

KOREA'S EXPERIENCE IN SCALING INDUSTRIAL DECARBONIZATION TECHNOLOGIES THROUGH PUBLIC R&D INVESTMENT

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National Strategy for Core Technology : The Mission-Oriented Approach

Strategic Paradigm Shift

Transition from fragmented, government-led research to a mission-oriented, private-led ecosystem designed for rapid commercialization

	Approach	Selection	Execution
Past Model	Fragmented, single-ministry initiatives	Ambiguous technological mandates	Rigid R&D budgeting and timelines
The Korean Model (Present)	Pan-governmental collaboration (Private-Public)	Targeted selection of 100 core technologies	Fast-track, flexible R&D with sector roadmaps

In the industrial sector, 44 specific technologies were selected across heavily emitting industries (Steel, Petrochemicals, Cement) with roadmaps linking fundamental R&D directly to commercial scale-up.

Green Industry : Three Priority Technology Clusters (2024–2050)

① Equipment Transition

Carbon-Free Combustion & Eco-Friendly Refrigerants

- H₂/NH₃ combustion for industrial boilers & furnaces
- 100% H₂ full-combustion (small-mid scale) by 2030
- 30% co-firing (large scale) target by 2030
- Natural refrigerant heat pump systems replacing HFCs
- 80%+ GHG reduction vs. conventional refrigerants

② Energy Efficiency

Electrification & High-Efficiency Drive Systems

- Electrification of fossil-fuel hydraulic/pneumatic systems
- 90% component efficiency target for electrified drives
- High-efficiency industrial motors (11 kW class pilot)
- SiC/GaN-based power converters: 30% loss reduction
- Full commercialization via staged public→private handoff

③ Clean Process

Low-GWP Gas Substitution in Semiconductors & Displays

- Replace high-GWP process gases (GWP < 150 target)
- 4+ alternative gases developed for etch/CVD/clean
- 99%+ decomposition of HFCs via abatement systems
- GWP monitoring precision: 80–85% accuracy target
- Progressive: R&D → pilot → mass production line

Case Study : Steel Sector (HyREX Project)

Demonstrating Hydrogen Reduction Ironmaking (HyREX) to replace coal with 100% hydrogen, creating direct reduction iron (DRI) via fluidized bed reactors

Project Economics Dashboard

Total Investment

814.5 Billion KRW

Public Funding: 308.8 Billion KRW
(De-risking early stage)

Private Capital: 505.7 Billion KRW
(Commercial commitment)

Deployment Roadmap



Phase 1 (~2025): Development of novel process design and engineering fundamentals.



Phase 2 (~2030): Construction and verification of a 1-million-ton demonstration facility



Phase 3 (~2040): Scale-up to a 3-million-ton commercial facility



Phase 4 (~2050): Phased, private-led transition of all domestic blast furnaces

Case Study : Petrochemical & Cement Sectors

Focusing on raw material substitution and circular resource utilization to eliminate embedded carbon in fundamental manufacturing processes.

PETROCHEMICAL SECTOR

Focus: Raw Material Substitution & Circularity

Key Technologies:

- Bio-feedstock: Substituting traditional naphtha with bio-naphtha and bio-olefins
- Chemical Recycling: Utilizing chemical solvent extraction and depolymerization of waste plastics

Roadmap Target: Pilot scale by 2029; transitioning to commercial phases post-2030

CEMENT SECTOR

Focus: Alternative Raw Materials & Fuel

Key Technologies:

- Non-Carbonate Substitution: Replacing limestones (a primary CO₂ source) with slag and waste concrete
- Fuel Substitution: Replacing bituminous coals with combustible waste synthetic resins

Roadmap Target: Targeting a 65%+ substitution rate for fuels; step-by-step expansion across 44 domestic kilns

Building Investment Pipelines: Tax Support

Mitigating Private investment risk during the critical “Valley of Death” between R&D and commercial deployment.

Mechanism: Designation of “New Growth & Core Technologies” within the national tax code

Scope of Support	
》》》 Eligible Technologies:	54 Specific carbon-neutral technologies designated (including CCUS, Hydrogen, and Industrial Processes).
》》》 R&D Deductions:	up to 30%, for SMEs up to 20%, for Large Enterprise
》》》 Facility Investments:	up to 10% base deduction for SMEs, coupled with accelerated deductions for incremental investment increases

Building Investment Pipelines: Direct Financing

Catalyzing large-scale private capital deployment for long-term, capital-intensive facility transformations.

Program: Net-zero Leading Project Loans

Structure: Provides long-term, low-interest loans and interest rate subsidies for both R&D and facility investments across all industrial sectors.



Conclusion & Implications

The Government should act as a systemic risk-mitigator to overcome the high capital costs and technological uncertainties of industrial decarbonization

TECHNOLOGY PUSH

Mission-oriented public R&D co-funds the engineering risk

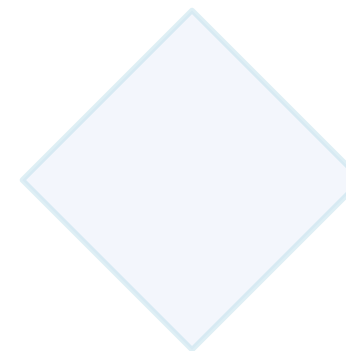
CAPITAL PULL

Tax credits and concessionary loans de-risk the balance sheet for facility adoption

MARKET SIGNAL

The Emissions Trading Scheme must be tightened to absorb oversupplied credits, ensuring carbon prices actively incentivize early adoption of green tech

Scaling industrial decarbonization is not just an engineering challenge; it requires a tightly interlocked policy triad of precise R&D targeting, aggressive financial pipelines, and robust carbon pricing.



**Thank you
for your attention**