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**Research Report**

## Impact of policy incentives on adoption of electric vehicles in South Korea

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# KDI FOCUS

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For Inquiry KDI Communications Unit

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Video Report



South Korea's strategies for deploying battery electric vehicles (BEVs) primarily include providing purchase subsidies and expanding charging infrastructure. An empirical analysis of new vehicle registrations from 2019 to 2022 shows that investing in charging facilities is more cost-effective than offering purchase incentives for increasing BEV adoption. To achieve a higher share of BEVs, a stronger policy focus on improving the charging network is necessary to stimulate overall demand for BEVs.

## Impact of Policy Incentives on Adoption of Electric Vehicles in South Korea

Hyunseok Kim, Fellow at KDI



## I. Background

Achieving the target of ‘deploying 4.5 million BEVs and FCEVs by 2030s’ requires a substantial increase in the number of these vehicles, necessitating a comprehensive review of effective policy strategies.

In pursuit of carbon neutrality by 2050, South Korea’s transportation sector is focusing on deploying clean vehicles, particularly battery electric vehicles (BEVs) and hydrogen cars (fuel cell electric vehicles, FCEVs), as a key means of implementation.<sup>1)</sup> BEVs and FCEVs can reduce greenhouse gas (GHG) emissions by replacing conventional motor vehicles powered by internal combustion engines (ICE). In October 2021, South Korea unveiled the “2050 Carbon Neutrality Scenario,” jointly announced by relevant ministries, which outlines plans to increase the market share of BEVs and FCEVs to over 85% by 2050, aiming to drastically bring down GHG emissions in the transportation sector (98 million tons, 13.5% of the total in 2018) to less than one-tenth of that figure. More specific targets are included in the “2030 National Determined Contribution (NDC) Upgrade Plan,” released around a similar time, targeting 4.5 million BEVs and FCEVs (16.7%) out of approximately 27 million total registered vehicles by 2030. These targets are also reflected in the “National Strategy for Carbon Neutrality and Green Growth and the First National Basic Plan” (2023).

Many countries have made BEVs eligible for government subsidies due to their higher prices than competing ICE vehicles and the requisite installation of charging infrastructure. South Korea is no exception. Official statistics indicate that BEV registrations in Korea started with 44 units in 2010, while FCEV registrations began with 28 units in 2015. In the years since, adoption rates have rapidly increased, supported by government initiatives. By the end of 2022, the cumulative number of BEV registrations (including passenger, commercial, and freight BEVs) reached about 390,000, with FCEVs recording about 30,000. Despite the trend of a steep increase, achieving the target of ‘deploying 4.5 million BEVs and FCEVs by 2030’ requires a further substantial increase in the number of these vehicles, necessitating a comprehensive review of effective policy strategies.

\* Summarized and adapted from Kim, Hyunseok, *A Study on Impact of Korea’s Policy Instruments for Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEVs)*, Policy Study 2023-11, Korea Development Institute, 2023 (forthcoming) (in Korean).

1) In South Korea, clean vehicles are defined into specific types by two legislative acts: the Act on Promotion of Development and Distribution of Environment-friendly Motor Vehicles (EFVs) (hereafter EFV Act) from the Ministry of Trade, Industry and Energy, and the Clean Air Conservation Act from the Ministry of Environment. The EFV Act specifically stipulates EFVs as “electric vehicle, solar-powered vehicle, hybrid vehicle, and hydrogen electric vehicle provided in subparagraphs 3 through 8, or a vehicle that meets the environmental standards set by Ordinance of the Ministry of Trade, Industry and Energy among vehicles subject to permissible emission limits prescribed in Article 46 (1) of the Clean Air Conservation Act.” Furthermore, the Enforcement Decree of the Clean Air Conservation Act categorizes low-emission motor vehicles into three types: Type 1 (electric, solar-powered, and hydrogen electric vehicles), Type 2 (hybrid vehicles), and Type 3 (gasoline and gas vehicles). It also designates zero-emission motor vehicles as Type 1 low-emission vehicles, encompassing electric, solar-powered, and hydrogen electric vehicles.

## II. Trends in BEV Adoption

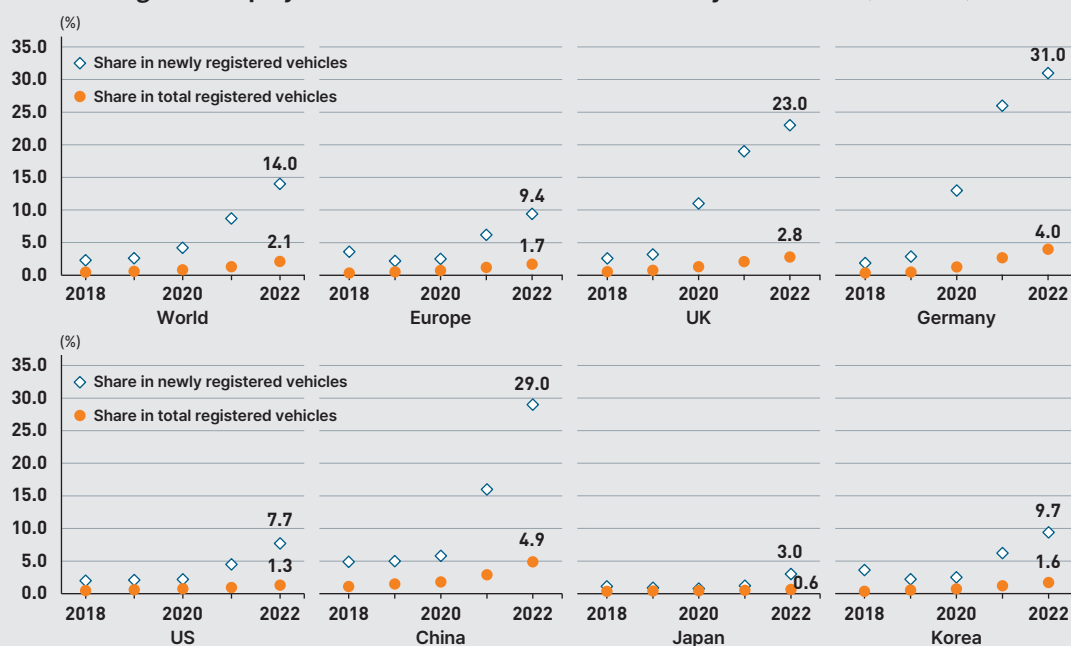
While Korea has witnessed a consistent increase in the cumulative number of BEVs (and PHEVs), it still lags behind the global average.

Recent data indicates a deceleration in the growth rate of new BEV registrations.

To facilitate the discussion, it is necessary to first assess the level of clean vehicle adoption in Korea. Based on data from the International Energy Agency (IEA), Figure 1 illustrates the overall deployment trends of battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)—types of clean vehicles that are experiencing global expansion—in Korea and major countries over the past four years (2018~22). The share of BEVs and PHEVs in new vehicle registrations and total registrations has been increasing in major countries, including Korea. In 2022, the global averages for these shares were 14.0% and 2.1%, respectively. Countries such as the UK, Germany, and China significantly exceeded these global averages, whereas Korea's figures were relatively low at 9.7% and 1.6%, respectively.

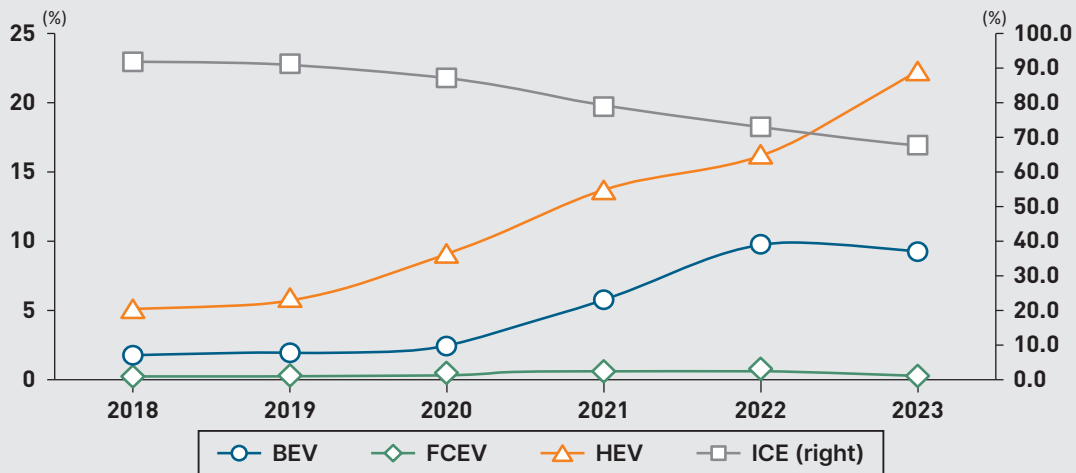
In Korea, newly registered clean vehicles primarily consist of BEVs, FCEVs, and hybrid electric vehicles (HEVs), with PHEVs being negligible. Based on data from the Ministry of Land, Infrastructure, and Transport, Figure 2 depicts the changes in shares of vehicle types in new registrations. The proportion of ICE vehicles in annual new registrations has steadily declined, while that of clean vehicles has increased. As of 2023, however, the sharper increase in the share of HEVs, as opposed to the marginal decrease in the BEV share, warrants a close-up examination of the future direction for clean vehicle deployment policy.

**Figure 1. Deployment Trends in BEVs and PHEVs in Major Countries (2018~22)**



*Note:* The figures are based on stock and sales data for battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).

*Source:* IEA, Global EV Data Explorer (<https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer>, last accessed: October 1, 2023).

**Figure 2. Proportions of Annual New Vehicle Registrations by Fuel Type in Korea (2018~23)**

*Note:* Internal combustion engine (ICE) vehicles include gasoline, diesel, and LPG vehicles.  
*Source:* Ministry of Land, Infrastructure and Transport, "Total Registered Motor Vehicles," various years.

### III. BEV Deployment Policy and Government Spending

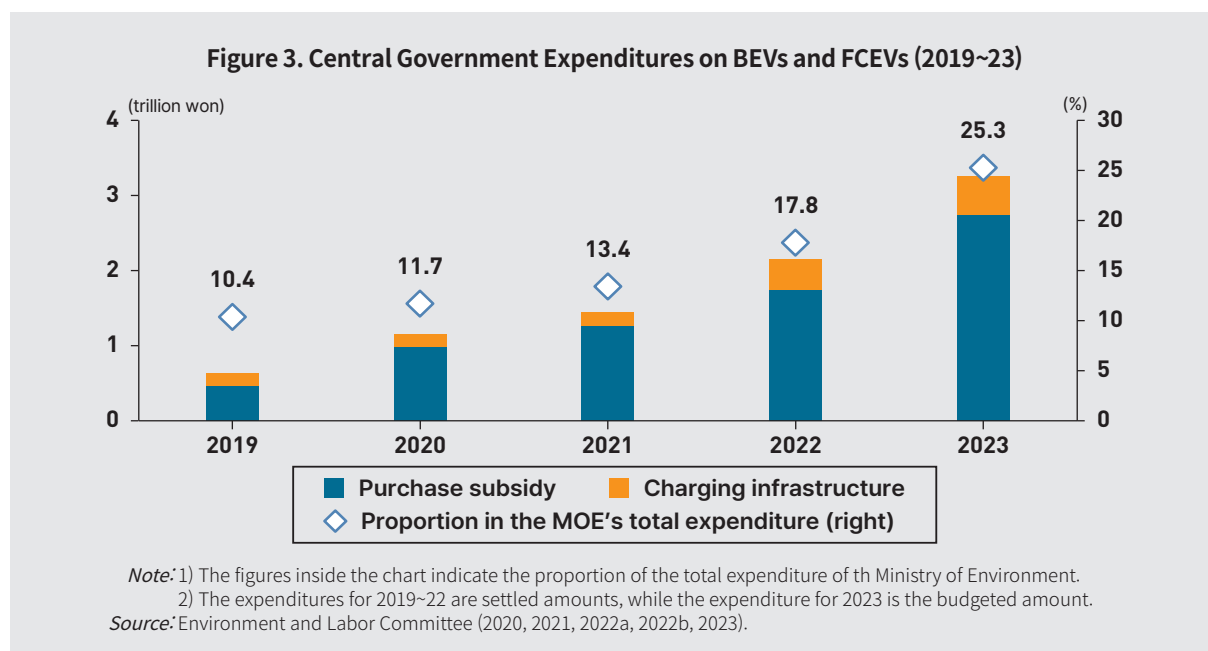
Korea's government policy support to promote the adoption of BEVs and FCEVs primarily comprises purchase subsidies and charging infrastructure installation. Fiscal spending for these measures has increased dramatically, with the related budget accounting for 25.3% of the Ministry of Environment's total budget in 2023.

Government policy support has been the chief driving force for expanding the adoption of clean vehicles. Based on the timing of the actual support, it can be categorized into support at the purchase stage and support during the ownership (and operation) stage. At the purchase stage, government support primarily includes the provision of purchase subsidies and reductions in individual consumption tax. During the ownership stage, support consists of the expansion of charging infrastructure and assistance with various costs.

The scale of fiscal expenditures associated with the deployment of BEVs and FCEVs can be estimated by examining the central government's budget execution. The central programs for BEVs and FCEVs consist of i) purchase subsidies and ii) charging infrastructure installation. Figure 3 shows the trajectories of their spending. Expenditures for the Ministry of Environment's BEV and FCEV programs have sharply increased from 2019 to 2023. In 2023, the related budget (2.8 trillion won for purchase subsidies and 0.5 trillion won for charging infrastructure deployment) accounts for 25.3% of the Ministry's total budget of 12.9 trillion won.

Based on Article 58 (Operation of Low-Emission Motor Vehicles) of the Clean Air Conservation Act, purchase subsidies from the national budget are granted according to set amounts for different vehicle models. Additionally, local governments provide tiered subsidies in coordination with national subsidies. Table 1 displays the maximum

unit subsidy amounts from national and local sources for 2018 and 2022. As clean vehicle adoption expanded, the unit subsidy amount from the central government has gradually decreased to support more vehicles with limited resources, and local subsidy levels have been adjusted accordingly.



**Table 1. Maximum Unit Amounts of Purchase Subsidies for Passenger BEVs**

(10,000 won)

City/Do (province)	Subsidies in 2018			Subsidies in 2022		
	National	Local	Total	National	Local	Total
Seoul	1,200	500	1,700	700	200	900
Busan		500	1,700		350	1,050
Daegu		600	1,800		400	1,100
Incheon		600	1,800		360	1,060
Gwangju		700	1,900		400	1,100
Daejeon		700	1,900		500	1,200
Ulsan		500	1,700		350	1,050
Sejong		700	1,900		200	900
Gyeonggi-do		500	1,700		300~500	1,000~12,00
Gangwon-do		320~840	1,520~2,040		440	1,140
Chungcheongbuk-do		800~1,000	2,000~2,200		700	1,400
Chungcheongnam-do		800~1,000	2,000~2,200		700~800	1,400~1,500
Jeollabuk-do		600	1,800		800	1,500
Jeollanam-do		100~1,100	1,300~2,300		620~950	1,320~1,650
Gyeongsangbuk-do		600~900	1,800~2,100		600~1,100	1,300~1,800
Gyeongsangnam-do		600~900	1,800~2,100		600~800	1,300~1,500
Jeju-do		600	1,800		400	1,100

**Note:** Some local subsidies are expressed in ranges when subsidy levels differ across local governments.

**Source:** Zero-Emission Vehicle Integrated *Nuri* Portal (<https://ev.or.kr/>, last accessed: October 1, 2023).

## VI. Impact of BEV Deployment Policies

Analysis reveals that a 10% increase in the cumulative number of chargers correlates with a 12.4% rise in new registrations, while a 10% price reduction due to subsidies results in a 15.8% increase in new registrations.

Since purchase subsidies and charging infrastructure expansion entail substantial fiscal outlays, assessing their effectiveness in promoting clean vehicle adoption is vital for guiding policy directions. Numerous empirical studies conducted abroad have investigated the effects of government support policies on the adoption of BEVs and PHEVs by analyzing changes in vehicle registration numbers. Similar to Li *et al.* (2017), this study investigates the effectiveness of Korea's BEV promotion policies by estimating elasticities for key policy variables based on BEV registrations from 2019 to 2022. Specifically, it sets 'annual new registrations of individual passenger BEV models by region' as the dependent variable, with 'cumulative number of chargers' and 'actual price paid after subsidies' (vehicle price minus subsidy) as primary explanatory variables to calculate charger elasticity and price elasticity.<sup>2)3)4)</sup>

According to the analysis, all main explanatory variables are statistically significant at the 1% level, with charger elasticity and price elasticity estimated at 1.24 and -1.58, respectively. The charger elasticity indicates that a 10% increase in the regional cumulative number of chargers is associated with a 12.4% rise in regional new registrations. Similarly, the price elasticity shows that a 10% decrease in regional vehicle prices due to subsidies corresponds to a 15.8% increase in regional new registrations. These estimates align with

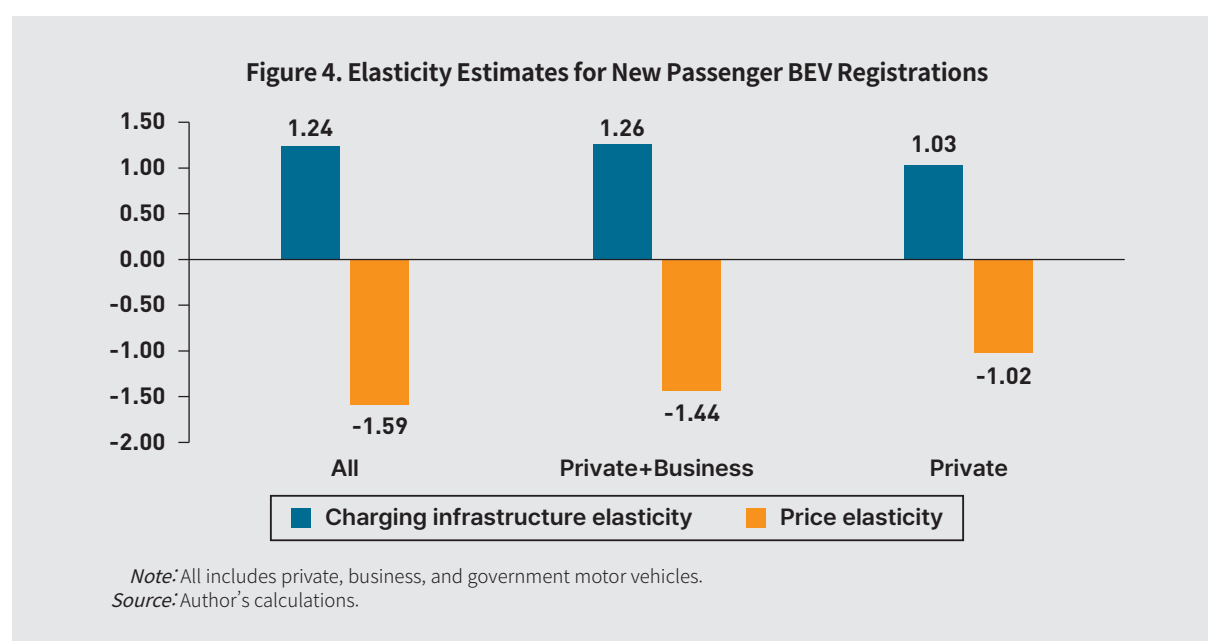
- 2) Due to potential endogeneity arising from the simultaneity of the charger variable, an instrumental variable needs to be employed (Li *et al.*, 2017). An appropriate instrumental variable should correlate with the number of cumulative chargers at the regional level while remaining unrelated to unobservable BEV demand shocks. Focusing on BEVs and PHEVs in the US, Li *et al.* (2017) construct an instrument based on the lagged number of grocery stores and supermarkets in all other regional units for the number of charging stations because they often operate charging facilities while not directly related to the demand for electric vehicles. This study adopts a different instrumental variable, the lagged number of newly constructed housing units in all other regions. The following considerations justify this selection: 1) as clean vehicle adoption progresses, charging facilities are being installed in or near newly constructed houses, and therefore, it can be expected that the volume of new housing construction will be related to the trend in cumulative charger deployment with a certain time lag, and 2) The volume of new housing construction from past periods (excluding the relevant region) is unlikely to have a direct relationship with the current electric vehicle demand in the region.
- 3) In addition to the main explanatory variables, the study incorporates two control variables, regional fiscal self-reliance ratio and gasoline price relative to electricity price. The regional fiscal self-reliance ratio is a proxy variable that accounts for potential adoption challenges from local government budget constraints affecting local subsidy payments. The gasoline price relative to electricity price is included to capture the increased attractiveness of BEVs when fuel costs for competing ICE vehicles rise relative to electricity costs, utilizing the previous year's value. Moreover, the model includes fixed effects for year, region, and vehicle model to control for average annual changes and time-invariant differences across regions and vehicle models in the dependent variable. In particular, by incorporating control variables with regional variations (such as regional fiscal self-reliance ratio, gasoline price relative to electricity price, and regional fixed effects), this study aims to estimate common demand patterns while accounting for regional heterogeneity in demand to the greatest extent possible.
- 4) This analysis encompasses 161 regions, including 9 metropolitan cities along with 152 cities and counties, in line with the operational units of the local BEV purchase subsidies. Vehicle models are classified into 14 domestic and 29 foreign categories. The analysis spans from 2019 to 2022, comprising 11,431 observations, with a relatively short time series with detailed regional divisions. Based on the analyzed data, the average (central and local) subsidy payment is 11.474 million won, which is 21.9% of the vehicle price, inclusive of effective taxes (individual consumption tax, education tax, and value-added tax).



Also, private vehicles exhibit lower elasticity in response to changes in the number of chargers and in price compared to their government and business counterparts.

analyses of the US BEV registration data (Appendix Table 1).<sup>5)</sup>

Furthermore, passenger cars are categorized based on their usage into government vehicles (managed and operated by central administrative agencies and their affiliates, as well as local governments), commercial vehicles (used for transportation, automobile sales, car rental services, etc.), and private vehicles (those not classified as government or commercial). The estimation results are compared across these categories, as shown in Figure 4, including comparisons excluding government vehicles and those excluding government and business vehicles.<sup>6)</sup> Notably, the results reveal that when limiting the scope to ‘private vehicles’ only, both elasticities are lower in absolute terms than analyses of ‘all vehicles’ and ‘private and business vehicles.’ This suggests that private vehicles are less responsive to changes in charging infrastructure availability and price fluctuations compared to government and commercial vehicles.



5) Appendix Table 1 summarizes the main empirical findings of studies on BEV and PHEV deployment policies, including this study, based on vehicle registration data. For comparison with the other studies, various subsidy variables (absolute subsidy amount and subsidy ratio) were also analyzed and presented in the final row. The estimation results from Li *et al.* (2017), which are methodologically most similar to this study, yielded less elastic outcomes than those found here. However, Li *et al.* (2017) analyzed BEVs and PHEVs collectively as the dependent variable, while this study focused exclusively on BEVs. Additionally, after accounting for the exchange rate, the estimates from this study closely align with those of Wee, Coffman, and La Croix (2018) in their analysis of the U.S. BEV market.

6) The estimated coefficient for the regional fiscal self-reliance ratio is 0.014, statistically significant at the 10% level, which means that all things begin equal, a 1% increase in the regional fiscal self-reliance ratio corresponds to a 1.4% rise in new passenger BEV registrations. Furthermore, the coefficient for the previous year's gasoline price relative to electricity price is estimated at 13.71, suggesting that a 1% increase in this price ratio is associated with a 13.7% increase in new passenger BEV registrations in the subsequent year. Statistical tests confirm the strength and exogeneity of the instrumental variables used in the analysis.



## V. Cost-Benefit Analysis of BEV Subsidies

Subsidy-induced adoption  
accounted for about  
27.4% of the 240,000  
BEVs eligible for purchase  
subsidies in 2019~22.

Building on the earlier estimation results, counterfactual scenarios can be explored by assuming that passenger BEV subsidy policies were absent throughout the study period (2019~22). Specifically, it is possible to estimate the decrease in the number of adoptions if subsidies were removed, or alternatively, the additional number of adoptions resulting from providing subsidies.<sup>7)</sup> Table 2 shows new registration estimates in the absence of BEV subsidies (national and local). This counterfactual analysis reveals that approximately 66,000 vehicles (27.4%) were added due to subsidies, out of the 240,000 new passenger BEV registrations eligible for subsidies during this period.<sup>8)</sup> In other words, the other 72.6% represents adoptions that would have taken place even without subsidies. This is an inevitable aspect in situations where it is difficult to provide differentiated support based on consumer preferences. Based on new passenger BEV registration figures and unit subsidy amounts, the combined national and local subsidies granted in 2019~22 stand at about 2.6 trillion won.

**Table 2. Estimations for New Passenger BEV Registrations without Subsidies**

(units)

	2019	2020	2021	2022	Total
Total new registrations	33,418	31,333	71,528	123,942	260,221
New registrations eligible for subsidies (A)	29,449	28,948	66,815	115,794	241,006
Estimated new registrations in the absence of subsidies (B)	19,868	20,590	45,435	89,186	175,080
Estimated new registrations induced by subsidies (A-B)	9,581	8,358	21,380	26,608	65,926
Ratio of new registrations induced by subsidies $([A-B]/A \times 100)$	32.5%	28.9%	32.0%	23.0%	27.4%

*Note:* Based on 11,431 total observations, applying annual prices and quantities, with a price elasticity of -1.59.

*Source:* Author's calculations.

7) Assume  $P_1$  and  $Q_1$  represent the price and quantity in the situation with subsidies, and  $P_0$  and  $Q_0$  represent the price and quantity in a hypothetical situation without subsidies. The own-price elasticity, expressed as an arc elasticity for two price-quantity combinations on the demand curve, can be represented as  $\epsilon_p = [(Q_1 - Q_0) / ((Q_1 + Q_0) / 2)] / [(P_1 - P_0) / ((P_1 + P_0) / 2)]$ . Since  $\epsilon_p$  has been identified from the estimation results and  $P_1$ ,  $Q_1$ , and  $P_0$  can be calculated from the basic statistics, this equation can be used to solve for  $Q_0$ .

8) Eligibility for purchase subsidies was determined by a vehicle type-specific subsidy rate table issued by the Ministry of Environment. The tiered support is based on vehicle price: as of 2023, subsidies are 100% for vehicles priced under 57 million won, 50% for those priced between 57 and 85 million won, and no subsidy for vehicles priced at 85 million won or higher. By annually cross-referencing the Ministry of Environment's subsidy-eligible vehicle types (model names) with the Ministry of Land, Infrastructure and Transport's new registration data by vehicle model name, it was found that some foreign vehicle types were ineligible. Of the 260,000 new passenger BEV registrations from 2019 to 2022, approximately 240,000 (92.6%) were eligible for subsidies.

Analysis suggests that promoting BEV adoption through the expansion of charging infrastructure would be more cost-effective than offering purchase subsidies. Additionally, the direct social benefits derived from BEV subsidies generally fail to outweigh their costs, indicating current subsidy levels may be excessive.

This section also estimates the cost required for charger installation to achieve the same adoption numbers as those resulting from purchase subsidies. Using the previous charger elasticity (1.24) for all passenger BEVs, an estimated 90,000 additional chargers would be needed to match the effect of subsidies (66,000 additional BEVs). In line with the government support criteria for charging stations while maintaining the existing composition of slow and fast chargers (89.6% slow, 10.4% fast as of 2022), installing these additional 90,000 chargers would require approximately 390 billion won in government support.<sup>9)</sup> This is substantially lower than the 2.6 trillion won spent on subsidies. Although this is a simplified calculation and the number of additional chargers (90,000) represents nearly 50% of those deployed over the past seven years, it suggests that promoting BEV adoption via expanding charging infrastructure could be more cost-effective.

Furthermore, it is also possible to carry out a cost-benefit analysis for the adoption expansion of passenger BEVs through purchase subsidies, albeit limited to subsidy policies with sufficient data for estimating government spending. Direct benefit estimation involves accounting for the subsidy amount transferred to consumers, the deadweight loss from subsidy payments, and the reduction in environmental externality costs from replacing ICE vehicles.<sup>10)</sup> Benefits and costs under several scenarios are examined based on assumptions regarding the social cost of carbon and the eco-friendliness of

9) The calculation of government support costs assumes sufficient physical space for installation of charging stations and adequate capacity for private sector participation. As of 2023, the government subsidized up to 100% of slow charger installation costs and 50% for fast chargers, subject to specified support limits (Ministry of Environment, 2023). For slow chargers, an average support unit price of 2.6 million won is assumed, based on the simple average of maximum support unit prices (1.2 million won, 1.6 million won, 5 million won) for three capacity standards ("7kW or more to less than 11kW," "11kW or more to less than 30kW," and "30kW or more") for standalone installations. For fast chargers, a weighted average of 19.4 million won is used, derived from maximum support unit prices (10 million won, 20 million won, 40 million won, 75 million won) for four capacity standards (50kW, 100kW, 200kW, 350kW or more), based on actual distribution data of fast charger capacities from the Zero-Emission Vehicle Integrated Nuri Portal.

10) As seen in the BEV market in its nascent stage, the price reduction effect of subsidies can fully benefit consumers due to supplier competition, and an elastic supply curve is assumed (Li *et al.*, 2017; Clinton and Steinberg, 2019). Under a linear demand function, consumer benefits are calculated by subtracting deadweight loss from total subsidy payments. Environmental cost calculations assume BEV adoption replaces typical ICE vehicles, with the size of social benefits understood as the reduction in environmental externality costs due to this substitution. For ICE vehicles, environmental externality costs from GHG and air pollutant emissions during operation are considered, while for BEVs, environmental externality costs from power generation during charging are accounted for. Also, the potential reduction in environmental costs is added based on the lifespan and survival rates of BEVs. This approach focuses on direct changes from BEV use, not including broader concepts such as "positive network effects between charger deployment and vehicle number increases," or "stranded asset effects in ICE vehicle-related industries and backward effects of BEV-related businesses."

electricity.<sup>11)</sup> Overall, the results (Appendix Table 2) show a negative value in net benefits with the ‘benefit-cost ratio’ (= benefit amount ÷ cost amount) below 1. The ratio being less than 1 is primarily due to the fact that when adoption surpasses the range of ‘consumers responsive to an appropriate level of subsidies,’ inefficiency increases, leading to a lower benefit-cost ratio. The consistent finding of benefit-cost ratios below 1 across various scenarios suggests that the current subsidy levels may be excessive.

## VI. Policy Implications

Future BEV deployment policies should prioritize reinforcing charging infrastructure over providing purchase subsidies. In particular, deploying enough fast-chargers at key travel hubs is essential to improve convenience and facilitate long-distance travel.

Based on the findings of this study, the key implications of deployment policies of BEVs, the primary type of clean vehicle, are as follows. As a fundamental direction, it is necessary to focus more on strengthening charging infrastructure rather than providing subsidies for BEV deployment policies. This approach is expected to enhance the efficiency of government spending related to clean vehicle policies.

The detailed considerations are as follows. First of all, purchase subsidies should be gradually reduced. As of 2022, the breakdown of cumulative registrations for all passenger motor vehicles was 92.2% private, 7.5% business, and 0.4% government, while for BEVs, it was 65.6%, 30.2%, and 4.2%, respectively. Thus far, BEVs have been more rapidly adopted in the business sector, particularly for rental cars and taxis, with substantial government adoption due to policy mandates for public BEV use. The breakdowns show that the future demand for BEVs should come from private BEV ownership. One finding worth noting in this study is that private car users are less price-sensitive. In addition, purchase subsidies are likely to become less effective as a policy tool because BEVs are gaining a competitive edge over ICE vehicles due to technological advancements that improve battery performance and reduce costs. The Korean government temporarily increased the national subsidy from 6.8 million won to 7.8 million won in late 2023 in response to the lower-than-expected BEV adoption rate, but such a measure is likely to prove ineffective in the long term given

11) The replacement of ICE passenger vehicles with passenger BEVs is estimated to reduce GHG emissions by about 1.17 tons per vehicle annually. Considering vehicle lifespan, the per-vehicle GHG reduction benefit ranges from 650,000 won to 1.54 million won, depending on social cost unit prices. Including the reduction of air pollutants, the total benefit from decreasing environmental externality costs per vehicle is estimated to be between 1.52 and 2.38 million won. Assuming all current power sources are converted to zero-carbon alternatives, this benefit increases to 2.44~4.39 million won per vehicle. Considering the elasticity estimates, the average benefit from a 10 million won subsidy for environmental cost reduction is between 380,000 and 590,000 won, while the benefit from a 10 million won investment in charger installation support is between 2.56 and 4.02 million won.

these contextual factors.<sup>12)</sup>

Secondly, charging infrastructure should be improved to enhance operational convenience. In the context of Korea, this policy direction can be addressed from both qualitative and quantitative perspectives. Qualitatively, policy efforts should focus on ensuring the full functionality of existing chargers by prioritizing maintenance tasks such as inspections, repairs, and replacements, as well as improving the user experience by making the system more convenient. In June 2023, the government announced a management plan for BEV charging facilities, and its inclusion of initiatives to upgrade charging service quality deserves positive appraisal (Joint Statement by Relevant Ministries, June 2023). However, the mandatory installation ratio of BEV charging units for new buildings was increased from 0.5% to 5% in January 2022 (scheduled to reach 10% by 2025), together with a 2% installation requirement imposed on existing buildings. These new regulations would place more importance on the management of charging stations.

Quantitatively, improving charging conditions at major travel hubs, such as highway rest areas, is becoming increasingly important in addition to enhancing charging infrastructure in residential and nearby vicinities. According to the 2019~23 S&P Global survey of major countries (see Table 3) and subsequent analysis, while the likelihood of purchasing clean vehicles initially increased after the widespread release of new models in 2021, it has since declined due to concerns about charging infrastructure and driving range. This suggests that, beyond purchasing, operational inconveniences could impede clean vehicle adoption. Although in international comparisons, Korea falls on the spectrum with relatively well-developed charging infrastructure, this assessment does not account for the distribution of slow and fast chargers. As of 2022, the shares of fast chargers out of total BEV charging units in major countries (IEA, Global EV data) are in the order of China (43.2%), US (21.9%), UK (17.0%), Germany (16.9%), Japan (13.9%), and Korea (10.4%). While those six countries had less than 5% in cumulative deployment rates for BEVs and PHEVs, even countries exceeding 10% demonstrate higher shares for fast chargers than Korea (Iceland 37.8%, Norway 17.5%). Consequently, future strategies

12) As illustrated in Figure 2, several factors may have contributed to the slowed growth of BEV adoption and the accelerated adoption of HEVs in 2023. Beyond the differing elasticities by vehicle use highlighted in this study, overall demand stagnation may have naturally occurred as the BEV market transitions from early adopters to mainstream consumers. Additionally, the introduction of several new domestic and foreign HEV models during this period likely influenced market dynamics. In light of these trends, the pace of subsidy rate reduction may need to be calibrated based on the persistence of the BEV adoption slowdown.

for deploying BEV-led clean vehicles should direct policy resources toward the widespread installation of fast chargers at key travel hubs to facilitate long-distance travel and increase overall BEV adoption.<sup>13)</sup> ■

**Table 3. Survey Results on the Likelihood of Purchasing BEVs and HEVs (Openness)**

Type	2019	2021	2022	2023
BEV + PHEV	58%	81%	71%	67%
HEV	63%	93%	73%	72%

*Note:* The 2023 survey, based on data collected in May, involves 5,166 respondents (622 from the US, 701 from the UK, 700 from Germany, 624 from China, 588 from Japan, 588 from Korea, 641 from India, and 702 from Brazil).

*Source:* S&P Global website (<https://press.spglobal.com/>, last accessed: November 1, 2023)

13) Recently, the Korean government finalized the subsidy budget for BEV charger installation projects at 371.5 billion won, representing a 42% increase from the previous year (Ministry of Environment, 2024). As an example of the additional deployments, the plan outlines 110,000 7kW slow chargers (91.0%) and 10,875 100kW fast chargers (9.0%), indicating a continued low proportion of fast charger deployment numbers.

**Appendix Table 1. Comparison of Estimated Effects of BEV and PHEV Deployment Policies**

Literature	Dependent variable	Country/Region	Analysis period	Estimations
Li <i>et al.</i> (2017)	BEV, PHEV New registration by region	353 metropolitan areas, US (Obs: 14,563)	Quarterly data for 2011~13	<ul style="list-style-type: none"> <li>• Price elasticity: -1.29</li> <li>• Charging infrastructure elasticity: 0.84</li> </ul>
Wee, Coffman, and Croix (2018)	BEV, PHEV New registration by region	50 states, US (Obs.: 4,287)	Yearly data for 2010~15	<ul style="list-style-type: none"> <li>• USD 1,000 subsidy leads to a 7.5% increase in the dependent variable</li> </ul>
	BEV New registration by region	50 states, US (Obs.: 1,952)		<ul style="list-style-type: none"> <li>• USD 1,000 subsidy leads to a 11.2% increase in the dependent variable</li> </ul>
	PHEV New registration by region	50 states, US (Obs.: 2,335)		<ul style="list-style-type: none"> <li>• USD 1,000 subsidy leads to a 5.6% increase in the dependent variable</li> </ul>
Münzel <i>et al.</i> (2019)	BEV, PHEV Market share by region	32 countries in Europe (Obs.: 226)	Yearly data for 2010~17	<ul style="list-style-type: none"> <li>• EUR 1,000 subsidy leads to a 5~7% increase in the dependent variable</li> </ul>
Kalthaus and Sun (2021)	BEV New registration by region	31 regions, China (Obs.: 207)	Yearly data for 2010~16	<ul style="list-style-type: none"> <li>• A 1% increase in subsidy amount results in a 0.51% increase in the dependent variable</li> </ul>
	PHEV New registration by region			<ul style="list-style-type: none"> <li>• A 1% increase in subsidy amount results in a 0.28% increase in the dependent variable</li> </ul>
This study	BEV New registration by region	161 cities & provinces, South Korea (Obs.: 11,431)	Yearly data for 2019~22	<ul style="list-style-type: none"> <li>• Price elasticity: -1.59</li> <li>• Charging infrastructure elasticity: 1.24</li> <li>• KRW 1 million subsidy leads to a 8.1% increase in the dependent variable</li> <li>• A 1% increase in subsidy amount results in a 0.79% increase in the dependent variable</li> </ul>

*Note:* Limited to empirical studies conducted on adoption figures of BEVs or PHEVs.

*Source:* Author's compilation.

**Appendix Table 2. Cost-Benefit Analysis of Passenger BEV Subsidies (2019~22)**

(100 million won)

Scenarios		Subsidy amount disbursed (A)	Deadweight loss (B)	Increase in consumer benefits (A-B)	Environmental cost reduction benefits (C)	Net Benefits (C-B)	Benefit-cost ratio ((A-B+C)/A)
1	Low CO <sub>2</sub> cost	26,734	3,717	23,017	1,002	-2,715	0.90
2	High CO <sub>2</sub> cost	26,734	3,717	23,017	1,571	-2,146	0.92
3	Low CO <sub>2</sub> cost + Zero-carbon electricity	26,734	3,717	23,017	1,609	-2,108	0.92
4	High CO <sub>2</sub> cost + Zero-carbon electricity	26,734	3,717	23,017	2,896	-821	0.97

**Note:** 1) Assumes that due to competition among initial BEV market suppliers, the resulting price reductions from subsidies are fully passed on to consumers under an elastic supply curve.

2) All monetary values are as of 2022.

3) Deadweight loss, a component of the benefits, is calculated as half of the subsidy expenditure allocated for additional adoptions induced by the subsidy.

4) Environmental cost reduction benefits, another component of the benefits, are calculated by converting the environmental benefits of BEV conversion to present value. These benefits consider air pollutants and GHG emissions from both the operation of ICE vehicles and the production of electricity for BEVs.

5) The low CO<sub>2</sub> cost scenario uses 46,012 won/tCO<sub>2</sub>eq, adjusted to reflect estimates by the Interagency Working Group on the Social Cost of Greenhouse Gases (IWG, 2021), while the high CO<sub>2</sub> cost scenario employs 108,263 won/tCO<sub>2</sub>eq, based on estimates from the Environmental Protection Agency (EPA, 2022).

6) Also assumes the zero-carbon electricity scenario with no GHG (and air pollutant) emissions from electricity consumption.

**Source:** Author's calculations.



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