

# EV Energy Convergence Plan for Reshaping the European Automobile Industry According to the Green Deal Policy

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## 그린딜 정책에 따른 유럽자동차 산업재편의 EV 에너지 융합방안

서대성

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**Abstract** The paper dealt with the fact that the green deal took place when the demand for electrical energy surged. However, the procurement of electric vehicles and much of the electric energy of the future still depends on fossil fuels. Accordingly, the importance of the IT industry is highlighted, and the demand for hydrogen-electric vehicles and related industries increases. The method of this study investigated the relevance of EV charging as a future next-generation power source rather than the electric energy demand of the IT industry. This study derives the correlation between industrial electricity and household energy PPP according to economic growth through empirical regression analysis. As the result, it was found that the amount of change, including electric and next-generation electric vehicles, was significant for on thirds of the countries in the change in purchasing power compared to GDP. This affects overall purchasing power as twelve out of thirty two countries with EV demand (Italy, Canada, Switzerland, Poland, Slovenia, Germany, Slovakia, Finland, Sweden, Czech Republic, Estonia, Denmark) are more sensitive to electric energy. This is related to the charging of EVs or hydrogen as the next-generation power of the future rather than the electric energy demand of the IT industry. By preventing waste of unused electricity of IT-electric energy sources and charging-preserving hydrogen electricity, it seems indispensable to prepare for the national IT power conservation buffer facility for supply and demand in future growth.

**Key Words** : Convergence, EV, Battery, Energy, PPP, Industrial-reorganization, Industrial-robots, Chasm

**요약** 이 논문은 그린 딜로 인한 전기 에너지 수요가 급증을 될 수 있기 때문에 이를 제시하고자 한다. 그러나 미래의 전기 자동차와 많은 전기 에너지의 조달은 여전히 화석 연료에 의존한다. 이에 IT 산업의 중요성이 부각되고 수소-전기차의 수요와 연관 산업으로 그 수요가 증가하게 된다. 본 연구의 방법은 IT 산업의 전기 에너지 수요보다 미래 차세대 동력으로 전기차의 충전과 연관성을 조사하였다. 이는 실증적 회귀 분석을 통해 경제 성장에 따른 산업용 전기와 가정용 에너지를 성장에 따른 PPP의 상관관계를 도출하였다. 그 결과 전기차와 차세대 전기차를 포함한 변화량은 GDP 대비 구매력 변화 국가의 1/3에서 유의미한 것으로 나타났다. 이는 전기차의 수요가 있는 32개국 중 12개 국가(이탈리아, 캐나다, 스위스, 폴란드, 슬로베니아, 독일, 슬로바키아, 핀란드, 스웨덴, 체코, 에스토니아, 덴마크)가 더 많은 전기 에너지에 더 민감하기에 전체 구매력에 영향을 미치게 된다. IT-전기 에너지원의 미사용 전력 낭비를 방지하고, 수소전기 충전-보존함으로써, 향후 성장을 위한 수급에 국가의 IT 산업 보존 완충 시설대비가 필수불가결하다.

**주제어** : 융합, EV, 배터리, 에너지, PPP, 산업 재편, 산업로봇, 캐즘

## 1. Introduction

EU puts in place countermeasures of the Eur

open automobile market within the green deal policy framework. The paper intends to present

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this because the demand for electric energy may increase rapidly due to the green deal. The Green Deal is the EU's green policy aimed at zeroing net carbon emissions in Europe in 2050. The ban on the sale of 'internal combustion engine cars' is to diversify cargo concentrated in the road sector to railways, seas, and canals. First, it is necessary to prepare for support for low-carbon hydrogen vehicles developed with hydrogen-based on renewable energy. This is because green hydrogen production projects are already involved in the Netherlands, Norway and the UK. European Union countries will connect to build large-scale renewable energy and hydrogen production complexes, and expand transportation and charging facilities using gas pipelines. However, the demand for platinum in the production of hydrogen electricity makes it difficult to popularize hydrogen cars when the similar gold price reaches \$2,000. Second, the European Clean Hydrogen Alliance is an opportunity for Korea. As it consists of industrial civil society, state and regional ministers, and European investment banks, there should be a strategy for that. Korea can supplement with own hydrogen application technology because the EU includes investment support for large-scale clean hydrogen production. It has a hydrogen production capacity of more than 10 million tons by 2030 and targets strict carbon emissions. To this end, the Clean Hydrogen Alliance plans to increase hydrogen production facilities at the level of 1GW by 2024 to 6GW and 40GW by 2030. For example, Spain, which has abundant sunlight, uses solar power as its main energy source, while Nordic countries facing the North Sea, where the wind is strong, use wind power, and Austria, which has abundant water resources, uses hydropower as its main energy source. In the EU, nuclear power plants account for 25.5% of total power generation. However, support for economic stimulus was reversed due to Covid-19, and

97.6% of the subsidy, or \$590.9 billion, was provided to industries with high carbon emissions such as aviation, automobiles, and oil companies. Only 2.4%, or \$12.3 billion, was provided to green industries such as renewable energy [1]. The method of the study investigated the relevance of EV(electric vehicle) charging as a future next-generation power source rather than the electric energy demand of the IT industry. It gets through empirical regression analysis to derive the correlation between industrial-household electricity energy and PPP per GDP to grow economically.

This shows that self-government with a green deal policy hinders national economic growth. First, the European Green Deal presented a policy response plan for each of six policy areas, including clean energy, sustainable industry, architecture, sustainable transport, agri-food, and biodiversity. It is a process conversion system of 100 billion euros.

Second, the process conversion fund is also quite insufficient to support the overall decarbonization conversion. It is confined to the coal industry, but relief benefits do not work well for workers. It is a device to attract coal countries in Eastern Europe such as Poland. In the Paris Climate Agreement, to voluntarily reduce greenhouse gases by country, a carbon tax or emission trading system is required. The improvement of transportation infrastructure (technology innovation, expansion of sustainable fuel use, intelligent transportation system, etc.), second, consumer policy, and third, improvement of laws related to emission regulation.

Existing studies have dealt with changes due to the use of electricity, but the necessity of this study is to prevent waste of unused electricity from IT-electric energy sources. To this end, it is indispensable to prepare for the national IT industry preservation buffer facility for supply and demand for future carbon-neutral-growth by charging

ing-preserving hydrogen or electricity.

## 2. Prior research

### 2.1 the modeling of methodology

Lapeyre, B., & Quinet, E., [4] in the paper, express the critical value in a closed format that contains the mean, standard deviation, and correlation of random variables. Simulations using wise current values of these parameters have shown that the systematic risks arising from the correlation between the benefits of the investment and economic growth are not very high, and more attention should be paid to the risks associated with the construction cost of the investment.

In addition, he designed a simple rule of thumb to estimate the threshold. Hoekstra, R. (2019). mention that many other methodological, theoretical, and practical considerations have become even more problematic because of ICT and globalisation. Other criticisms focus on the fact that GDP does not measure well-being, sustainability (or any other aspect of the future) or inequality. Langarita, R., Duarte, R., Hewings, G., & Sánchez-Chóliz, J. (2019) address the economic and environmental impacts of three change scenarios for Spain's electricity sector under the European Union's objectives. It is to increase environmental sustainability and increase the use of renewable energy sources while reducing the use of brown energy sources. To increase the competitiveness of the Spanish power sector. Their results suggest potential improvements in production and trade, and reductions in CO<sub>2</sub> emissions were also observed in Scenario 2. They cover the impact of three policy scenarios on the Spanish power sector. Analyze the effects of increasing trade, renewable energy and competitiveness [5]. The computational general equilibrium (CGE) model distinguishes between the business and production technologies in the sector. they f

ound improvements in production and trade and reductions in CO<sub>2</sub> emissions as Fig. 1. (a) and (b) It could be argued that this is an analysis according to the existing fossil fuel era.

However, this paper is not in the aspect of the classical CGE model, but because the change according to the ICT growth and the diversity that suits the era of human intelligence before the model was found, the environmental friendly electric energy changes were made the PPP against economic growth a multinomial regression analysis when compared.

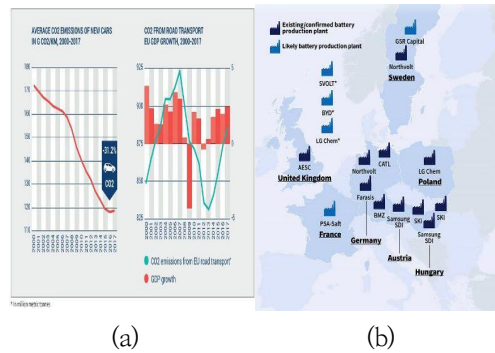


Fig. 1. (a) Average CO<sub>2</sub> emissions & GDP growth  
(b) Lithium & next-generation battery plant

### 2.2 Reshaping post Covid automotive alliance

It is reshaping for green deal as Table 2. shows

Table 1. Number of industrial robots per 10,000 people

	Automotive	General industry	Overall industry	Rank
US	1,287	139	228	7th
Germany	1,311	199	346	3th
China	938	95	187	12th
Japan	1,248	273	346	4th
Korea				2th

Source: International Federal Robotics, 2021.

This is an additional financial burden on auto parts makers [2]. There are also auto parts

suppliers that have financial conditions like Bosch, but most auto parts companies are in crisis of turning point with more parts makers than finished car companies due to the disruption of car production and maintenance of the auto parts supply network due to the Covid-19 crisis. The German federal government doubled subsidies for EVs as a result of the Covid-19 economic stimulus (EV subsidy: 9,000 euros, plug-in-hybrid subsidy up to 6,750 euros).

In Asia, despite the robotics giant, regional average density figures are lower than the global average, with 66 per 10,000 employees compared to the average for 99 in Europe. However, compared to 5% in Europe, industrial robots are being automated at 9%, which is the fastest growth rate in the world.

The IFR predicts a global average annual growth rate of 15% for industrial robots by 2020, and a potential surge of 25% for professional service robots, so it shows reduction of EV production manpower

The German automobile industry is gradually recovering after the Covid-19 outbreaks. Enterprise expectations in the automotive industry increased by 16.8 points from the previous month to 43.7 points. The automobile industry is being re-organized in earnest factory robot operation due to the Covid-19 incident. This depends on the proportion of automated production as Table 1. shows.

**Table 2. SWOT analysis**

Strength	Weakness
<ul style="list-style-type: none"> <li>Strengthening the competitiveness of labor costs in the manufacturing industry</li> <li>Automotive industry manufacturing base (Benz, Suzuki, BMW, VW, Audi, etc.)</li> <li>Powerful automobile exports (more than 80% of domestically produced automobiles are exported)</li> <li>Cultivation of new techno</li> </ul>	<ul style="list-style-type: none"> <li>International competitiveness limited to some companies in green deals</li> <li>High dependence on overseas technology and parts</li> <li>High domestic production costs</li> <li>EV process simplification and reductions due to automation facilities</li> <li>Response to changes in</li> </ul>

logies in production such as small and medium-sized vehicles <ul style="list-style-type: none"> <li>Ahead of the EV era, a base for producing and supplying core parts (batteries)</li> </ul>	the procurement of existing automobile parts <ul style="list-style-type: none"> <li>Lack of own industry growth capability</li> <li>Low demand and high-quality manpower outflow</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Next-generation automobile development and production base sustainability</li> <li>Securing existing automobile manufacturing technology</li> <li>Multiple global multilateral trade agreements</li> <li>Maintaining partnerships with Asian and automotive companies</li> <li>Support for the battery industry as a new growth engine (digitalization)</li> <li>Subsidy incentive policy</li> </ul>	<ul style="list-style-type: none"> <li>High investment in reshoring industry (one third of global automobile R&amp;D. Europe an economy's R&amp;D investment destination)</li> <li>Economic instability (Brexit, US-China-EU trade dispute)</li> <li>Problem of conversion of production bases for EV &amp; autonomous vehicles</li> <li>Strengthening EU-level regulations(CO<sub>2</sub>, RDE,WLTP)</li> <li>Reduced production of internal combustion engine manufacturers, the diesel scandal</li> </ul>

### 2.3 The proportion of automobile production in CE Europe following the transition to EV

In Europe, industry restructuring is accelerating in line with the green deal policy. This was facing a decrease in production manpower due to the conversion to EVs, and the direction of the industry is becoming clear with Covid 19. With scaling down for innovation the top 10 European EV Models were registered in 2020. RenaultZoe (21.4%), TeslaModel3 (13%), Volkswagen(8.1%), Peugeot-208(7.4%), Hyundai Kona BEV(5.3%), NissanLeaf(4.4%), KiaNiro EV(4.3%), Volkswagene-Up(4.2%), Audi e-Tron(4.1%), BMW i3(3.6%), Other (24.3%). With Covid 19, global automakers have laid off tens of thousands of additional employees. Reduction of human resources in the European automobile industry is required to obtain a synergy effect of R&D investment or M&A according to efficiency. This will result in continued employment and employment reduction, and significant positive policy changes are required overall [3]. Hungary

and Poland have similar employment rates between the ages of 15 and 65, while the Czech Republic and Slovakia have consistently maintained stable employment rates. It is lower than that of Korea, but has a similar employment curve. This plays an important role in external investment conditions. When comparing the sales volume of passenger cars and commercial vehicles in the CEE SWOT analysis of European automobile and parts industry by country as Table 2. Poland showed a stable growth side in terms of commercial vehicles, while the Czech Republic and Hungary differed by period. This could mean that Poland can play an important role in terms of exports and suppliers if the proportion of hydrogen vehicles is expected to increase in the commercial vehicle sector.

### 3. Energy & country's eco-friendly vehicle

#### 3.1. Green deal for EV fuel charging

The EU has strengthened environmental regulations on automobiles, lowering the carbon dioxide emissions of existing vehicles from 130g per km to 95g per km, and by 2030 Germany, France, and the Netherlands will ban the sale of internal combustion vehicles. In the EU 2050, carbon-neutrality is important in the automotive industry. Since 2019, among Hungary's foreign direct investment countries, Korea is the No. 2 market for rechargeable battery companies. In Hungary Hyundai-Kia

Kona and Iconic EV of Korea are sold along with Tesla, Nissan Leaf, Opel and Volkswagen e-Golf. The government subsidy for EVs is less than 1.5 million forints. In addition, the introduction of EVs is increasing every year, including top-tier vehicles. In each country, the expansion of EVs continues, such as gradually restricting sales of internal combustion engine vehicles, policies to promote EV purchases, and expansion of charging infrastructure. Also, they try to maintain the stability of the powergrid through real-time power generation and demand balance. Grid-scale energy storage systems are increasingly being deployed to provide grid operators with the flexibility, they need to maintain this balance.

So energy storage also gives them the grid infrastructure resilience and robustness. The distribution of large-scale energy storage systems has increased significantly over the past few years [5].

Hydrogen fueling stations as Table 3. shows still have the potential to grow in Western Europe, and there are many challenges to overcome such as charging manpower and hydrogen supply to expand them to Central and Eastern Europe. Korea's responsiveness to this has quickly advanced to Europe, but the expansion of CEE seems premature. It can be seen that commercial vehicle hydrogen vehicles have greater potential than internal combustion freight vehicles.

**Table 3. Hydrogen fuel charging station & EV fast charging station EV fast CCS in Euproee**

H <sub>2</sub> , EV charging	NO	UK	DK	SE	ES	LT	DE	CZ	AT	CH	NL	BE	FR	IT	ES	IS	PL	HU	FI
In operation, H <sub>2</sub>	4	10	4	4	0	1	92	0	5	9	5	3	4	4	0	3	0	0	0
In progress, H <sub>2</sub>	0	1	3	0	1	0	15	3	0	1	10	4	2	2	2	0	0	0	0
Electric fast charging per 100km	n.a.	19.7	7.4	8.4	0.4	3.2	14.4	5.1	7.8	n.a.	17.2	4.1	4.3	2.3	2.4	n.a.	1.4	1.8	1.8

Source: GmbH ; Statista, 2021

EV fast-charging stations have several meanings in terms of direct current and alternating current. Since it is possible to use charging in residential homes, the policy of CEE for electricity bills is very important. Accordingly, the demand and supply of electric vehicles will also develop[6].

### 3.2 Empirical analysis

In the statistical analysis of the above 32 countries, the countries with 95% CI (L) significant dotted lines (countries that will affect purchasing power for economic growth versus price changes of electric energy) are Italy, Canada, Switzerland, Poland, Slovenia, Germany, Slovakia, Finland, Sweden, the Czech Republic,

Estonia, and Denmark. Countries that exist within the 95% CI (U) potential are Latvia, Portugal, and the Netherlands (which are related to electrical energy but are eligible for PPP). Other countries include Korea and others (Greece, USA, Hungary, Austria, Belgium, Australia, France, Ireland.) 95% PI: prediction interval-countries most likely to contain 1 new observation at a given confidence level It was found to belong to the range for the characteristic value of them. (Except for Luxembourg). However, since this statistical significance is analyzed as 2017,8-2019, it may appear differently depending on the period.

-Regression Statistics as Table 4. shows

Table 4. Regression Statistics

	Coefficients	Std Err	LCL	UCL	t Stat	p-value	H0 (5%)
Intercept	2,353.44929	364.94173	1,608.13885	3,098.75974	6.44884	4.00534E-07	Rejected
Home 2019-2018or 17 gap(elect)	45.78010	23.00846	-1.20945	92.76965	1.98971	0.05581	Accepted
T (5%)	2.04227						

R : 0.3414, R-Squared :0.1166

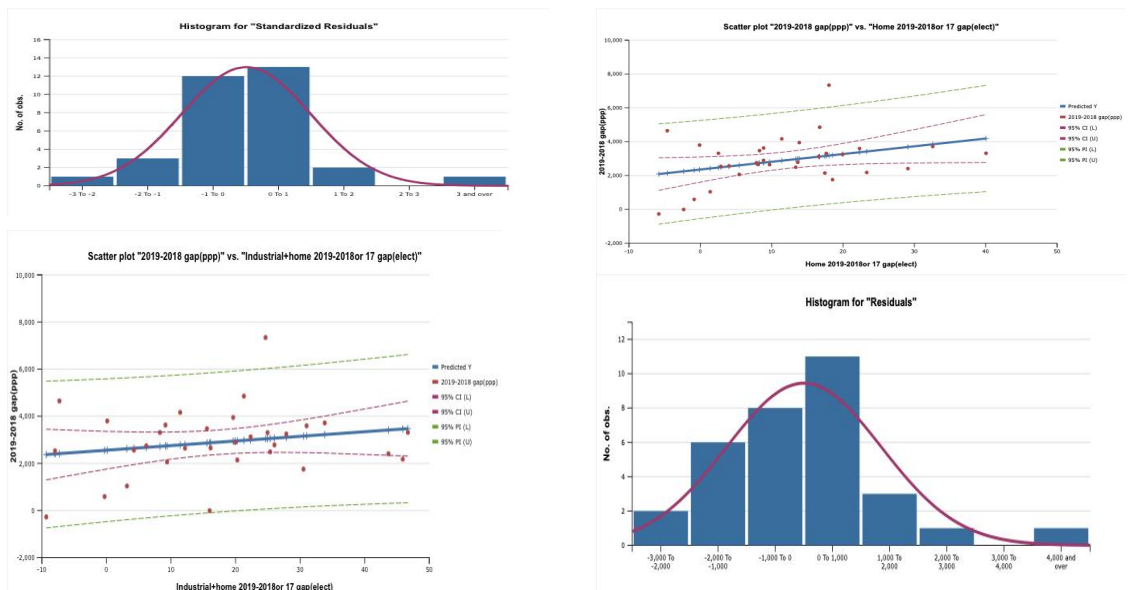


Fig. 2. Statistical significance

### 3.2 Korean perspective

Scenario 1: Covid-19 prolongs and demand taste change. As the Covid-19 the automobile industry will be divided into automobile companies that overcome by creating new demand through a rapid transition to electric vehicles rather than a long-term recession. Scenario 2: Slovakia, Poland, and the Czech Republic will form a top similar EV consumption group (excluding Hungary) with Lithuania. Scenario 3: Europe will rebuild its global supply chain. Implement digital and process automation to revitalize mid-to long-term global supply chains and mitigate the risk of operational disruption with a strategic perspective that takes crisis as an opportunity. Digital transformation and smart factory construction to respond to the recurrence of similar shocks, continually monitor risk management cases and upgrade response plans. The Nosovices plant is equipped with a robot manufacturing facility for the assembly line of battery cells, including a production line including a stamping and welding process as well as a painting plant, up to Hyundai Motor's Genesis brand (invested \$87 billion). Scenario 4: Losing initiative in Europe's next-generation battery policy and China's low-cost strategy. Battery cell suppliers are LG Chem(Energy Solution) and SK Innovation based in Poland and SDI in Hungary. In addition, ABB is LG Chem's supplier of substations for the largest EV battery plant in Poland and its core equipment includes transformers, lightning arrestors and gas-insulated switchgear for a safe and reliable power supply. However, Europe is trying to lead the EV market with the start of 2020 in the US and China. On the other hand, the EU was the 'European Battery Alliance' in 2017, which was a trend of automakers seeking to secure stable and

diversify supply of rapidly growing electric vehicles and batteries. However, Belgian Basf (BASF), which has invested in Finland and Germany, mainly for self-developed production, can supply next-generation batteries (manganese-rich NCM), raw materials (nickel and cobalt), and produce precursors and cathode materials in Europe.

This means that the EU Battery 2030+Research Initiative is also conducting joint development of artificial intelligence automation and manufacturing.

## 4. European perspective and countermeasures

### 4.1 Reorganizing automotive industry

Korea needs to recognize and prepare for CEE as a regional cluster. This region is creating a regional platform through one voice and economic policy. This is because Korea has to share industrial relations as a role in the German automobile platform market due to the automobile industry reorganization. The automotive industry is carbon-neutral due to market contraction and EU Green Deal. ACEA(European Automobile Manufacturers Association) says that one of the biggest drivers of change in addressing environmental issues. This requires a lot of change in carbon-neutral road transport. This is a way for Europe to carry out the Green Deal. 16 major automakers in the EU auto industry can effectively reduce CO<sub>2</sub> emissions. First, it does not impose technology or ban vehicles that can provide CO<sub>2</sub> reduction. Second, charging stations and re-gas stations suitable for automobiles and commercial vehicles should support the deployment of alternative power vehicles for each core network, and should be deployed throughout Eastern Europe from the center of Western Europe. Third, the new reduction emission

technology of internal combustion engines is expensive and will not change much in the future. Fourth, a subsidy incentive system is required. Fifth, the Green Deal should be suitable for mobility and reasonable road prices. The EC's Green Deal will also be strengthened as a means to strengthen the global competitiveness of the automotive industry.

ACEA has been growing for six years in a row, but after that, EU passenger car sales will decrease by 2% in 2020, and at the time when investment in pollution-free vehicles is greatly strengthened, the market shrinks not only in the EU but also around the world, which accelerates the transition to carbon neutrality and Industry robotization. In the case of Samsung, which formed the automotive electronics business team in 2015 currently supplies FSD chips make Tesla's fully autonomous driving possible, can produce semiconductors for an electric self-driving car. Samsung's next-generation self-driving cars may appear in the production market in Europe. It is leading the autonomous driving and connected automotive sectors, including the acquisition of HARMAN electronics. It can be seen that the role of converting, producing, and selling battery production bases in Eastern Europe invested by Samsung or LG into EV production bases is always potential.

#### 4.2. Summary measures: EV energy

The study could be demonstrated that a third of 32 countries affects the GDP of purchasing power. If large-scale EV production changes to increase rapidly. So it is more sensitive to consume electrical energy that affects the overall purchasing power. By preventing waste of unused power from IT-electrical energy sources and charging and conserving hydrogen electricity, they become dependent on electrical

energy storage or battery sector development [12]. Because it affects the purchasing power of GDP. In the end, this proves that it will have a major impact on sustainable economic growth. Central Europe, which has maintained its automobile manufacturing base for the past 20 years for the EU, is at a turning point in investment of EV. In the future, the platform industry and EV business, the reshoring industry, and the low wages of workers through robotic automation manufacturing will not guarantee stability in the region and good industrial infrastructure relations in neighboring Western European countries. The reason why Apple electric cars and Google electric cars are not commercialized like Tesla is in the market and autonomous artificial intelligence technology contrary to the electric energy charging supply [13]. National policies such as energy supply are also important here. But despite electricity costs in Europe are relatively high, eventually, dependence on automated production will change to foster its own state industries. Here is Korea's export strategy that the reorganization of the automobile industry has already appeared as a green deal, and in order to enable production with an automated process or less manpower, the production of EV or the industrialization of platforms [14] is further accelerated on electric competition in post Covid-19.

### 5. Conclusion and Implications

At the era of the great energy transition, it is time to prepare the national IT power-saving buffer facility for supply and demand for future growth. IT-electricity energy sources should be prevented from wasting unused power and have the ability to charge and preserve hydrogen or electricity. As a result of the above empirical analysis, expanding this regional own charger



through renewal or electric hydrogen energy could lead to a new EV purchasing power strategy ahead of the Western European automotive and parts supply line, despite electricity of EU is relatively expensive. When the internal combustion vehicle industry faces a shrinking market, it is very important to respond to changes in the growth engines of the industry. Therefore, Korea's investment policy for IT-energy charging electricity for CCS or hydrogen for ESG and expansion should also be changed.

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