Analysis of the Wider Aggregated Electric Vehicles Utilisation in Electricity Markets - Finnish Case Study

Author(s): Solomon, A. A.; Laaksonen, Hannu; Karimi, Mazaher; Enell-Nilsson, Mona

Title: Analysis of the Wider Aggregated Electric Vehicles Utilisation in Electricity Markets - Finnish Case Study

Year: 2026

Version: Accepted manuscript

Please cite the original version:

Solomon, A. A., Laaksonen, H., Karimi, M., & Enell-Nilsson, M. (2026). Analysis of the Wider Aggregated Electric Vehicles Utilisation in Electricity Markets - Finnish Case Study. In *2026 22nd International Conference on the European Energy Market (EEM),* 1-6. IEEE. https://doi.org/10.1109/EEM68581.2026.11589901

Analysis of the Wider Aggregated Electric Vehicles Utilisation in Electricity Markets - Finnish Case Study

Solomon A. A.[1], Hannu Laaksonen[1], Mazaher Karimi[1], Mona Enell-Nilsson[2]
[1]University of Vaasa, School of Technology and Innovations, Vaasa, Finland, solomon.asfaw@uwasa.fi
[2] University of Vaasa, School of Marketing and Communication, Wolffintie 32, 65200 Vaasa, Finland, moen@uwasa.fi

***Abstract*—The accelerating adoption of electric vehicles (EVs) offers significant potential for supporting electricity markets. This study integrates a heuristic modeling tool with a revenue estimation model to evaluate EV contributions in the Finnish electricity markets for 2025 and 2030. The heuristic model determines the number of EVs required to provide three key balancing products—FCR, aFRR, and mFRR—under varying flexibility levels including wholesale-participation, accounting for consecutive-hour charging and discharging patterns. Results demonstrate that secure supply over extended periods depends on these temporal patterns, with EV capacity requirements fluctuating by product and ramping direction. Introducing flexibility via participation in wholesale markets reduces the necessary EV fleet for year-round supply. The estimated revenue shows that profitability depends on bi-directional EV-charger cost, vehicle type, and operational flexibility. Policy interventions, particularly promoting bi-directional chargers, are critical to unlocking EV-flexibility. Without such measures, substantial EV-based resources remain untapped by 2030, despite projected market growth.**

***Index Terms*—Vehicle-to-everything, EV flexibility, balancing market, wholesale market, revenue potential**

I. INTRODUCTION

The global EV market is expanding rapidly and is projected to grow further throughout the 2030s. In 2025, EV sales in the Nordic countries—among the fastest-growing EV markets—exceeded 60% of new vehicle sales[1]. This accelerated adoption has intensified interest in the potential role of EVs within the broader economy, particularly as providers of Vehicle-to-Everything (V2X) services[2], [3], [4]. The battery flexibility of EVs is increasingly regarded as a critical asset for advancing renewable energy integration and the development of smart grid systems.

Aggregated EVs represent one of the most significant emerging flexibility resources in modern electricity markets, transforming dispersed individual batteries into a virtual storage unit capable of delivering energy and balancing services[5]. This flexibility manifests primarily through demand response—where charging is optimized in response to electricity price fluctuations—and Vehicle-to-Grid (V2G) services, which require bi-directional charging capability. While the exploitation of demand response potential remains at an early stage, V2G applications are largely confined to pilot projects and continue to face substantial technical, economic, and regulatory barriers.

Existing research on EV participation in electricity markets, particularly in the context of V2X, identifies multidimensional constraints spanning technical, economic, regulatory, market, and social domains[2], [4], [6], [7]. Addressing these complex challenges necessitates coordinated and adaptive policy interventions if V2X is to achieve meaningful short-term impact. Concurrently, much of the literature models EV aggregators' market participation—most frequently in frequency regulation markets—by representing aggregated EVs as stochastic demand rather than as virtual storage assets[8], [9], [10], [11]. These analyses often rely on limited historical charging datasets that do not reflect current adoption levels, thereby constraining assessment of large-scale participation risks. Moreover, delays in V2X deployment and slow policy responses risk exacerbating power system challenges, rather than leveraging V2X capabilities for systemic and stakeholder benefit [12].

This paper integrates multiple analytical tools and datasets to examine the large-scale integration of aggregated EVs into electricity markets. Using Finland as a case study, it evaluates the alignment between EV adoption rates, aggregator-based flexibility—including V2X—and immediate system-level demand. Specifically, the study addresses the following research questions: What EV capacity is required to deliver specified frequency control related services? How does the development of EV flexibility potential influence optimal utilization? What are the principal shortcomings of current policy measures in supporting short-term flexibility

This project has received funding from the Nordic Energy Research Grand Solutions Programme under project number 174998.

deployment? Which factors determine potential revenue streams?

By systematically investigating these questions, the study aims to clarify the strategic role of aggregated EV fleets in modern electricity markets and to provide evidence-based insights for policymakers, market designers, and industry stakeholders.

II. METHODOLOGY

This paper examines the potential of large-scale aggregated electric vehicles (EVs) to provide balancing services in the Finnish electricity market, while retaining flexibility to participate in the wholesale market. Existing studies are predominantly small-scale, typically focus on bidding into specific markets or assessing feasibility, and often employ complex vehicle-level mathematical formulations that require high-performance computational resources[9], [10], [11], [13], [14]. Moreover, EVs are frequently modeled as stochastic demand, disregarding the storage characteristics of their batteries, and existing approaches generally lack the capacity to evaluate how the provision of specific products affects overall EV flexibility.

This study models the capabilities of large-scale EV aggregation to capture the combined effects of multiple vehicles. A heuristic modeling framework is implemented for the balancing market to estimate the EV capacity required to supply activated Automatic Frequency Restoration Reserve (aFRR), Frequency Containment Reserve for Disturbances (FCR-D), and manual Frequency Restoration Reserve (mFRR) under varying conditions. Figure 1 illustrates the typical characteristics of balancing products for the frequency control in the Nordic electricity market. The following section outlines the principal methodological steps and describes the types and sources of data employed in this research.

Products/ Processes	Ramp direction	Fast Frequency reserve	Frequency containment Process		Frequency Restoration Process	
Automatic Products	Up ward	FFR	FCR-D	FCR-N	aFRR	
	Down ward		FCR-D	FCR-N	aFRR	
Manual Products	Up ward					mFRR
	Down ward					mFRR
Response Time (Full capacity)		5 Seconds		5 Minutes		12.5 minutes
Minimum Bidding requirement		0.1 MW	1 MW	1 MW	1 MW	1 MW
Purpose of the product		Assist in the frequency containment process.	Stablize frequency after disturbance, when frequency goes below 49.9 or above 50. 1 Hz.	Maintains frequency in the normal range, 49.9 - 50. 1 Hz.	FRR brings frequency back to 50 Hz after frequency deviation, particularly when deviation is lar ge and approaches 49.5 0r 50.5 Hz.	
Remark	FFR is procured as an upward only and activated when FCR-D is not sufficient to contain frequency deviation in order to prevent low frequency load shading. All other products are procured both as upward and down ward simultaneously.					

Fig. 1. Characteristics of Finnish balancing market products, modified[15].

A. *Finnish EV market and it projection*

Driven by supportive policy frameworks, the uptake of electric vehicles (EVs)—including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PhEVs)—in Finland has increased markedly over the past decade. Empirical data indicate that BEVs have grown at a faster rate than PhEVs, increasing its share of total EV from roughly 17% in 2020 to 41% from 2024. This shift has significant implications for vehicle-to-everything (V2X) development, as the expanding share of BEVs implies higher battery capacity per vehicle, reflecting recent technological advancements. Given the substantial number of light-duty vehicles (LDVs) and their relatively long parking durations, the large-scale deployment of V2X services is expected to rely primarily on this segment. Accordingly, the present study focuses on the Finnish LDV market.

Recent EV models in the Nordic region typically exhibit battery capacities ranging from 50–110 kWh for BEVs and 13–38 kWh for PhEVs, following sustained technological improvements. The Finnish LDV stock is projected to increase from 0.3 million (M) by the end of 2024 to approximately 1.1 M by 2030. Assuming median battery capacities of 70 kWh for BEVs and 25 kWh for PhEVs, the total aggregated battery capacity is estimated at 12.4 GWh in 2024, rising to 61.4 GWh by 2030.

To mitigate battery degradation risks and enable near-unlimited cycling in V2X applications, this study assumes that aggregators adopt a conservative state-of-charge (SOC) operating range of 50%–80%. Under this assumption, the V2X-available capacity is estimated at 3.7 GWh in 2024 and 18.5 GWh in 2030.

B. *Flexibility analysis steps*

In our modeling framework, each aggregated EV is represented as a single V2X-available battery capacity (see above) corresponding to its vehicle type. Under a 30% charge range constraint, the V2X capacities of BEVs and PhEVs are 21 kWh and 7.5 kWh, respectively. We assume that each vehicle is equipped with a bi-directional charger capable of delivering its full V2X capacity within one hour. Accordingly, the minimum average bi-directional charger capacities are 22 kW for BEVs and 7.6 kW for PhEVs. The model estimates the combined V2X capacity required to meet hourly ramping demand and evaluates how up-ramping, down-ramping, and other flexibility scenarios affect this aggregate capacity across consecutive hours. To this end, we implement a three-step approach in MATLAB using activated hourly balancing data for 2023 obtained from [16].

1) *Hourly vehicle need estimate*

The following simplified system of equation calculates the required number of BEVs and PhEVs to provide hourly activated ramping needs regardless of ramp direction.

$$BV2X_{PhEV} * n_{PhE}^{i} + BV2X_{BEV} * n_{BEV}^{i} = Ramping^{i} \quad \text{(i)}$$

$$(1 - S_{PhEV}) * n_{PhE}^{i} - S_{PhE} * n_{BEV}^{i} = 0 \quad \text{(ii)}$$

where $BV2X_{PhEV}$, $BV2X_{BEV}$, n_{PhE}^{i}, n_{BEV}^{i}, S_{PhEV} are the V2X available battery capacities of PhEV and BEV, number of PhEV and BEV required at hour i, the share of PhEV in EV market, respectively. By the end of 2024, PhEVs accounted for 59% of total EVs; this share is assumed to decline to 25% by 2030. The MATLAB simulation applies the governing equation on an hourly basis throughout the year to estimate the required number of vehicles of each type, based on the activated hourly balancing profile. The maximum ramp event of the year determines the highest number of EVs required (hereafter referred to as the maximum hourly vehicles). However, this approach does not fully capture the total number of EVs needed to provide year-round service, as battery availability in a given hour depends on its utilization in the preceding hour, given the absence of independent energy replenishment. Therefore, the aggregated required number of vehicles is estimated by accounting for consecutive upward and downward ramping events, while assuming that V2X capacity is dedicated exclusively to V2X applications.

2) EV volume estimate

The volume of the vehicle at time, i, is estimated by following formula in a simplified case:

$$V_{PhEV}^{i} = V_{PhEV}^{i-1} \pm n_{PhEV}^{i} \tag{iii}$$

$$V_{BEV}^{i} = V_{BEV}^{i-1} \pm n_{BEV}^{i} \tag{iv}$$

Where V denotes the vehicle volume at a given hour. The operator ± indicates that the estimated number of vehicles at time i is either added or subtracted depending on the ramping direction, according to the following rule: during an upramp, additional vehicles are required to enable V2X supply, and therefore the vehicle count increases; conversely, during a downramp, the vehicle count decreases.

3) Flexibility scenarios and pattern analysis

Limited utilization of EV flexibility may result in unjustifiably large EV volumes. Therefore, scenario-dependent flexibility constraints are applied to reduce the fleet size to a level consistent with appropriate battery utilization. To operationalize flexibility, we analyze year-round EV volume patterns derived from hourly activated balancing products and select one or more of the following measures.

The first measure assumes that only a small fraction of vehicles charge or discharge each hour. Specifically, the maximum hourly participation is limited to approximately 5 per 1,000 vehicles (i.e., 0.005 times the maximum fleet size). This assumption is feasible given vehicle availability of approximately 95% of the time.

The second measure, typically implemented after the first, introduces random charging or discharging through wholesale market trading. Pattern analysis may restrict its application to specific periods of the year. The randomly selected hourly activation ranges between 25% and 40% of the annual maximum vehicle requirement.

The third measure is applied when short-term surges or dips in volume are observed. It refines the first approach by allowing larger, model-estimated charge/discharge volumes during specific periods to counterbalance fluctuations. Compared with the second measure, this approach offers greater controllability. Detailed descriptions of these techniques are provided in [17].

In the absence of explicit criteria for determining the final target volume, the characteristics of balancing products are assessed. Some products exhibit frequent up- and down-ramps (e.g., FCR-D), whereas others, such as mFRR, may remain active for extended periods—occasionally exceeding 24 hours—or remain inactive. Given the available flexibility and the observation that ramping levels are typically below maximum capacity, two flexibility scenarios are defined: (i) a low flexibility scenario, constraining volume to 20–30 times the maximum hourly vehicle requirement, and (ii) a medium flexibility scenario, limiting volume to 12–14 times the maximum. A third scenario, high flexibility, emerges endogenously in some simulations, resulting in volumes 3–5 times the maximum. Simulations are conducted for 2025 and 2030. In the 2030 case, the projected vehicle share is updated, while a constant scaling factor—derived from balancing capacity forecasts—is applied to adjust activated balancing energy supply

C. *Revenue estimation*

The revenue estimation was made using the output of the flexibility modelling and some financial assumptions. The estimation was made by considering three components:

$$\mathrm{NetRevenue} = \mathrm{EVenergyservice\_Net\_revenue} + \mathrm{EV\_revenue\_FromCapacityMarket} - \mathrm{AnnualizedCostofCapital}, \tag{v}$$

Detailed information on the model and its underlying assumptions is provided in [18]. The annualized capital cost is derived from the bi-directional charger cost per vehicle, for which three cost scenarios are assumed: €500, €1,000, and €1,500. Procured capacity data and the corresponding 2025 cost constitute additional inputs. A conservative estimation approach is adopted by considering only 70% of the maximum hourly vehicle number and applying a prorating rule to calculate energy revenue.

III. RESULTS

A. *Hourly vehicle need estimate*

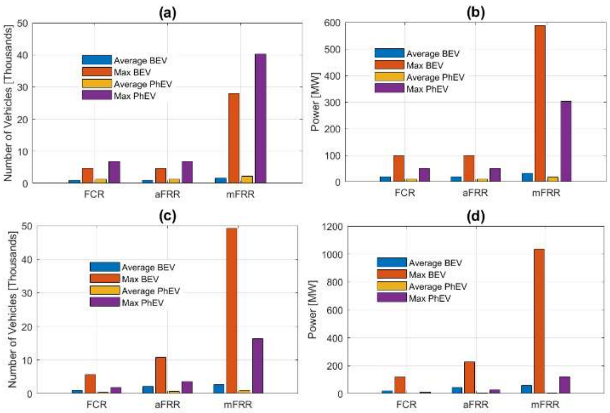

Fig. 2. The estimated maximum hourly number of vehicles (first column) and V2X available power (second column) for BEV and PhEV, as estimated using one year hourly activated balancing data and vehicle shares by category, for years 2025 (top row) and 2030 (bottom row), respectively.

Fig. 2 illustrates the maximum hourly vehicle requirement and the corresponding V2X available capacity for three balancing products in the Finnish electricity system. The estimated maximum hourly vehicle numbers are substantially lower than the current EV stocks of both types. However, the hourly estimates assume temporal independence, which does not reflect actual operating conditions. In practice, vehicle usage in a given hour affects its availability in subsequent hours, alongside other operational factors such as battery flexibility and vehicle utilization patterns. The relatively larger share of PhEVs in 2025 reflects a higher proportion within the EV stock, which declines by 2030. Overall, the increase in V2X capacity results from both growth in the number of vehicles and an expansion of V2X available capacity per vehicle.

B. EV flexibility potential

The number of required vehicles of both types strongly depends on the scenario when inter-hourly relationships are considered. Fig. 3 shows that vehicle requirements rise sharply if V2X battery capacity is minimally flexible. The direction of volume change (BEV or PhEV) reflects the dominant ramping direction of the balancing product and its temporal distribution. For FCR (Fig. 3a), volume declines steadily through the year, while for mFRR (Fig. 3c) it rebounds near year-end, driven by downward ramp predominance and timing. For aFRR (Fig. 3b), downward ramps dominate but are offset by simultaneous ramping periods, with upward ramps outside these periods influencing volume growth. In all cases, high vehicle requirements persist, yet other scenarios underscore the value of diverse flexibility in V2X service development. Here, resource underutilization arises because the product characteristics limit frequent charge–discharge cycles, producing an artificially high vehicle requirement.

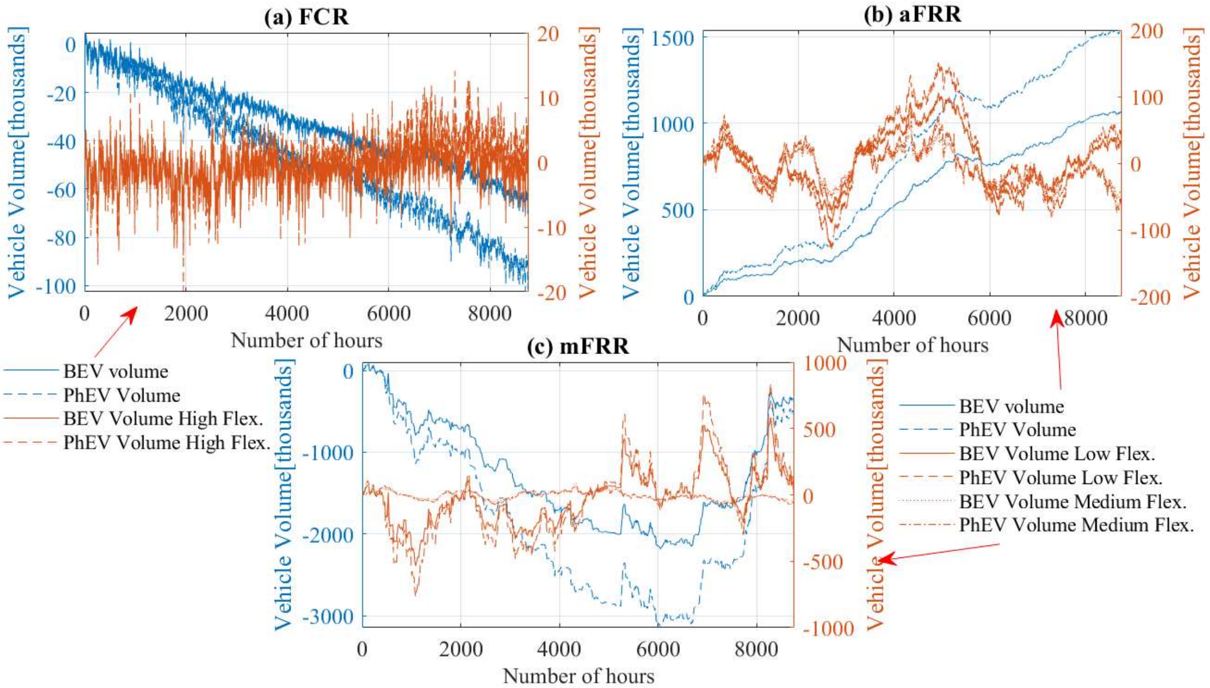

Fig. 3. EV volume when no flexibility (left y-axis) is considered and after EV flexibility utilization, in the case of high flexibility for FCR (a) and medium and low flexibility for aFRR and mFRR.

Coming to the three scenarios, high flexibility emerges when implementing the first flexibility measure (i.e., enforcing the discharge of 4.3 vehicles in a thousand), demonstrating a uniform charge–discharge swing in the FCR throughout the year. While the observed high flexibility—requiring only 3–5 times the maximum hourly vehicle number—may not be technically feasible due to the limited vehicle fleet, as it demands high availability and poses supply security risks. But the scenario highlights key business opportunities for vehicles capable of meeting the availability requirement across most days. It also underscores the need to define minimum bidding requirements based on multiple criteria; relying solely on the probability of power availability would be inadequate. These criteria are essential for accurately assessing revenue potential.

The medium and low scenarios, by contrast, feature sufficient vehicle numbers to manage all contingencies with some forecasting, partly due to their lower average vehicle requirements. In the low scenario, batteries are largely underutilized compared to the medium scenario. Nonetheless, both scenarios can exhibit dispatch swings similar to the very-high flexibility scenario, albeit with lower vehicle availability. For example, in the medium scenario, most days can be managed with six times the maximum hourly vehicle number, corresponding to a vehicle availability requirement of roughly 50% annually.

Maximum volumes for the flexibility scenarios are presented in Fig. 4. The figure shows that mFRR requires a larger vehicle fleet under both low and medium scenarios, while the combined demand for aFRR and FCR remains well below the current EV stock. The higher mFRR requirement reflects the need for prolonged continuous supply once activated, whereas extended idle times reduce resource utilization. Optimizing deployment can, therefore enhance revenue collection.

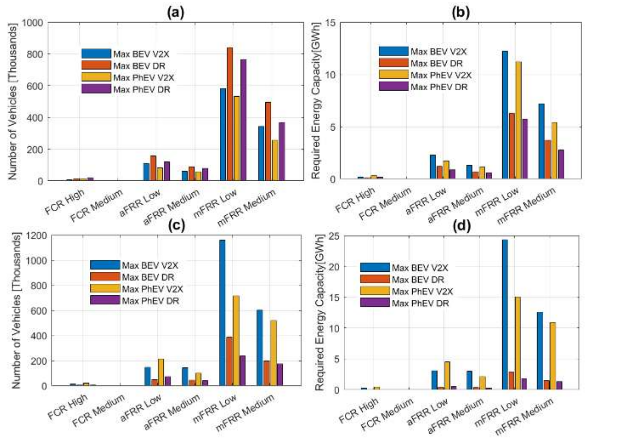

Fig. 4. The estimated vehicle volume (first column) and V2X Available energy capacity (second column) for BEV and PhEV, for years 2025 (top row) and 2030 (bottom row), respectively.

Projections for 2030 reveal notable shifts, particularly in the medium scenario, where required vehicle numbers fall below the forecasted EV market across all products. Combined requirements approximately match the projected EV stock, suggesting that, assuming minimal locational constraints, EVs could meet balancing product needs by 2030 if V2X technologies are fully developed. Given that these requirements are based on a conservative assumption of 30% V2X-accessible battery capacity, it can be concluded that a significant resource may remain untapped without appropriate policy and regulatory support.

C. Revenue estimation

The revenue potential of the Aggregated EV is contingent on multiple factors, as illustrated in Fig. 5. The figure shows high revenue generation requires optimizing flexibility and revenue streams, reducing bi-directional charger costs, and selecting an appropriate balancing product. The limited revenue potential of mFRR may be partially attributed to its low activation frequency and the corresponding constraints on vehicle flexibility. Realizing these resources necessitates several policy measures, with the most critical being the early rollout of bi-directional EV charger installations.

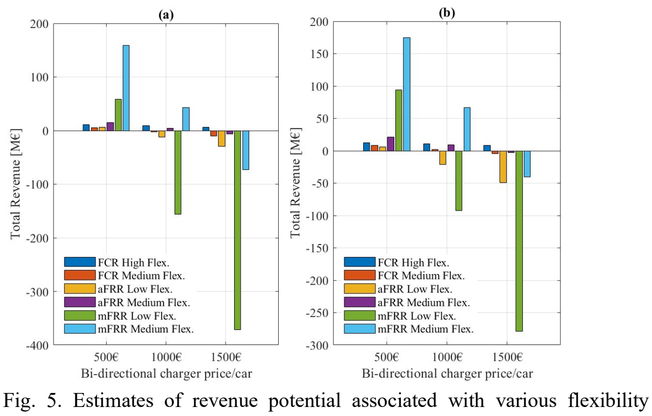

Fig. 5. Estimates of revenue potential associated with various flexibility scenarios.

IV. Summary and conclusion

The increasing adoption of EVs has generated substantial interest in understanding their role in the future electricity market. In this paper, we integrate a heuristic modeling tool, developed to assess the aggregated contribution of EVs in the Nordic balancing market, with a revenue estimation model that uses the output of the former, to evaluate EV potential in the Finnish electricity market. The heuristic model examines the number of EVs required to deliver various balancing products under different levels of flexibility, for years 2025 and 2030. For this case study, we focus on three balancing market products in Finland—FCR, aFRR, and mFRR—selected based on the availability of corresponding activated energy. The model further investigates the impact of consecutive hours of charging or discharging by tracking how the required EV volume (positive or negative) varies with observed consecutive up- and down-ramps.

Results indicate that ensuring secure supply over extended periods requires accounting for how charge–discharge patterns influence the required EV capacity. In this case, EV volume can reach high positive or negative levels depending on the balancing product and the predominance of up- or down-ramping requirements. Introducing flexibility for EV utilization outside a specific product, for instance by participating in the wholesale market, is implemented by modifying the model. These results show that a smaller number of EVs could manage year-round supply for a given service. EVs' substantial flexibility potential—as demand response resources, V2X providers, and participants in parallel market segments—presents a significant business opportunity. However, securing supply requires defining the minimum aggregated EVs necessary for consecutive-hour bidding, which is essential for optimizing operation and assessing associated revenue streams. Based on projected EV market growth and vehicle volumes, the Finnish balancing market could be predominantly supplied by EVs once such services are developed.

Our revenue model employs a straightforward approach, combining EV capacity data with accepted balancing capacity to estimate potential earnings. The results indicate that positive revenue depends on factors such as flexibility, the cost of bi-directional chargers for V2X, and vehicle type. Realizing this potential will rely on policy and regulatory measures, with a key priority being the immediate cessation of unidirectional charger installations and promotion of bi-directional chargers to fully leverage V2X flexibility. Without appropriate actions, it can be concluded that a significant resource may remain untapped due to lack of appropriate policy and regulatory support by 2030.

V. References

[1] S. Wappelhorst and S. Díaz, "Market Spotlight August 2025 Europe's Electric Vehicle Market Leaders: Denmark, Sweden, and Finland," 2025.

[2] A. Goncearuc *et al.*, "The barriers to widespread adoption of vehicle-to-grid: A comprehensive review," *Energy Reports*, vol. 12, pp. 27–41, Dec. 2024, doi: 10.1016/j.egyr.2024.05.075.

[3] F. Gonzalez Venegas, M. Petit, and Y. Perez, "Active integration of electric vehicles into distribution grids: Barriers and frameworks for

flexibility services," Jul. 01, 2021, *Elsevier Ltd*. doi: 10.1016/j.rser.2021.111060.

[4] G. Mendes *et al.*, "Vehicle-to-Everything (V2X): An Updated Review of Key Research Challenges, Implementation Barriers, and Real-world Innovation Projects," in *CIRED 2024 Vienna Workshop*, Vienna, Jun. 2024.

[5] S. M. Ebrahimi, *ACTA WASAENSIA 575 Future Electricity Network Management Effects and Possibilities of Local Markets and Electric Vehicles*. [Online]. Available: http://urn.fi/URN:ISBN:978-952-395-239-3

[6] O. Homaee, C. Essayeh, V. Vahidinasab, V. Tikka, G. Mendes, and J. Fawcett, "Vehicle-to-Everything: Looking into the Future of Flexibility Services." [Online]. Available: https://drive2x.eu/

[7] C. Gschwendtner, S. R. Sinsel, and A. Stephan, "Vehicle-to-X (V2X) implementation: An overview of predominate trial configurations and technical, social and regulatory challenges," *Renewable and Sustainable Energy Reviews*, vol. 145, Jul. 2021, doi: 10.1016/j.rser.2021.110977.

[8] G. A. Lunde, E. V. Damm, P. A. V. Gade, and J. Kazempour, "Aggregator of Electric Vehicles Bidding in Nordic FCR-D Markets: A Chance-Constrained Program," Apr. 2025, [Online]. Available: http://arxiv.org/abs/2404.12818

[9] S. Ma, "Optimal scheduling of electric vehicle aggregators for frequency regulation and cost efficiency in renewable-powered grids," *Computers and Electrical Engineering*, vol. 118, Aug. 2024, doi: 10.1016/j.compeleceng.2024.109317.

[10] G. A. Lunde, E. V. Damm, P. A. V. Gade, and J. Kazempour, "Aggregator of Electric Vehicles Bidding in Nordic FCR-D Markets: A Chance-Constrained Program," Apr. 2025, [Online]. Available: http://arxiv.org/abs/2404.12818

[11] M. Botoft Hansen, M. Secchi, F. Pastorelli, J. Arnsdorf Pedersen, and M. Marinelli, "Multi-market bidding for frequency and balancing services with residential EV chargers," *Sustainable Energy, Grids and Networks*, vol. 44, Dec. 2025, doi: 10.1016/j.segan.2025.101941.

[12] A. A. Solomon, M. Karimi, M. Enell-Nilsson, and H. Laaksonen, "An analysis of V2X related business models from different stakeholders' point of views."

[13] J. Einolander, A. Kiviaho, and R. Lahdelma, "Valuing the household power outage self-sustainment capabilities of bidirectional electric vehicle charging," *Appl. Energy*, vol. 374, Nov. 2024, doi: 10.1016/j.apenergy.2024.124071.

[14] P. Codani, M. Petit, and Y. Perez, "Missing money for EVs: economics impacts of TSO market designs." Accessed: Mar. 06, 2026. [Online]. Available: http://ssrn.com/abstract=2525290

[15] Fingrid, "Power system reserve." Accessed: Mar. 06, 2026. [Online]. Available: https://www.fingrid.fi/en/electricity-market/reserves/power-system-reserves/

[16] ENTSOe, "Transparency platform." Accessed: Jun. 06, 2025. [Online]. Available: https://transparency.entsoe.eu/

[17] A. A. Solomon, H. Laaksonen, and M. Karimi, "Flexibility potential of EV in Nordic Electricity Market and Estimates of number of vehicles, Journal article, in preparation."

[18] A. A. Solomon, H. Laaksonen, M. Karimi, and M. Enell-Nilsson, "Business potential of EV flexibility in Nordic Electricity Market, Journal article, in preparation."