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Challenges to Korea's Industrial Decarbonization

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Rachel Ko
Director, Industrial Decarbonization Program, NEXT Group

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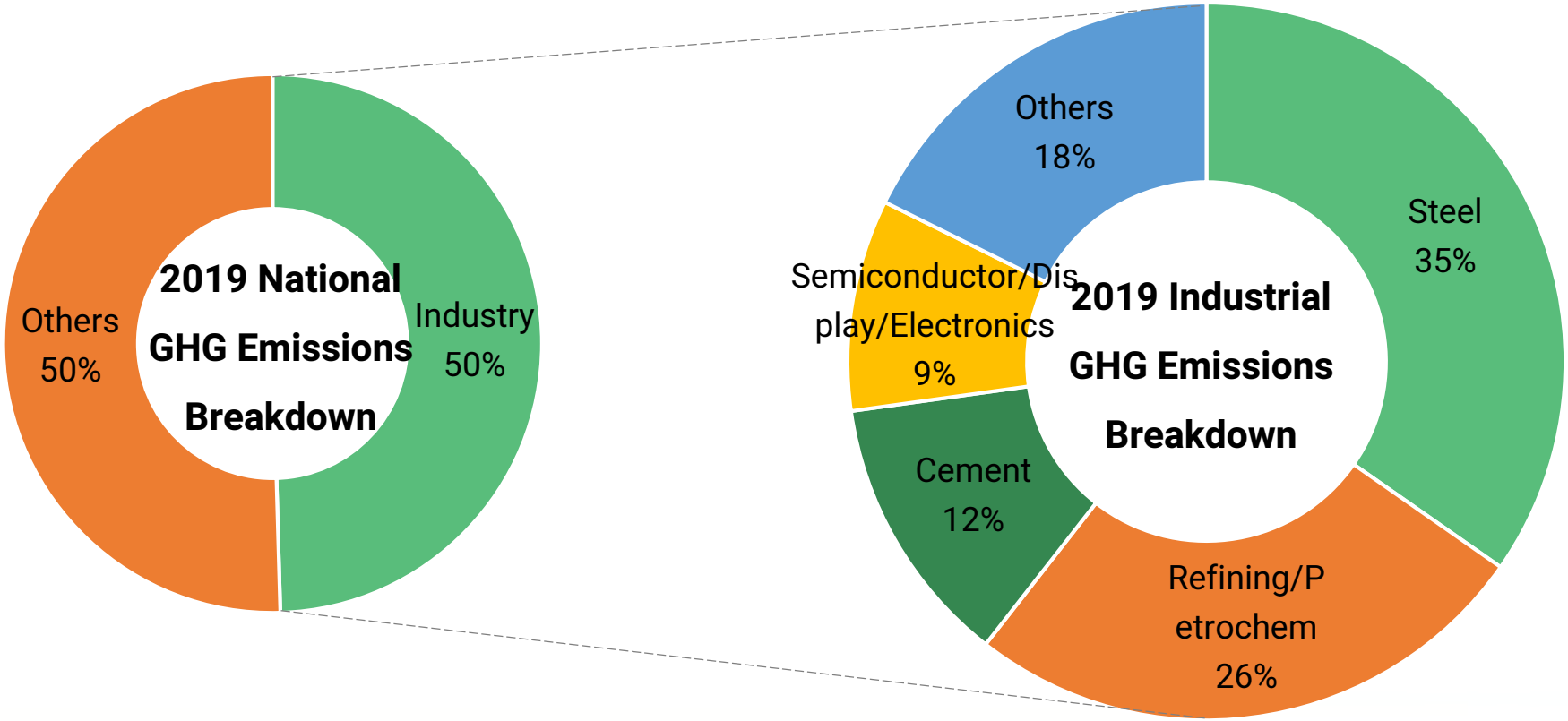
Industrial decarbonization is critical for Korea's net-zero transition.

- Industrial emissions take up 50% of the country's entire emissions (scope 1+2).
- Four largest emission-intensive industries account for 82% of the overall industrial emissions.

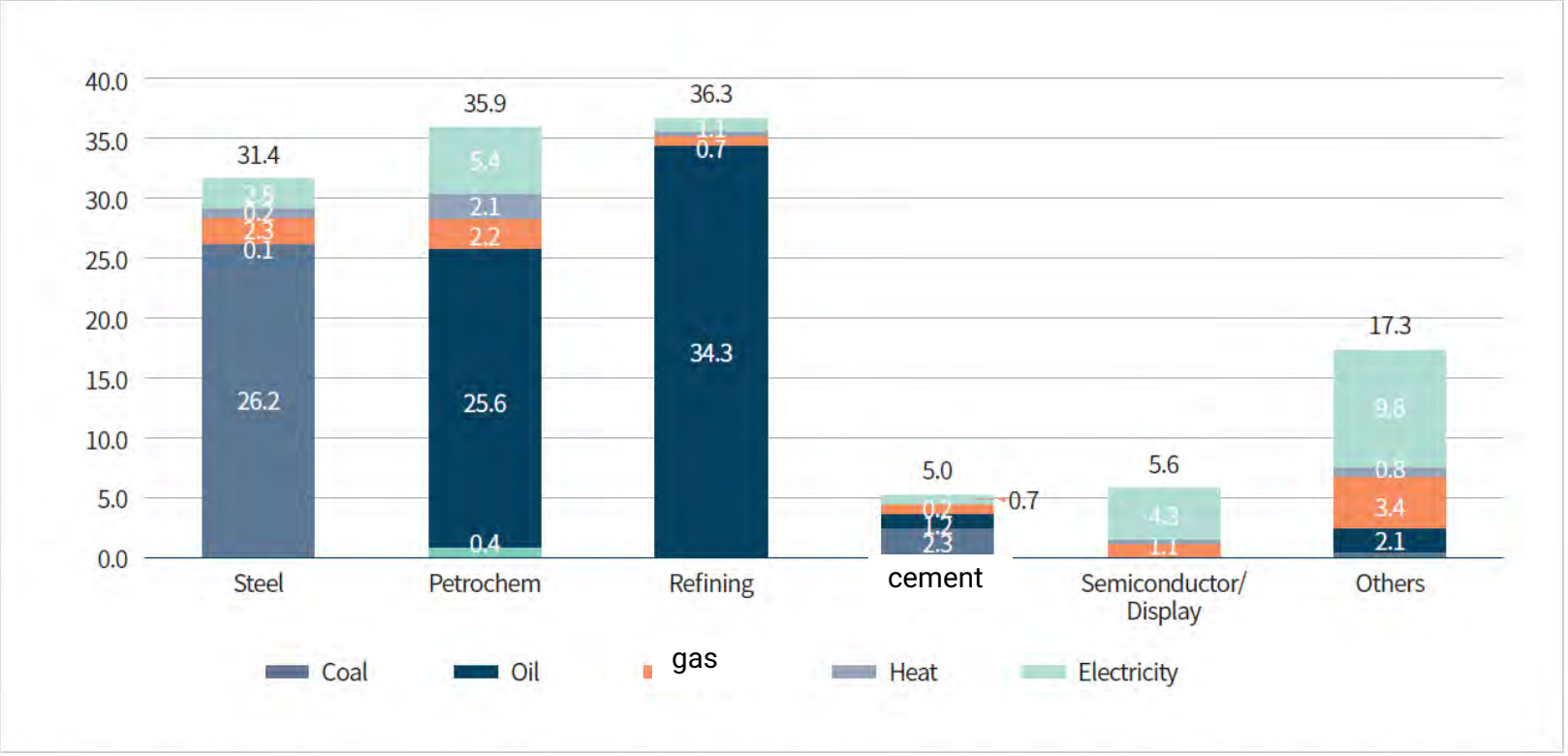


Industry in Korea is Energy-Intensive by Nature

To drive down industrial GHG emissions, reducing the reliance on fossil fuel and sourcing clean electricity are the first steps.

FIGURE 2. ENERGY CONSUMPTION BY SECTOR (2019)

(Unit : mil. TOE)

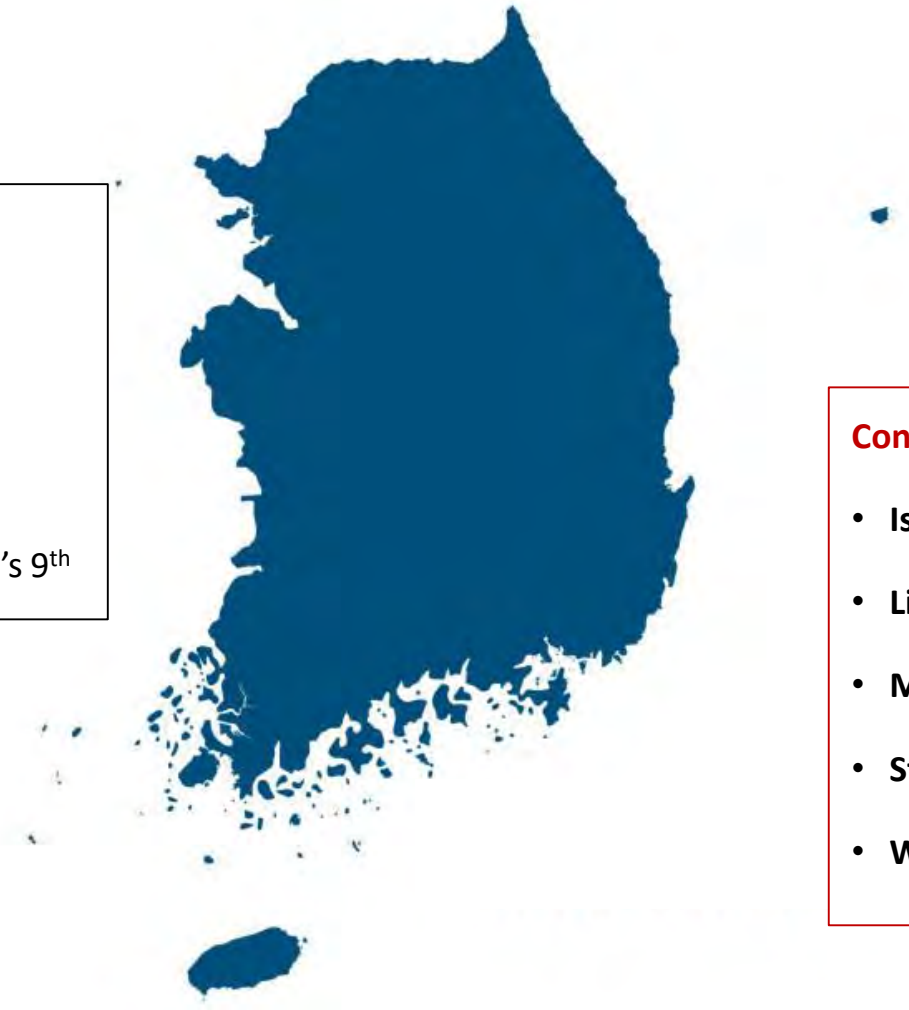


Note: Although heat and electricity consumption by type of industry are included in the above figure, emissions from heat and electricity are not included in this study. As indirect emissions (Scope2), they are included in the power sector.

Source: 한국에너지공단 (2022)

Korea faces a number of constraints in transitioning to a net-zero economy.

- **Population** : 52 million (2022)
- **Size :** 10 million ha.
- **GDP :** 1.6 trillion USD (2020) – world's 12th
- **GDP per capita** : $29,958 (2020) – world's 31th
- **GHG emissions** : 701 billion tCO2 (2019) – world's 9th



Constraints in net-zero transition

- **Isolated grid**
- **Limited carbon storage space**
- **Manufacturing-oriented economy**
- **Strong resistance from industry**
- **Weak consensus on carbon neutrality**

Korea's NDC and 2050 Carbon Neutrality Scenario by the Government

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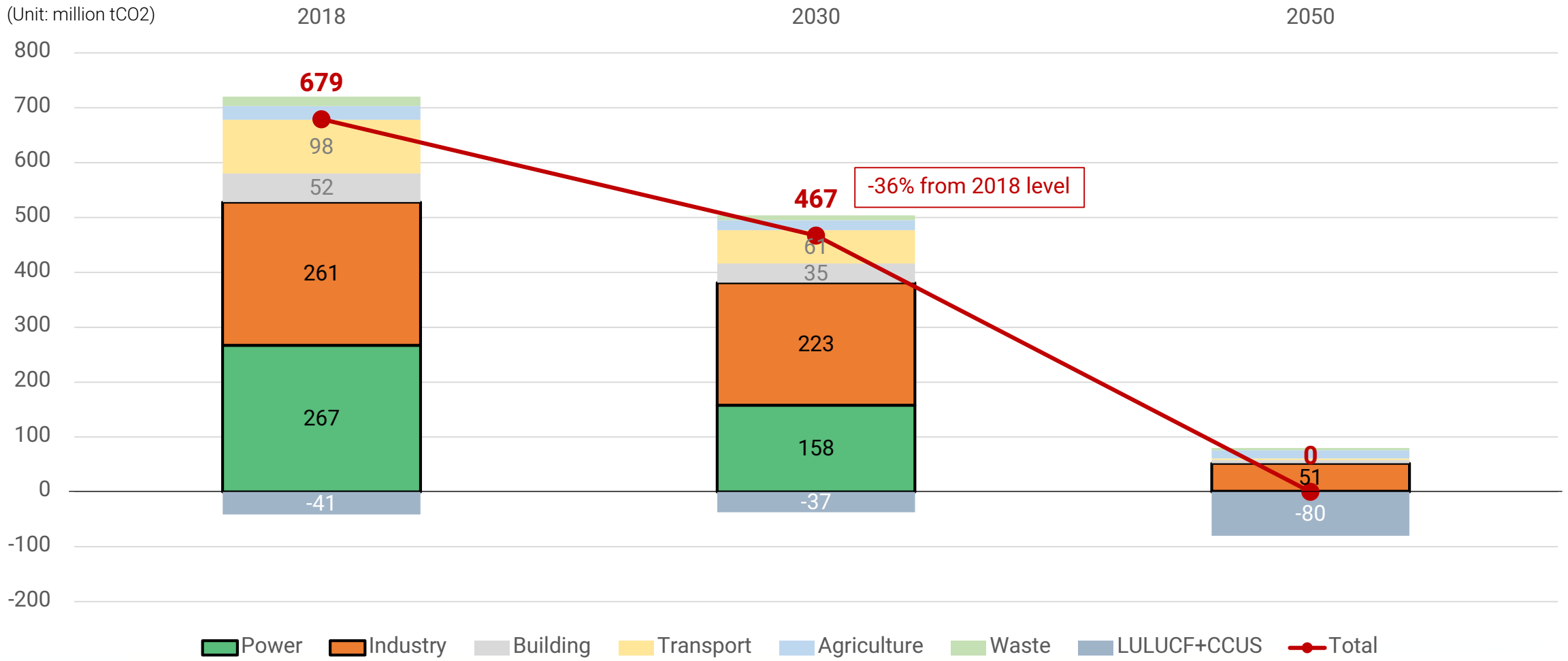
Industrial emissions reduction is strikingly slower than the power sector.



Challenges to Industrial Decarbonization : Net-Zero Technology

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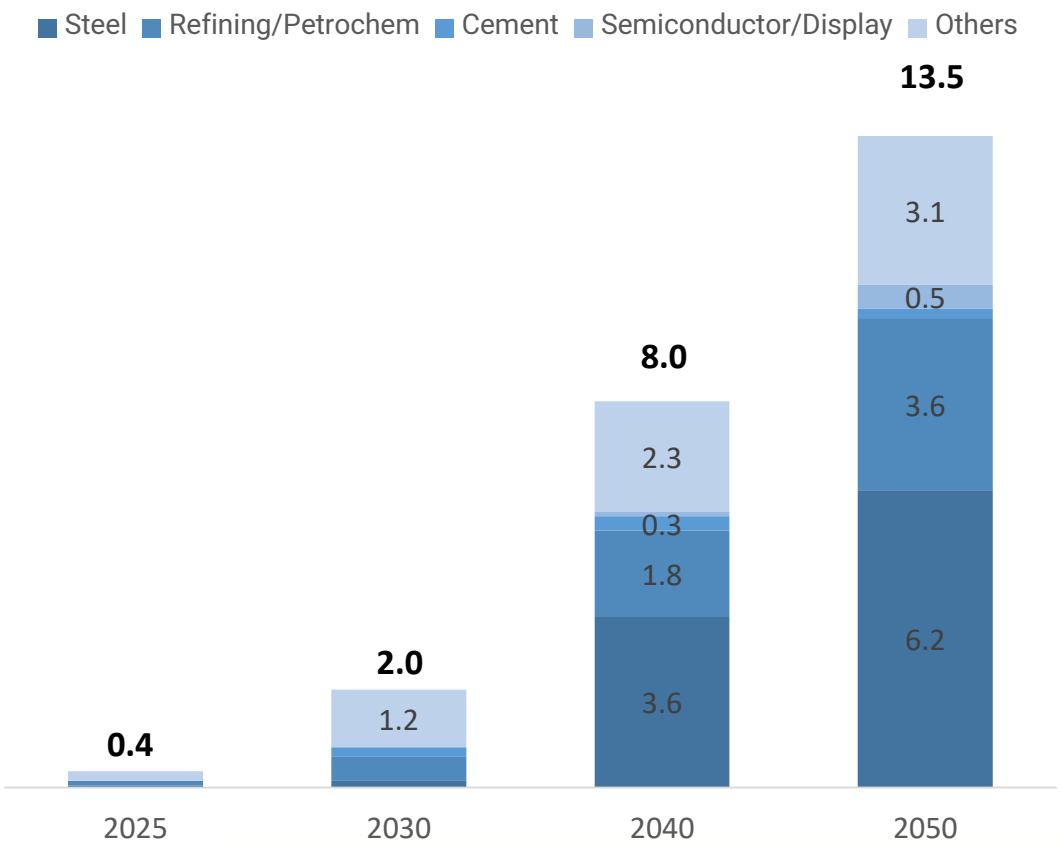
Adoption of many critical net-zero technologies is targeted between 2035 to 2050.

Source: 과학기술정보통신부,한국에너지기술연구원 (2021)

Using green hydrogen as feedstock and heat source will dramatically reduce industrial GHG emissions, but regulatory frameworks and infrastructure are not in place.

[Hydrogen demand forecast by Industry (unit: mil tons)]

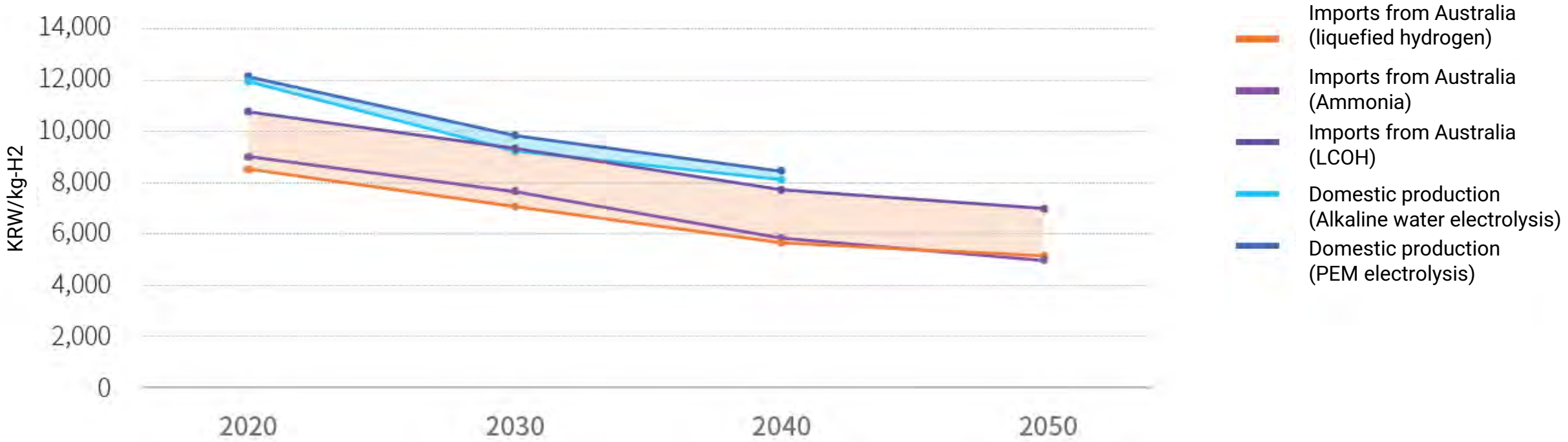


Source: S. Jeong and R.E.Ko (2022), *2050 Carbon Neutrality Roadmap for Korea : K-Map Scenario for Industrial Sector*

- **Hydrogen can provide high temperature heat (higher than 200℃), which heat pumps can't provide.**
- **Hydrogen can be blended in the existing gas boiler or burners.**
- **Considering the country's limited electricity capacity, hydrogen prevents the economy's too much dependence on electricity.**

How to secure a competitively priced green hydrogen in Korea?

- **It is necessary to secure hydrogen import routes, as well as to promote renewable electricity to bring down domestic production cost of hydrogen.**



Note 1: Imports from Australia are assumed to be distributed through pipelines domestically.
Note 2: For domestic production, 100MW electrolyzer sourcing renewable electricity is assumed.

Source: Imports - NEXT Group(2022), Domestic production - KEEI(2020)

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In the K-Map analysis, electricity demand from industry will more than double by 2050.

FIGURE 6. ENERGY CONSUMPTION AND EMISSIONS FROM ENERGY COMBUSTION (2018–2050)

- **An expected explosive growth of semiconductor industry and electricity-based new technologies (e.g. CCU, EAF) wil contribute to increasing electricity demand.**
- **Without clean electricity, carbon neutrality is an impossible goal for industry.**

Note: (Heat) Heat energy procured from integrated energy providers; (Others) energy produced from waste and others..

Source: S. Jeong and R.E.Ko (2022), *2050 Carbon Neutrality Roadmap for Korea : K-Map Scenario for Industrial Sector*

Challenges to Industrial Decarbonization : Little Demand for Green Products

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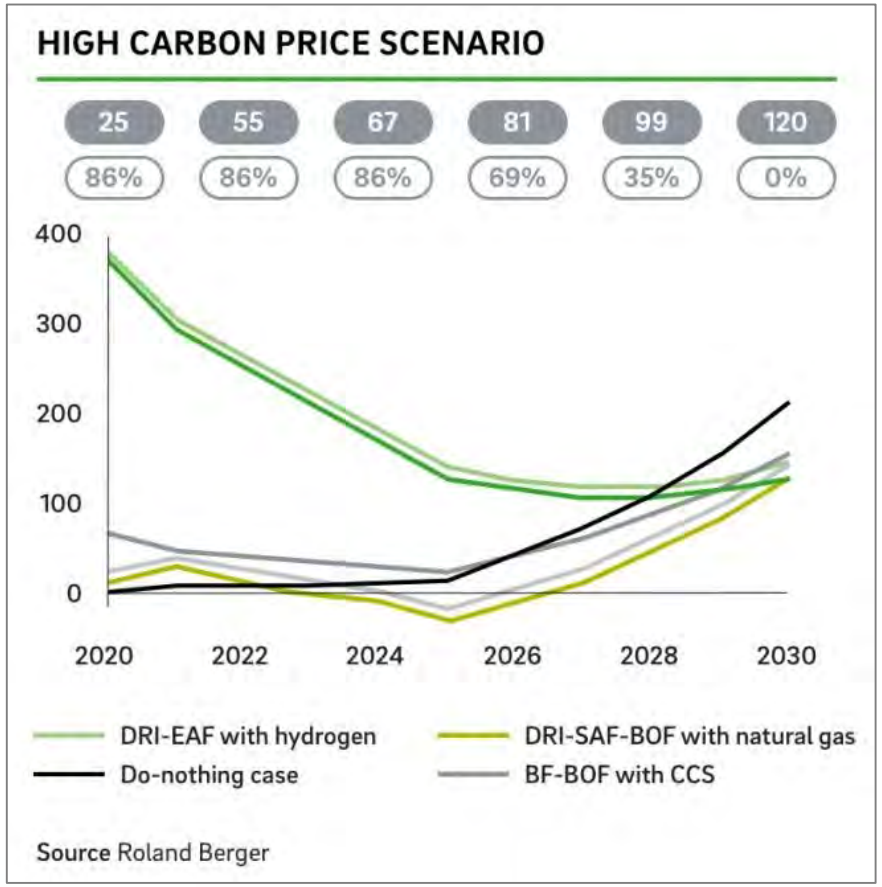
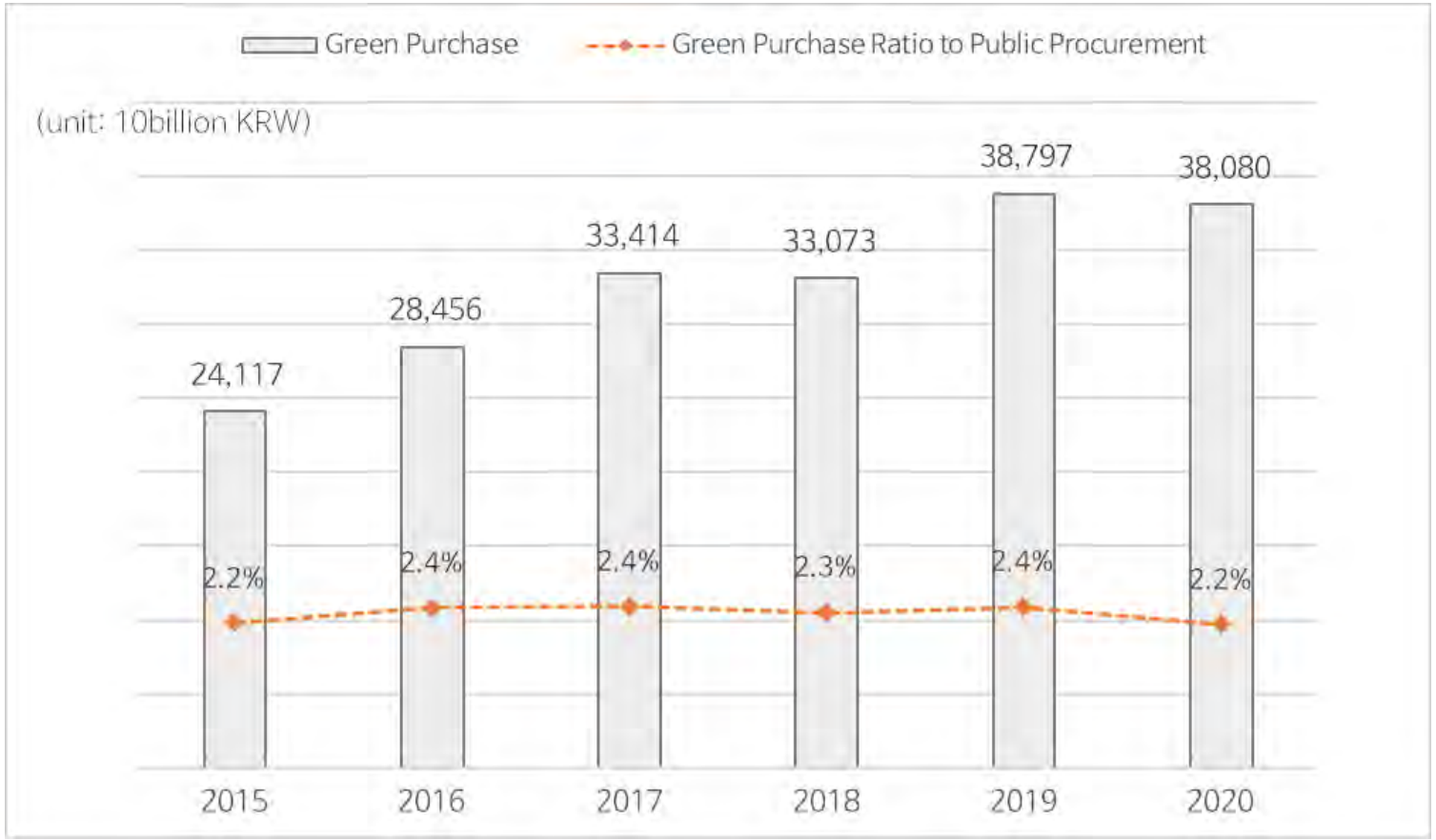
It is necessary to form lead markets for higher-priced green industrial products.

- **Carbon pricing and green public procurement policy are effective levers in creating green demand.**

Production cost for steel (unit: EUR/t-steel)

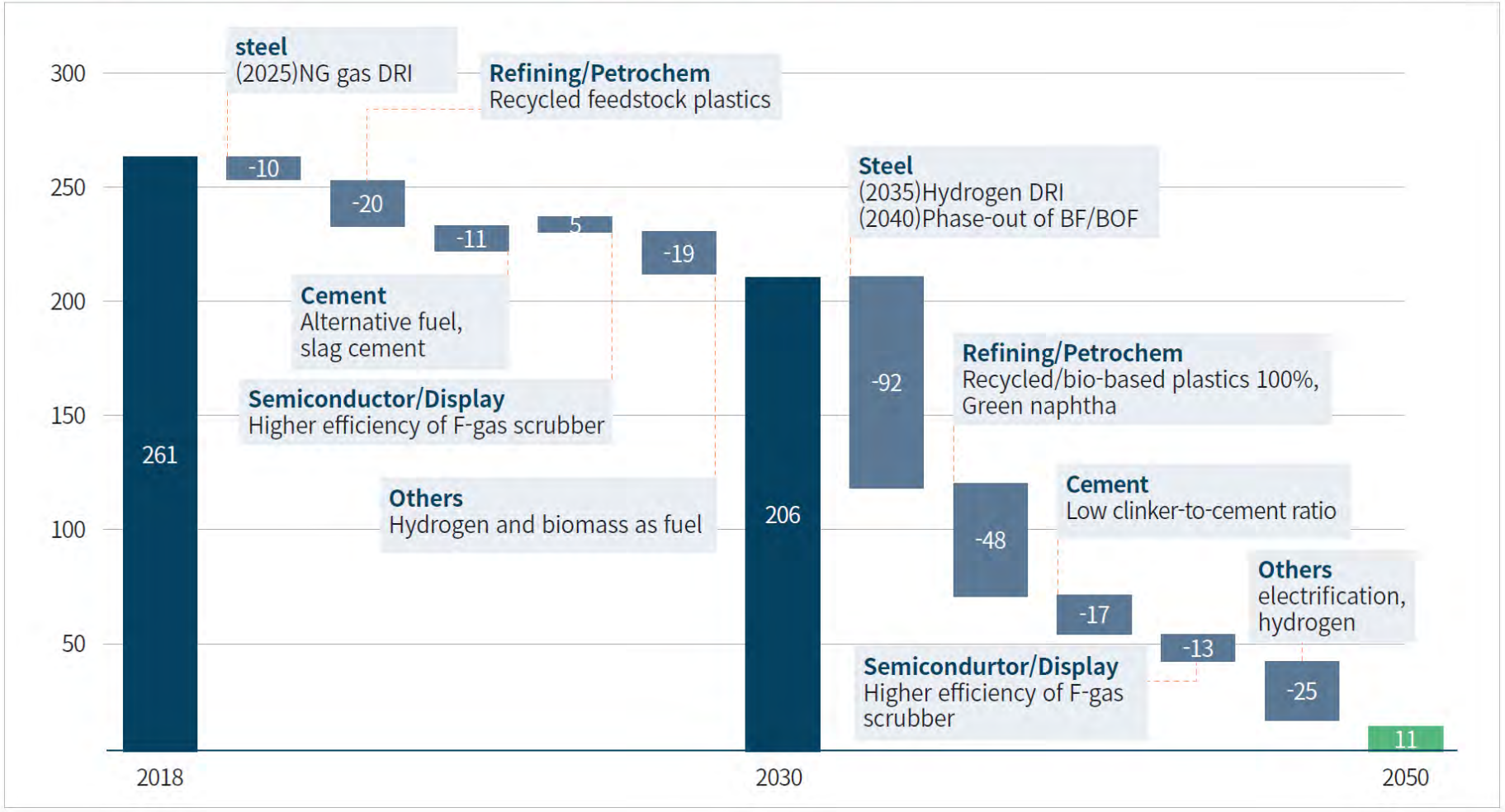


Green Public Procurement Volume of Korean Government (2015-2020)



In the K-Map, industry cuts 96% of GHG emissions compared to the 2018 level.

FIGURE 4. SCENARIO TO REDUCE EMISSIONS IN THE INDUSTRIAL SECTOR



Policy Implications

1	**Renewable Electricity Deployment**	Increasing social acceptance, tax benefits, deregulations
2	**Support to Technology Development**	Hedging investment uncertainties by adopting CCfD
3	**Support to Green Hydrogen Supply**	Building hydrogen infrastructure and subsidies
4	**Incentives for behavioral changes**	Reinforced carbon pricing (K-ETS), green public procurement

THANK YOU

Rachel Eun Ko rachel.eun.ko@nextgroup.or.kr
www.nextgroup.or.kr

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