations</b>	Integration-focused, skeptical	Potential blocker	Transparency: "Here's our API documentation and uptime SLA"

### Cognitive Biases to Leverage Ethically

**Anchoring: How to Set Price and Value Reference Points**

- **Frame against gasoline:** "Equivalent to ¥0.35/km vs ¥0.80/km for gasoline" — anchors the savings
- **Tiered pricing:** Display "Standard: ¥1.2/kWh" next to "Premium: ¥1.5/kWh (guaranteed 30-min slot)" — the standard price becomes the anchor, making premium feel like a small upgrade for certainty
- **Membership anchor:** Show "Non-member: ¥1.5/kWh" next to "Member: ¥1.0/kWh + ¥99/month" — the non-member price makes membership feel like a steal

**Loss Aversion: What the Customer Risks by NOT Buying**

- **Time loss:** "Without us, you waste 40 minutes per week searching for working chargers"
- **Status loss:** "Your colleagues are already using us — don't be the last to switch"
- **Money loss:** "Non-members pay 50% more per charge"
- **Control loss:** "Without priority booking, you risk being stranded during holiday travel"

**Social Proof: Which Type Works for This Audience**

Type	Effectiveness	Application
Expert	High for first-time EV buyers	"Recommended by China EV100 think tank"
Peer	Highest for daily users	"3,847 drivers in your neighborhood use us"
Numbers	High for trust	"2 million successful charges completed"
Celebrity	Moderate, depends on region	Partner with local KOLs (e.g., auto reviewers on Douyin)
Similar others	Highest for conversion	"Drivers of your exact model (BYD Han) prefer us 4:1"

**Scarcity & Urgency: Legitimate Signals**

- **Time-based:** "Peak hours (5-8 PM) — only 3 priority slots remaining at this station"
- **Capacity-based:** "This station has 8 chargers — 6 are currently occupied"
- **Exclusive access:** "Early members get lifetime priority booking — only available to first 10,000 users"
- **Event-based:** "Spring Festival travel rush — book your holiday charging slot now"

**The Endowment Effect: Making Customers Feel Ownership Before Purchase**

- **Free trial period:** "Try 7 days of Premium Membership free — we'll even pre-load ¥50 credit"
- **Personalized station:** "Your home station is set to [nearest location] — you'll get priority there"
- **Customized plan:** "Based on your driving pattern, we recommend the ¥79/month plan — here's your personalized dashboard"
- **Progress ownership:** "You've already saved ¥23 this week with us — don't lose your savings streak"

**Commitment & Consistency: Micro-Yeses Leading to Conversion**

Step	Micro-Yes	Psychological Effect
1	"Enter your license plate to check compatibility"	Small commitment to the process
2	"Would you like to see nearby stations?"	Confirms need exists
3	"We found 3 stations near you — which looks best?"	Choice reinforces interest
4	"This station has 2 available chargers. Ready to navigate?"	Action-oriented commitment
5	"One tap to start charging. Ready?"	Final micro-yes before conversion

### 3. Psychological Barrier Map

#### Awareness Barrier: "Why They Don't Know They Need This"

**Trigger:** User has never experienced a charging failure. Their current solution (home charging, competitor network) works "well enough."

**Manifestation:** User ignores ads, skips app store listings, dismisses recommendations.

**Dissolution:**

- **Problem-first messaging:** "Ever arrived at a charger to find it broken? We guarantee 99.9% uptime."
- **Contextual triggers:** Geofence competitor stations and show "We're 2 minutes away — and we work."
- **Social proof in context:** "3 of your WeChat contacts charged here yesterday."
- **Comparison tool:** "Enter your current network → see how much time/money you'd save with us."

#### Trust Barrier: "Why They Don't Believe It Works"

**Trigger:** Past experience with unreliable charging networks, negative reviews, or general skepticism about new services.

**Manifestation:** User reads reviews, compares pricing, delays signup, asks for references.

**Dissolution:**

- **Real-time transparency:** Show live charger status (available, in use, offline) without login
- **Verified reviews:** "Verified driver, charged 3 hours ago" — with photo of their car at the station
- **Uptime guarantee:** "If a charger is offline when you arrive, you get ¥50 credit — no questions asked"
- **Third-party certification:** Display China Quality Certification (CQC) badge, fire safety compliance
- **WeChat integration:** Use WeChat Pay's trust signal — "Backed by WeChat Pay security"

#### Risk Barrier: Financial, Social, Emotional Risk

Risk Type	Trigger	Manifestation	Dissolution
Financial	"What if I prepay and the network fails?"	Chooses pay-per-use, avoids membership	"No prepayment required — pay per charge. Upgrade anytime."
Social	"What if my friends think this is cheap/low-quality?"	Hides app, doesn't share	"Premium stations with lounge areas — share your charging experience on WeChat Moments."
Emotional	"What if I get stranded because of your network?"	Anxiety during first use, over-plans routes	"24/7 roadside assistance included. If you're stranded, we send a mobile charger within 30 minutes."

### Inertia Barrier: The Existing Habit to Abandon

**Trigger:** User already has a routine — home charging overnight, or a competitor network they've used for months.

**Manifestation:** User says "I'll look into it later," never downloads app, ignores onboarding emails.

**Dissolution:**

- **Switching cost reduction:** "Import your charging history from [competitor] in one tap — we'll match your loyalty status."
- **Habit stacking:** "Charge with us every Tuesday — same time, same station. We'll remind you."
- **Better default:** "Set us as your default charging network in your car's navigation system."
- **Gradual migration:** "Try us once for a top-up charge. No commitment. Just see if it's faster."

### The Hidden Objection: "I Don't Want to Look Stupid"

**What they'll never say:** "I'm afraid I'll plug it in wrong, the app won't work, and I'll look incompetent in front of other drivers."

**Manifestation:** User avoids first use, reads instructions repeatedly, asks support obvious questions.

**Dissolution:**

- **Zero-learning onboarding:** "Scan QR code → plug in → charge. That's it. No app needed for first use."
- **Video guide at station:** QR code on charger plays 15-second demo video
- **On-site ambassador:** "First-time user? Press the help button — a real person will guide you via video call."
- **Forgiveness design:** "If you make a mistake, we'll refund the session. No questions asked."

## 4. Trust & Credibility Architecture

## Credibility Hierarchy for This Product

Signal	Importance	Application
Government endorsement	Highest	"Approved by Ministry of Transport" badge, partnership with state grid
Automaker partnerships	Very high	"Official partner of BYD, NIO, XPeng" — displayed on charger and app
Real-time reliability data	High	"99.7% uptime over the last 30 days" — shown on station page
User reviews	High	"4.8 stars from 12,000 verified drivers" — with filter by car model
Press coverage	Moderate	"Featured in 36Kr, PingWest" — link to articles
Social media presence	Low-moderate	Douyin account with station walkthroughs, not just ads

## Social Proof Playbook

### Testimonials:

- Format: "Driver [Name], drives [Model], has charged [X] times with us"
- Context: "Before using [Network], I spent 20 minutes per charge searching for working stations. Now I just go."
- Medium: Short video (15s) on station screen, text in app

### Case Studies:

- "How Didi Fleet Shanghai Reduced Downtime by 40% Using Our Network"
- "How [Corporate Client] Saved ¥120,000/year on Charging Costs"

### User Counts:

- "Join 2 million drivers who charge with us"
- "500,000 successful charges this week alone"

### Certifications:

- ISO 9001 (quality management)
- China Compulsory Certification (CCC) for charging equipment
- Fire safety certification from local authorities

## Transparency Signals

### What to Show:

- Real-time charger status (available, in use, offline, estimated wait time)
- Pricing breakdown: "¥1.2/kWh = ¥0.8 electricity + ¥0.4 service fee"
- Charger maintenance history: "Last serviced 3 days ago"
- Queue position: "You're #2 in line. Estimated wait: 8 minutes."

**What to Hide (and Why):**

- Raw number of offline chargers (creates unnecessary anxiety)
- Negative reviews without context (show resolved complaints instead)
- Internal error logs (irrelevant to user experience)

**Why:** Transparency builds trust, but information overload creates paralysis. Show what's actionable, hide what's noise.

**Risk Reversal Design**

Risk Reversal	Mechanism	Conversion Impact
First charge free	"Your first charge is on us — up to ¥50"	Eliminates financial risk for trial
Satisfaction guarantee	"If you're not satisfied after 3 charges, we'll refund your membership fee"	Removes commitment fear
Uptime SLA	"If a charger is offline when you arrive, get ¥50 credit"	Builds reliability trust
Price lock	"Lock in today's rate for 12 months — if prices drop, you get the lower rate"	Removes future price anxiety
Free cancellation	"Cancel membership anytime, no questions asked"	Removes lock-in fear

**Authority Positioning**

**How to Be Seen as the Expert:**

- **Publish an annual "China EV Charging Report"** with data on usage patterns, peak times, regional trends — become the source of truth
- **Partner with universities** (e.g., Tsinghua, Shanghai Jiao Tong) for charging infrastructure research
- **Host industry events:** "China EV Charging Summit" — invite regulators, automakers, fleet managers
- **Thought leadership on WeChat Official Account:** Weekly articles on EV charging tips, battery health, travel planning
- **Certification program:** "Certified EV Charging Specialist" — train and certify station operators

**5. Behavioral Product Design**

**Habit Loop Engineering (BJ Fogg Tiny Habits Framework)**

**Anchor:** Driving behavior that already exists

- **Anchor 1:** "When I park my car at home" → "I open the app to schedule overnight charging"
- **Anchor 2:** "When I arrive at work" → "I check if my car needs a top-up charge"
- **Anchor 3:** "When my battery hits 20%" → "I open the app to find nearest charger"

**Tiny Habit Design:**

- **Minimum viable action:** "Open app → one tap to start charging" (remove login, payment confirmation friction)
- **Celebration:** After each charge, show "You saved ¥12 vs gasoline today!" with a satisfying animation
- **Habit stacking:** "After you charge, share your green miles to WeChat Moments with one tap"

**Frequency Engineering:**

- **Low frequency (weekly):** Home charging scheduling
- **Medium frequency (daily):** Work charging top-up
- **High frequency (multiple times/day):** Route planning, station checking during long trips

**Variable Reward Schedule (Hooked Model)**

Reward Type	Variable Element	Psychological Effect
Tribal	"You unlocked the 'Green Pioneer' badge"	Social recognition, status
Hunt	"Surprise bonus: 2x points on your next charge"	Excitement, anticipation
Self	"You've saved ¥500 this month — beat your personal best?"	Mastery, progress

**Variable Reward Implementation:**

- **Mystery bonus:** After every 5th charge, spin a wheel for bonus points (10-500 points)
- **Surprise station upgrade:** Randomly assign "Premium Charging Spot" with faster speed
- **Leaderboard fluctuation:** "You're #47 in your city this week — 3 more charges moves you to #44"
- **Seasonal events:** "Spring Festival Bonus: Double points on all charges during holiday travel"

**Onboarding Psychology: Emotional Milestones in Session 1**

Milestone	Emotion	Design Element
1. Discovery	Curiosity	"See real-time charger availability near you — no signup needed"
2. Compatibility check	Relief	"Your BYD Han is fully compatible. We've optimized charging speed for your model."
3. First tap	Anticipation	"Tap to navigate to the nearest available charger"
4. Arrival	Excitement	"You've arrived! Scan the QR code to start charging."
5. Charging begins	Satisfaction	"Charging started. Estimated time: 28 minutes to 80%."

Milestone	Emotion	Design Element
6. Completion	Pride	"Charge complete! You saved 2.3 kg of CO2 today — equivalent to planting 0.1 trees."

**Critical milestone:** The "aha moment" is when the user realizes they never have to worry about finding a working charger again. This happens after 2-3 successful charges without any friction.

### Friction Audit: Where to Add and Remove Friction

#### Remove Friction (where speed matters):

- **Registration:** Allow WeChat/■■■■ login — no email/password
- **Payment:** Auto-pay via WeChat Pay — no confirmation needed for charges under ¥50
- **Station selection:** Default to nearest available charger — one tap to navigate
- **Charging start:** Scan QR code → plug in → auto-start — no app interaction needed

#### Add Friction (where deliberation matters):

- **Membership upgrade:** Require 3-second hold on "Upgrade to Premium" button — prevents accidental charges
- **Cancellation:** "Are you sure? You'll lose your ¥50 credit balance." — prevents impulsive churn
- **High-cost actions:** "This station charges ¥2.0/kWh during peak hours. Confirm?" — prevents surprise bills

### Notification Strategy: Re-engage Without Annoying

Notification Type	Trigger	Timing	Frequency
Charge complete	Car reaches 80%	Immediate	Per session
Station availability	User is within 1km of station	Real-time	Max 2x/week
Price drop alert	Off-peak pricing starts	30 min before	Max 1x/day
Holiday reminder	3 days before Spring Festival	Once	Seasonal
Points expiring	7 days before expiry	Once	Monthly
Personalized tip	"Your battery health is excellent — keep charging regularly"	Weekly	Max 1x/week

#### Anti-annoyance rules:

- No more than 2 notifications per day
- No notifications between 10 PM and 7 AM
- "Quiet mode" toggle: "I'm sleeping" → no notifications for 8 hours
- Notification preview: "Your car is at 80% — [Dismiss] [Navigate to car]"

## 6. Pricing Psychology

### Price Anchoring: Frame Your Price as a Bargain

#### Anchor 1: Gasoline comparison

- Display: "Equivalent to ¥0.35/km vs ¥0.80/km for gasoline"
- Psychological effect: User frames charging cost as "saving ¥0.45/km"

#### Anchor 2: Competitor pricing

- Display: "Our standard rate: ¥1.2/kWh. Competitor average: ¥1.5/kWh."
- Psychological effect: User frames our price as "20% cheaper"

#### Anchor 3: Premium tier as reference

- Display: "Premium: ¥1.5/kWh (guaranteed slot). Standard: ¥1.2/kWh (first-come, first-served)."
- Psychological effect: Standard feels like a smart choice, not a cheap one

### Decoy Pricing: Optimal Plan Structure

Plan	Price	Charging Rate	Priority Booking	Monthly Points
Free	¥0/month	¥1.5/kWh	No	0
Standard	¥49/month	¥1.2/kWh	No	100
Premium	¥99/month	¥1.0/kWh	Yes	500

**Decoy effect:** The Free plan makes Standard look reasonable. The Premium plan makes Standard look affordable. Most users choose Standard — the target tier.

**Alternative decoy:** Add a "Premium Plus" at ¥149/month with same features as Premium but +200 bonus points — makes Premium look like the best value.

### Payment Psychology: Annual vs Monthly Framing

Frame	Monthly	Annual	Psychological Effect
Standard	¥49/month	¥490/year (save 17%)	Annual feels like "getting 2 months free"
Premium	¥99/month	¥990/year (save 17%)	Annual feels like "getting 2 months free"

#### One-time vs subscription perception:

- **One-time fee:** "¥99 lifetime membership" — feels like ownership, reduces churn anxiety
- **Subscription:** "¥99/month" — feels like ongoing commitment, higher perceived value if used frequently

**Recommendation:** Offer both. "Lifetime: ¥499 (best for frequent drivers). Monthly: ¥99 (flexible)." The lifetime option anchors high, making monthly feel affordable.

### Charm Pricing vs Round Numbers

Pricing Strategy	Application	Why It Works
Charm pricing (¥49.9)	Membership plans	In China, ¥49.9 feels significantly cheaper than ¥50 — left-digit effect
Round numbers (¥50)	Per-charge fee	For variable costs, round numbers feel "fair" and easy to calculate
Odd pricing (¥1.23/kWh)	Electricity rate	Precision signals "we calculated this exactly, not arbitrary"
Bundle pricing (¥99 for 100 kWh)	Prepaid packages	Feels like buying in bulk — "save 17% vs pay-per-use"

**Cultural note:** In China, avoid ¥4 (sounds like "death") and ¥14. Prefer ¥8 (sounds like "prosperity"), ¥9 (sounds like "long-lasting"), ¥6 (sounds like "smooth").

## 7. Ethical Persuasion Playbook

### Top 5 Persuasion Techniques (Cialdini Framework)

#### 1. Liking: Build Rapport Through Shared Identity

- **Application:** "You drive a BYD Han — join 50,000 other BYD Han drivers who use our network"
- **Mechanism:** Similarity breeds trust. Show users they're part of a tribe of similar drivers.
- **Ethical boundary:** Don't fabricate numbers. Use real, verifiable data.

#### 2. Reciprocity: Give Before You Ask

- **Application:** "Your first charge is free (up to ¥50). No strings attached."
- **Mechanism:** When you give something valuable, users feel obligated to reciprocate (by signing up, referring friends).
- **Ethical boundary:** Make the gift truly unconditional. Don't hide terms in fine print.

#### 3. Authority: Be the Trusted Expert

- **Application:** "Recommended by China EV100. Partnered with State Grid."
- **Mechanism:** People follow credible experts. Display certifications, partnerships, and media coverage prominently.
- **Ethical boundary:** Only claim what you can prove. Don't exaggerate partnerships.

#### 4. Social Proof: Show What Others Are Doing

- **Application:** "3,847 drivers in your neighborhood use us. 2 million charges completed."
- **Mechanism:** People look to others for correct behavior, especially in uncertain situations (first EV charging experience).
- **Ethical boundary:** Use real, current data. Don't fabricate user counts.

#### 5. Scarcity: Highlight Genuine Limitations

- **Application:** "Only 3 priority slots remaining at this station for peak hours."
- **Mechanism:** Limited availability increases perceived value and urgency.

- **Ethical boundary:** Only use real scarcity. Don't create artificial limits.

### Where the Ethical Line Is

Technique	Ethical	Unethical
Scarcity	"3 slots left at this station" (real)	"Only 3 memberships left" (fake countdown)
Social proof	"2 million charges completed" (real)	"Join 1 million users" (inflated)
Urgency	"Spring Festival travel rush — book now" (real event)	"Sale ends in 24 hours" (recurring fake deadline)
Anchoring	Show competitor prices honestly	Fabricate a fake "original price"
Reciprocity	Free first charge (no conditions)	Free trial that auto-charges without warning

**Why staying ethical builds LTV:** Chinese consumers are highly sensitive to manipulation. A single "dark pattern" exposed on social media (Weibo, Douyin) can destroy trust permanently. Ethical design creates word-of-mouth advocacy — the most powerful acquisition channel in China.

### Dark Patterns to Avoid

Dark Pattern	Why It Destroys Trust	Alternative
Hidden cancellation	"Cancel membership" buried in settings	One-tap cancellation with clear confirmation
Forced continuity	Auto-renew without reminder	Send reminder 7 days before renewal, require opt-in
Confusing pricing	"¥1.2/kWh" but adds "service fee" at checkout	All-in pricing displayed upfront
Fake social proof	"1,000 people charging now" (fabricated)	Show real-time count from actual sessions
Roach motel	Easy to join, hard to leave	Same friction for join and cancel
Guilt trip	"You'll lose your ¥50 credit if you cancel"	"Your ¥50 credit will be refunded to your wallet"

## 8. Retention & Churn Psychology

### Why Users Quit: Emotional Triggers Behind Churn

Trigger	Emotional State	Behavioral Signal
Charger failure	Anger, betrayal	"Charger was broken when I arrived" → immediate churn
Price increase	Resentment, unfairness	"They raised prices without warning" → switch to competitor
App complexity	Frustration, incompetence	"I can't figure out how to book a slot" → abandon
Competitor improvement	Curiosity, disloyalty	"Competitor opened a station closer to my home" → trial
Life change	Indifference, habit break	"I moved to a new city" → forget to re-download app
Negative social proof	Shame, conformity	"My friends all switched to [competitor]" → follow

### The "Aha Moment": From Skeptical to Hooked

**Definition:** The moment when the user realizes the product delivers its core promise with zero friction.

**For EV charging network:**

- **Aha moment 1:** First successful charge — "It worked exactly as promised."
- **Aha moment 2:** Second charge at a different station — "It works everywhere."
- **Aha moment 3:** Holiday travel — "I didn't have to worry about charging at all."

**Design for aha moment acceleration:**

- **Guarantee first success:** Onboard user at a station with 100% uptime history
- **Create a "perfect first week":** Send user to 3 different stations, each with guaranteed availability
- **Celebrate milestones:** "You've charged at 5 different stations — you're a true network explorer!"

### Win-Back Psychology: What to Say and When

Churn Reason	Timing	Message	Psychological Lever
Charger failure	24 hours after churn	"We fixed the charger at [station]. Here's ¥30 credit to try again."	Reciprocity, problem resolution
Price sensitivity	7 days after churn	"We've introduced a new ¥29/month plan — same network, lower price."	Loss aversion (they left, now can return)
Competitor trial	14 days after churn	"We noticed you tried [competitor]. We'd love to win you back — here's 3 free charges."	Comparison, reciprocity

Churn Reason	Timing	Message	Psychological Lever
Life change	30 days after churn	"You moved to [new city]? We have 50 stations there. Welcome back with ¥50 credit."	Personalization, relevance
Inactivity	60 days without charge	"It's been a while. Your car misses us. Here's a free charge to get reacquainted."	Nostalgia, low-friction re-entry

**Win-back channel:** WeChat message (not SMS) — higher open rate, feels more personal.

### Loyalty Design: Making Customers Feel Like Insiders

#### Insider Status Levels:

Level	Criteria	Benefits	Psychological Effect
Green Member	0-50 charges	Standard pricing, basic support	Entry-level belonging
Silver Member	51-200 charges	5% discount, priority support	Status progression
Gold Member	201-500 charges	10% discount, priority booking	Exclusivity, achievement
Platinum Member	500+ charges	15% discount, dedicated concierge, station naming rights	Identity, legacy

#### Insider Behaviors to Design:

- **Early access:** "Gold members get first access to new stations — 48 hours before public launch"
- **Exclusive events:** "Platinum members invited to annual EV Charging Summit — meet industry leaders"
- **Co-creation:** "Vote on where we build our next 10 stations — your voice matters"
- **Recognition:** "Driver of the Month" feature on app home screen — with photo and story
- **Referral rewards:** "Invite a friend — you both get ¥50 credit. No limit."

**The ultimate loyalty goal:** Make customers feel like co-owners of the network. When they say "our network" instead of "their network," retention becomes nearly permanent.

### Summary: The Psychological Flywheel

...

Trust → First Success → Habit Formation → Identity Integration → Advocacy → Trust (loop)

...

Each stage feeds the next. Break any link, and the flywheel stops. Design every touchpoint to strengthen the next stage.

**Final recommendation:** Start with trust (government partnerships, uptime guarantees). Engineer the first success (perfect onboarding). Build habits (anchors, tiny habits). Integrate identity (badges, insider status). Then let advocacy (referrals, social proof) bring new users into the flywheel.

This is not a marketing campaign. This is a psychological system. Execute it rigorously, and the network becomes indispensable — not just a utility, but an identity.

## TECHNICAL

# EV Charging Network in China: Complete Technical Blueprint

## Part 1: Architecture

### System Design

##### Full Component Diagram (Described Precisely)

...

#### [Client Layer]

- Web App (React SPA)
- Mobile App (React Native)
- Admin Dashboard (React)

#### [CDN/Edge Layer]

- Cloudflare (global CDN, DDoS protection, SSL termination)
- Edge Workers (API caching, geolocation routing)

#### [Load Balancer Layer]

- AWS ALB (Application Load Balancer) - HTTP/HTTPS traffic
- AWS NLB (Network Load Balancer) - WebSocket traffic

#### [API Gateway Layer]

- Kong API Gateway (rate limiting, auth, routing, logging)

#### [Service Layer - Microservices]

- Auth Service (Node.js/Express)
- User Service (Node.js/Express)
- Charging Station Service (Go)
- Payment Service (Go)
- Notification Service (Node.js/Express)
- Analytics Service (Python/FastAPI)
- Real-time Service (Node.js + WebSocket)

#### [Data Layer]

- Primary DB: PostgreSQL (user data, stations, transactions)
- Cache: Redis (sessions, real-time status, rate limiting)
- Search: Elasticsearch (station search, geospatial queries)
- Queue: RabbitMQ (async tasks, notifications, payment processing)
- Time-series: InfluxDB (charging session metrics)
- File Storage: AWS S3 (user avatars, station images, reports)

[External Integrations]

- WeChat Pay / Alipay (payment gateways)
- WeChat Mini Program (user authentication)
- Baidu Maps / AMap (geolocation, routing)
- China Telecom / China Mobile (SMS verification)
- Government APIs (EV subsidy verification)

...

#### #### Data Flow Between Services

##### User Registration Flow:

- User submits form → Web App → API Gateway → Auth Service → User Service → PostgreSQL (user created) → RabbitMQ (send welcome email/SMS) → Notification Service

##### Start Charging Session Flow:

- User taps "Start" → Web App → WebSocket → Real-time Service → Charging Station Service → Station API (hardware) → PostgreSQL (session created) → Redis (status update) → RabbitMQ (billing start) → Payment Service

##### Payment Flow:

- Session ends → Charging Station Service → Payment Service → WeChat Pay/Alipay API → PostgreSQL (transaction recorded) → RabbitMQ (receipt generation) → Notification Service → User

##### Search Flow:

- User searches → Web App → API Gateway → Elasticsearch (geospatial query) → Redis (cache check) → Response with stations

#### #### API Design: REST vs GraphQL vs tRPC — Which and Why

##### Selected: REST + WebSocket

##### Rationale:

- **REST** for CRUD operations (users, stations, transactions) - simple, cacheable, widely supported
- **WebSocket** for real-time charging status, notifications - bidirectional, low latency
- **Why not GraphQL:** Overkill for this domain; complex queries can be handled by Elasticsearch; REST is easier to cache at CDN level
- **Why not tRPC:** Requires full-stack TypeScript; our backend uses Go for performance-critical services

##### API Endpoints (Key Examples):

...

GET /api/v1/stations?lat=39.9&lng=116.4&radius=5km (search stations)

GET /api/v1/stations/:id (station details)

POST /api/v1/sessions (start charging)

PUT /api/v1/sessions/:id/stop (stop charging)  
 GET /api/v1/users/:id/transactions (user history)  
 POST /api/v1/payments/charge (process payment)  
 ...

##### Real-time Requirements: WebSocket, SSE, Polling — Which and When

Use Case	Technology	Why
Charging status updates (real-time)	WebSocket	Bidirectional, low latency, persistent connection
Notifications (alerts, promotions)	WebSocket	Push-based, immediate delivery
Station availability	SSE (Server-Sent Events)	Unidirectional, simpler than WebSocket, auto-reconnect
Dashboard analytics (non-critical)	Polling (30s interval)	Simple, no persistent connection needed
Payment confirmation	WebSocket	Real-time feedback for user experience

### Tech Stack Decision Matrix

Layer	Options Considered	Selected Choice	Trade-offs
<b>Frontend</b>	React, Vue, Angular, Svelte	React (with TypeScript)	Largest ecosystem, strong community, excellent for complex UIs. Vue is simpler but less library support.
<b>Backend</b>	Node.js, Go, Python, Java	Node.js (Express) for auth/user/notification; Go for charging/payment services	Node.js: fast development, async I/O. Go: better performance for real-time charging control.
<b>Primary DB</b>	PostgreSQL, MySQL, MongoDB, CockroachDB	PostgreSQL	ACID compliance, excellent geospatial support (PostGIS), mature. MongoDB lacks joins for relational data.
<b>Caching</b>	Redis, Memcached, Hazelcast	Redis	Rich data structures, pub/sub, persistence options. Memcached is simpler but less feature-rich.

Layer	Options Considered	Selected Choice	Trade-offs
Queue	RabbitMQ, Kafka, SQS, Redis Streams	RabbitMQ	Reliable, supports complex routing, good for async tasks. Kafka is overkill for current scale.
Search	Elasticsearch, Algolia, Meilisearch	Elasticsearch	Full-text search, geospatial queries, aggregations. Algolia is easier but more expensive at scale.
Auth	Auth0, Firebase Auth, Keycloak, Custom JWT	Custom JWT + OAuth2 (WeChat)	Full control, no vendor lock-in. Auth0 is expensive for China market.
File Storage	AWS S3, Alibaba Cloud OSS, MinIO	AWS S3 (with China region)	Reliable, scalable. Alibaba Cloud OSS is cheaper in China but less global.
CDN	Cloudflare, Akamai, Alibaba Cloud CDN	Cloudflare	Global coverage, DDoS protection, edge workers. Alibaba Cloud CDN better for China-only but limited globally.
Hosting	AWS, Alibaba Cloud, Tencent Cloud, GCP	AWS (Beijing/Ningxia regions)	Best global infrastructure. Alibaba Cloud is cheaper in China but AWS has better tooling.

## Database Design

#### Core Entities and Relationships (ERD)

...

[User] 1--- [ChargingSession] ---1 [ChargingStation]

[User] 1---\* [Transaction]

[User] 1---\* [PaymentMethod]

[ChargingStation] 1---\* [ChargingPort]

[ChargingStation] 1---1 [Location] (PostGIS point)

[ChargingSession] 1---1 [Transaction]

[ChargingSession] 1---\* [SessionMetrics] (time-series)

...

**Key Tables:**

```
```sql
```

```
CREATE TABLE users (
  id UUID PRIMARY KEY DEFAULT genrandomuuid(),
  wechatopenid VARCHAR(255) UNIQUE,
  phone VARCHAR(20) UNIQUE NOT NULL,
  email VARCHAR(255),
  name VARCHAR(100),
  avatar_url TEXT,
  role VARCHAR(20) DEFAULT 'user', -- user, admin, operator
  created_at TIMESTAMPTZ DEFAULT NOW(),
  updated_at TIMESTAMPTZ DEFAULT NOW()
);
```

```
CREATE TABLE charging_stations (
  id UUID PRIMARY KEY DEFAULT genrandomuuid(),
  name VARCHAR(255) NOT NULL,
  address TEXT,
  location GEOGRAPHY(Point, 4326) NOT NULL, -- PostGIS
  status VARCHAR(20) DEFAULT 'active', -- active, maintenance, offline
  total_ports INT DEFAULT 0,
  available_ports INT DEFAULT 0,
  priceperkwh DECIMAL(10,4),
  operator_id UUID REFERENCES users(id),
  created_at TIMESTAMPTZ DEFAULT NOW()
);
```

```
CREATE TABLE charging_sessions (
  id UUID PRIMARY KEY DEFAULT genrandomuuid(),
  user_id UUID REFERENCES users(id),
  stationid UUID REFERENCES chargingstations(id),
  portid UUID REFERENCES chargingports(id),
  start_time TIMESTAMPTZ NOT NULL,
  end_time TIMESTAMPTZ,
  kwh_used DECIMAL(10,2),
  cost DECIMAL(10,2),
  status VARCHAR(20) DEFAULT 'active', -- active, completed, cancelled, failed
  created_at TIMESTAMPTZ DEFAULT NOW()
);
```

```
CREATE TABLE transactions (
  id UUID PRIMARY KEY DEFAULT genrandomuuid(),
```

```

user_id UUID REFERENCES users(id),
sessionid UUID REFERENCES chargingsessions(id),
amount DECIMAL(10,2) NOT NULL,
currency VARCHAR(3) DEFAULT 'CNY',
paymentmethod VARCHAR(50), -- wechatpay, alipay, wallet
status VARCHAR(20) DEFAULT 'pending', -- pending, completed, failed, refunded
gatewaytransactionid VARCHAR(255),
created_at TIMESTAMPTZ DEFAULT NOW()
);
...

```

#### Indexing Strategy

```

```sql
-- Primary indexes
CREATE INDEX idxusersphone ON users(phone);
CREATE INDEX idxuserswechat ON users(wechatopenid);
CREATE INDEX idxstationslocation ON charging_stations USING GIST(location);
CREATE INDEX idxstationsstatus ON charging_stations(status);
CREATE INDEX idxsessionsuserid ON chargingsessions(user_id);
CREATE INDEX idxsessionsstationid ON chargingsessions(station_id);
CREATE INDEX idxsessionsstarttime ON chargingsessions(start_time);
CREATE INDEX idxtransactionsuserid ON transactions(userid);
CREATE INDEX idxtransactionscreatedat ON transactions(createdat);

-- Composite indexes for common queries
CREATE INDEX idxsessionsuserstatus ON chargingsessions(user_id, status);
CREATE INDEX idxstationslocationstatus ON chargingstations(location, status);
...

```

#### Sharding Plan

**Current Scale (1K-10K users):** Single PostgreSQL instance with read replicas.

**Medium Scale (100K users):** Shard by `user\_id` hash across 4 PostgreSQL instances.

**Large Scale (1M+ users):**

- Users: Shard by `user\_id` modulo 16
- Sessions: Shard by `user\_id` modulo 16 (co-located with user data)
- Stations: No shard needed (read-heavy, use read replicas + Redis cache)
- Transactions: Shard by `user\_id` modulo 16

**Sharding Key:** `user\_id` (ensures data locality for user queries)

**Implementation:** Use PostgreSQL partitioning + application-level routing via a proxy (pgpool-II or Citus).

#### Caching Strategy

What to Cache	Cache Type	TTL	Invalidation Strategy
Station list (nearby)	Redis Sorted Set	30 seconds	On station status change
User session	Redis String	1 hour	On logout/password change
Station details	Redis Hash	5 minutes	On station update
Search results	Redis String	1 minute	On station add/remove
Rate limiting counters	Redis Sorted Set	1 minute	Automatic expiry
API response (GET)	CDN Edge Cache	1-5 minutes	Cache purge on update

## Scalability Architecture

### #### Scaling Decision Points

- 100 concurrent users:** Single server (t3.medium) + PostgreSQL
- 1,000 concurrent users:** 2 web servers + read replica
- 10,000 concurrent users:** Auto-scaling group (4-8 instances) + Redis cluster + Elasticsearch
- 100,000 concurrent users:** Microservices split + sharded DB + CDN + edge workers

### #### Load Balancing

- **Application Load Balancer (ALB):** Routes HTTP/HTTPS traffic to web servers
- **Network Load Balancer (NLB):** Routes WebSocket traffic to real-time service
- **DNS Load Balancing:** Route53 geolocation routing for China regions
- **Internal Load Balancer:** Between microservices (AWS PrivateLink)

### #### CDN/Edge Caching

- **Cloudflare:** Static assets (JS, CSS, images) - 1 year cache
- **Cloudflare Workers:** API response caching for GET endpoints
- **Edge-Side Includes (ESI):** Dynamic content caching at edge

### #### Read Replicas

- **1 read replica** for every 3 write instances
- **Read replicas** serve: search queries, analytics, user history
- **Writes** go to primary PostgreSQL

### #### Cost Projections (Monthly)

User Count	Compute	Database	Cache	CDN	Storage	Total
1,000	\$200	\$100	\$50	\$20	\$30	\$400
10,000	\$800	\$400	\$200	\$100	\$100	\$1,600
100,000	\$4,000	\$2,000	\$800	\$500	\$500	\$7,800
1,000,000	\$20,000	\$10,000	\$4,000	\$2,000	\$2,000	\$38,000

## DevOps & CI/CD

##### Pipeline (GitHub Actions)

```
``yaml
```

```
name: Deploy EV Charging Network
```

```
on:
```

```
push:
```

```
branches: [main, develop]
```

```
pull_request:
```

```
branches: [main]
```

```
jobs:
```

```
test:
```

```
runs-on: ubuntu-latest
```

```
steps:
```

- uses: actions/checkout@v3
- name: Run tests

```
run: |
```

```
npm install
```

```
npm run test
```

```
npm run lint
```

```
build:
```

```
needs: test
```

```
runs-on: ubuntu-latest
```

```
steps:
```

- name: Build Docker images

```
run: |
```

```
docker build -t ev-auth-service .
```

```
docker build -t ev-station-service .
```

```
docker build -t ev-payment-service .
```

- name: Push to ECR

```
run: |
```

```
aws ecr get-login-password | docker login --username AWS --password-stdin $ECR_URL
```

```
docker push $ECR_URL/ev-auth-service:latest
```

```
deploy:
```

```
needs: build
```

```
runs-on: ubuntu-latest
```

```
environment: production
```

```
steps:
```

- name: Deploy to ECS

```
run: |
```

```
aws ecs update-service --cluster ev-cluster --service auth-service --force-new-deployment
aws ecs update-service --cluster ev-cluster --service station-service --force-new-deployment
...
```

#### #### Environments

- **Development:** Single EC2 instance, local PostgreSQL
- **Staging:** Mirrors production, smaller instances, test data
- **Production:** Auto-scaling, multi-AZ, full monitoring

#### #### Deployment Strategy

- **Blue-Green Deployment:** Two identical environments (blue=live, green=new). Switch traffic after health checks.
- **Canary Releases:** Route 10% traffic to new version, monitor errors, gradually increase to 100%.

#### #### Monitoring Stack

- **Metrics:** Prometheus + Grafana (CPU, memory, request latency, error rates)
- **Logging:** ELK Stack (Elasticsearch, Logstash, Kibana) - centralized logging
- **Tracing:** Jaeger (distributed tracing for microservices)
- **Alerting:** PagerDuty (critical alerts), Slack (warnings)
- **Uptime:** Pingdom (external monitoring)

#### #### Disaster Recovery

- **RPO (Recovery Point Objective):** 5 minutes (continuous WAL archiving to S3)
- **RTO (Recovery Time Objective):** 30 minutes (automated failover to standby)
- **Backup Strategy:**
  - PostgreSQL: Daily full backup + continuous WAL archiving
  - Redis: AOF persistence + daily RDB snapshots
  - S3: Cross-region replication
- **Failover:** Multi-AZ deployment with automatic failover via AWS RDS Multi-AZ

## Security Architecture

#### #### Auth and Authorization

- **Authentication:** JWT (access token: 15 min, refresh token: 7 days)
- **OAuth2:** WeChat OAuth for social login, Alipay OAuth for payment
- **RBAC:** Three roles: `user`, `operator`, `admin`
- **2FA:** Optional TOTP (Google Authenticator) for admin accounts
- **Session Management:** Redis-based session store with automatic expiry

#### #### API Security

- **Rate Limiting:** Kong API Gateway - 100 req/min per user, 1000 req/min per IP
- **OWASP Top 10 Protection:**
  - SQL Injection: Parameterized queries (no raw SQL)
  - XSS: Content-Security-Policy headers, input sanitization
  - CSRF: SameSite cookies, CSRF tokens for state-changing requests
  - Broken Authentication: Rate limiting on login, account lockout after 5 failed attempts

- Sensitive Data Exposure: Encryption at rest and in transit
- **API Keys:** For third-party integrations (rotated every 90 days)

#### Encryption

- **At Rest:** AES-256 for database, S3 server-side encryption
- **In Transit:** TLS 1.3 for all HTTP traffic, mTLS for inter-service communication
- **PII Handling:** Phone numbers, emails encrypted with application-level encryption (AWS KMS)

#### PII Handling (China Compliance)

- **Data Localization:** All user data stored in China region (AWS Beijing/Ningxia)
- **Consent Management:** Explicit consent for data collection, opt-out options
- **Data Retention:** 90 days for session data, 7 years for financial records (Chinese law)
- **Right to Delete:** User can request data deletion within 30 days

## MVP Roadmap

#### Sprint 1 (2 weeks): Core Infrastructure + Auth

- **Team:** 3 developers, 1 DevOps, 1 PM
- **Tasks:**
  - Set up AWS infrastructure (ECS, RDS, Redis, S3)
  - Implement CI/CD pipeline
  - User registration/login (phone + WeChat OAuth)
  - JWT authentication + RBAC
  - Basic user profile API
- **Cost:** \$15,000 (salaries + infrastructure)

#### Sprint 2 (2 weeks): Core Feature 1 - Station Search & Booking

- **Team:** 4 developers, 1 QA, 1 PM
- **Tasks:**
  - Station CRUD API (admin)
  - Geospatial search (PostGIS + Elasticsearch)
  - Station detail page
  - Real-time availability (WebSocket)
  - Start/stop charging session
- **Cost:** \$20,000

#### Sprint 3 (2 weeks): Core Feature 2 - Payments & Analytics

- **Team:** 4 developers, 1 QA, 1 PM
- **Tasks:**
  - WeChat Pay / Alipay integration
  - Transaction history
  - Basic analytics dashboard (admin)
  - Notification system (SMS + in-app)
  - Error handling + logging
- **Cost:** \$20,000

#### Sprint 4 (2 weeks): Polish + Launch

- **Team:** 3 developers, 1 QA, 1 PM, 1 Designer

- **Tasks:**
  - UI polish (responsive, animations)
  - Performance optimization
  - Security audit
  - Load testing
  - Documentation
  - Production deployment
- **Cost:** \$18,000

**Total MVP Cost:** \$73,000 (8 weeks)

---

## Part 2: Complete Production Web Pages

### Page 1: Landing Page

```

`html
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<title>EV Charge China - Smart EV Charging Network</title>
<link
href="https://fonts.googleapis.com/css2?family=Inter:wght@300;400;500;600;700;800&display=swap"
rel="stylesheet">
<style>
    • { margin: 0; padding: 0; box-sizing: border-box; }
body { font-family: 'Inter', sans-serif; color: #1a1a2e; background: #f8f9fa; overflow-x: hidden; }
.container { max-width: 1200px; margin: 0 auto; padding: 0 20px; }

/ Navigation /
nav { position: fixed; top: 0; width: 100%; background: rgba(255,255,255,0.95); backdrop-filter: blur(10px);
z-index: 1000; border-bottom: 1px solid #e9ecef; }
nav .container { display: flex; justify-content: space-between; align-items: center; padding: 16px 20px; }
.logo { font-size: 24px; font-weight: 800; color: #0d6efd; }
.logo span { color: #1a1a2e; }
.nav-links { display: flex; gap: 32px; align-items: center; }
.nav-links a { text-decoration: none; color: #495057; font-weight: 500; transition: color 0.3s; }
.nav-links a:hover { color: #0d6efd; }
.btn-primary { background: #0d6efd; color: white; border: none; padding: 10px 24px; border-radius: 8px;
font-weight: 600; cursor: pointer; transition: all 0.3s; }
.btn-primary:hover { background: #0b5ed7; transform: translateY(-2px); box-shadow: 0 4px 12px
rgba(13,110,253,0.3); }

```

```

.btn-secondary { background: transparent; color: #0d6efd; border: 2px solid #0d6efd; padding: 10px 24px;
border-radius: 8px; font-weight: 600; cursor: pointer; transition: all 0.3s; }
.btn-secondary:hover { background: #0d6efd; color: white; }

/ Hero Section /
.hero { padding: 160px 0 100px; background: linear-gradient(135deg, #f8f9fa 0%, #e9ecef 100%); position:
relative; overflow: hidden; }
.hero::before { content: ""; position: absolute; top: -50%; left: -50%; width: 200%; height: 200%;
background: radial-gradient(circle, rgba(13,110,253,0.05) 0%, transparent 70%); animation: pulse 4s
ease-in-out infinite; }
@keyframes pulse { 0%, 100% { transform: scale(1); } 50% { transform: scale(1.1); } }
.hero-content { display: flex; align-items: center; gap: 60px; position: relative; z-index: 1; }
.hero-text { flex: 1; }
.hero-text h1 { font-size: 56px; font-weight: 800; line-height: 1.1; margin-bottom: 24px; }
.hero-text h1 .highlight { background: linear-gradient(135deg, #0d6efd, #6610f2); -webkit-background-clip:
text; -webkit-text-fill-color: transparent; }
.hero-text p { font-size: 18px; color: #6c757d; line-height: 1.6; margin-bottom: 32px; max-width: 500px; }
.hero-buttons { display: flex; gap: 16px; }
.hero-image { flex: 1; }
.hero-image img { width: 100%; max-width: 600px; border-radius: 16px; box-shadow: 0 20px 60px
rgba(0,0,0,0.1); }

/ Features Section /
.features { padding: 100px 0; background: white; }
.section-title { text-align: center; font-size: 36px; font-weight: 700; margin-bottom: 16px; }
.section-subtitle { text-align: center; color: #6c757d; font-size: 18px; margin-bottom: 60px; }
.features-grid { display: grid; grid-template-columns: repeat(auto-fit, minmax(280px, 1fr)); gap: 32px; }
.feature-card { background: #f8f9fa; padding: 32px; border-radius: 16px; transition: all 0.3s; cursor: default;
}
.feature-card:hover { transform: translateY(-8px); box-shadow: 0 12px 40px rgba(0,0,0,0.08); }
.feature-icon { width: 64px; height: 64px; background: linear-gradient(135deg, #0d6efd, #6610f2);
border-radius: 16px; display: flex; align-items: center; justify-content: center; margin-bottom: 20px; }
.feature-icon svg { width: 32px; height: 32px; fill: white; }
.feature-card h3 { font-size: 20px; font-weight: 600; margin-bottom: 12px; }
.feature-card p { color: #6c757d; line-height: 1.6; }

/ How It Works /
.how-it-works { padding: 100px 0; background: #f8f9fa; }
.steps { display: flex; justify-content: center; gap: 40px; flex-wrap: wrap; }
.step { text-align: center; max-width: 250px; position: relative; }
.step-number { width: 60px; height: 60px; background: #0d6efd; color: white; border-radius: 50%; display:
flex; align-items: center; justify-content: center; font-size: 24px; font-weight: 700; margin: 0 auto 20px; }
.step h3 { font-size: 18px; font-weight: 600; margin-bottom: 8px; }
.step p { color: #6c757d; font-size: 14px; }

```

```
.step:not(:last-child)::after { content: '→'; position: absolute; top: 20px; right: -30px; font-size: 24px; color: #0d6efd; }
```

*/ Testimonials /*

```
.testimonials { padding: 100px 0; background: white; }
.testimonial-carousel { display: flex; gap: 32px; overflow-x: auto; scroll-snap-type: x mandatory; padding: 20px 0; }
.testimonial-card { min-width: 350px; background: #f8f9fa; padding: 32px; border-radius: 16px; scroll-snap-align: start; }
.testimonial-card .stars { color: #ffc107; font-size: 20px; margin-bottom: 16px; }
.testimonial-card p { font-style: italic; line-height: 1.6; margin-bottom: 16px; }
.testimonial-author { display: flex; align-items: center; gap: 12px; }
.testimonial-author img { width: 48px; height: 48px; border-radius: 50%; object-fit: cover; }
.testimonial-author h4 { font-size: 16px; font-weight: 600; }
.testimonial-author span { color: #6c757d; font-size: 14px; }
```

*/ Pricing /*

```
.pricing { padding: 100px 0; background: #f8f9fa; }
.pricing-toggle { display: flex; justify-content: center; align-items: center; gap: 16px; margin-bottom: 60px; }
.pricing-toggle span { font-weight: 500; }
.toggle-switch { width: 60px; height: 32px; background: #dee2e6; border-radius: 16px; cursor: pointer; position: relative; transition: background 0.3s; }
.toggle-switch.active { background: #0d6efd; }
.toggle-switch::after { content: ""; width: 28px; height: 28px; background: white; border-radius: 50%; position: absolute; top: 2px; left: 2px; transition: transform 0.3s; }
.toggle-switch.active::after { transform: translateX(28px); }
.pricing-grid { display: grid; grid-template-columns: repeat(auto-fit, minmax(300px, 1fr)); gap: 32px; }
.pricing-card { background: white; padding: 40px; border-radius: 16px; text-align: center; transition: all 0.3s; border: 2px solid transparent; }
.pricing-card:hover { border-color: #0d6efd; transform: translateY(-8px); box-shadow: 0 12px 40px rgba(0,0,0,0.08); }
.pricing-card.featured { border-color: #0d6efd; background: linear-gradient(135deg, #f8f9fa, white); }
.pricing-card h3 { font-size: 24px; font-weight: 600; margin-bottom: 8px; }
.pricing-card .price { font-size: 48px; font-weight: 800; color: #0d6efd; margin: 16px 0; }
.pricing-card .price span { font-size: 16px; color: #6c757d; font-weight: 400; }
.pricing-card ul { list-style: none; margin: 24px 0; }
.pricing-card ul li { padding: 8px 0; color: #495057; }
.pricing-card ul li::before { content: '✓'; color: #0d6efd; margin-right: 8px; }
```

*/ FAQ /*

```
.faq { padding: 100px 0; background: white; }
.faq-list { max-width: 700px; margin: 0 auto; }
.faq-item { border-bottom: 1px solid #dee2e6; padding: 16px 0; }
```

```

.faq-question { display: flex; justify-content: space-between; align-items: center; cursor: pointer;
font-weight: 600; font-size: 18px; }
.faq-question svg { transition: transform 0.3s; }
.faq-item.active .faq-question svg { transform: rotate(180deg); }
.faq-answer { max-height: 0; overflow: hidden; transition: max-height 0.3s, padding 0.3s; }
.faq-item.active .faq-answer { max-height: 200px; padding-top: 12px; }
.faq-answer p { color: #6c757d; line-height: 1.6; }

/ Footer /
footer { background: #1a1a2e; color: white; padding: 60px 0 30px; }
.footer-grid { display: grid; grid-template-columns: repeat(auto-fit, minmax(200px, 1fr)); gap: 40px;
margin-bottom: 40px; }
.footer-col h4 { font-size: 18px; margin-bottom: 16px; }
.footer-col a { display: block; color: #adb5bd; text-decoration: none; padding: 4px 0; transition: color 0.3s; }
.footer-col a:hover { color: white; }
.footer-bottom { border-top: 1px solid #495057; padding-top: 20px; text-align: center; color: #adb5bd; }

/ Animations /
.fade-in { opacity: 0; transform: translateY(20px); transition: opacity 0.6s, transform 0.6s; }
.fade-in.visible { opacity: 1; transform: translateY(0); }

@media (max-width: 768px) {
.hero-content { flex-direction: column; text-align: center; }
.hero-text h1 { font-size: 36px; }
.hero-buttons { justify-content: center; }
.nav-links { display: none; }
.step:not(:last-child)::after { display: none; }
}
</style>
</head>
<body>
<nav>
<div class="container">
<div class="logo">EV<span>Charge</span></div>
<div class="nav-links">
<a href="#features">Features</a>
<a href="#pricing">Pricing</a>
<a href="#faq">FAQ</a>
<button class="btn-primary" onclick="window.location.href='dashboard.html'">Get Started</button>
</div>
</div>
</nav>

<section class="hero">

```

```

<div class="container">
<div class="hero-content">
<div class="hero-text fade-in">
<h1>Power Your Journey with <span class="highlight">Smart EV Charging</span></h1>
<p>China's largest EV charging network. Find, book, and pay for charging stations seamlessly. Join 100,000+ satisfied drivers.</p>
<div class="hero-buttons">
<button class="btn-primary" onclick="window.location.href='onboarding.html'">Start Free Trial</button>
<button class="btn-secondary"
onclick="document.getElementById('features').scrollIntoView({behavior:'smooth'})">Learn More</button>
</div>
</div>
<div class="hero-image fade-in">

</div>
</div>
</div>
</section>

<section id="features" class="features">
<div class="container">
<h2 class="section-title fade-in">Why Choose EV Charge?</h2>
<p class="section-subtitle fade-in">Everything you need for stress-free EV charging</p>
<div class="features-grid">
<div class="feature-card fade-in">
<div class="feature-icon">
<svg viewBox="0 0 24 24"><path d="M12 2C6.48 2 2 6.48 2 12s4.48 10 10 10 4.48 10 10 10s17.52 2 12 2zm-2 15l-5-5 1.41-1.41L10 14.17l7.59-7.59L19 8l-9 9z"/></svg>
</div>
<h3>Real-Time Availability</h3>
<p>See live station status, port availability, and wait times. Never arrive at a full station again.</p>
</div>
<div class="feature-card fade-in">
<div class="feature-icon">
<svg viewBox="0 0 24 24"><path d="M12 2C8.13 2 5 5.13 5 9c0 5.25 7 13 7 13s7-

```