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A Level 2 Residential Charger as a Competitive Advantage of EVs in the USA: A Cost-Benefit and Stakeholder Analysis

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ABSTRACT

The EV adoption rate in the USA directly correlates with the installation of residential Level 2 chargers. These ports, combined with scheduled charging and time-of-use electricity plans, create a competitive advantage for EVs by eliminating "charging" and "range" anxieties through reduced expenditures and improved operating cycles, when car owners eradicate trips to refueling or public charging stations in up to 96% of daily cases. The analysis determined that off-peak charging could be up to 25 times less expensive than refueling with gasoline. In most assessed states, a payback period for installation of a home charger combined with off-peak charging is 16-25 months. Finally, the solution effectively addresses grid stability concerns of a government, which has a monopoly on issuing corresponding permits, and thus could benefit vehicle owners and the public.

Keywords: electric vehicles; EVs; charging; charging infrastructure; residential chargers, sustainabilit

I. Introduction

Globally, the BEV (EV) adoption rate correlates with the charging infrastructure [1,2,3] primarily due to "charging" and/or "range" anxiety, which dominates customer choice in the selection of electric vehicles [4]. In the USA, however, the share of EVs in a particular area and a state depends rather on installation of residential Level 2 chargers and not publicly accessed AC/DC ports [5].

Fundamentally, it could be attributed to the type of housing, when 62% of American households constitute single-family houses (SFH) [6], of which 77% have the capacity to install an Electric Vehicle Charging System (EVCS) [7]. As a result, up to 80% of charging is currently assigned to residential chargers [8,9]. It is projected that by 2030, they could constitute 95% of all ports in the USA [3,10].

Residential Level 2 EVCSs could create a competitive advantage for EVs when a car is recharged overnight at home in 4-10 hours [11], thus eliminating the need for its owner to spend time at gasoline or public charging stations [5]. Besides the improved EV operational pattern, this type of charging could be financially beneficial for EV owners. In this regard, a comparative customer-oriented cost-benefit analysis of such EVCSs to public chargers and gasoline refueling stations is performed.

Whereas the solution could be advantageous for consumers and other stakeholders, who benefit from offering applicable products and services, including electricity suppliers, manufacturers of EVs and chargers, the interests and concerns of the government need to be assessed at non-market conditions. Since government authorities have a monopoly on issuing EVCS installation permits [12] in order to maintain grid stability, which is defined as the issue of national security [13,14], its considerations and solutions are to be investigated.

II. EVCS Installation Permit

Whereas Level 1 charging does not require the installation approval, a regulatory permit is overwhelmingly needed for Level 2 EVCSs [12], with federal and state authorities being a monopoly stakeholder.

EVs are high electricity-consuming appliances [15], which can affect grid stability [16]. According to the U.S. Energy Information Administration, a residential customer used about 10,791 kWh in 2022 [17]. With an average EV efficiency of 0.30 kWh/mile [18] and 13,476 miles accumulated by a car per year [19], an EV might consume 4,000 kWh annually, which potentially translates to 30% of an annual house-hold power usage. Overall, households account for 38% of the national electricity consumption [20], thus making EVs a potentially unbalancing to the grid appliance. Negative impacts of EVs on the grid include high load patterns in peak hours, system instability, component overloading, and phase and voltage unbalance if a significant number of cars were simultaneously plugged [21,22]. With multiple charging scenarios modeled, the EV adoption rate in the USA exceeding 30% would result in peak demand grid breakpoints [16]. In case of a 50% EV adoption rate, the peak demand is to be increased by 3-9% from the current grid capacity [16].

Moreover, grid loads vary depending on weekly and daily usage patterns, seasonality, and region [23]. However, EIA determined that the highest loads occur daily from 6 AM to 10 PM – a period when electricity consumption is at least twice as high [23]. At the same time, peak hours match the charging time span of most EVs [24,25]. Therefore, the current EV charging pattern contributes to grid imbalances and can hardly be supported by the government.

For the government to address grid instability with the increasing number of EVs, most practices envisage scheduled EV charging [21]. Within their framework, prominent mitigation strategies are described by a cooperative game theory and minimizing charging cost framed by the Nash Equilibrium [21]. Moreover, off-peak periods are priced at the

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lowest points in Time-of-Use (TOU) plans and thus are most financially appealing to EV owners [26]. Overall, electricity prices and grid loads are intertwined with off-peak loads occurring from around 10 PM to 7 AM [23,27].

Scheduled EV charging requires advanced (smart) metering infrastructure (AMI) installations, which allow measuring and recording electricity usage at hourly intervals with two-way customer-utility communication of data and charging points that support scheduled electricity consumption [28]. In the USA, 73% of residential customers have AMI [28].

Thus, off-peak residential Level 2 charging would contribute to balancing the grid, might be economically beneficial for EV owners and could be installed in most households.

III. Residential EVCS As A Competitive Advantage

A. *Addressing charging anxiety*

By eliminating customer concerns and negative experience associated with charging [5,29,30], installation and operation of residential Level 2 EVCSs foster a distinctive competitive advantage for EVs based on a differentiation leadership [31].

In particular, overnight EV Level 2 charging up to 80% at home in 4-10 hours [11] eliminates unnecessary activities of rerouting a car, charging/fueling, paying, and resuming a trip when visiting gasoline or public charging stations [5]. By limiting trips to public charging stations to long journeys typically of over 124 miles, which constitute 4% of daily trips [32], a current EV disadvantage could become a competitive advantage in the operation cycle of residential Level 2 and destination charging.

While the concepts of a measured percentile-based and shared charging [33,34] partially address the issue, they do not match the most favored car operation pattern in the USA. In particular, for 94% of gasoline (ICE) car owners, it could be described as 'maximum range per refueling', when drivers overwhelmingly opt for a full tank at a refueling station [5,35].

The immediate availability of EVCS installation in approximately 50% of households or 60 million residences at a personal garage, driveway/carport, parking garage/lot, or on-street [5,6] might dramatically contribute to the expansion of EVs in the USA.

B. *Economic analysis*

To calculate potential savings for EV owners, a cost-benefit analysis of charging at residential and publicly accessible EVCSs and gasoline refueling is per-formed. The assessment incorporates state variations and standard yearly mileage. With an average ICE car fuel economy of 22.2 miles per gallon, the gasoline consumption of a car is around 600 gallons per year [19,36]. As calculated earlier, an EV requires 4,000 kWh annually [18,19].

Since there are approximately 400 electricity suppliers in the USA with unique tariff policies, which are not cumulatively assessed or aggregated, a selection of the largest companies is used in this paper. Accumulated data account for off-peak TOU plans for over 22 million residential households in more than 20 states, which represent 18% of all residences in the USA, gasoline refueling and public charging prices in January 2026 [37-44]. Average state electricity prices range from the lowest in Idaho to the highest in California [45]. The Pacific noncontagious states, Hawaii and Alaska [45], were not assessed.

TABLE I.

Costs	Idaho	N.C.	S.C.	Florida	Georgia	Alabama	Ohio	Penn.	Cal.
EVs, residential charging									
Average electricity rate, $/kW	0.13	0.15	0.15	0.15	0.15	0.16	0.17	0.2	0.32
Off-peak rate, $/kW; supplier	0.09; Idaho Power	0.07; Duke Energy	0.08; Duke Energy	0.04; Duke Energy	0.015; Georgia Power	0.1; Georgia Power	0.016; American Electric Power	0.12; PPL Electric Utilities	0.39; PG&E
Off-peak charging per year, $	360	280	320	160	60	400	64	480	1,560
EVs, public charging									
Average charging rate, $/kW	0.378	0.356	0.443	0.402	0.404	0.427	0.408	0.374	0.419
Charging at average rate per year, $	1,512	1,424	1,772	1,608	1,616	1,708	1,632	1,496	1,676
Public charging to off-peak charging, %	420	508	554	1,005	2,693	427	2,550	312	107
ICE cars, gasoline refueling									
Gasoline price per gallon, $	2.92	2.65	2.54	2.90	2.75	2.58	2.61	3.11	4.31
Fuel per year, $	1,752	1,590	1,524	1,740	1,650	1,548	1,566	1,866	2,586
Gas refueling to off-peak charging, %	487	568	476	1,087	2,750	387	2,447	389	166
Gas refueling to public charging, %	116	112	86	108	102	91	96	125	154

Fig. 1. Charging and refueling costs.

Figure 1 highlights multiple patterns. All electric companies, except the one in California, encourage off-peak electricity consumption by introducing rates that are from 37% to 90% lower than average state rates. According to a median, off-peak charging is 5 times cheaper than gasoline refueling.

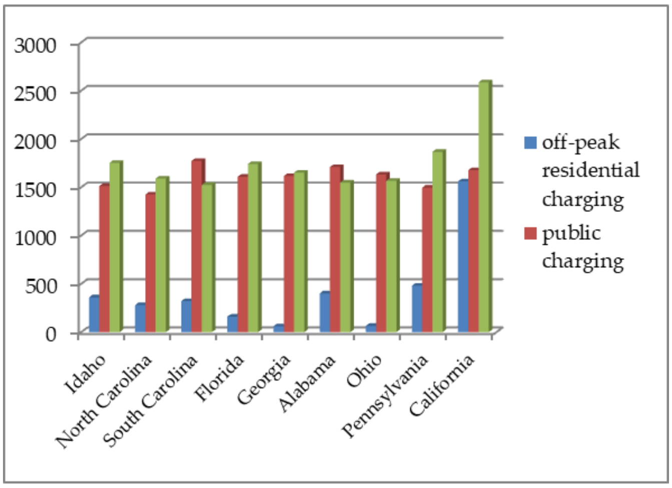

Fig. 2. Comparison of charging and refueling costs.

According to Figure 2, by charging off-peak hours, EV owners in all states would spend from 4% to 60% of their gasoline expenditures. However, in comparison to gasoline refueling, public charging is cheaper by 2%-35% in 6 states and 4%-16% more expensive in 3 states. California has a unique pattern, where off-peak and public charging differs by 7%.

Even though off-peak residential charging is cheaper than car refueling and public charging, it requires capital investments by customers in the form of due fees and EVCS installation. With over 400 Level 2 chargers certified by Energy Star [46], devices that comply with the NEMA level 3R or 4 standards for outdoor environments with charging scheduling were randomly selected from an average range of $380 to $689 [47] based on customer preferences [48-52]. Figure 3 includes a pedestal for outdoor installation, average installation price [26], and permit fees [53].

TABLE II.

EVCS	Tesla	Emporia	ChargePoint	Wallbox
Model	Universal Wall Connector	Pro	Home Flex	Pulsar Plus
Max charging speed, mph	44	46	37	35
NEMA standard	3R	4	3R	4
Charging schedule	+	+	+	+
Price, $	600	599	599	749
Pedestal, $	120-425	120	120	120-499
Average installation, $	1,286			
Permit fees, $	45 (calculated as 3.5% of a project cost of 1,286)			
Fixed costs, $	2,051-2,356	2,050	2,050	2,200-2,579

Fig. 3. Fixed costs of Level 2 EVCS.

The economic benefits for a vehicle owner switching from a gasoline car to an EV could be calculated as a payback period (PB), net present value (NPV), and return on investment (ROI). Even though there could be less expensive options with average EVCS prices constantly declining [47], this calculation is based on the least expensive option with the highest NEMA level 4 standard of $2,050.

PB implies a Standard Payback Method and calculated breakeven points for pairs of residential/public charging and residential charging/gasoline refueling:

EVCS fixed cost + (off-peak electricity cost x months) ≤ gasoline refueling x PB_1;

EVCS fixed cost + (off-peak electricity cost x months) ≤ public charging x PB_2.

NPV, calculated for off-peak charging to compare against gasoline refueling and public charging:

NPV_1 = gasoline refueling x years – (EVCS fixed cost + (off-peak electricity cost x years));

NPV_2 = public charging x years – (EVCS fixed cost + (off-peak electricity cost x years)).

ROI, calculated for off-peak charging to compare against gasoline refueling and public charging:

$ROI_1 = NPV_{1\ (years)}$ / (EVCS fixed cost + (off-peak electricity cost x years));

$ROI_2 = NPV_{2\ (years)}$ / (EVCS fixed cost + (off-peak electricity cost x years)).

The metrics are calculated for 1-year short-term, 3-year mid-term and 6-year long-term periods. One-year period is selected since out of 44 million households occupying rentals, which represent 34% of all households, 59.6% are 12-month leases [54-55]. A mid-term span is needed to calculate a payback period. A long-term 6-year NPV is justified by the average car ownership of 7 years [56] and residence statistics. With an 8% mover rate, the average time of residence was around 12 years in 2025 [57].

To assess financial benefits, the scenario is based on assumptions of residential charging only. This paper prioritizes issues associated with "charging anxiety" and thus assesses only the fuel/charging cycle of EVs and ICE cars without considering variables such as vehicles' relative cost, insurance, maintenance, taxation, etc. None of the enacted federal and state incentives associated with EVs and/or charging were included; even though as of December 2025 there EVCS related conditional rebates [58] in Alabama ($500), California ($1000), Florida ($100-$300), Idaho ($1000), Ohio ($250), Georgia ($1000), North Carolina ($1000), South Carolina ($200-$1,236), and Pennsylvania ($100-$300).

TABLE III.

Metrics	Idaho	N.C.	S.C.	Florida	Georgia	Alabama	Ohio	Penn.	Cal.
EVs, off-peak charging									
Fixed costs, $	2,050								
Off-peak charging per year, $	360	280	320	160	60	400	64	480	1,560
ICE cars									
Gasoline refueling per year, $	1,752	1,590	1,524	1,740	1,650	1,548	1,566	1,866	2,586
NPV_1 (1 year), $	-658	-740	-846	-470	-460	-902	-548	-664	-1,024
PB_1, months	18	18	19	16	16	19	17	17	25
NPV_1 (2 years), $	1,094	570	358	1,110	1,130	246	954	722	2
ROI_1 (2 years), %	39	22	13	47	52	9	44	24	0
NPV_1 (3 years), $	2,126	1,880	1,562	2,690	2,720	1,394	2,456	2,108	1,028
ROI_1 (3 years), %	68	65	52	106	122	43	110	60	15
NPV_1 (6 years), $	6,302	5,810	5,174	7,430	7,361	4,838	6,962	6,266	4,106
ROI_1 (6 years), %	150	156	130	233	308	109	286	127	36
EVs, public charging									
Public charging per year, $	1,512	1,424	1,772	1,608	1,616	1,708	1,632	1,496	1,676
NPV_2 (1 year), $	-898	-906	-598	-602	-494	-742	-482	-1,034	-1,934
PB_2, months	22	22	17	17	16	19	16	25	180>
NPV_2 (2 years), $	254	518	854	846	1,062	566	1,086	-18	-1,818
ROI_2	9	20	32	36	49	20	50	-1	-35

(2 years), %									
NPV_2 (3 years), $	1,406	1,382	2,306	2,294	2,618	1,874	2,654	998	-1,702
ROI_2 (3 years), %	45	48	77	91	117	58	118	29	-25
NPV_2 (6 years), $	4,862	4,814	6,662	6,638	7,286	5,798	7,358	4,046	-1,354
ROI_2 (6 years), %	115	129	168	221	302	130	302	82	-12

Fig. 4. NPV, PB, and ROI for gasoline refueling, off-peak and public charging.

When comparing off-peak charging to gasoline refueling or public charging, the payback period for consumers in all states, except California, varies from 16 to 25 months (Figures 4-6). In 3 years, the returns on home charger installation fluctuate from 43% to 122%, with California being an exception with just 15%. In 6 years, ROI could reach 300% in selected states. With a payback of 16-25 months, public charging is similar in returns to gasoline refueling, except for California.

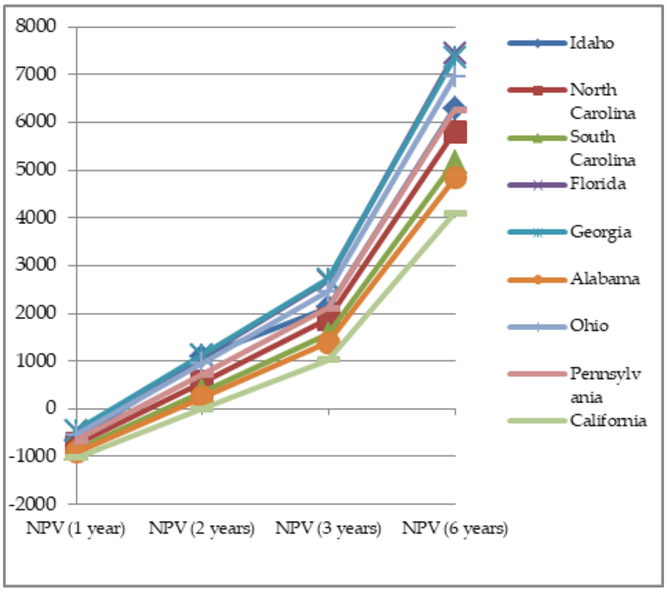

Fig. 5. Cost savings for off-peak charging when compared to gasoline refueling.

Overall, installation of residential chargers with applied off-peak rates is highly beneficial for EV owners compared to public charging and gasoline refueling (Figures 4 and 5).

C. *EVCS installation procedures*

Activities and the time required to install an EVCS vary considerably depending on a local regulation. Identified key processes include gathering information and submitting an application to building and/or permitting authorities, pre- and/or post- charger installation inspection, waiting for an approval which could be around 5 days, and instalment from the moment of signing a contract to works on a spot which on average lasts 21 days [12,53,59]. This translates to around 30 days after necessary documents are gathered, which might require drawings of a project and a floor plan, specifications of an available or yet to be procured EVCS, a single-line diagram, electrical load calculations, and occasionally testimonials from an electricity supplier and electrical contractor [60]. Moreover, 27% of households [28] lack a meter to fit a particular TOU plan that would require up to 10 business days for integration [61].

At the same time, when compared to SFH, the installation of EVCSs in multi-unit houses (MUH) could be more protracted and complicated. To address the issue, California adopted a regulation which demands that 40% of parking spaces in new MUHs to be equipped with EVCSs [62]. Along with other norms, it contributes to the installation of chargers in such buildings when the California Air Resources Board (CARB) regulation increases the likelihood of EV purchase by 52%, if adopted in other states [30].

Overall, simplification of the application process and reduction of waiting times could be required and achieved with standardization of a permit application, inspections, review process, and requirements [60]. Additional measures could address concerns of MUH EV owners. Since multiple stakeholders might be involved, including electricity suppliers, electrical contractors, permit issuing authorities, charger producers, construction authorities, a single-window digital portal for all participants with synchronized activities prioritizing an EV customer and his low participation could be advantageous to streamline the process.

IV. Practical Implications For Stakeholders

A. *EV manufacturers*

Off-peak charging creates financial and timely benefits for EV owners by framing a competitive advantage and could encourage ICE car owners to switch to electric vehicles. The availability of Level 2 residential chargers would thus contribute to EV sales. Besides information and customer support, EV manufacturers might facilitate the growth of private charging infrastructure by offering chargers and related grid appliances [51] or partnering with their producers since fixed costs of a Level 2 EVCSs and its installation represented 4% of a new car in 2025 [63].

B. *Manufacturers of EVCSs*

With over 400 certified models [46], manufacturers of EVCSs are interested in their sales and optional subscription services.

C. *Electricity generation companies*

Companies might capitalize on the opportunity to increase revenues due to the expansion of a customer base and electricity consumption by up to 30%, a substitute for gasoline refueling [31]. Moreover, EVCSs with scheduled overnight charging would balance their grids.

To improve the intake of private chargers, electricity suppliers could introduce EV-related TOU plans and serve as a platform for informing its clients about the advantages of off-peak charging. This might be especially effective if partnered with manufacturers of EVs and chargers. A linked EV TOU contract, similar to a "contract phone" concept, could be elaborated. Finally, the stakeholder has detailed information about loads at every level and thus has the capacity to fast-track installation of chargers or to introduce pre-qualified permits for an area by cooperating with federal or state permitting authorities.

D. Government

Federal and state authorities are key stakeholders due to their monopoly on issuing permits. They are interested in grid stability and environmental preservation through the adoption of EVs [64] – objectives which might be contradictory if scheduled charging or TOU plans are not introduced [21,26,27]. On the other hand, if applied, they can improve grid stability [27].

While the permit issuing time is around 17% of the overall charger installation timeframe [12,53,59], the government could contribute to improving customer experience by accelerating and simplifying processes with unified standards and a single-window communication portal for all participants, with simultaneously scheduled activities when possible. If partnered with electricity companies, the distribution of pre-qualified permits for an area linked to a TOU plan could be implemented.

V. CUSTOMER SEGMENTATION AND MANAGEMENT AGENDA

By applying the research findings [5], cost-benefit analysis, and assessment of stakeholders, a management agenda is derived based on a customer segmentation in Figure 6: 20% of households with 12-month rental contracts [55], 27% of residential customers lacking AMI [28], 25% of the population without access to assigned parking places, i.e. on-street parking [8], and 75% of residences with potential to arrange charging at a personal garage, carport or assigned parking lot/garage [8]. However, households with 12-month rental contracts might seek for a one-year payback period (a reduction from the current 16-25 months), simplified application process, and EVCS dismantling or sealing procedure.

TABLE IV.

Customers	Government	Electricity suppliers	EV Mfg.	EVCS Mfg.
Households with 12-month rental contracts.	Standardize and simplify the process on a federal and/or state level of EVCS installation within a month. Create or certify a single window application website/app. Consider pre-qualified permits for an area with a known load surplus.	Proactively inform consumers on TOU tariffs and selected EVCSs to match a one-year payback period, considering gasoline prices in a state. Introduce a linked a EV TOU contract.	Inform consumers on benefits and simplicity of EVCS installation and operation. Encourage Level 2 charger packages when buying a car.	Design a sealing solution for an EVCS in case of its dismantlement under a landlord demand.
Customers without AMI.	Incentivize installation of AMIs along with EVCSs.	Inform consumers on TOU tariffs with AMI and selected EVCSs to match a one-year payback period.		
Single-family house residents with a personal garage and carport.	Standardize and simplify a process on a federal and/or state level of AMI and/or EVCS installation. Consider pre-qualified permits for areas with a load surplus.	Inform customers on TOU tariffs and selected EVCS. Distribute information about prequalifying charger installation conditions for areas with load safety margins. Introduce a call/AI support.		
Multiunit dwellers with assigned parking lot/garage.	Standardize and simplify the process on a federal and/or state level of AMI and/or EVCS based on CARB policies.	Inform customers on TOU tariffs and selected EVCS.		
Population with on-street unassigned parking.	Incentivize residential charging installations on a street per street bases, targeting the "one EV – one overnight charging parking place" concept.	Introduce an EV TOU tariff with selected or branded EVCSs.	Promote suitable home charger packages when buying a car.	Design an affordable solution for on-street parking.

Fig. 6. Management agenda.

VI. TESLA CASE

By evaluating the economy of a private charging infrastructure, the logic of this research could be used by all stakeholders, primarily EV manufacturers and energy companies, to advance their products and services in the US market. As a producer of chargers, Tesla [51] might inform potential customers about the benefits of overnight Level 2 charging with a TOU plan and prioritize its Universal Wall Connector while considering its upgrade to the NEMA 4 standard.

Furthermore, the research highlighted the importance of electricity distributors in improving a residential charging network and their interest in doing so. Moreover, the companies supply electricity to every American household, thus making them valuable partners in encouraging transition to EVs. A $2,000 EVCS with a payback period of 1-2 years makes home charging from 2 to 25 times less expensive than gasoline refueling (Figure 4). The strategy is advantageous for Tesla in all assessed states, except for California. With a payback period of over 15 years for a residential EVCS (Figure 4), when compared to public charging, installation of Tesla's solar panels, which cost $21,900 – $26,400 [65], might be rather appealing to Californian customers.

Since Tesla is the leading EV supplier in the USA and producer of chargers [66], it could capitalize on its experience of a global adoption of North American Charging Standard (NACS) and introduce simplified customer-oriented digital and hardware solutions for installation of residential chargers.

VII. CONCLUSION

Residential Level 2 chargers, when applied with scheduled charging and time-of-use plans, create a competitive advantage for EVs. This operational pattern saves time and finances for car owners and dramatically reduces anxieties associated with charging. Since over 50% of the households or 60 million residences in the USA have the immediate capacity to install such chargers at parking venues, the solution could dramatically improve the EV intake rates.

Along with manufacturers of EVs and chargers, electricity generation and supplying companies were identified as key stakeholders due to their interest in increasing revenues and electricity consumption by up to 30%. Moreover, they could contribute to a simplified and improved process of installation of connected to the grid chargers.

Finally, the solution effectively addresses concerns about the grid stability of the government, which has the monopoly on issuing charger installation permits.

REFERENCES

[1] F.S. Alrasheedi, H.H. Ali, “A Graph Theoretic Approach for Exploring the Relationship between EV Adoption and Charging Infrastructure Growth”, Vehicles, 2025, 7(2).

[2] D. Byun, “The AHP approach for selecting an automobile purchase model”, Information & Management, 2001, 38(5), pp. 289-297.

[3] J. Dijk, N. Delacrétaz, B. Lanz, “Technology Adoption and Early Network Infrastructure Provision in the Market for Electric Vehicles”, Environmental and Resource Economics, 2022, 83, pp. 631–679.

[4] J.P. Arenas, “On the impact of electric vehicle transition on urban noise pollution”, Current Opinion in Environmental Science & Health, 2025, 45.

[5] P. Tolkunov, “The role of residential chargers in the EV transition in the USA: A quantitative analysis of a charging infrastructure”, International Journal of Advanced Multidisciplinary Research and Educational Development, 2026, 2(2), pp. 1559-1564.

[6] “Table HC2.1 Structural and geographic characteristics of U.S. homes, by housing unit type, 2020”, U.S. Energy Information Administration. Available online: https://www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%202.1.pdf.

[7] D. Lee, M.H. McDermott, B.K. Sovacool, R. Isaac, “Toward just and equitable mobility: Socioeconomic and perceptual barriers for electric vehicles and charging infrastructure in the United States:, Energy and Climate Change, 2024, 5.

[8] Y. Ge, C. Simeone, A. Duvall, E. Wood, “There's No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure”, National Renewable Energy Laboratory, 2021.

[9] R. Zhang, N. Horesh, E. Kontou, Y. Zhou, “Electric vehicle community charging hubs in multi-unit dwellings: Scheduling and techno-economic assessment”, Transportation Research Part D: Transport and Environment, 2023, 120.

[10] E. Wood, B. Borlaug, M. Moniot, D.Y.D. Lee, Y. Ge, F. Yang, Z. Liu, “The 2030 National Charging Network: Estimating U.S. Light-Duty Demand for Electric Vehicle Charging Infrastructure, National Renewable Energy Laboratory, 2023.

[11] “Charger Types and Speeds”, U.S. Department of Transportation, 2025. Available online: https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds.

[12] “Charging Electric Vehicles at Home”, Alternative Fuels Data Center of the U.S. Department of Energy's Vehicle Technologies Office, 2026. Available online: https://afdc.energy.gov/fuels/electricity-charging-home.

[13] J. Sarda, N. Patel, H. Patel, R. Vaghela, B. Brahma, A. Bhoi, P. Barsocchi, “A review of the electric vehicle charging technology, impact on grid integration, policy consequences, challenges and future trends”, Energy Reports, 2024, 12.

[14] “Evaluating the Reliability and Security of the United States Electric Grid”, U.S. Department of Energy, 2025. Available online: https://www.federalregister.gov/documents/2025/04/14/2025-06381/strengthening-the-reliability-and-security-of-the-united-states-electric-grid.

[15] N. Samarakoon, D. Herath, K. Sankalpa, S. Sampath, M. Wickramasingha, “A Comprehensive Review of Electric Vehicles”, Journal of Research Technology and Engineering, 2024, 5(3), pp. 111-142.

[16] S. Powell, G. Cezar, L. Min, I. Azevedo, R. Rajagopal, “Charging infrastructure access and operation to reduce the grid impacts of deep electric vehicle adoption”, Nat Energy, 2022, 7, pp. 932–945.

[17] “How much electricity does an American home use?” U.S. Energy Information Administration, 2024. Available online: https://www.eia.gov/tools/faqs/faq.php?id=97&t=3.

[18] “What If One of Your Cars was Electric?” U.S. Environmental Protection Agency, 2025. Available online: https://www.epa.gov/greenvehicles/what-if-one-your-cars-was-electric.

[19] “Average Annual Miles per Driver by Age Group”, Federal Highway Administration, 2022. Available online: https://www.fhwa.dot.gov/ohim/onh00/bar8.htm.

[20] “Electricity: United States”, IEA, 2025. Available online: https://www.iea.org/countries/united-states/electricity.

[21] H. Das, M. Rahman, L. Li, C. Tan, “Electric vehicles standards, charging infrastructure, and impact on grid integration: A technological review”, Renewable and Sustainable Energy Reviews, 2020, 120.

[22] M. Khan, A. Hossain, A. Ullah, M. Lipu, S. Siddiquee, M. Alam, T. Jamal, H.vAhmed, “Integration of Large-Scale Electric Vehicles into Utility Grid: An Efficient Approach for Impact Analysis and Power Quality Assessment”, Sustainability, 2021, 13(19).

[23] “EIA’s Hourly Electric Grid Monitor provides timely data about electricity usage patterns”, U.S. Energy Information Administration, 2020. Available online: https://www.eia.gov/todayinenergy/detail.php?id=46117.

[24] “EV WATTSBi-Annual Activity Update”, Energetics, 2023. Available online: https://www.clearesult.com/sites/default/files/2024-05/EVWATTS_EVSE_National.pdf.

[25] E. Pritchard, B. Borlaug, F. Yang, J. Gonder, “Evaluating Electric Vehicle Public Charging Utilization in the United States using the EV WATTS Dataset”, 36th Electric Vehicle Symposium and Exposition (EVS36), 11-14 June 2023, Sacramento, California. Available online: https://docs.nrel.gov/docs/fy24osti/85902.pdf.

[26] B. Borlaug, S. Salisbury, M. Gerdes, M. Muratori, “Levelized Cost of Charging Electric Vehicles in the United States”, Joule, 2020, 4(7), pp. 1470-1485.

[27] M. Harding, S. Sexton, “Household Response to Time-Varying Electricity Prices”, Annual Review Resource Economics, 2017, 9, pp. 337-359.

[28] “How many smart meters are installed in the United States, and who has them?”, U.S. Energy Information Administration, 2023. Available online: https://www.eia.gov/tools/faqs/faq.php?id=108&t=11.

[29] L. Fischer, F. Rupalla, S. Sahdev, A. Tanweer, “Exploring consumer sentiment on electric-vehicle charging”, McKinsey & Company, 2024.

[30] P. Hertzke, P. Schaufuss, P. Kampshoff, T. Möller, A. Smith, F. Rupalla, “New twists in the electric-vehicle transition: A consumer perspective”, McKinsey & Company, Tech. Rep., 2025.

[31] M. Porter, Competitive Advantage. New York: Free Press, 1998.

[32] P. Plötz, F. Sprei, “Variability of daily car usage and the frequency of long-distance driving”, Transportation Research Part D: Transport and Environment, 2021, 101.

[33] Y. Ge, C. Simeone, A. Duvall, E. Wood, “There's No Place Like Home: Residential Parking, Electrical Access, and Implications for the Future of Electric Vehicle Charging Infrastructure”, National Renewable Energy Laboratory, 2021.

[34] R. Zhang, N. Horesh, E. Kontou, Y. Zhou, “Electric vehicle community charging hubs in multi-unit dwellings: Scheduling and techno-economic assessment”, Transportation Research Part D: Transport and Environment, 2023, 120.

[35] J. Lenard, “High Five”, NACS Magazine, 2019.

[36] “Greenhouse Gas Emissions from a Typical Passenger Vehicle”, U.S. Environmental Protection Agency, 2025. Available online: https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle.

[37] "Save with Plug-In Electric Vehicle (PEV) Rate", AEPOhio, 2025. Available online: https://www.aepohio.com/clean-energy/electric-cars/plug-in-electric-vehicle-rate.

[38] "Time Advantage Rates", Alabama Power, 2025. Available online: https://www.alabamapower.com/residential/residential-pricing-and-rate-plans/time-advantage-rates.html.

[39] "EV Charging Prices", American Automobile Association, 2025. Available online: https://gasprices.aaa.com/ev-charging-prices.

[40] P. Burwell, "How to Use the Duke Energy EV Charger Rebate to Charge at Home for Less", Qmerit, 2025. Available online: https://qmerit.com/blog/duke-energy-ev-charger-rebate.

[41] "Rate Plan: Smart Usage", Georgia Power, 2025. Available online: https://www.georgiapower.com/residential/rate-plans/smart-usage.html.

[42] "Idaho Time of Use Plan", Idaho Power, 2025. Available online: https://www.idahopower.com/accounts-service/understand-your-bill/pricing/idaho-pricing/time-use-plan.

[43] "Rate plans", PG&E, 2025. Available online: https://www.pge.com/en/account/rate-plans.html.

[44] "Time-of-Use Program", PPL Electric Utilities, 2025. Available online: https://www.pplelectric.com/site/Ways-to-Save/Rates-and-Shopping/Time-of-Use-Plan.

[45] "Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector", U.S. Energy Information Administration, 2025. Available online: https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

[46] "ENERGY STAR Certified Electric Vehicle Chargers AC", Energy Star, 2026. Available online: https://www.energystar.gov/productfinder/product/certified-evse-ac-output/results.

[47] C. Nelder, E. Rogers, "Reducing EV Charging Infrastructure Costs", Rocky Mountain Institute, 2019.

[48] "Home ev chargers", Amazon, 2025. Available online: https://www.amazon.com/s?k=home+ev+chargers&ref=sr_nr_p_rag_integrated_qb_1.

[49] "Charge forward with ChargePoint Home Flex", ChargePoint, 2025. Available online: https://www.chargepoint.com/drivers/home.

[50] "Emporia Pro Level 2 EV Charger", Emporia, 2025. Available online: https://shop.emporiaenergy.com/products/emporia-pro-ev-charger.

[51] "Universal Wall Connector", Tesla, 2025. Available online: https://shop.tesla.com/product/universal-wall-connector.

[52] "Pulsar Plus", Wallbox, 2025. Available online: https://wallbox.com/en_us/pulsar-plus-ev-charger.

[53] S. Stephen, K. Chu, J. Smart, "Breakdown of Electric Vehicle Supply Equipment Installation Costs. Report INL/RPT-22-68598", Idaho National Laboratory, 2022.

[54] "U.S. single-family homes - statistics & facts", Statista, 2025. Available online: https://www.statista.com/topics/5144/single-family-homes-in-the-us.

[55] "Housing Leases in the U.S. Rental Market", U.S. Bureau of Labor Statistics, 2022. Available online: https://www.bls.gov/spotlight/2022/housing-leases-in-the-u-s-rental-market/home.htm.

[56] "Average length of vehicle ownership in the United States in 2006 and 2016, by vehicle type (in months)", Statista, 2025. Available online: https://www.statista.com/statistics/581017/average-length-of-vehicle-ownership-in-the-united-states-by-vehicle-type.

[57] "CPS Historical Geographic Mobility/Migration Graphs", Census Bureau, 2024. Available online: https://www.census.gov/library/visualizations/time-series/demo/historic.html.

[58] "EV Charging Rebates in Your State", Qmerit, 2025. Available from: https://qmerit.com/locations.

[59] "Expedited Permitting Process for Electric Vehicle Charging Stations (EVCS)", Pleasant Hill, 2025. Available online: https://www.phillca.gov/1522/Electric-Vehicle-Charging-Stations-EVCS.

[60] "Permitting and Site Selection Strategies for EV Charging Infrastructure", Joint Office of Energy and Transportation, 2024. Available online: https://driveelectric.gov/files/u/webinar/38/presentation_upload/Permitting%20and%20Site%20Selection.pdf?4a2e94b8c2.

[61] "Charger Installation: Relax and Recharge", Los Angeles Department of Water and Power, 2025. Available online: https://www.ladwp.com/residential-services/programs-and-rebates-residential/electric-vehicles/charger-installation.

[62] "Mandatory Electric Vehicle (EV) Charger Building Standards", Alternative Fuels Data Center of the U.S. Department of Energy's Vehicle Technologies Office, 2022. Available online: https://afdc.energy.gov/laws/11068.

[63] "Sean Duffy Sworn In as Secretary of U.S. Department of Transportation and Takes Immediate Action to Make Cars More Affordable", U.S. Department of Transportation, 2025. Available online: https://www.transportation.gov/briefing-room/sean-duffy-sworn-secretary-us-department-transportation-and-takes-immediate-action.

[64] "Global EV Outlook 2020", IEA, 2020. Available online: https://www.iea.org/reports/global-ev-outlook-2020.

[65] "Solar Panel Cost Breakdown", Tesla, 2025. Available online: https://www.tesla.com/learn/solar-panel-cost-breakdown.

[66] Z. Shahan, "Tesla Had 46% of US EV Market in 2025 (Down from 49% in 2024) — GM 13%, Ford 7%", CleanTechnica, 2026. Available online: https://cleantechnica.com/2026/02/04/tesla-had-46-of-us-ev-market-in-2025-down-from-49-in-2024-gm-13-ford-7.