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KGID 2025 Green Growth: The Path to Sustainable Jobs

Session 3-2: Leveraging Ocean Resources for Climate Resilience, Biodiversity, and Sustainable Growth

"Transitioning to Green Ports: Korea's Experience"

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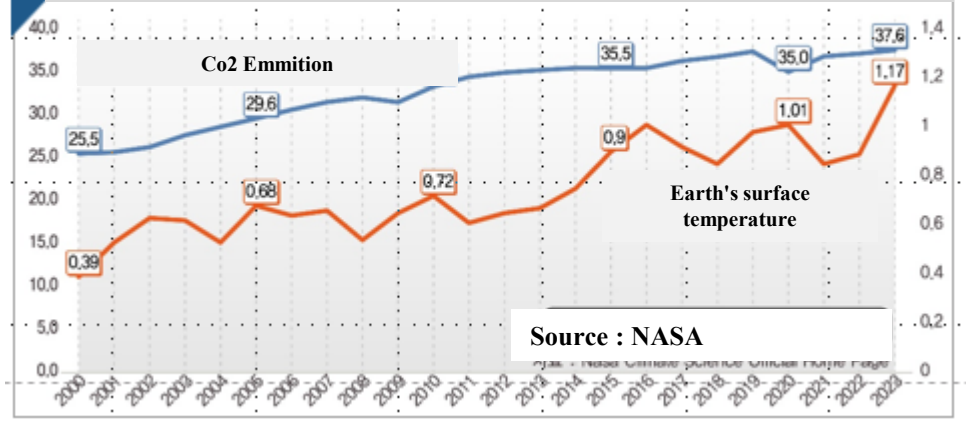
1. Background

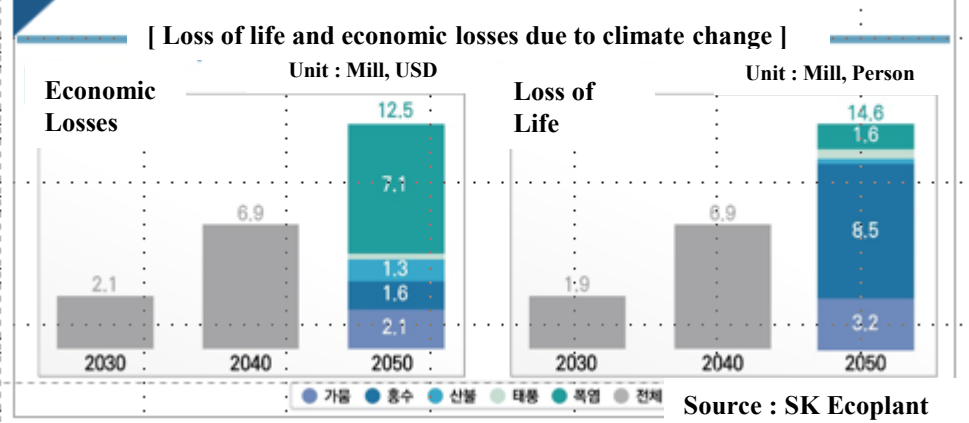
- Transition to a Carbon-Neutral Society in Response to the Global Climate Crisis
  - ✓ (International) To achieve carbon neutrality by 2050 (IPCC), the EU (Renewable Energy Directive, Carbon Neutrality Industry Act, Carbon Border Adjustment Mechanism) and IMO (EEXI, CII) are strengthening environmental regulations
  - ✓ (Domestic) While the National Strategy for Carbon Neutrality and Green Growth (2023) was established, concrete sector-specific industrial policies remain insufficient

Global temperatures continue to rise due to persistent carbon emissions growth



Source : NASA

Economic losses from extreme weather events totaled $4.3trillion (since 1970)



Source : SK Ecoplant Newsroom

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1. Background

- Expansion of the role and functions of ports in the transition to a carbon-neutral society

Cargo Transportation

Storage

Products Distribution

Raw Material Procurement

[Maritime Regulations]

- EEXI (Existing Ship Energy Efficiency Index)
  - ✓ CO2 emissions index per ton of cargo transported per nautical mile
  - ✓ Applicable to vessels over 400 tons starting in 2023
  - ✓ Failure to meet index results in operational suspension, reduced speed, port access restrictions, and fines
- CII (Carbon Intensity Indicator)
  - CO2 emissions index per ton of cargo transported per nautical mile (based on actual annual fuel consumption)
  - Implemented for vessels over 5,000 tons starting in 2023
  - Speed reduction if index is not met

[Carbon Neutrality at Ports]

- Electrification of cargo handling equipment
- Introduction of hydrogen fuel cells
- Establishment of charging stations (electric and hydrogen), etc.
- Construction of power infrastructure

[Industrial Support]

- Establishment and Operation of Eco-Friendly Fuel Bunkering Facilities
- Installation of AMPs at Ports
- Providing space for renewable energy generation
- Construction of Support Facilities Related to Renewable Energy
- Construction of Eco-Friendly Energy Supply Facilities
- Construction of CCUS Support Facilities

[Industrial Regulations and Support Guidelines]

- RED (Renewable Energy Directive)
  - ✓ 45% renewable energy consumption target by 2030 69% target set relative to total electricity generation
  - ✓ Promotion and encouragement of the renewable energy sector
- NZIA (Carbon Neutrality Industry Act)
  - Granting fast-track permits and financial benefits to projects significantly contributing to the EU's 2050 climate neutrality goal (effective 2024)
- CBAM (Carbon Border Adjustment Mechanism)
  - The EU will impose a tax on imports of carbon-intensive products (steel, cement, aluminum, fertilizers, electricity, and hydrogen) from other countries based on the carbon emissions generated during production (2023)

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1. Background

- Major ports worldwide are implementing carbon neutrality policies in the port sector

[LA/LB]

- **80% greenhouse gas reduction target by 2050 (CAAP, 2006)**
  - ✓ **(Ships) Shore Power Supply, Speed Reduction in Port Area**
  - ✓ **(Cargo Handling Equipment) Replacement of outdated diesel equipment**
  - ✓ **(Energy) Utilization of renewable energy, ESS, etc.**

[Rotterdam]

- **Port Vision 2030 (2017)**
  - ✓ **(Global Hub) Transition to the world's top eco-friendly port by 2030 (eco-friendly fuels, electrification, etc.)**
  - ✓ **(Industrial Hub) Providing space for eco-friendly energy production, storage, and related industries (wind power, hydrogen production)**

[Singapore]

- **Maritime Singapore Decarbonization Blueprint: Working towards 2050 (2022)**
  - ✓ **(Port) Equipment electrification and eco-friendly fuel use, renewable energy utilization, smart grid establishment**
  - ✓ **(Bunkering) Construction of supply facilities for biofuels, methanol, ammonia, hydrogen, etc.; Development of CCS-related technologies**

[Shanghai]

- **Announcement of Special Plan for Energy Conservation and Emission Reduction Related to Green Circular Low-Carbon Port Construction (2015)**
  - ✓ **(Bunkering) LNG Bunkering Infrastructure Development**
  - ✓ **(Renewable Energy) Solar Power Generation (4,500 kW/day)**

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2. Vision and Goals

- (Vision) Building an eco-friendly future port (Net-Zero) and a national carbon-neutral gateway port

	Net-Zero Port	Gateway Port
Goals	• Achieve Zero Carbon Emissions within the Port by 2050 and Prepare for Future Eco-Friendly Vessels ✓ (Zero Direct Emissions) Energy transition within the port (Fuel oil → electricity, etc.) ✓ (Minimizing Indirect Emissions) Expanding the adoption of renewable energy ✓ (Future Vessel Readiness) Establishing eco-friendly fuel bunkering	• Establishing Energy Logistics Infrastructure to Achieve National Carbon Neutrality by 2050 ✓ (Energy) Expanding eco-friendly energy infrastructure ✓ (Offshore Wind) Establishing an Offshore Wind Support System ✓ (Carbon Logistics) Establishing CCS Hub Terminals
Impleme-Nation Plans	• (Energy Transition) ✓ Conversion of cargo handling equipment, AMP construction ✓ Charging (electric, hydrogen) infrastructure establishment ✓ Timely Supply of Substations • (Expansion of Renewable Energy) ✓ Establishment of a system to utilize idle port space ✓ Expanding Renewable Energy Utilizing Port Space ✓ Establishment of Institutional Framework • (Eco-friendly Fuel Bunkering) ✓ Enhancing Utilization of Existing Facilities ✓ Phased Construction of Eco-Friendly Fuel Bunkering Facilities	• (Hydrogen, Ammonia Terminals) ✓ Phased construction considering demand by period ✓ Developing a plan for shared use of docks • (Offshore Wind Support System) ✓ Expanding Existing Terminal Functions ✓ Establish offshore wind cluster foundation (port + offshore wind industry) • (CCS Hub Terminal) ✓ Establishment of Carbon Processing, Security, and Export Infrastructure Considering National Greenhouse Gas Reduction Targets

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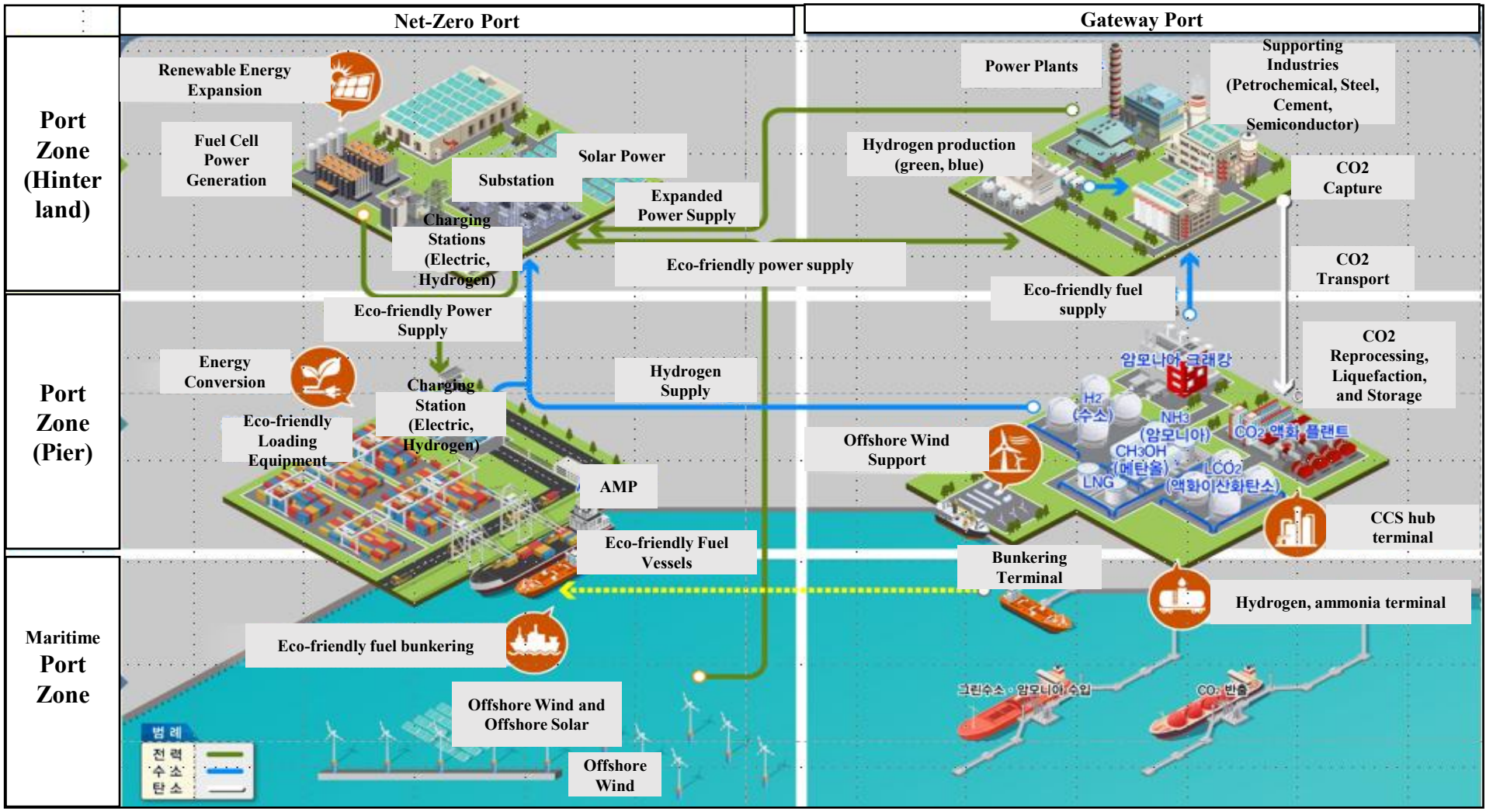
2. Vision and Goals



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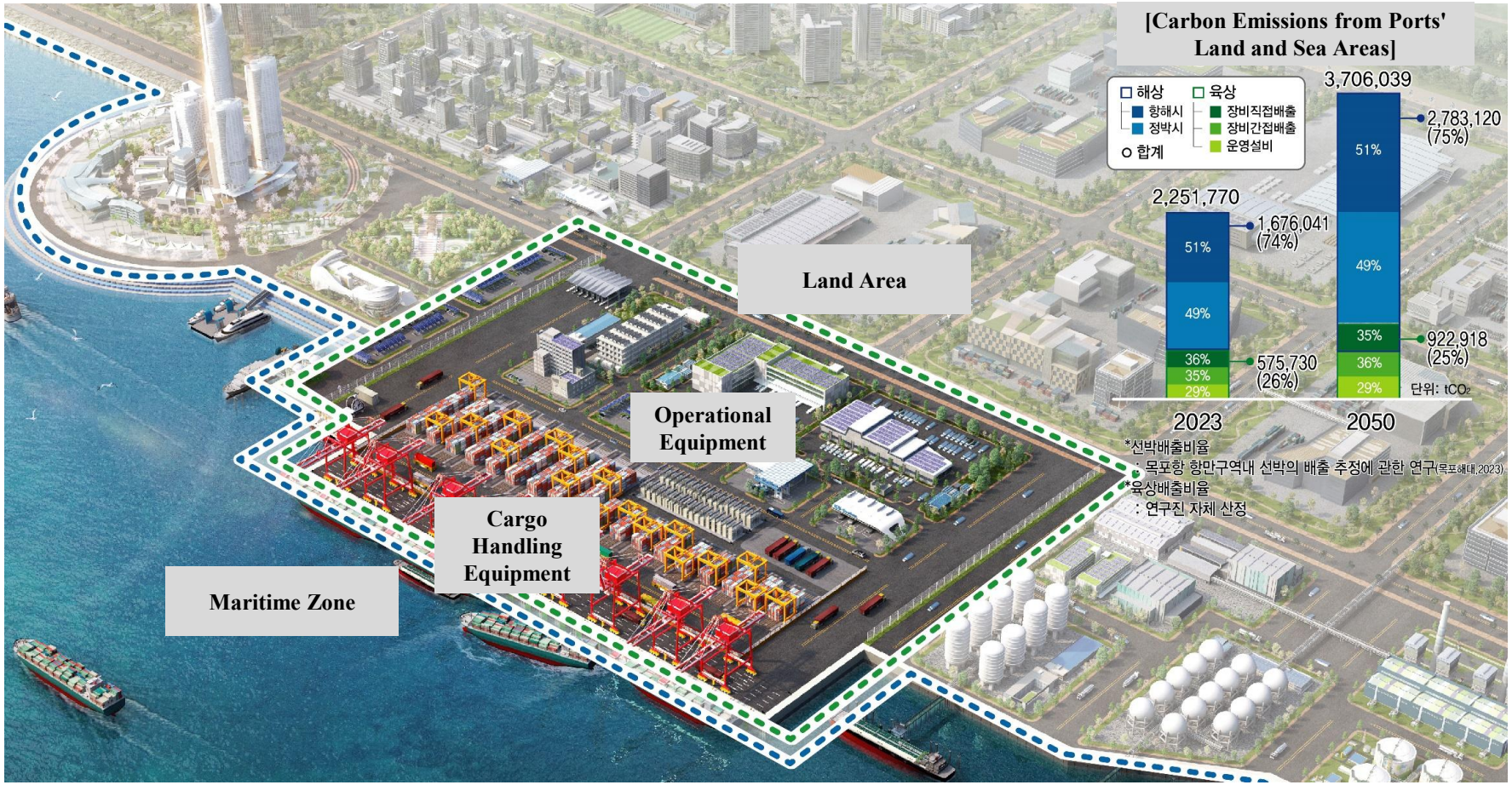
3. Eco-Friendly Future Port (Net-Zero Port)

- (Energy Transition) Port carbon emissions totaled 2.25 million tons in 2023 and are projected to increase to 3.71 million tons by 2050



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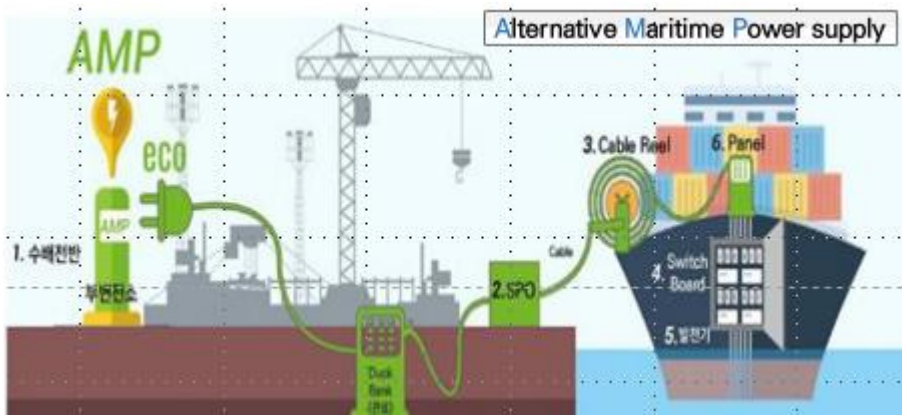
3. Eco-Friendly Future Port (Net-Zero Port)

- (Energy Transition)
  - ✓ (Land-Based Equipment) Equipment Power Conversion (Fuel Oil → Electricity and Hydrogen, etc.) and charging infrastructure development
    - Port-wide equipment transition to eco-friendly energy (electrification of stationary and mobile equipment, introduction of hydrogen equipment after 2040)
    - Introduction of charging infrastructure considering equipment conversion both inside and outside the port

3. Eco-Friendly Future Port (Net-Zero Port)

- (Energy Transition)
  - ✓ Installation of AMPs for power substitution (fuel → electricity) during ship berthing
    - Installation of AMPs for power supply to berthing vessels (86 berths by 2040)

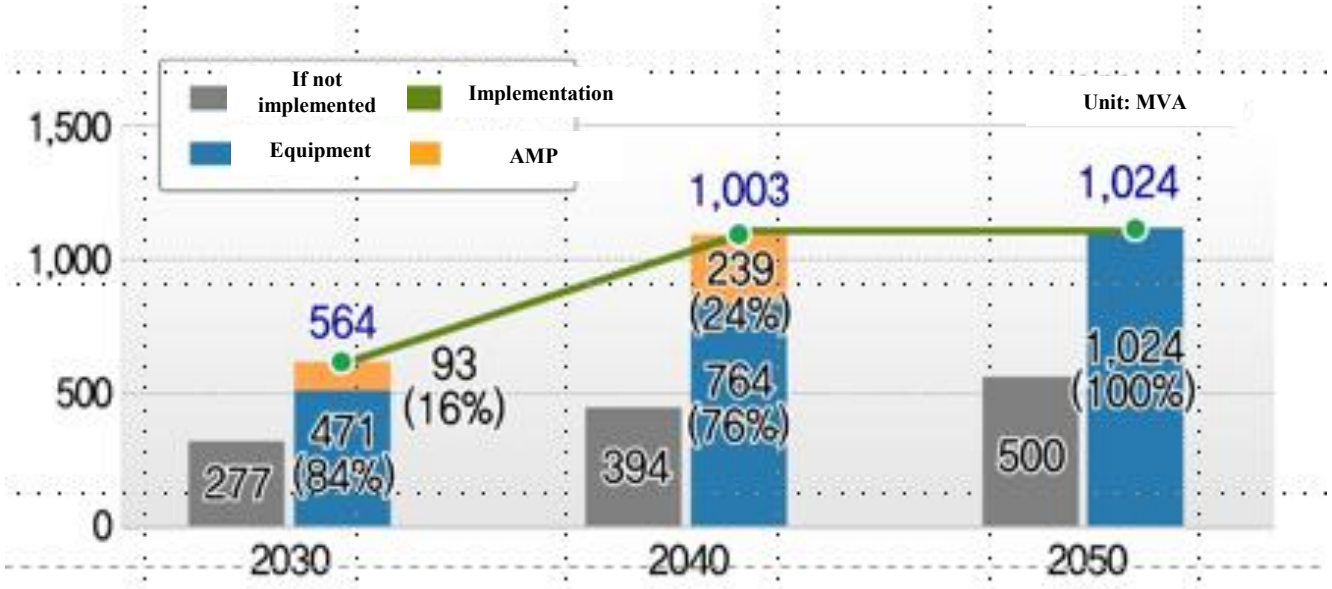


[Fixed AMP Facilities]

[Mobile AMP Facilities]

3. Eco-Friendly Future Port (Net-Zero Port)

- (Energy Transition)
  - ✓ (Power Infrastructure) Expansion of power infrastructure to address increased power demand due to power conversion
    - Approximately double the power demand compared to existing levels due to power transition and AMP introduction
    - Introduction of new substations accordingly



3. Eco-Friendly Future Port (Net-Zero Port)

- (Expanding Renewable Energy) Expanding renewable energy generation by leveraging port space advantages
  - ✓ (Responding to Renewable Energy Demand) Solar and wind power planned to reach 115.5GW by 2038 (23GW in 2022) (11th Basic Plan for Electricity Supply and Demand, 2024)
  - ✓ (Expanding Green Shipping Routes) Establishing an early supply system for RE100 energy sources within ports
    - (Green Shipping Corridor) Routes with zero carbon emissions throughout the entire maritime transport process using carbon-free fuels or eco-friendly technologies are currently operating on 57 routes worldwide (2024)
    - Korea-U.S. Green Shipping Corridor pilot operation (scheduled for 2027)

Source: www.polestarglobal.com

3. Eco-Friendly Future Port (Net-Zero Port)

- (Expanding Renewable Energy)
  - ✓ Korean ports are in the initial stages of introducing renewable energy facilities, lagging behind overseas ports
  - ✓ However, various renewable energy generation projects are being proposed within ports, led by the private sector. Support is being provided while reviewing potential issues in advance.
    - Available space,
    - Port Development and Operational Interference,
    - Potential for Energy Supply within Ports,
    - Facility management, etc.

→ Establishing institutional frameworks for port space utilization

- Sharing of available space and information by port, etc.

Overseas

Solar power generation at Singapore's Tuas Port

Offshore wind power at Rotterdam Port, Netherlands

Korea

Solar power generation at Incheon North Port

Wind Power Generation at Byeongdo, Gunsan Port

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3. Eco-Friendly Future Port (Net-Zero Port)

- (Green Fuel Bunkering) While an increase in eco-friendly ships is anticipated, the diversity of green fuels and their low business viability are current issues.
  - ✓ Expected increase in eco-friendly ships due to IMO's 2050 target of 100% greenhouse gas reduction
    - The reduction target for greenhouse gases from ships is at least 20% by 2030, at least 70% by 2040, and net-zero by 2050.
  - ✓ Accordingly, the proportion of orders for ships using eco-friendly fuels like methanol and LNG is increasing, and the resulting sustained demand for eco-friendly ship fuels is expected to grow
  - ✓ However, securing project viability remains challenging due to the uncertainty of current demand relative to facility construction costs

→ To secure business viability, establish bunkering infrastructure linked to related facilities (LNG receiving terminals and storage tanks, methanol and ammonia storage tanks, etc.)

→ Phased construction of bunkering facilities considering the trend in orders for eco-friendly fuel ships

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4. National Carbon-Neutral Gateway Port

- (Hydrogen, Ammonia Terminal) Securing port infrastructure to support the nation's transition to eco-friendly energy
  - ✓ South Korea's hydrogen demand is projected to rise from 3.9 million tons in 2030 to 27.9 million tons by 2050
    - Of this, 51% will be imported by 2030 and 82% by 2050 (First Basic Plan for Hydrogen Economy Implementation, 2021)
    - Hydrogen demand is expected to increase, primarily in petrochemicals and steel
    - Increased demand for ammonia and hydrogen anticipated due to the promotion of co-firing power generation (coal + ammonia, LNG + hydrogen)

→ Need to prepare countermeasures for establishing hydrogen and ammonia supply chains

- (Temporary Port Mixing Permission) Discussions underway regarding port mixing and port classification system reorganization for importing ammonia and hydrogen for power generation

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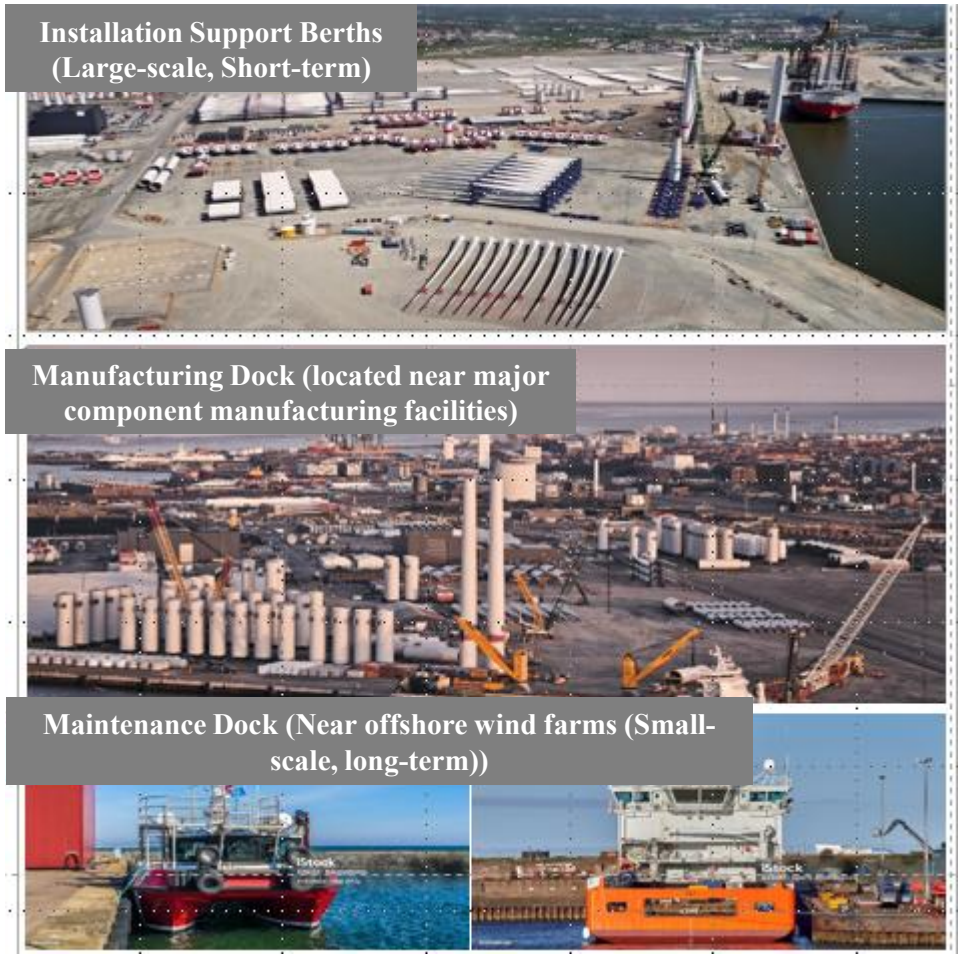
4. National Carbon-Neutral Gateway Port

- (Offshore Wind Support System) The port's role (manufacturing, installation, maintenance) is necessary in light of the projected expansion of offshore wind power generation.
  - ✓ Compared to onshore wind, lower site constraints and potential for high utilization rates due to large capacity → Projected 18.3GW of wind power generation by 2030

→ Development of installation support berths, manufacturing berths, and maintenance berths to support this

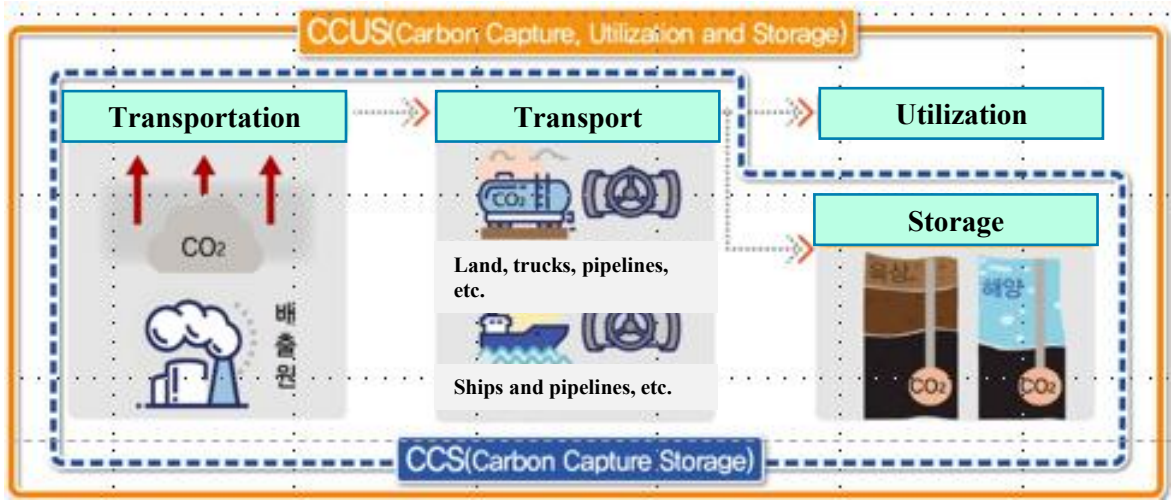
→ However, phased support considering offshore wind's variability and port operational conditions



4. National Carbon Neutrality Gateway Port

- (CCS Hub Terminal) Requires a terminal for CO_2 emission, capture, and storage
  - ✓ Projected annual CO_2 shipment volume of 35.6 million tons by 2050 from power plants, steel, and petrochemical sectors
  - ✓ Utilization of captured carbon depends on technological development level; priority lies in developing CCS facilities
  - ✓ Overseas ports are constructing CCS facilities and advancing demonstration projects

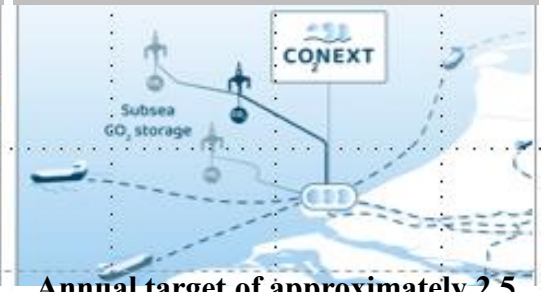
→ Select target ports for CCS terminal development to support this and pursue as a private-sector-led initiative



Norway Northern Light Project

Annual target of approximately 5 million tons

Rotterdam Port, Netherlands



Annual target of approximately 2.5 million tons (under demonstration project)

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Thanks !!

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