Net Zero Industrial Policy Lab



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# South Korea’s promise and pitfalls in the cold war clean energy race: autos, batteries and chips supply chains

## PREFACE

South Korea’s economic transformation in the second half of the twentieth century is one of the best, and best-known, industrial policy success stories. The global environment has dramatically changed in the past few years, bringing new challenges

and opportunities for Korea. These changes include systemic conflict between the US and China; a widespread shift towards resilience in supply-chains; and rapid advances in clean energy and transport. Connected to all of these factors, several powerful countries and blocs are re-energizing their strategic industrial policy efforts – a particularly significant development for South Korea, which has used these tools successfully in the past but now faces a more competitive environment in many sectors.

On December 20th 2023, the Yoon government passed "The List of Critical and Emerging Technologies" officially confirming the selection of "12 Critical and Emerging Technologies." These technologies represent the development goals that South Korea must secure in order to survive and excel in the global competition for technological dominance. They include[1] batteries, autos, and semiconductors, which we analyze in this report.

**Our report analyzes questions and tradeoffs facing Korean policymakers at this critical juncture:**

- How can Korea sustain its status as China's largest trading partner while preserving its security and trade relationship with the US?
- Will Korea be able to hedge its bets by creating a dual supply chain - one for the US and European Market and one for the Chinese and Asian market?
- Can Korea create investment at home to create jobs and boost domestic growth as global growth deteriorates?
- How can Korea maintain its technological leadership even as it boosts investments in allied countries?
- How can Korea meet its climate goals while simultaneously boosting its export competitiveness?

**In short: How should Korea's industrial policy respond to this new and challenging international environment?**

# CONTENTS

## Korea holds potential in the clean energy race because of its advanced manufacturing base

The Republic of Korea (ROK; henceforth Korea) has long been the poster-child of successful state-led industrial policy. The country achieved its miraculous economic development from a poor, war-torn agricultural nation into a highly industrialized economy through a strategy of corporatist, export-led growth. In 2023, Korea was the world's 5th largest manufacturer by value–added (*Figure 1*), and the world's 7th-largest goods exporter, with a trade-to-GDP ratio of 70 percent.

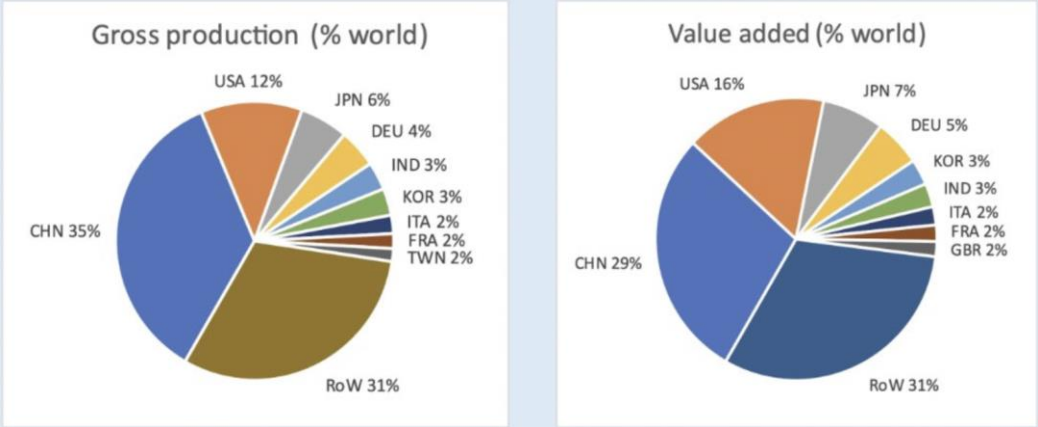


**Figure 1: Korea's manufacturing prowess** Source: OECD Trade in Value Added (TiVA) database, Richard Baldwin (2023)

To bring off its "Miracle on the Han River," Korea embarked on a program of government-directed economic policies including land reform, privatization, and intensive foreign trade to pursue reconstruction after the war. Many of these firms, trading commodities like sugar, wool, and cotton, accumulated foreign exchange and intensified the country's export-oriented growth strategy, eventually growing into the *chaebols*, or large, family-owned conglomerates, for which Korea's business sector is now famous.

Samsung, for example, began as a small retailer that expanded into foreign trade, specializing in sugar and textiles. Today, Samsung's electronics arm and rivals like SK Hynix, battery makers LG Energy Solution, SK On and Samsung SDI, and auto company Hyundai, are leading players in critical sectors like semiconductors, batteries, EVs, and biotech. The *chaebol* model, in which major corporate actors work hand-in-glove with

government policy, is well positioned to take advantage of step-change shifts in industrial and national security strategy.

**Korea's advanced manufacturing base gives it a head start in the clean energy race. According to our NZIPL assessment, Korea is a pivotal "middle energy power" because of key assets it has developed, namely:**

**Clean energy**: cheap, clean energy is a key factor in investment decisions today. Korea's current weakness is its heavy reliance on fossil energy imports - 83% of final energy consumption in 2022 - coupled with an industrial sector that is responsible for over half of its GHG emissions. But with structured incentives from domestic laws and regulations in export markets (see our policy recommendations), Korea has great room for improvement to boost renewable energy share from its currently low base.

**Existing production networks**: the ability to benefit and learn from nearby firms is essential.

**Proximity to large markets**: ability to feed large markets on time is an advantage. Korean firms have large, growing and dynamic markets in Asia, Europe and North America.

**Science and technology**: R&D spend on applied support and underlying patents. Korea is the leading country in the world on a per capita basis in generating new patents. Strong linkages exist between industry R&D, factories, universities and research facilities.

**Skilled workforce**: Korea's already high levels of human capital development has been further boosted by an integrated approach to link education and training with national economic development planning in recent budgets in line with the projected demand of skills.

**Innovation ecosystems**: Korea's high quality institutions facilitate good industrial policy. Korean government agencies like Ministry of Trade, Industry and Energy (MOTIE), Ministry of Science, Export-Import bank, K-Sure, have an enviable track record in supporting innovation ecosystems, and flexibly responding to challenges.

## Korea is facing new challenges from geopolitical shifts and protectionist industrial policy

The first challenge facing Korea is acute geopolitical tensions. Seismic shifts of the New Cold War have opened fault lines in the country's balancing act of industrial growth, security, and political objectives.

Korea's growth miracle was a product of active management of relationships with three actors – US, China, and North Korea – all three of whom have now changed their strategic orientation towards each other. The Korean strategy of balancing between them was based on a policy of detente between China, its main trading partner; close security partnership with the US; and deterring North Korea.

The IMF has warned that Korea could be the largest potential loser from rising tensions between the US and China, due to its companies' entanglements in strategic high-tech sectors with both countries. Put simply, Korea's chips and batteries are crucial not just for its own economic development, but vulnerable to the industrial growth and security strategies of both China and the US.

> *China is Korea s largest export destination, followed by the US. Korea exports large amounts of semiconductors to China, often for use in products that China then exports to the world, while Korea s car exports are disproportionately destined for the US. A significant share of Korea s intermediate goods for manufacturing are sourced from China. Korean companies also maintain sizable manufacturing facilities in the US and China, as Korea s FDI linkages with China and the US are large. Hence, a reduction in trade and investment as a result of geoeconomic fragmentation would impact Korea s leading industries, leading to lower output and employment, and higher import costs transmitted through inflation….these* ***losses could be as large as 2-4 percent of Korea s GDP****"*

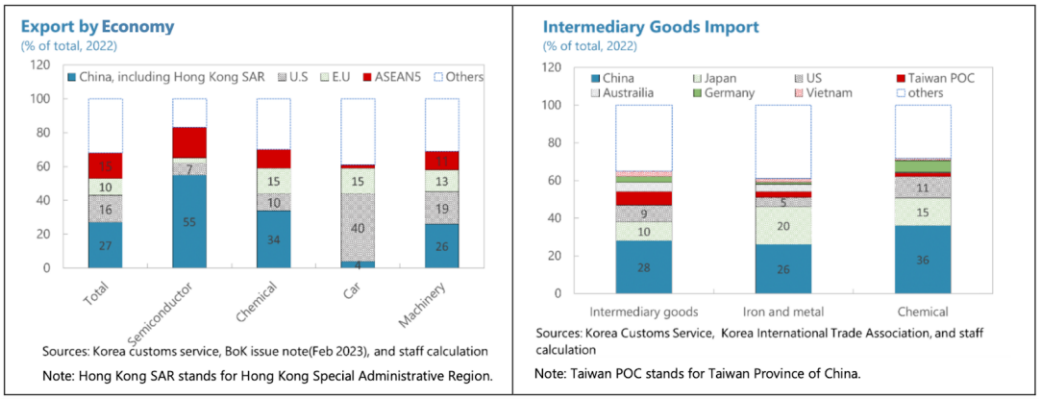

Figure 2: Korea's export challenge in the New Cold War: largest export destination is China (largest sector is chips), followed by the US (largest sector is cars). Source: IMF Staff Report for Korea (2023)

The second challenge facing Korea is the global rise of protectionist industrial policy. The rise of protectionism is not a temporary change, but a structural shift in many countries due to a variety of reasons such as national security, concern about domestic competitiveness of strategic sectors, left-behind areas and climate change. As the IMF has documented, Advanced economies (AE) used industrial policy interventions more frequently than emerging markets and developing economies (EMDE) (*Figure 3*)

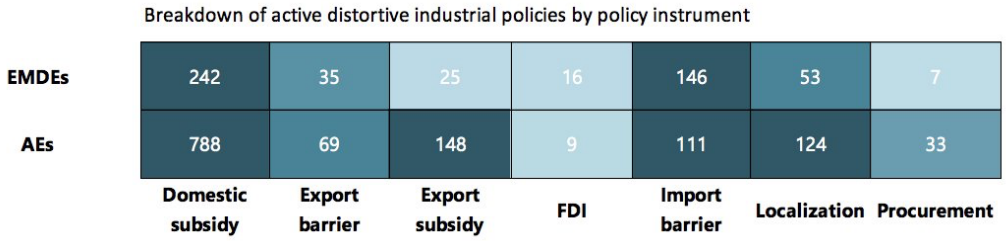


**Figure 3: Rise of National protectionism i.e local content restrictions** Source: IMF, New Industrial Policy Observatory (2023)

Both of Korea's largest export markets - US and Chinese - have legislated industrial policy with 'make in America 'in the IRA or 'make in China 'requirements. Such local content requirements are a clear violation of WTO rules, which were intended to allow countries equal and non-discriminatory access to each other's markets. For Korea, local content requirements meant that American consumers buying models like Hyundai's increasingly popular Ioniq 5—assembled at its plant in Ulsan, Korea— would lose access to the US EV consumer tax credit. Similarly, in 2016 Chinese industrial policy denied auto subsidies to Korean firms like Hyundai, and EV sales of Korean firms dropped rapidly, and they were forced to redirect to US markets.

## In response to these twin challenges, Korea has made a geo-economic pivot

In the past two years under President Yoon, Korea has made a major geopolitical and geo-economic pivot. President Yoon has doubled down on its trilateral cooperation with the US and Japan, even while remaining a key trading partner to China. Korea increased its military spending by 4.3 percent and upgraded its US-operated THAAD air defense system that had previously provoked economic retaliation from China on Korean firms in 2017.

This geopolitical pivot – despite potential risks as estimated by the IMF, and by past experience – is in response to increasing intensity of belligerent actions from DPRK which in 2019 made a profound shift away from its policy of normalization towards the United States and ROK at the end of the Cold War in 1990. Since then DPRK has sought a strategic reorientation towards China and Russia. Pyongyang's missile testing was at a record high in 2023, aimed at targets in the ROK and in Japan, and led to multiple civilian evacuations in South Korea.

Korea and the US have responded to DPRK's aggressive actions with the Washington Declaration in April 2023 and increasing coordination of their foreign and defense ministries. The two countries have made assurances of extended deterrence and deploying American nuclear-capable submarines, carriers and long-range bombers to the Korean peninsula for the first time since 1991. Having obtained extended deterrence commitments from the US, President Yoon shelved earlier plans for Korea to unilaterally breakout with its own nuclear weapons and reaffirmed ROK's commitment to the Nuclear non-proliferation treaty.

The tighter bilateral alliance with the US, was matched with steps taken by Korea to reduce tensions with Japan. In March 2023, Japan and ROK held their first summit in twelve years. President Kishida invited President Yoon to attend the G7 Hiroshima meeting in 2023 in May. In June, the defense ministers of Japan, Korea and the US met in Singapore and in July the three countries held a trilateral missile defense exercise. The tightening trilateral relationship culminated in a Camp David Summit in August 2023. The three countries made a "commitment to consult" and created a new mechanism for trilateral consultations in response to "regional challenges, provocations, and threats to our collective interests and security". The three countries identified economic security and climate change as core threats.

# KEY FINDINGS

## Assessing chips, batteries and automotive EV supply chains

In the following section, we assess recent Korean government policy action (see Appendix for policies) for each of chips, batteries and EV supply chains using the criteria laid out in *Table 1*.

*Table 1. Summary of NZIPL policy assessment criteria for Korean government in the three strategic industries*

| **Policy assessment criteria** | **Batteries** | **EVs** | **Chips** |
|---|---|---|---|
| Did government incentivize domestic production? | Yes | Yes | Yes |
| Did it promote innovation to stay ahead of competitors? | Yes - LFP; recycling | Yes - charging speed | Yes - non memory chips |
| Did it promote skills and workers? | Yes | Yes | Yes, but too little |
| Did it help left-behind areas? | Yes | Yes | No, concentrated in Seoul |
| Did it use diplomatic efforts to retain market share overseas? | Yes | Yes | Yes |
| Did it support outbound FDI to de-risk from China? | Yes, but fails to achieve self-sufficiency targets | Yes | Yes |
| Will it meet market share targets? | No | No | Likely |

## 1. Korea made a strategic EV policy victory

The Korean government reacted quickly and negatively to the surprise passage of the IRA. Seoul was upset that Hyundai vehicles would be excluded from receiving the

$7,500 consumer EV incentives that the IRA extended, but with local sourcing requirements. Whereas the old EV incentive was available to all EVs, under the IRA, only made-in-America EVs with significant shares of North American battery components and Free Trade Agreement critical materials qualify.

After the passage of the IRA in July 2022, the US tried to compel Koreans and Europeans to accept the IRA as a potential benefit and find some work-arounds to avoid the worst effects on EU and Korean car exporters, who complained vigorously via their national governments. In addition, Korean battery companies lobbied the Biden Administration. A November 2022 Treasury roundtable included input from LG Energy Solution, Samsung SDI, SK On, Hyundai and Kia.

Because of this coordinated opposition, a US Treasury concession was given to allow Korean and EU manufacturers to qualify for American taxpayer subsidies for batteries made in the EU or Korea as long as the vehicle is *leased* and not purchased. Moreover, the Treasury ruling relaxed sourcing constraints such that EVs assembled in North America with batteries whose inputs (critical minerals and components) were made outside America were eligible. These concessions had a dramatic positive effect on Korean companies in America. In 2022, leased vehicles comprised only 2 percent of Korean-assembled EVs in the US market; that figure shot up to over 40 percent by April 2023 (*Figure 4*)

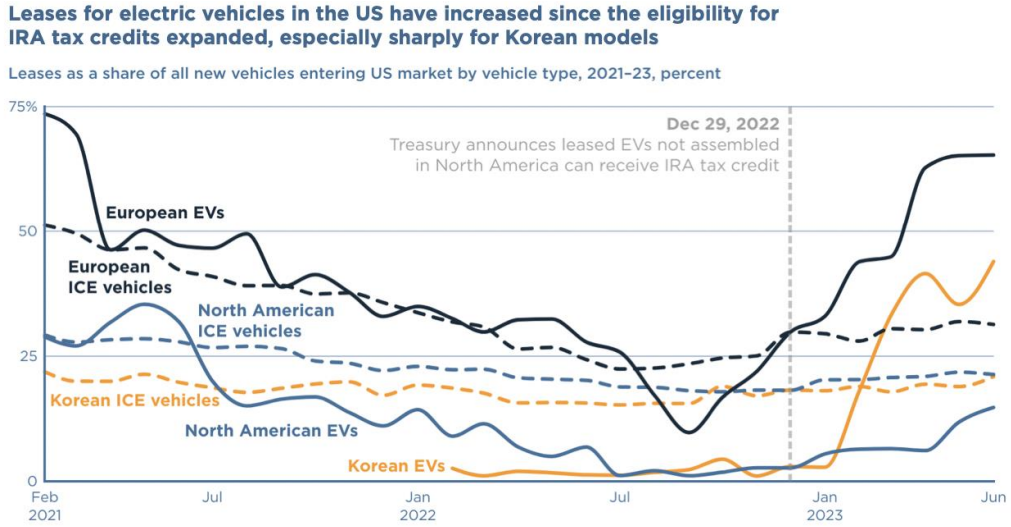


Figure 4: Korean EV and battery policy victory in the US (Source: Peterson Institute for International Economics (2023)

## 2. Korea faces acute challenges in its other two strategically critical industries: chips and batteries

### Korea caught in middle of US-China chip war

In October 2022, the US issued sweeping restrictions on high end chips – the so-called US-China Chip war — to limit China's access to "dual use" technologies. China's former deputy Commerce minister Wei Jianguo told China daily, "If the high-tech restrictions on China become tougher in the future, China's countermeasures will also escalate. By 2023, China's retaliation by imposing export controls on gallium, germanium and graphite made it increasingly clear that the fallout from the Chips war is roiling automotive and clean energy industries. Korea's POSCO was forced to procure graphite from Tanzania and Madagascar. Despite US efforts to keep them de-linked, Beijing's backlash explicitly weaponizes supply chain vulnerabilities of US and G7 allies across chips, critical minerals and batteries.

Korean firms are poised to receive substantial subsidies from the 2022 US Chips Act. However, US conditions are that companies which receive Chips act funding are not allowed to expand advanced chip making in China by more than 5% over ten years. Samsung Electronics has decided to invest $17 billion in Taylor, Texas near its existing foundry in Austin and is expected to receive $6 billion from US Chips act. While SK Hynix is still uncertain over complying with Chips act conditionalities but is planning a high bandwidth memory chip foundry by self-investing $15 billion in Indiana.

### Korea's diplomatic efforts for resilience against China with CHIP alliance

The Korean government launched a strategic chips alliance - the Chip 4 initiative - with the US, Japan, Taiwan in February 2023. The Chip 4 initiative is designed to balance three objectives (1) to enhance cooperation between the four countries on design and production of sophisticated chips (2) to coordinate export controls against China (3) to stabilize semiconductor supply chains by creating a 'strategic reserve 'of chips in case of a future conflict with China.

Given the risk of Chinese retaliation if it perceives the initiative as an anti-China alliance, President Yoon has said that Seoul will protect its national interest. Most vulnerable to Chinese retaliation are Samsung and SK Hynix, who depend on China as a

key manufacturing site and a large market. Around 20% of Samsung's memory chips are produced in Xi'an while SK Hynix makes about 40% of its chips in China using US-made chips equipment. Korea's diplomatic efforts bore fruit in October 2023 when both Samsung and SK Hynix received waivers from the US government, allowing them to indefinitely supply certain US chipmaking tools to their Chinese factories.

**K-Chips Act incentivizes domestic production and innovation**

President Yoon said semiconductors "determine the fate of the South Korean economy" and has acted decisively to both attract Korean chipmakers that were threatening to flock to the US and to worries that Korean firms would lose competitiveness to US, Japanese, Taiwanese and Chinese firms. The K-Chips act, passed by the legislature in April 2023

- Expands tax breaks for semiconductor firms of all sizes. From 8% to 15% for large companies, and from 16% to 25% for SMEs.
- Cuts regulatory red tape that has slowed new investments
- Provides infrastructural support of electricity and water supply for manufacturers
- Establishes the worlds largest "chip cluster" in *Gyeonggi-do by 2042* and aims to attract foreign chipmakers to Korea.
- Expands research and development so Korea remains on cutting-edge
- Trains over 150,000 people over 20 years to upgrade skills

The incentives provided in the K-Chips act will result in creation of the world's largest chip making cluster. Samsung and SK Hynix will together spend more than 622 trillion KRW ($470 billion) to build five advanced plants in Yongin by 2042. The Chips cluster in Seoul is expected to create a stunning 3.46 million jobs. The policy Goal is to achieve 10% or more system semiconductor market share, boost market share of global logic chip production from 3% now to 10%, and a supply chain self-reliance rate of 50%.

## Assessing domestic Batteries and automotive EV supply chains

**Korean battery policy incentivized domestic production and innovation**

On November 1, 2022, the Ministry of Trade, Industry and Energy (MOTIE) announced the Secondary Battery Industry Innovation Strategy with the vision of becoming the world leader of secondary batteries by 2030. The strategy set out objectives to increase Korea's global market share to 40% by 2030 and attract more than KRW 50 trillion in domestic investment by achieving three goals: 1) securing a stable battery supply chain, 2) building a high-tech innovation hub, and 3) creating a healthy industrial ecosystem.

On April 20, 2023, the government and its top battery companies launched the Korean Battery Alliance: a public-private partnership to build battery supply chains and technologies. a public-private partnership plan to jointly invest 20 trillion won ($15.1 billion) through 2030 to develop advanced battery technologies, including solid-state and iron phosphate (LFP) batteries. The goal was to ensure that Korean firms account for at least 40 percent of battery material production by 2030. Firms committed 50 trillion won ($35 billion). Government support included expanded tax credits and R&D funding. Government spending alone totaled upwards of KRW 37.5 Trillion ($28 billion)

In December 2023, the government announced an even larger domestic spending plan for the battery sector. It would use all traditional means of policy support - loans, guarantees, grants, and significantly boost investment tax credits further, from 8% to 15% for large firms, and from 16 to 25% for SME - to achieve its goals.

**Korean policy diplomatically supported market share overseas**

Korea has a Free Trade Agreement with the US, which makes it well-positioned to benefit from the critical minerals sourcing requirements in the IRA. But given the complexities of the battery supply chain, the US Treasury needed to make determinations about what counted as a critical mineral versus a battery component. Its decision that critical minerals include battery active materials means that Korean value added all the way to cathode counts toward the EV incentive sourcing requirements. Thus, Korean-produced cathode will help automakers meet the sourcing requirements. This also enabled Korean-firms to channel Chinese material into Korea where it could be produced as IRA-compliant. POSCO, for example, signed deals with Huayou Cobalt and CNGR Advanced Material to make cathode and anode in Korea.

**Outbound FDI has ticked up since the IRA as Korea supported firms**.

Even before the IRA, Korean firms were well positioned in the North American battery pipeline with projects in Tennessee (SK On & LG), Kentucky (SK On), Georgia (SK On),

Ohio (LG) and Ontario (LG). Upstream, POSCO had announced a project to produce cathode active material in Quebec in a joint venture with GM.

Post IRA, Korean firms are playing a decisive role in building out US production. LG, for example, announced large new facilities in Georgia, Arizona, and Michigan Samsung announced joint ventures with GM and Stellantis for Indiana-based production.

In total, NZIPL finds that LG Energy Solution, Samsung SDI, and SK On invested a total of $35 billion to the U.S. through independent factories and joint ventures.

| Status | Name | Company | State / Province | Mfg Product | Targeted annual production | Production units | Capital Investmen.. | Target Year |
|---|---|---|---|---|---|---|---|---|
| Operating | LG Energy Solution Mich.. | LG | MI | Battery Cell | 5 | GWh | $303 | Null |
| | Hyundai Motor Manufac.. | Hyundai | AL | EVs | 50,000 | EVs | $300 | 2022 |
| | SK Signet EV Charger Pla.. | SK Signet | TX | EV Chargers | 10,000 | EV Fast Chargers | $15 | 2023 |
| Operating Partially | LG Energy Solution Mich.. | LG | MI | Battery Cell | 16 | GWh | $1,700 | 2025 |
| | SK Georgia Plant 1 | SK Innovation | GA | Battery Cell | 9 | GWh | $903 | 2022 |
| Construction | Stellantis & LG Battery P.. | LG, Stellantis | ON | Battery Cell | 49 | GWh | $4,100 | 2024 |
| | LG Cathode Facility | LG | TN | Battery Cell Com.. | 600,000 | # EVs supported .. | $1,600 | 2026 |
| | Metaplant America | Hyundai | GA | EVs | 500,000 | EVs | $1,200 | 2025 |
| | SK Georgia Plant 2 | SK Innovation | GA | Battery Cell | 11 | GWh | $727 | 2023 |
| Planned | LG Energy Solution Arizona | LG | AZ | Battery Cell | 36 | GWh | $3,200 | 2025 |
| | | | | Battery Cell Com.. | 16 | GWh | $2,300 | 2026 |
| | Hyundai SK Battery Facil.. | Hyundai, SK | GA | Battery Cell | 35 | GWh | $5,000 | 2025 |
| | Metaplant America - Bat.. | Hyundai, LG | GA | Battery Cell | 30 | GWh | $4,300 | 2025 |
| | GM-SDI Battery Factory | GM, Samsung | IN | Battery Cell | 30 | GWh | $3,000 | 2027 |
| | LG Energy Solution- Toy.. | LG | MI | Battery Cell | 19 | GWh | $3,000 | 2025 |
| | Metapolant America - Ba.. | Hyundai, LG | GA | Battery Cell | Null | Null | $2,000 | 2025 |
| | LG Cathode Facility (Pha.. | LG | TN | Battery Cell Com.. | 525,000 | # EVs supported .. | $1,600 | 2027 |
| | Hyundai Battery Plant Al.. | Hyundai | AL | Battery Pack | 15 | GWh | $205 | 2024 |
| | Kia West Point Assembl.. | Kia | GA | EVs | Null | Null | $200 | 2024 |
| | NVH Korea | NVH Korea | GA | EV Parts | Null | Null | $72 | 2024 |
| | SK Battery Recycling Pla.. | SK Ecoplant | KY | Recycled Materia.. | 24,000 | tpa | $65 | 2025 |
| Rumored | Kia Manufacturing Facili.. | Kia | TBD | EVs | Null | Null | Null | 2024 |

**Figure 5: Korean battery investments in the US since the passage of the IRA (**Source: NZIPL; Jay Tuner's EV supply chain tracker)

All of these Korean firm investments in the US highlight classic tradeoffs; jobs are being created in the US, and not in Korea. Our NZIPL estimate for the number of US jobs created by these $35 billion Korean EV and battery investments is 28,000 jobs.

However, the Korean government has explicitly judged the benefits from security and expanded dollar earnings in the US market to be worth the jobs loss at home.

After the passage of the IRA, export promotion agencies K-Sure, and the Export-Import bank were instructed by the Yoon administration to provide loan guarantees, higher credit lines, interest rate cuts and insurance to facilitate investments in the US. MOTIE

Minister Lee Chang-yang emphasized "the Government will fully support domestic firms' efforts to keep achieving the best outcomes in the global market." In April 2023, MOTIE announced that a total of 7 trillion won has been provided to Korean battery firms in North America. In December 2023, a further 28 trillion won has been provided to support Korean battery firms in North America.

### *Korean government will miss 2030 target battery market share*

Despite all this government support, Korean firms are still trailing China and the EU in EV export growth. While Korean exports are growing, the slope of the curve is far below that of the EU and China (*Figure 6*)

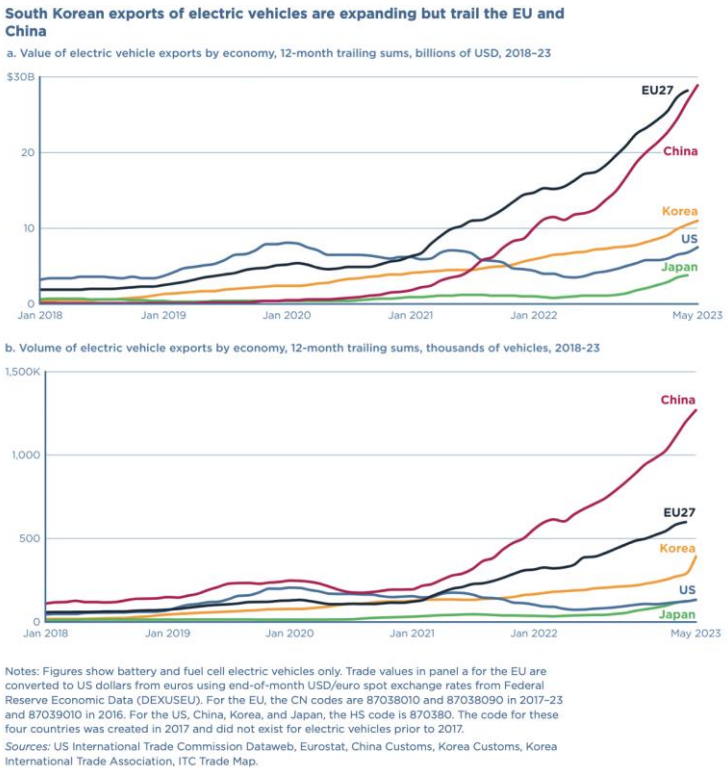


Figure 6: Korean exports of EVs are expanding but trail the EU and China Source: Peterson Institute for International Economics (2023)

*Table 2 Market share of Korea's "big 3" battery champions is going to decline and miss government targets for world market share 2030 (unit: GWh)*

| Supply chain segment | Total Korean production in 2023 (LG + SK + Samsung) | Total Korean production in 2030 (LG + SK + Samsung) | Current world productio n (2023) | Estimated world demand in 2030 | Current Korean company world share (2023) | Estimated Korean company world share in 2030 |
|---|---|---|---|---|---|---|
| Battery Cell | 194.8 | 240 | 1150 | 3000 | 17% | 8% |
| Cathode | 109 | 189 | 1150 | 3000 | 9% | 6% |
| Precursor | * | 284 | 1150 | 3000 | - | 9% |

Source: Net Zero Industrial Policy Lab analysis. Notes: * currently, 97.5% of precursor consumption in Korea is imported from China

*Table 2* tallies announced projects expected to be operational before 2030. Even with many new overseas projects [Appendix], Korean firms' overall share of batteries and battery materials production is likely to decline to 2030. As a share of world market, NZIPL estimates that Big 3 market share to fall to 6-9% by 2030, missing the governments stated target of 12%.

The reason is stronger government policy support for US, European, and Chinese firms driving booms in competing firms. Tesla, Northvolt, and CATL are all expanding production of cells without Korean partners. Tesla is aiming to produce its own Cathode, BASF and Umicore are moving into battery materials, and the large Chinese firms are expanding rapidly.

Our conclusion is that despite support from the Korean government more ambitious policy action is necessary to secure long-term market share.

### *Korea's push to reduce mineral dependency on China to 50% by 2030 is insufficient*

The Ministry of Trade and Industry has announced a global strategy (the "3050 strategy") to reduce dependency on China to less than 50% by 2030. To accomplish this goal, the ministry is offering incentives and financial support to companies that source materials from other countries. Korea is currently pursuing partnerships with

Australia, Canada, Chile, Tanzania, Indonesia, Morocco. LG for example, has partnered with China's Huayou and invested $9 billion in a battery value chain in Indonesia. Similarly, LG Chem and Huayou Group have signed an MOU to produce a LFP cathode material plant in Morocco, that holds the world's largest reserve of phosphate rocks.

NZIPL's conclusion is that Korea remains excessively reliant on China to source battery minerals (*Table 3*).

*Table 3: Share of Korea battery mineral imports by country.*

| Battery mineral | Share sourced from China | Share sourced from other countries |
|---|---|---|
| Cobalt Sulphate | China: 100% | |
| Cobalt Oxide | China: 72% | Belgium: 26%, Finland: 1.7% |
| Synthetic Graphite | China: 95% | Switzerland: 3.2%, Canada: 1%, Japan: 0.5% |
| Natural Graphite | China: 93% | Germany:3.3%, Japan: 2.1%, Canada: 1% |
| Manganese Sulphate | China: 64% | Belgium: 36% |
| Nickel Sulphate | China: 18% | Finland:62%. S Africa: 9.5%, Belgium: 7.5%, Japan: 1%, Taiwan: 1%, India: 0.8% |
| Lithium Hydroxide | China: 80% | China: 17.5%, US: 12%, Russia: 0.7% |
| Lithium Carbonate | China: 8.2% | Chile:85%, Argentina: 5%, UK: 1.8% |

Sources: Kotra, Korea Customs service; Bloomberg

## Korean chipmakers face competitive risk from rival manufacturers of "green chips"

Electricity demand and hence carbon emissions from both manufacturing and usage of semiconductor chips is increasing rapidly. As chips become smaller, they become

more energy-intensive to manufacture. The manufacturing of chips account for the largest share of the life cycle climate impact. Over 20% of emissions are from design and fabrication phase; 65% from electricity supplied to equipment, and 15% from process chemicals that enter the atmosphere as potent greenhouse gasses during manufacturing.

Semiconductor companies now have two reasons to compete in making "green chips". One is that companies that use renewable energy will have lower operational costs than companies that do not use renewables, hence giving them a competitive cost advantage. The second is that their clients - especially Apple, Microsoft, Google - consumers and host country governments are demanding green chips to meet their net zero goals. On the demand side, the International Energy Agency estimates that future demand from data centers and AI could more than double in the next five years between 2022 to 2026, hitting 1,000 TWh, making the chip industry's electricity demand comparable to the country of Japan.

These competitive pressures to make "green chips" are already putting Korean chipmakers at a disadvantage. "Access to renewable energy may be a major factor as companies decide where they should build new fabs—something that is becoming more common as they try to increase capacity to alleviate the chip shortage," according to consultancy McKinsey.

**Rivals TSMC and Intel are accelerating net-zero plans**

Hoping to gain a competitive edge over rival chipmakers, leading semiconductor firms are investing across a range of strategies to achieve net zero emissions. Strategies to reach this goal include improving energy efficiency of manufacturing, renewable procurement via corporate PPA, and most crucially on-site renewable buildout.

TSMC has made a strategic decision to become a leader in manufacturing green chips. Electricity consumption at TSMC - it consumed a total of 22,300 GWh in energy in 2022- is on track to grow 267 per cent by 2030, when it will consume as much electricity as 5.8 million people, or roughly one fourth of Taiwan's population. Domestic pressure from the Taiwanese government to accelerate green was combined with pressure from international clients like Apple which aims to make all products carbon neutral by 2030. These factors pushed TSMC to become the first chip company to make a 100% RE by 2050 commitment.

But achieving long-term targets require substantial capital investment decisions at chip manufacturing complexes during this decade. In September 2023, TSMC has now significantly accelerated its 100% RE by 2050 plan by ten years to 2040. To meet that increased ambition, TSMC increased its 2030 goal to 60 per cent renewable energy from an earlier 40 per cent. In 2022 only 10% of its electricity use came from renewables. TSMC's chairman Mark Liu has acknowledged that "The reality is Taiwan does not have enough green energy for us to use."

Hence TSMC's goal is to use the company's rising energy demand to *drive* the development of a diverse renewable energy industry, and attract international renewable energy investment in Taiwan.

TSMC signed a 20-year long-term contract with ARK Power for 20,000 GWh solar electricity and in 2020, TSMC made the world's largest renewables power purchase agreement with Danish wind giant Orsted, committing to purchase the entire off take of a 1 GW offshore wind facility in the Taiwan straits. In addition to purchasing renewable energy, TSMC has installed solar panels on-site at its own facilities. In 2021, it installed 4.88 GWh of renewable electricity. In 2022, TSMC installed another 5,340 kWp in solar panels which provided 4.56 GWh in electricity.

TSMC is also driving renewable on-site generation for its facilities in China and Japan. Nanjing and Shanghai also joined energy conservation for carbon reduction and are being supplied with renewable electricity. After receiving the largest ever subsidy support that Japan has granted to a single company, TSMC has stepped up investments in plant in Japan's 'silicon island' Kyushu to more than $20 billion. The fab is set to run entirely on renewable electricity, mainly onshore wind and solar.

Intel too has accelerated its net-zero plans.In less than three years since announcing their RE 100 target, Intel is 97% renewable powered in 2023 including 93% for its global chipmaking electricity. The companywide 3.4 billion kWh electric bill is entirely powered by renewables, about half through RE certificate purchases, and the rest through conservation and on-site generation. In 2023, Intel has achieved 100% renewable electricity in the U.S, European Union, Israel, and Malaysia and also near 100% in Costa Rica.

## Korean chipmakers Samsung and SK Hynix are falling behind in green chips race

In comparison to its US and Taiwanese rivals, Samsung is only taking baby steps towards green electricity. Samsung Electronics is projected to consume 109TWh of electricity by 2030 in Korea, a 164 per cent increase from 2021, with emissions exceeding 32 million tonnes of CO2e per year, higher than Denmark's total emissions in 2021. Like TSMC, Samsung has committed to 100 per cent renewable energy. However, Samsung's RE 100 goal is differentiated by location - facilities outside Korea by 2027 and for facilities inside Korea by 2050.

In 2022, SK Hynix sourced 29.6% of its global electricity use via renewable electricity. By 2030, they are planning to power 33% of its global operations using renewable electricity. SK Hynix has already achieved 100% renewable electricity at its Chinese facilities in Chongqing and Wuxi. However, it too is stymied by the lack of renewable buildout in Korea. The electronics industry is growing fast, and baby steps are not sufficient to address the industry's massive carbon footprint.

Korea is now at risk of losing advanced semiconductor manufacturing investment because of difficulty securing renewable electricity in the country. The Dutch manufacturer of chipmaking equipment ASML has a 100% renewable energy commitment and is partnering with both Samsung and SK Hynix but has stated that "We continue to face challenges in South Korea, where there is little to no credible renewable electricity."

## 3. Renewables investments is falling behind Korea's Paris climate targets

Korea ranked the world's seventh-largest energy-consuming nation in 2022 reaching annual electricity consumption of 547.9TWh, an increase of 2.7% from the previous year due to the prevalence of energy-intensive industrial sectors. Between 1990 and 2020, Korea's GHG emissions more than doubled. Korea's current share of renewable energy in its power mix is the lowest in the OECD.

Korea has pursued efforts to achieve carbon neutrality, including converting aging coal power plants to LNG, and greening carbon-intensive industries. The Korean government under President Moon Jae-in established the 3rd Energy Master Plan in June 2019, which contains mid- to long-term energy policy goals and plans for each energy source for the next 20 years under a legislative framework known as the Framework Act on Low Carbon, Green Growth.

The master plan's objective is to reduce Korea's total energy consumption by 14.4% by 2030, 17.2% by 2035, and 18.6% by 2040 below the projected business-as-usual (BAU) level. In October 2021, Korea announced its revised Nationally Defined Contribution (NDC) at the UN Climate Change Conference in Glasgow which includes plans to reduce its carbon emissions by 40% by 2030 from 2018 levels.

The Yoon administration, with the introduction of the 10th energy supply plan in January 2023, reversed the revised NDC proposal of the previous Moon administration. Under the scheme, the percentage shares of power generation mix by energy source should be nuclear power 32.4%, coal 19.7%, LNG 22.5%, renewable energy 21.6%, hydrogen and ammonia 2.1% by 2030. To keep its NDC pledge consistent in terms of greenhouse gas (GHG) emissions from the power sector, the government has made two main changes: a reduction in electricity share from renewable energy from 30.2% to 21.6%, and an increase in 2030 nuclear power target from 23.9% to 32.4%.

**These lowered targets already have had detrimental consequences to green investments**. In 2023, the state budget allocated 4.3 trillion won (3.2 billion euros) to the power sector, a decrease of about 0.3 trillion won compared to the previous year. The budget flows into five priority areas: low- carbon transition, nuclear energy, resource supply chain, energy affordability for vulnerable consumers, and energy facility safety. While the budget for nuclear energy and the resource supply chain was increased on a year-over-year basis by 19% and 36%, respectively, the budget for the low-carbon transition was decreased by 25%. In particular, the support for renewable electricity decreased significantly, with 124 billion won ($92 million) less spending on feed-in tariffs and 154 billion won ($114 million)

**Consequently, the International Energy Agency (IEA) now projects a Slowdown in Renewables deployment** (*Figure 7*)

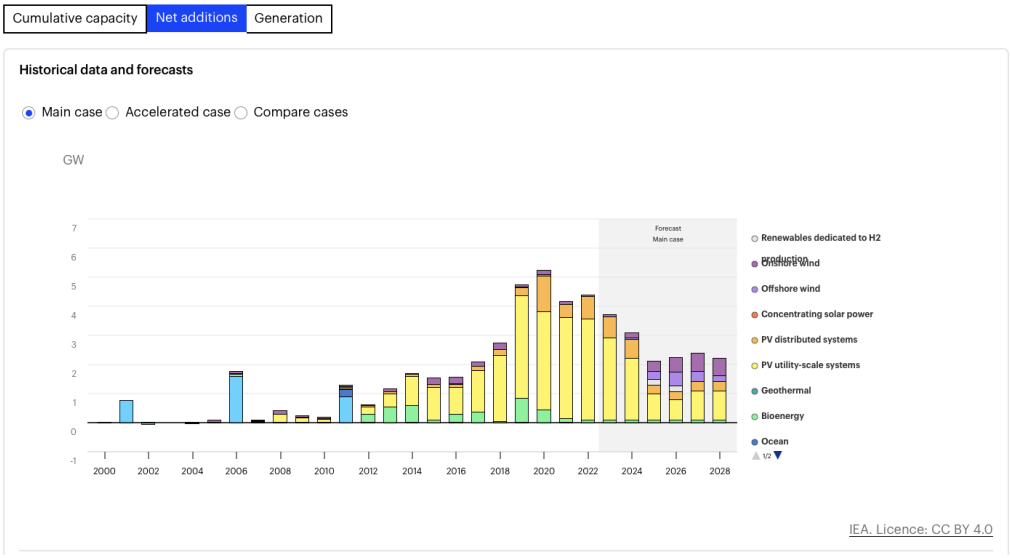


**Figure 7 : Korean renewable installations are projected to decline through 2030 because of withdrawal of government support** (Source: IEA)

According to the IEA Renewable Energy Progress Tracker:

> *Korea s renewable energy capacity is expected to increase by 16 GW over 2023-2028.* ***We have revised our forecast down from Renewables 2022 because the Korean government has lowered its renewable energy targets*** *and participation in competitive auctions has decreased. Corporate procurement of renewable energy under the K-RE100 initiative remains the key driver for utility-scale wind and solar PV expansion over the next five years. Renewable energy certificates provide additional revenues to these projects, improving their bankability….*
>
> *Despite government incentives, Korea s forecast is being revised down for two main reasons. The first is that the country s 10th Basic Plan for Long-Term Electricity Supply and Demand, released in January 2023, places emphasis on nuclear power – a distinct difference from previous plans in which nuclear-based generation was to be phased out. This renewed focus on nuclear power comes at the expense of renewables, resulting in lower wind and solar PV targets and leading to a decline in additions throughout the forecast period. The second reason is that few auctions for new capacity have been held, and even those were undersubscribed because the reference price was considered to be too low by developers. Additional challenges include long permitting and grid connection wait times and social acceptance issues.*

## 4. Korea’s exports are at risk because of global macroeconomic slowdown and domestic fiscal austerity that is slowing growth and worsening inequality

The Korean economy has been mired in low growth since the 2008 financial crisis. The GDP growth rate since 2010 has been hovering just over 2-3 percent per year. The domestic economy has lacked economic dynamism and its growth potential burdened with structural problems: a fast-growing aging population, the world's lowest fertility rates, high unemployment rates, and worsening inequality.

**Korea's productivity gap between SMEs and large conglomerates and manufacturing versus services is much larger than that of other OECD countries.** Micro, small, and medium-size enterprises (MSMEs) accounted for 88 percent of total employment in 2000–18, compared to the average of around 70 percent in OECD countries. The relative labor productivity of small firms to large firms in Korea is also far lower than the OECD average. The large share of workers in small firms with lower productivity growth prospects has contributed to a widening wage gap, with significant implications for income inequality.

Korea's last government led by President Moon Jae-In attempted to boost aggregate domestic demand by choosing a "economic democratization" policy that focused on increasing household consumption and incomes and to reverse inequality by focusing on SME growth. However, escalating tensions between the US and China significantly decreased trade growth in 2019, reducing export growth to -10 percent, and the resulting reduction in industrial investment was greater than the rise in household incomes, and President Moon abandoned both fiscal stimulus and SME growth policy.

**In the current decade, weak economic growth in China, and the EU are key sources of contagion and downside risk for Korea's manufacturing export sector.** Korean growth is heavily dependent on China, its largest trading partner, hence growth flatlined in 2021 and 2022 due to the slowdown in Chinese consumer demand from pandemic-related shutdowns and lack of fiscal support to Chinese households. Despite improving economic growth in China during the first half of 2023, Korean exports to China remained weak due to declining exports of semiconductors and mobile phones.

**The structural problem that Korea faces is one of deficient aggregate domestic demand.** In 2023, Yeo Han-koo, who until last year served as Korea's trade minister, said to the Financial Times: "It's natural for Korean policymakers to be nervous because for decades, South Korea rode on the back of a fast-growing Chinese economy, without which we might have had to endure some painful structural changes".

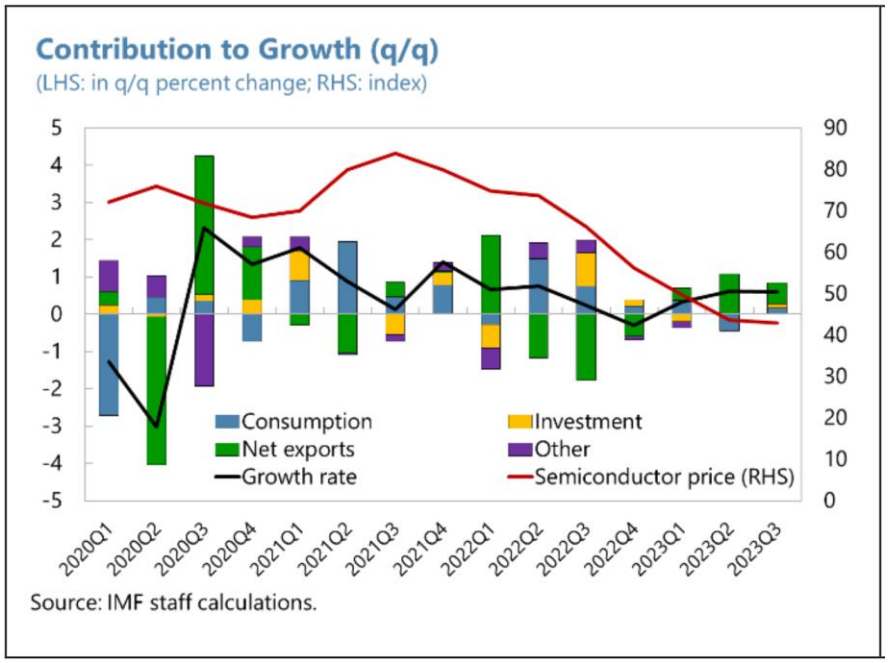


**Figure 8: Korea's structural growth problem is caused by weak domestic demand and investment** (Source: IMF Article 4 2023 Staff Report on South Korea)

Korea's export-dependent economy is further at risk because of the overall slowdown in global growth. According to the World Bank the global economy is on track for its "worst half-decade of growth in 30 years".

> *"Global trade growth in 2024 was expected to be only half the average in the decade before the pandemic. Global goods trade contracted in 2023, marking the first annual decline outside of global recessions in the past 20 years. The recovery in global trade in 2021-24 is projected to be the weakest following a global recession in the past half century."*

Both domestic investment and consumption are projected to decline further, rendering Korea's net exports insufficient to boost domestic growth rates (*Figure 8*). The IMF projects Korea's GDP growth to fall below 1.4 percent in 2024.

**President Yoon's restrictive stance on fiscal policy reflects a persistent ideology of austerity that is worsening Korea's economic prospects amid the global growth slowdown.** Instead of boosting government spending countercyclically, President Yoon has chosen a policy of fiscal consolidation in 2023 and in 2024 – cutting budgets and reducing spending on social programs. The Yoon government concerns about fiscal deficits and rising government debt are without merit. Korea's gross public debt as a percentage of GDP remains extremely low at 56 percent in 2023 – compared to an OECD average of 120 percent.

## POLICY RECOMMENDATIONS

President Yoon, a former prosecutor who campaigned as a hard-nosed geopolitical realist, has put strategic industrial sectors at the top of his governments agenda. Yoon emphasizes leadership on chips, autos and batteries, as sectors that will cement Korean self-sufficiency and competitiveness in the coming decades. President Yoon has weakened his predecessors ambitious emissions-cutting targets thinking that climate goals and industrial competitiveness are opposed to each other. However, Yoon's industrial growth and climate goals for Korea can be integrated. Below we give some recommendations to achieve both of these goals together, and overcome specific challenges we identified in Section 2 of this report.

*Challenge: Domestic renewables investments falling behind Climate targets could lead to loss of economic competitiveness*

**Recommendation: Large scale support of Renewables manufacturing and deployment to accelerate transformation of Korean economy**

Business-as-usual dynamics of the Yoon government is not likely to achieve its own 2030 climate targets. The stated target to achieve a renewable share of 21.6% by 2030 is unachievable without a big change in government policy in the upcoming 11th Basic Plan on electricity supply and demand. Korea's levelized cost of energy (LCOE) for RE is one of the highest among major countries and second only to Japan. High costs, primarily due to Korean policy settings that mean land acquisition, financing, and corporate taxes are far bigger barriers than in most peer countries.

Renewables must be boosted systematically throughout the government's electricity policy mix - renewable energy target, RE auction, feed-in tariffs, net metering and import tax. Introduction of carbon prices will also help make renewables remain cost competitive with coal power. But the largest reason for the cost-competitiveness of renewables will remain the fast learning rate of solar, wind and storage batteries. Once given significant policy support, the higher learning rate will ensure that both renewables manufacturing and deployment results in cheaper unit costs.

*Challenge: Chips, auto, batteries industrial policy is not integrated with energy policy*

**Recommendation: Co-locating renewables with industrial clusters for a coherent industrial and energy policy**

The industry ministry has said it would ensure the new mega chips and battery manufacturing cluster would be supplied with enough electricity. President Yoon has clarified that nuclear power plants will be built to provide stable electricity to the new chips clusters. However, the

slow rate of nuclear permitting and opposition by community groups is a risk to achieving both the government's industrial and climate goals. There are two main reasons why on-site renewable generation for chips clusters is a better long-term strategic choice for the Korean government.

**(i) Rising external pressure on Korea for greener chips**: Korea should expect more regulatory pressure as its chip competitors such as China, Taiwan, Japan, United States, and EU apply carbon border tariffs to give their companies an advantages, placing Korea's carbon-intensive chip exports at a disadvantage if nuclear is unable to overcome its permitting obstacles. There is already a trend of rising regulatory, ESG and shareholder pressure on Korean companies.

(ii) **Cost advantage of RE will make manufacturing green chips cheaper and more competitive:** The chip market is becoming oversupplied and putting more pressure on chips manufacturers to reduce manufacturing costs to remain competitive in the global market. Since electricity is a major input cost to chip manufacturing, Korean firms that use cheaper RE plus storage options to supply electricity will find themselves more competitive. There is a long lead time to making chips fabs and clusters, so there is a high risk of future stranded investments if the wrong electricity choices are made now.

These concerns are why Samsung followed other major semiconductor companies TSMC and Intel in joining the RE100 initiative. Both Intel and TSMC are now rapidly building out their on-site RE generation.

To achieve on-site renewable generation for domestic chips manufacturing, we recommend that the Korean government take the following active steps:

1. **Create a designated renewable energy complex to accelerate permitting**: Give permits to certain areas to receive support for a total package of solar PV, wind power and ESSs. The government should take the responsibility of obtaining permits rather than putting the burden on private companies. In order to improve public acceptance, provide incentives for plant construction projects with local participation in manufacturing clusters where opposition from local residents is likely.

2. **Remove distancing rules:** The government should remove the distancing rules that local governments have imposed that currently penalize solar. Researchers at Agora estimate that removing distancing restrictions in relation to roads – while keeping those for residential areas – could provide 524 TWh of additional solar PV generation potential to Korea.

3. **Mandate public procurement of low-carbon steel and cement to build these plants**. The goal should be to develop linkages between strategic sectors in the economy to commercialize and scale low-carbon materials that will be in high demand.

*Challenge: Achieving energy security*

## Recommendation: Greening outbound investment as part of Korea's 'Global Pivotal State' strategy

To achieve energy security, we recommend that the Korea take the following active steps to boost the Yoon governments 2023 'Global Pivotal State' strategy.

**Green Korean export credit agencies** - Korea Trade Insurance Corporation (K-Sure), and Korea Export-Import Bank (K-Exim) are still supporting coal and LNG in other countries with their outbound investments. According to a recent Perspectives Climate Research study, over 90% of their investments is for fossil fuels and only 10% for clean energy and minerals. In 2021, Korea decided to stop public support for overseas coal-fired power plants but it currently has no policy for its export credit agencies to limit support for oil and gas value chains, which are now up to 13 times higher in the last 10 years than support for coal was before the ban. Overall, K-Sure and K-Exim were rated as unaligned with the Paris Agreement in the Perspectives study.

Because of this continued support of fossil fuel overseas, Korea is one of the main laggards compared to other G20 countries. Hence Korea will find it difficult to meet K-Exim own stated goal to bank-wide carbon neutrality by 2040 (Scope 1 and Scope 2) and carbon neutral portfolio by 2050, or meet K-Sure's own ESG strategy.

*Table 4: Korean export credit agencies support fossil finance over clean energy finance.*
*(Estimates are from period 2019-2021)*

| Agency | Clean energy finance | Fossil energy finance | Ratio of clean to fossil |
|---|---|---|---|
| K-Sure | $633 million | $5130 million | 12% |
| KEXIM | $6.4 million | $8580 million | 0.07% |

Source: Perspectives Climate Research (2023)

Our recommendation is to take urgent steps to reverse that financing fossil fuel to clean energy ratio to actually achieve emissions reduction overseas. This can be ensured by supporting renewable energy buildout overseas and targeted financing support for Korean firms to deploy renewables installations, especially in K-Exim's own targeted sectors of solar, wind, batteries, hydrogen and to exclude oil and gas from their portfolios. If supported, Korean energy companies can take advantage of renewable friendly policies in other countries. For example, KEPCO won a large solar 1500 MW installation bid in Saudi Arabia, that is much larger than any of its domestic nuclear power projects.

**Aggressive overseas investment push for midstream battery materials -** Global cell capacity is likely to far exceed demand in 2030. Korea should rebalance its battery strategy on building

global market share in cathode, precursors, and intermediates. Scaling innovators into this space will be crucial.

Korea is currently excessively reliant on China to source battery minerals (**Table 3**). Ministry of Trade and Industry has announced a global strategy (the "3050 strategy") to reduce dependency on China to less than 50% by 2030. To accomplish this goal, the ministry is offering incentives and financial support to companies that source materials from other countries. Korea is currently pursuing partnerships with Australia, Canada, Chile, Tanzania, Indonesia, Morocco. LG for example, has partnered with China's Huayou and invested $9 billion in a battery value chain in Indonesia. Similarly, LG Chem and Huayou Group have signed an MOU to produce a LFP cathode material plant in Morocco, that holds the world's largest reserve of phosphate rocks.

We recommend increasing the resources provided to finance mineral-led development projects in a larger set of countries as it is both critical to meeting the goals of the "3050 strategy" and meeting other strategic goals of President Yoon's Global Pivotal State (GPS) initiative. In addition, we recommend such investments include local value-added capacity expansion to encourage mineral development as that is critical to Korea's success in expanding networks and cooperation with like-minded nations that share the country's identity, values, and strategic interests.

*Challenge: Slowing growth and worsening inequality*

### Recommendation: Enhance low small and medium enterprises (SME) productivity by linkage policy to boost jobs and incomes at home

The low productivity of SMEs as well as the services sector in Korea is among the most crucial policy challenges for not just jobs and incomes but to achieve social buy-in for Korea's ambitious industrial policy. To level the playing field and enhance low SME productivity, the country's innovative growth model should focus more on SME globalization and take advantage of rapidly changing global value chains in collaboration with Korea's large export-oriented firms. The Korean government has laid out SME globalization strategy in its **Comprehensive Plan for Fostering Small and Medium Enterprises.** This SME policy needs adequate funding, and requires Korean government to break out of its self-imposed restrictive fiscal policy stance.

## APPENDIX

| Policy Goal | Method | Government entity | Date of policy |
|---|---|---|---|
| Launch of fund to nurture high-tech strategic industries | Capital injection and equity stakes | Eximbank | 3/2/2023 |
| Support worth KRW 10.5 trillion for startups and venture business | Capital injection and equity stakes | Financial Services Commission | 4/20/2023 |
| Support worth KRW 20 trillion "technology super-gap" in secondary battery industry by 2030 | State aid | Ministry of Trade, Industry and Energy | 4/20/2023 |
| Support worth KRW 7 trillion for Korean battery firms after Inflation Reduction Act | Loans, guarantees, boost of investment tax credits from 8% to 15% for large firms, 16% to 25% for SMR | Ministry of Trade, Industry and Energy | 4/7/2023 |
| Second package to support Korean battery firms after IRA worth KRW 38 trillion. | Loans, guarantees, investment tax credits | Ministry of Trade, Industry and Energy | 2/28/2023 |
| Measures for securing critical mineral supply and recycling | State aid, loans, guarantees | Ministry of Trade, Industry and Energy | 12/12/23 |

Source: Net Zero Industrial Policy Lab, New Industrial Policy Observatory

*Table: Select Korean policy measures in 2023 for EVs, batteries and chips*

## List of Korean supply chain investments in EVs and batteries

| Europe | | | | | | | |
|---|---|---|---|---|---|---|---|
| **status** | **Name** | **Company** | **State/ Province** | **Mfg Product** | **Targeted annual production** | **Production Units** | **Capital investment (billion)** |
| **operating** | LG Energy Solutio | LG | Wroclaw, Poland | | 70 | GWh | |
| | SK on Hungary Kft | SK | Komarom, Hungary | EV battery | 7.5 | GWh | $3 |
| | SK on Hungary Kft | SK | Komarom, Hungary | EV battery | 9.8 | GWh | $8 |
| | Samsung SDI | Samsung | Goed, Hungary | EV battery | 30 | GWh | |
| | EcoPro BM | EcoPro | Debrecen, Hungary | EV battery parts (Cathode Material) | 108,000 | tonnes | $0.30 |
| | Dongwha Electroly | Dongwha | Soskut, Hungary | EV battery parts (NMP) | 36,000 | tonnes/yr | |
| | Hanon Systems | Hanon Systems | Hungary | EV battery parts (heat pump) | 2,200,000 | heat pumps | $0.04 |
| | Hanon Systems | Hanon Systems | Bratislava, Slovakia | EV battery parts (HVAC/ HEX) | 10,040,000/ 54,5 | parts | |
| | Shin Heung Energ | Shin Heung En | Hungary | EV battery parts (cylindrical battery parts) | 10 | million | |
| | Lotte Aluminium C | Lotte Aluminium | Tatabánya Industrial Park, Hungary | EV battery parts (anode foil) | 18,000 | tonnes/yr | $0.08 |
| | Solus Advanced M | Solus Advanced | Tatabánya industrial Park, Hungary | EV battery parts (battery foil) | 23,000 | tonnes/yr | $0.03 |
| | HMMC | Hyundai | Nošovice, Czechia | EVs | 120,000 | Evs | |
| **planned** | Samsung SDI | Samsung | Goed, Hungary | EV battery (cylindrical cells) | 10 | GWh | |
| | Samsung SDI | Samsung | Goed, Hungary | EV battery | 40 | GWh | $0.80 |
| | SK on Hungary Kft | SK | Iváncsa, Hungary | battery cell | 30 | Gwh | $2.29 |
| | SK Geocentric | SK | Saint-Avold, France | | | | |
| | SK nexilis' Stalowa | SK | Stalowa Wola, Poland | Ev Battery parts (copper foil) | 50,000 | tonnes | |
| | SKIET | SK | ŚLĄSKE, Poland | EV Battery parts (battery separaters) | null | null | |
| | SK Nexilis | SK | Baden-Württemberg, German | Ev Battery parts (copper foil) | null | null | |
| | LG Magna e-Powe | LG | Miskolc, Hungary | | null | null | |
| | LG Toray Hungary | LG | Nyergesujfalu, Hungary | Separator film | null | null | $0.04 |
| | PLSC | POSCO | Poland | Recycling facility | 700 | tonnes | |
| | WCP | WCP | Nyíregyháza, Hungary | Ev Battery parts (ithium-ion Battery Separator) | null | null | $0.80 |

| Africa | | | | | | | |
|---|---|---|---|---|---|---|---|
| **status** | **Name** | **Company** | **State/ Province** | **Mfg Product** | **Targeted annual production** | **Production Units** | **Capital investment (billion)** |
| **operating** | | | | | | | |
| **planned** | LG Chemical | LG | Morocco | LFP cathode material | 50,000 | tonnes | |

| Asia | | | | | | | |
|---|---|---|---|---|---|---|---|
| **status** | **Name** | **Company** | **State/ Province** | **Mfg Product** | **Targeted annual production** | **Production Units** | **Capital investment (billion)** |
| **operating** | SK On | SK | Changzhou, China | EV battery | 7.5 | GWh | $2.50 |
| | SK On | SK | Yancheng, China | EV battery | 10 | GWh | $1.50 |
| | SK On | SK | Huizhou, China | EV battery | 10 | GWh | |
| **planned** | LG Chemical | LG | Karawang, Indonesia | nickel sulfate | 150,000 | tonnes | $9.80 |
| | LG Chemical | LG | Batang Park, Indonesia | Precursor | 220,000 | tonnes/yr | $2.40 |
| | LG Chemical | LG | Batang Park, Indonesia | cathode materials | 42,000 | tonnes/yr | $2.40 |
| | Wuxi Battery Com | LG | Nanjing, China | EV battery | 32 | GWh | $1.70 |
| | Wuxi Battery Com | LG | Jiangsu Province, China | cathode materials | 140 | GWh | |
| | Samsung SDI Ene | Samsung | Seremban, Malaysia | cylindrical cells | 16 | GWh | $1.30 |

| United States | | | | | | | |
|---|---|---|---|---|---|---|---|
| **status** | **Name** | **Company** | **State/ Province** | **Mfg Product** | **Targeted annual production** | **Production Units** | **Capital investment (million)** |
| **operating** | LG Energy Solutio | LG | MI | Battery Cell | 5 | GWh | $303 |
| | Hyundai Motor Ma | Hyundai | AL | EVs | 50,000 | EVs | $300 |
| | SK Signet EV Cha | SK Signet | TX | EV Chargers | 10,000 | EV Fast Cha | $15 |
| **Operating partially** | LG Energy Solutio | LG | MI | Battery Cell | 16 | GWh | $1,700 |
| | SK Georgia Plant 1 | SK Innovation | GA | Battery Cel | 9 | GWh | $903 |
| **Constructio** | Stellantis & LG Ba | LG, Stellantis | ON | Battery Cell | 49 | GWh | $4,100 |
| | LG Cathode Facilit | LG | TN | Battery Cell Composition | 600,000 | # EVs suppo | $1,600 |
| | Metaplant America | Hyundai | GA | EVs | 500,000 | EVs | $1,200 |
| | SK Georgia Plant 2 | SK Innovation | GA | Battery Cell | 11 | GWh | $727 |
| **Planned** | LG Energy Solutio | LG | AZ | Battery Cell | 36 | GWh | $3,200 |
| | | | | Battery Cell Composition | 16 | GWh | $2,300 |
| | Hyundai SK Batter | Hyundai, SK | GA | Battery Cell | 35 | GWh | $5,000 |
| | Metaplant America | Hyundai, LG | GA | Battery Cell | 30 | GWh | $4,300 |
| | GM-SDI Battery Fa | GM, Samsung | IN | Battery Cell | 30 | GWh | $3,000 |
| | LG Energy Solutio | LG | MI | Battery Cell | 19 | GWh | $3,000 |
| | Metapolant Americ | Hyundai, LG | GA | Battery Cell | Null | Null | $2,000 |
| | LG Cathode Facilit | LG | TN | Battery Cell Composition | 525,000 | # EVs suppo | $1,600 |
| | Hyundai Battery Pl | Hyundai | AL | Battery Pack | 15 | GWh | $205 |
| | KIA West Point As | KIA | GA | EVs | Null | Null | $200 |
| | NVH Korea | NVH Korea | GA | EV Parts | Null | Null | $72 |
| | SK Battery Recycli | SK Ecoplant | KY | Recycled Materials | 24,000 | tpa | $65 |
| **Rumored** | Kia Manufacturing | KIA | TBD | EVs | Null | Null | Null |