Exploring the potential of bidirectional charging in residential buildings in Germany and Brazil with a simulation tool

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Abstract

This study analyses the potential of Vehicle-to-Home (V2H) systems in Germany and Brazil, focusing on their effects on residential self-consumption, self-sufficiency, electricity costs, and CO_2 emissions. The main contribution of this work lies in the development of a novel simulation tool and methodological approach that harmonizes high-resolution hourly time-series data for household demand, photovoltaic (PV) generation, stationary battery storage, and bidirectional electric vehicle charging across different national contexts. It is important to note that the results strongly depend on input assumptions, such as driving patterns, which in this study include very specific profiles. Since the pandemic, the rise in home office workers – who often benefit the most from having a "battery on wheels" – has significantly changed mobility behaviors.

Preliminary results show that V2H can enhance household energy autonomy, though the extent of benefits differs between the two countries. In Brazil, under reference conditions, household self-sufficiency increases by around 6%, while in Germany it increases by around 5%. Higher electricity prices in Germany result in stronger economic impacts. Seasonal and daily analyses further illustrate how performance varies with solar availability and demand patterns, revealing key technical factors that determine V2H viability. The findings underline that V2H can contribute to more resilient and sustainable residential energy systems, while its large-scale adoption will depend on supportive regulatory and market frameworks.

Keywords: battery electric vehicle, bidirectional charging, vehicle-to-home, simulation tool residential buildings, self-sufficiency, photovoltaics

1. Introduction

The global energy transition is characterized by the simultaneous decentralization and decarbonization of the electricity and transport sectors. A key driver of this shift is the rapid electrification of road transport, facilitated by advancements in battery electric vehicle (BEV) technology. Global BEV sales have surged from two million in 2020 to over ten million in 2024, reflecting an average annual growth rate of nearly 49% (Wicke & Jung, 2025). At the same time, residential energy systems are becoming more interconnected, flexible and sustainable thanks to smart home technologies, advanced metering infrastructure and distributed renewable generation, such as small-scale photovoltaic (PV) systems. These developments have turned households into 'prosumers', capable of producing and consuming their own energy (Luthander et al., 2015).

With their large battery capacities and extended home parking times, BEVs represent a significant and largely untapped source of flexible storage capacity. In Germany, for example, the cumulative battery capacity of BEVs is estimated at around 80 GWh, which is double the country's total pumped hydro storage capacity (Schmidt et al., 2023). Vehicle-to-Home (V2H) technology enables bidirectional energy flows between households and BEVs, enabling electric vehicles to act as temporary energy storage units. By increasing PV self-consumption, V2H systems can enhance residential self-sufficiency, reduce reliance on grid electricity, lower household electricity costs and decrease CO_2 emissions – especially in regions with high grid carbon intensity.

10.18086/swc.2025.06.20 Available at http://proceedings.ises.org

The effective use of V2H requires advanced digital control systems, such as Home Energy Management Systems (HEMS), to optimize self-consumption of self-generated energy based on economic and technical objectives (Schnabel, 2020). The performance and benefits of V2H depend heavily on the context and are shaped by factors including electricity price structures, solar resource availability, regulatory frameworks and consumer behavior.

The following section provides an overview of the current state of research and pilot projects on V2H systems. This section summarizes key findings from recent pilot projects and simulation-based studies examining the technical feasibility and economic potential of V2H systems in residential contexts.

Pilot Projects on V2H in Germany: Empirical investigations from German pilot projects provide valuable insights into real-world performance and benefits of V2H applications.

- **Bidirectional Charging Management (BDL)** (M. Müller et al., 2023): The model involved households with rooftop PV, a bidirectional EVSE (11 kW) and BEVs (38–60 kWh). Controlled one-way charging increased annual revenues by €140–€230, whereas full V2H added €10–€430. V2H increased PV self-consumption from 23% to 65%, as well as optimisation revenue from €200 to €300. Higher returns were achieved with larger PV systems and non-commuter households, while heat pumps and stationary batteries reduced revenues by 40–50%. Reduced feed-in tariffs enhanced V2H benefits.
- **Bi-clEVer** (E.ON SE, 2023): Compared conventional charging to combined V2H and vehicle-to-grid (V2G) in single-family homes with 42 kWh BEVs. The combined applications saved households up to €920 per year, of which €420 came from V2H alone. Self-sufficiency was 51% without stationary batteries and increased to 59% with them.

Simulation Studies Quantifying V2H Benefits: Several simulation studies complement pilot project data by projecting the broader technical and economic impacts of V2H under varying contexts and assumptions.

- **Potential of a Full EV Power System Integration in Europe** (Kühnbach et al., 2024): Across six EU countries, PV-optimized charging reduced electricity costs by 16–31%. Bi-charging provided an additional reduction of 4–9% (up to €250 in savings). Self-sufficiency gains varied geographically.
- **Bidirectional Charging – Status, Trends, and Potential** (Wille-Haussmann et al., 2023): Year-long simulations for German households showed that the benefits of V2H increased with PV size, improving self-sufficiency by 2–5 percentage points. Daytime occupancy increased absolute self-consumption. However, bidirectional charging was more expensive than unidirectional charging for smaller PV sizes.
- **Energy Management in Households with Smart Technologies** (Rehm, 2024): In a German single-family home, V2H increased self-sufficiency from 47% to 52%, albeit with a slight reduction in PV self-consumption. V2H power limits maximized the benefits, while the size of the BEV battery had a limited impact. Parking availability and control strategies had a significant influence on outcomes.

The reviewed literature demonstrates that V2H technologies significantly enhance residential energy self-sufficiency and reduce electricity costs, especially in non-commuter households with larger PV systems. Pilot projects report self-sufficiency gains ranging from 23% to 65% and annual savings up to €600, with further increases to over €900 when combined with V2G services. Economic viability varies depending on system design, local tariff structures, and the presence of other flexible assets like heat pumps or stationary batteries, which can reduce revenue potential by up to 50%. Key factors influencing V2H effectiveness include EV charging power, control strategies, parking availability, and dynamic tariffs that benefit daytime EV availability. Battery capacity has a limited impact. Overall, these findings underscore the promising role of V2H as part of future decentralized energy systems, conditioned on favourable configurations and market conditions.

This study investigates the potential of V2H technology in two contrasting countries, Germany and Brazil, which have significant differences in their energy markets, regulatory environments, infrastructure maturity and climatic conditions. Representative datasets from both countries are used to conduct simulations evaluating V2H scenarios, with a focus on seasonal and daily self-sufficiency dynamics. This research is novel in its cross-country comparative approach, which provides insights into operational differences and the potential for optimizing V2H in diverse contexts. The results are intended to inform policymakers, grid operators and technology developers, and contribute to the wider discourse on distributed energy resources (DER) and the integration of BEVs in future smart grids. Ultimately, they will support the global transition towards a sustainable and resilient energy future.

2. Material and Methods

This study adopts a comparative, simulation-based approach to evaluate the technical and economic potential of V2H systems in contrasting regional contexts, focusing on: Germany and Brazil. To capture the influence of differing PV generation profiles, household electricity consumption patterns and BEV mobility behaviors, a deterministic, bottom-up modelling framework was developed. The simulation uses hourly time-series data over a full calendar year to dynamically calculate electricity flows between PV generation, household demand, stationary battery energy storage systems (BESS) and bidirectional BEV charging.

The simulation model integrates key technical parameters, including storage capacities, charging power limits, round-trip efficiencies and operational constraints, such as state-of-charge (SoC) boundaries. Implemented through a Python-based computation engine, it ensures efficiency and flexibility. It is accompanied by Excel tools for scenario management, parameter configuration, and result visualization. This combined architecture supports transparency and reproducibility and allows adaptation to diverse boundary conditions.

Reference households were constructed for each country using representative empirical datasets. The household load profiles reflect seasonal and daily variability, as measured in situ. Meanwhile, PV generation was modelled using location-specific irradiance data, in order to account for regional solar potential. This is characterized by seasonal variations in Germany, as opposed to abundant year-round solar resources in Brazil (Enio Bueno Pereira et al., 2017). BEV parameters include typical battery capacities, charging behaviors, parking durations and daily driving distances to ensure a realistic representation of vehicle availability for V2H operation. System components such as PV arrays, BESS, BEVs and charging infrastructure were parameterized based on current technological benchmarks and literature. For both countries, the reference configurations assumed 10 kWp PV systems.

Market and regulatory frameworks were explicitly incorporated into the modelling scenarios. In Germany, the Renewable Energy Act sets fixed feed-in tariffs and retail electricity prices are comparatively high, providing strong incentives for maximizing self-consumption (T. Müller, 2012). In contrast, Brazil employs a net metering scheme whereby exported electricity offsets consumption, although grid usage charges are gradually being introduced (Vieira et al., 2016). Together with solar resource contrasts, these frameworks shape the operational and economic dynamics of V2H and were systematically embedded in the scenario design.

To ensure robustness and validity, the outputs of the simulations were cross validated against empirical data. Sensitivity analyses were conducted to explore the impact of variations in battery size for BEVs, household electricity demand, PV generation and charging behavior on V2H performance metrics. The study focuses on detailed analyses of seasonal and daily fluctuations in self-sufficiency, moving beyond aggregate annual assessments to provide a nuanced understanding of V2H dynamics under diverse climatic, economic and regulatory conditions.

Figure 1 illustrates the key input data and model components. The left side of the illustration shows the schematic structure of the integrated system, which comprises PV generation, household consumption, BESS and BEV. Each component is defined by specific technical specifications, such as resolution, capacity, charging power and operational limits. The right side of the illustration shows compares key household characteristics in Germany and Brazil, including number of occupants, annual electricity demand, BEV energy consumption and installed PV. These parameters provide a basis for evaluating the contribution of energy storage and e-mobility to residential systems in these two regions, see further details on the system in the appendix Table 3.

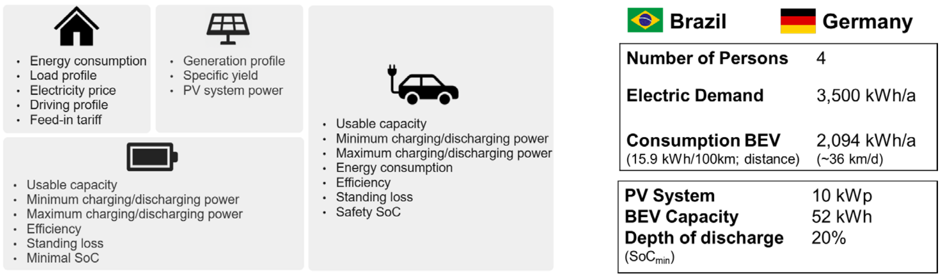

Figure 1: Data used as input for the simulation tool and reference house.

2.1 Household Assumptions

For comparability, the simulations consider single-family households with an annual electricity consumption of 3,500 kWh in both Germany and Brazil, even though the average consumption in Brazil is typically lower (around 2,300 kWh) (Agência de Notícias - IBGE, 2023; co2online gemeinnützige Beratungsgesellschaft mbH, 2025; Flavio Raposo de Almeida). Electric heating and cooling systems are excluded due to their low adoption rate in the reference scenarios. The household load profiles differ seasonally: Germany shows a summer peak in July and August, whereas Brazil experiences higher demand in January and has a more evenly distributed load throughout the year. Synthetic load profiles, generated using PV*SOL and based on regional data, were employed to reflect typical consumption patterns in both countries ("PV*SOL Premium 2025").

The resulting monthly distributions are illustrated in Figure 2, highlighting seasonal and behavioral differences in energy use between the two countries.

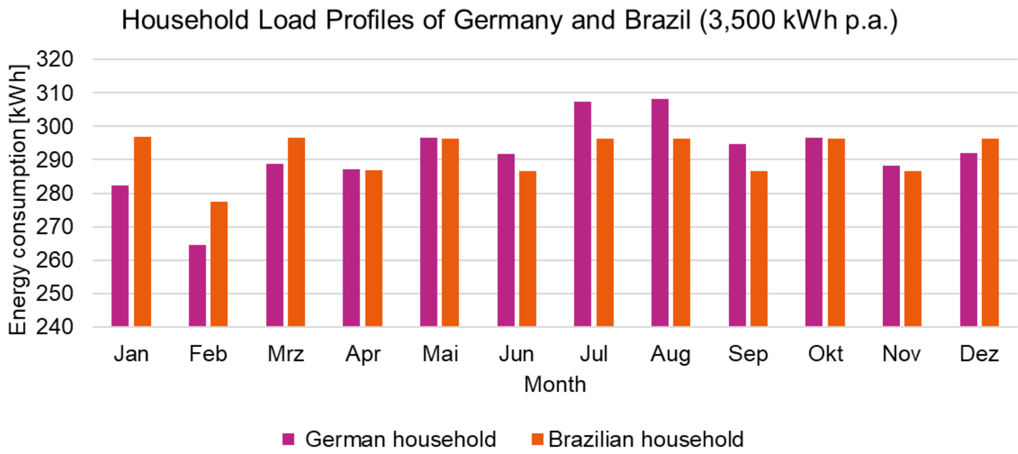

Figure 2: Household load profiles of Germany and Brazil (3,500 kWh p.a.).

2.2 PV System Assumptions

The annual specific PV yield varies significantly between Germany and Brazil due to differences in solar resource availability. Germany's specific yield ranges from approximately 900 to 1,300 kWh/kWp per year, with the highest values occurring near the Alpine foothills. Brazil benefits from substantially higher yields of between 1,300 and 1,800 kWh/kWp per year, particularly in its semi-arid north-eastern and central-western regions. For instance, a 10 kWp rooftop system in Florianópolis, Brazil, generates around 30% more electricity per year than an equivalent system in Cologne, Germany.

PV generation profiles for the V2H simulations were generated using *Renewables.ninja*, with fixed tilt angles optimised for each hemisphere (35° southward in Germany and northward in Brazil) and no tracking systems. This represents typical residential installations. Three PV capacity scenarios (7 kWp, 10 kWp and 13 kWp) were modelled to assess the impact of system size on self-consumption and self-sufficiency performance.

Figure 3 illustrates the resulting profiles for Germany and Brazil based on renewable ninja (Pfenninger & Staffell, 2025).

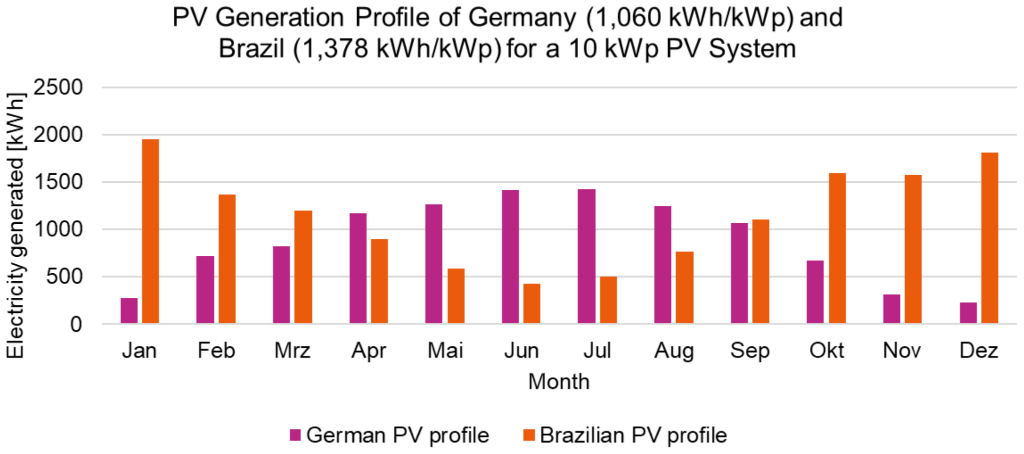

Figure 3: PV generation profile of Germany (1,060 kWh/kWp) and Brazil (1,378 kWh/kWp) for a 10 kWp PV system.

2.3 BEV Assumptions

To ensure consistency, both the German and Brazilian scenarios use the 2025 Volkswagen ID.3 as the representative BEV (Volkswagen AG, 2025). It has a usable battery capacity of 52 kWh and an estimated charging/discharging efficiency of 74.2%, derived from empirical round-trip efficiency data. The vehicle's standing loss is set at 200 W, with an average energy consumption of 15.9 kWh/100 km (Rudschies, 2022). Charging infrastructure (EVSE) limits differ due to grid configurations: Germany supports up to 11.0 kW bidirectional power via a three-phase grid, whereas Brazil's single-phase residential grids limit this to 7.4 kW. A minimum controllable power threshold of 500 W is applied in both countries based on demonstrated technical feasibility. A safety SoC cut-off at 20% ensures battery longevity by preventing deep discharge (Zecar, 2025).

Charging and discharging follow a PV-optimized control strategy: surplus solar energy first charges stationary batteries, then the BEV. During PV deficits, energy is first drawn from stationary storage, then the BEV and finally from the grid. This algorithm prioritizes instantaneous PV balance regardless of electricity price signals.

3. Results

This section provides a comparative analysis of the outcomes of simulations across multiple scenarios, including sensitivity analyses to evaluate the impact of parameters.

3.1 Features of the simulation

A detailed evaluation of baseline scenarios in Germany and Brazil is conducted using representative summer days and annual data. A time-based analysis is performed for both Germany and Brazil using two representative days: a summer day in Germany and a summer day in Brazil. All time values are provided at Coordinated Universal Time (UTC). For Germany, a uniform time zone of UTC+2 is applied across all simulations, corresponding to the daylight-saving time used in summer. In contrast, the Brazilian state of Santa Catarina follows UTC-3. Figure 4 shows the bidirectional power flows and SoC's of the reference scenario on July 15 in Germany.

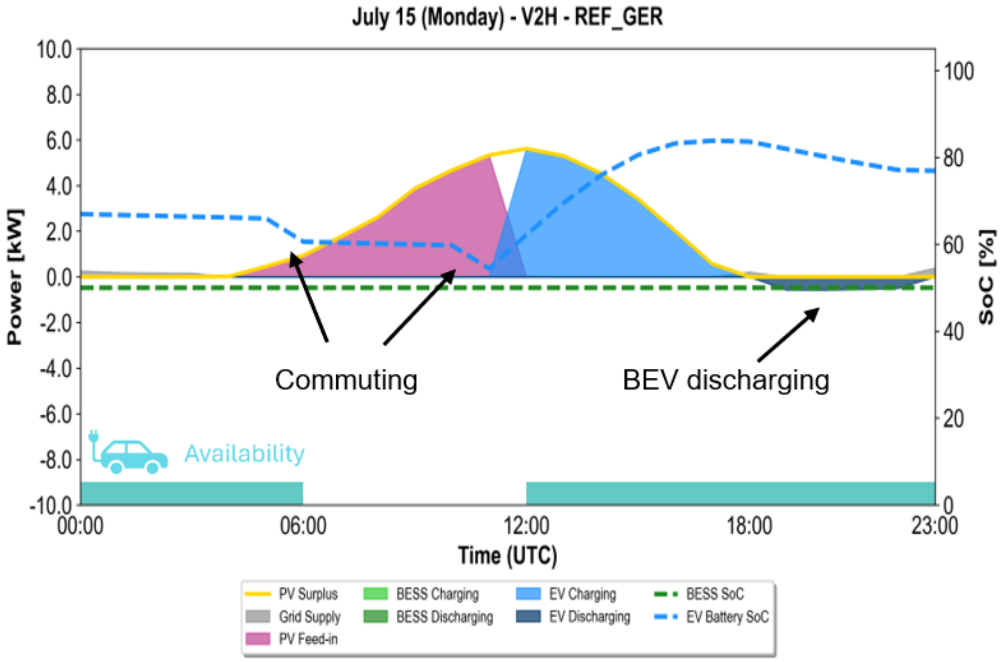

Figure 4: Power flows of a typical summer day of scenario REF_GER.

This Monday, the BEV is not available in the morning due to commuting and becomes available again around 12:00 UTC, corresponding to 2 p.m. local time. During the early hours, the household load is too low to activate discharging since the minimum discharging threshold of 500 W is not reached. During midday, PV generation is high and exceeds household demand, which leads to BEV charging when the BEV returned from work. The SoC increases significantly during PV surplus and decreases in the evening through discharging. Figure 4 illustrates the same type of analysis for January 15, a summer day in Brazil.

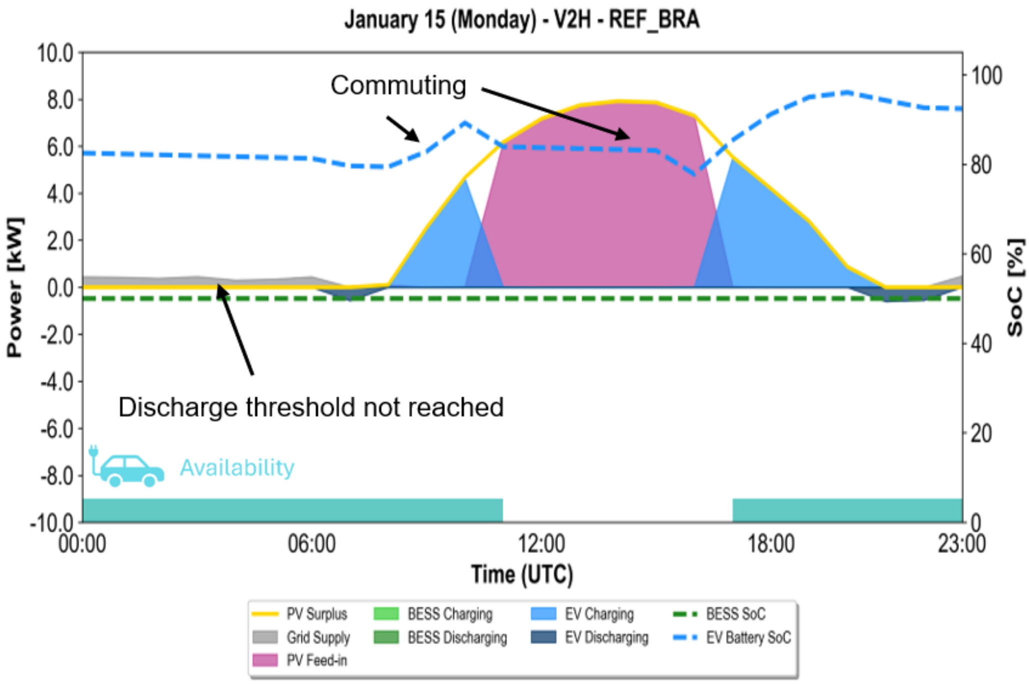

Figure 5: Power flows of a typical summer day of scenario REF_BRA.

On this representative January day in Brazil, the BEV remains connected to the household system until the beginning of the morning commute. During the night, household electricity demand stays mostly below the minimum discharging threshold of the BEV, which prevents any energy transfer from the vehicle battery to the household. With sunrise, increasing solar irradiance leads to PV surplus, which is primarily allocated to charging the BEV before it departs around 11:00 UTC.

After returning in the afternoon, the vehicle is again charged with solar surplus. The discharging phase is concentrated in the evening hours, when household demand is high and PV generation has already declined, resembling the German summer case. Nevertheless, the Brazilian profile differs by exhibiting higher and more stable solar generation throughout the day, which ensures that the BEV state of charge remains at comparatively higher levels and reduces the need for grid imports.

The following figures illustrate the temporal development of the BEV SoC over the course of one year. Both visualizations display the safety SoC threshold line, as well as the daily fluctuation of the BEV battery's actual SoC. Figure 6 shows the SoC pattern for Germany.

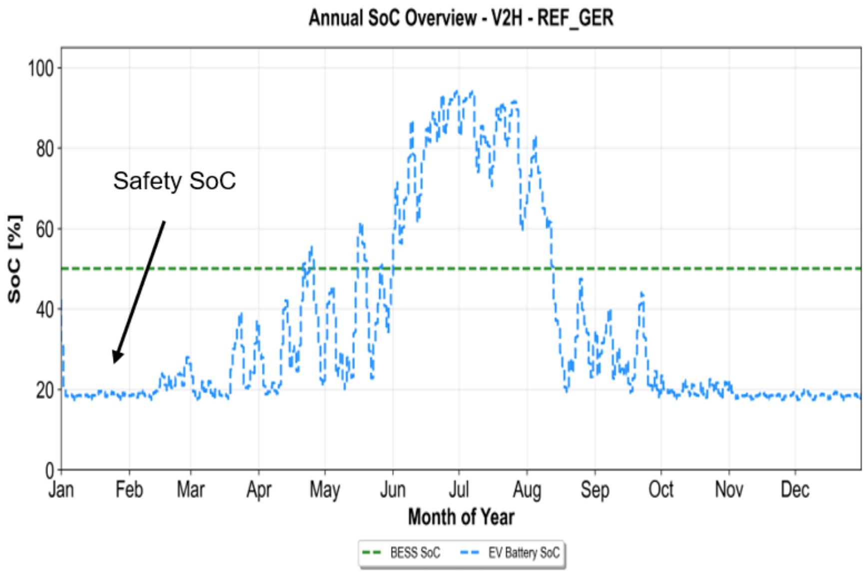

Figure 6: Annual SoC overview of scenario REF_GER.

During the winter and early spring months, the SoC remains close to the safety SoC, indicating limited solar energy availability. Starting in late April, the SoC increases significantly due to PV generation and remains consistently elevated throughout the summer. This reflects the improved capability of the V2H system to recharge the BEV battery and maintain a high SoC level. The values drop again in September, reaching lower levels during autumn and winter, in line with decreasing PV yields. Figure 7 illustrates the corresponding SoC development for the Brazilian context.

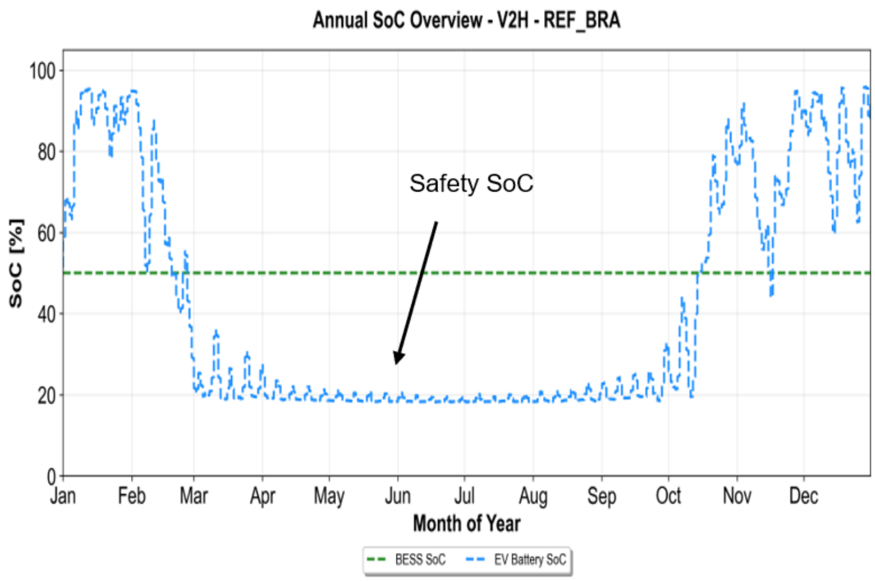

Figure 7: Annual SoC overview of scenario REF_BRA.

In contrast to Germany, the highest SoC values are observed in the months of December and January. A pronounced decline is visible from March through September, with the SoC remaining close to the safety threshold. The safety SoC is reached around June and July due to reduced PV generation. Toward the end of the year, SoC levels recover, driven by increased solar irradiation during the Southern Hemisphere's summer. Overall, both figures highlight the seasonal influence on the availability of solar energy and the BEV battery's operational state.

The simulation tool reproduces household energy flows with an hourly resolution. It takes into account PV generation, demand, BEV availability and system constraints. Representative day analyses illustrate typical charging and discharging patterns. In Germany, for example, a summer day shows that the BEV is recharged with midday PV surplus and discharged in the evening. In the winter months, however, the SoC remains close to the safety threshold due to low solar availability. In Brazil, higher and more stable irradiance enables consistent BEV charging throughout the year, maintaining a higher SoC even in the winter months. Annual SoC profiles confirm that Germany is characterized by strong seasonal fluctuations, whereas Brazil exhibits more balanced patterns with fewer critical periods near the minimum SoC. These results demonstrate that the model realistically represents both temporal system behaviour and technical constraints such as minimum discharging thresholds, efficiency losses, and commuting-driven availability.

3.2 Energy-related Key-Performance-Indicators

Based on the temporal profiles presented in the previous section, this section provides energy-related Key Performance Indicator (KPI) for the German and Brazilian reference scenarios. The evaluation is based on three charging strategies: uncontrolled unidirectional charging (UC), unidirectional PV optimized charging (UNI) and bidirectional V2H operation (REF).

Table 1 summarizes the core KPIs that serve as a quantitative basis to assess the energy-related benefits of each charging strategy.

Table 1: Energy-related KPIs for different charging strategies in the German scenarios.

KPIs for German households	Uncontrolled unidirectional charging	Unidirectional charging	Bidirectional charging (REF_GER)
Self-consumption rate	32%	43%	48%
Self-sufficiency rate	24%	57%	62%
PV feed-in	7,259 kWh	6,013 kWh	5,545 kWh
Grid import	4,248 kWh	2,429 kWh	2,112 kWh
Full load cycles of the BEV	40	40	49
V2H operation hours per day	0	0	2.3

Both the self-consumption and self-sufficiency rates increase significantly as the charging strategy becomes more advanced. A comparison of the results shows that unidirectional charging, which is optimized for PV self-consumption, has a greater impact on both indicators than the additional implementation of the V2H functionality. While the transition from uncontrolled to unidirectional charging leads to substantial improvements, the subsequent shift to bidirectional charging results in only moderate additional gains. Specifically, the self-consumption rate and the self-sufficiency rate increase by only 5 pp when moving from unidirectional to bidirectional operation. The results for Brazil show a similar pattern, as shown in Table 2.

Table 2: Energy-related KPIs for different charging strategies in the Brazilian scenarios.

KPIs for Brazilian households	Uncontrolled unidirectional charging	Unidirectional charging	Bidirectional charging (REF_BRA)
Self-consumption rate	**20%**	**31%**	**34%**
Self-sufficiency rate	**13%**	**50%**	**56%**
PV feed-in	11,059 kWh	9,570 kWh	9,151 kWh
Grid import	4,870 kWh	2,775 kWh	2,488 kWh
Full load cycles of the BEV	40	40	47
V2H operation hours per day	0	0	1.5

Compared to uncontrolled charging, unidirectional charging increases the self-consumption rate by approximately 11 pp and the self-sufficiency rate by 37 pp. When switching from unidirectional charging to V2H operation, the self-consumption rate increases slightly from 31% to 34% and the self-sufficiency rate rises from 50% to 56%. Analogous to the German case, the most substantial improvements in energy-related KPI indicators are already achieved through smart unidirectional charging, as also illustrated in Figure 8.

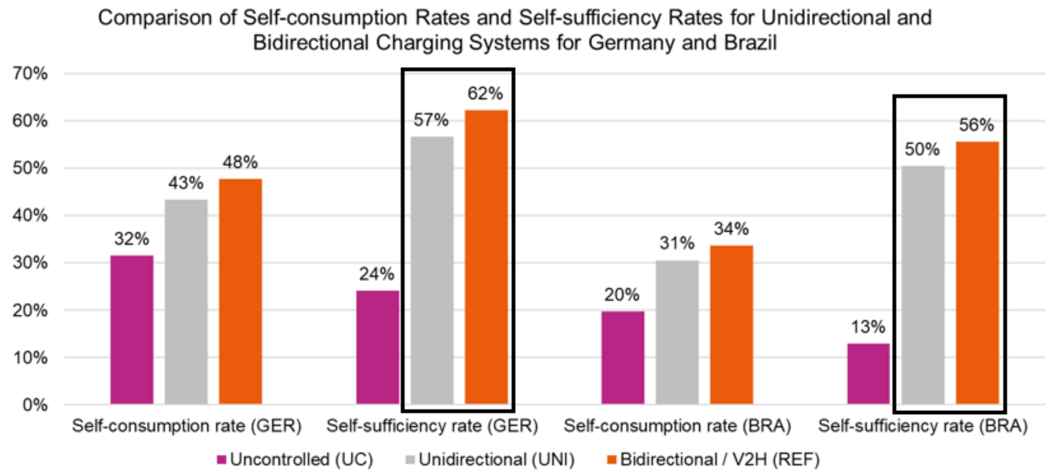

Figure 8: Comparison of self-consumption rates and self-sufficiency rates for unidirectional and bidirectional charging systems for Germany and Brazil.

Overall, both the self-consumption rate and the self-sufficiency rate are significantly higher in Germany than in Brazil across all charging configurations. In both countries, the integration of V2H systems leads to further, yet comparatively moderate, improvements in performance.

These results confirm that although unidirectional charging already provides a substantial benefit in terms of energy independence and local consumption, bidirectional systems can further enhance household energy autonomy, especially under high solar generation and stable demand profiles.

3.2 Scenarios (Sensitivities)

The technical sensitivity analysis is based on the German reference scenario (REF_GER) and evaluates the influence of three parameters: minimum and maximum charging/discharging power of the EVSE and the charging/discharging efficiency of the BEV. Each parameter varies in a range from -100% to +100% relative to its base value. The self-sufficiency rate was then recalculated for each variation to determine the relative change compared to the reference scenario. It is assumed that the sensitivities for Brazil follow a similar pattern to those observed in the German reference scenario and are therefore not examined.

Figure 9 illustrates the results of the sensitivity analysis. The horizontal axis shows the percentage variation of each parameter, while the vertical axis represents the resulting percentage change in the self-sufficiency rate compared to the baseline value. Positive values indicate an increase in self-sufficiency, while negative values represent a decrease.

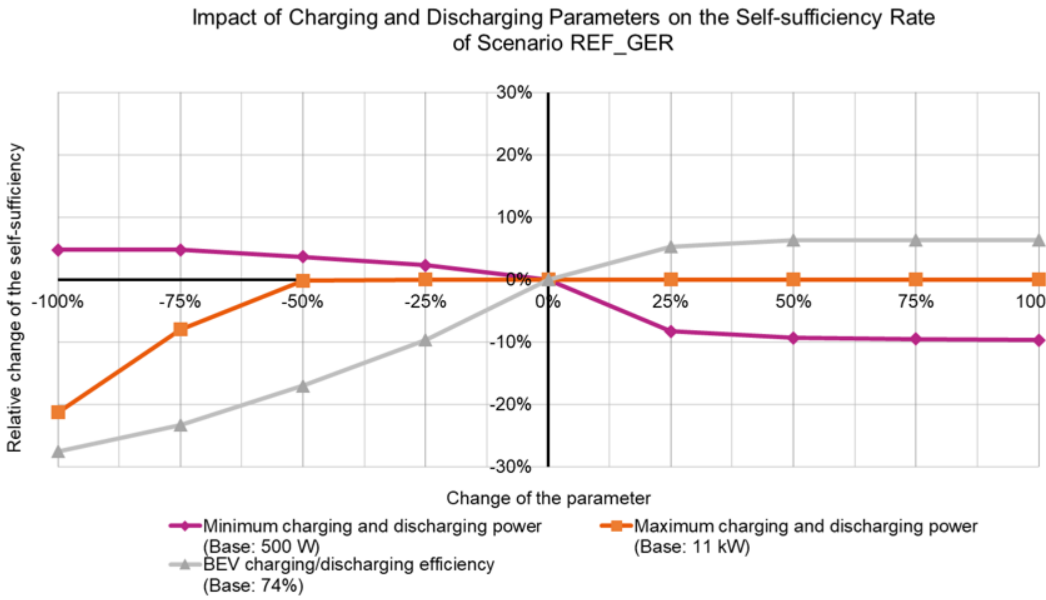

Figure 9: Impact of charging and discharging parameters on the self-sufficiency rate for scenario REF_GER.

4. Discussion

The results of this study are broadly consistent with those of existing pilot projects and modelling approaches, confirming the simulation framework's plausibility. Reported self-consumption and self-sufficiency levels are in line with those of the Bidirectional Charging Management (BDL) project.

In the Bi-clEVer field study, the additional gains from V2H were found to be somewhat lower in the present analysis than with smart unidirectional charging. While the BDL project recorded an increase of up to 20 percentage points, this study found more modest improvements between 3 and 5%. These discrepancies can be attributed to methodological differences, including assumptions relating to household load, the size of the PV system and traction energy management.

The sensitivity analysis shows that the effectiveness of V2H is particularly influenced by household mobility, PV system size and the availability of stationary storage. Driving profiles significantly impacts self-sufficiency: households with home offices can increase it by up to 10%, whereas full-time commuters experience a reduction of over 20%. The effects are more pronounced in this study because the model assumes a constant annual household demand across different mobility scenarios. Additionally, integrating stationary storage reduces the vehicle battery's contribution to self-sufficiency, consistent with other project results.

Three further key findings relate to the parameters of the charging process. Reducing the minimum charging/discharging power of the charging station allows for greater flexibility in partial charging and increases self-sufficiency by up to 5%. Conversely, increasing this threshold by 25% leads to a decline of around 10%, as surplus PV energy can no longer be stored in the vehicle. The efficiency of the charging/discharging process also has a significant impact: improving efficiency reduces losses and increases self-sufficiency by up to 6%, but no further improvements are possible beyond a theoretical upper limit of 100%. Decreasing efficiency can lead to losses of up to 28%, highlighting the importance of high-quality electronics and low-loss bidirectional systems. However, maximum charging and discharging power has little effect on self-sufficiency as this value is rarely reached in a residential environment.

Overall, the results show that improving energy conversion and enabling more flexible operation at low power levels are significantly more effective than increasing peak power capacity in terms of achieving self-sufficiency through V2H.

5. Conclusion

In conclusion, this study has advanced the integration of renewable energy by investigating the potential of V2H systems in residential properties in Germany and Brazil. The main contribution of this paper lies in the methodological approach and the development of a simulation tool that harmonizes representative datasets and enables systematic cross-country comparisons. It is important to emphasize that the results depend to a large extent on the input assumptions, such as driving habits. These can be very specific; for example, the time of day that assumed commuter's drive. Notably, recent societal changes following the pandemic, including the growing prevalence of home office, have altered mobility patterns significantly. This demographic particularly benefits from V2H systems by effectively having a "battery on wheels" available, underscoring the relevance of adapting models to reflect evolving user behaviors.

The simulation tool allowed for the analysis of the impact of bidirectional charging on household self-sufficiency, electricity costs, and CO_2 emissions. The results demonstrate that V2H systems can enhance energy autonomy in both countries, particularly in households with high PV penetration and favorable driving profiles. However, the extent of the benefits depends on contextual factors such as solar availability, electricity pricing schemes, regulatory frameworks, and mobility patterns. While Brazil's high solar potential enables longer periods of self-sufficiency, Germany's higher electricity prices and falling feed-in tariffs make a strong economic case for V2H adoption. The findings emphasize the growing importance of the residential sector as an interface between electricity, heat, and mobility. Future research should refine the analysis of seasonal and weekday-specific patterns to capture the short-term dynamics of household operations, particularly considering the ongoing shifts in work and mobility behavior.

Overall, the proposed methodology can be transferred across national contexts to support policymakers and technology developers in assessing the role of V2H in advancing sustainable and resilient energy systems.

6. Acknowledgments

This work was supported by the PROBRAL international cooperation program, fostering a collaborative exchange between the University of Applied Sciences Cologne and the Universidade Federal de Santa Catarina (UFSC). The partnership was funded by the Brazilian Federal Agency for Support and Evaluation of Graduate Education, under the Ministry of Education of Brazil (CAPES) and the German Academic Exchange Service (DAAD). Amanda Mendes Ferreira Gomes acknowledges CAPES for a Ph.D scholarship.

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8. Appendix

Table 3: Appendix - Input Parameters of the reference scenarios.

Input parameter	Reference Germany (REF_GER)	Reference Brazil (REF_BRA)
Type of household load profile	German household load	Brazilian household load
Energy consumption household	3,500 kWh	3,500 kWh
Heat pump	off	off
Electricity price	€0.41/kWh	€0.11/kWh
Feed in tariff	€0.0811 /kWh	/
Net metering charge	/	30% TUSD-Fio B charges
Emission factor of electricity mix	363 g CO_2e/kWh	103 g CO_2e/kWh
Driving profile	Part-time	Part-time
Type of PV profile	German PV profile	Brazilian PV profile
Specific yield of the location	1,060 kWh/kWp	1,378 kWh/kWp
PV power of simulation	10 kWp	10 kWp
EVSE minimum charging/ discharging power	500 W	500 W
EVSE maximum charging/ discharging power	11.0 kW	7.4 kW
Usable BEV capacity	52 kWh	52 kWh
BEV charging/discharging efficiency	74%	74%
BEV standing loss	200 W	200 W
BEV Safety SoC	20%	20%
BEV Energy consumption	15.90 kWh/100 km	15.90 kWh/100 km