Necessity to Activate Derivatives of Carbon Emission Allowances

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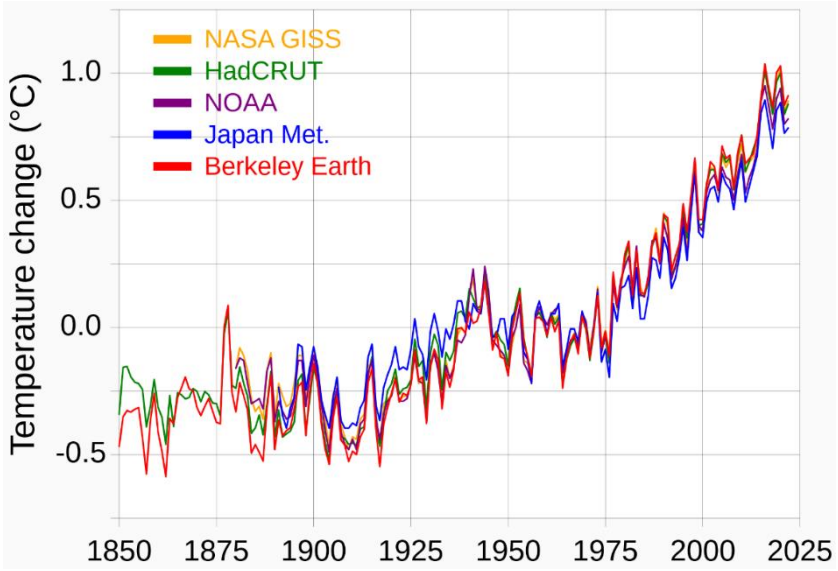
Role of ETS(Emission Trading System) for Reducing Carbon Emissions

Necessity to Reduce Carbon Emissions

- **Global warming is serious**
  - Since the Industrial Revolution, global temperatures have increased by more than 1.5˚C

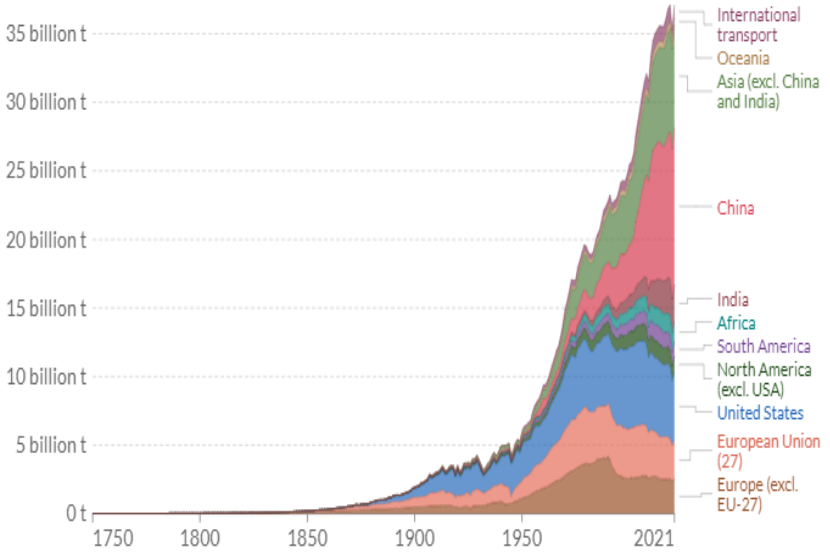
- **Main cause of global warming is CO2 Emissions**
  - In 1990, annual CO2 emissions were only 2 billion tons
  - But in 2020, annual CO2 emissions increased to 36 billion tons

Global average temperatue change



Source: NCDC(National Climate Data Center)

Trends in CO2 emissions by region



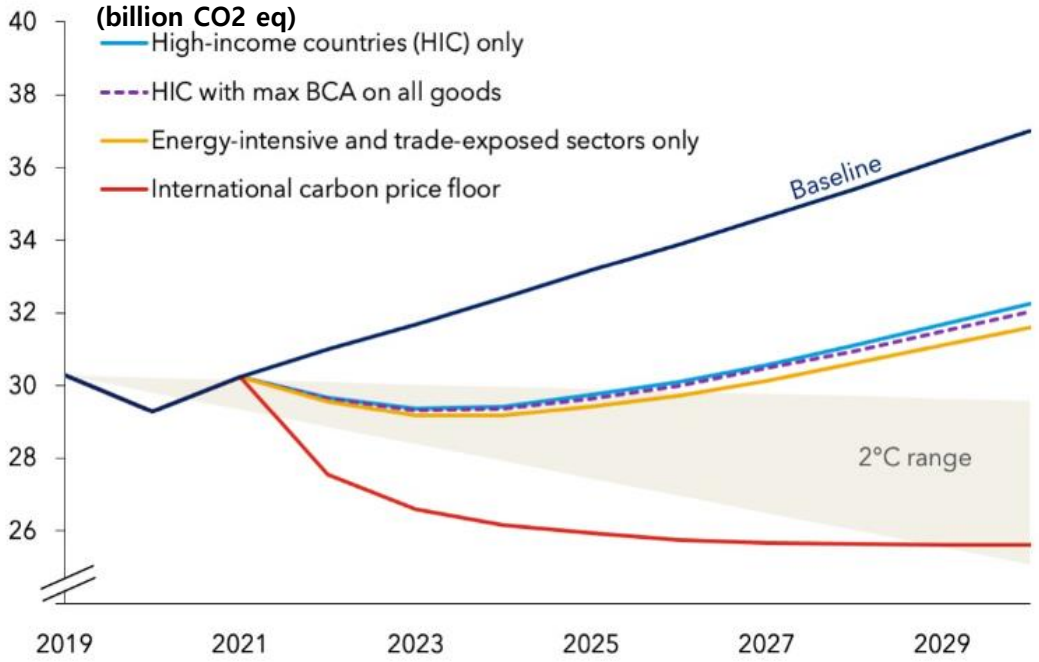
Source: Ourworldindata.org

Carbon Reduction is the key to respond to Climate Crisis

- **To respond to the climate crisis, reducing carbon emission is the only solution**
  - IMF(2020) argue that it could not promote carbon emission reduction without strong measures such as setting a carbon price floor

- **Emission Trading System is the most efficient way to reduce carbon emissions**
  - In order for the emission trading system to function well, both the spot and derivatives markets need to be vitalized

Carbon Emission Reduction by Climate Response Scenario



No Response

Efforts in Advanced Countries

Efforts in All Countries

Source: IMF(2020)

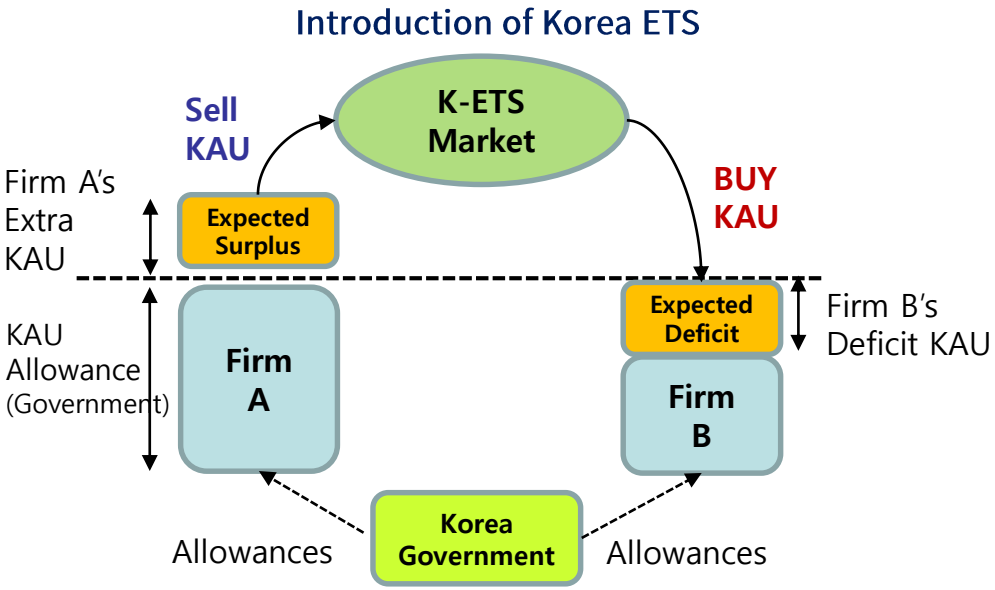
Advantages of Emissions Trading System

❖ Various advantages of ETS

- Accurately control GHS reduction targets
- Provide flexibility in carbon reduction with market-based approach
- Promote the development of carbon reduction technologies
- Provide opportunity to generate revenue
- Increase the transparency of corporate accounting

❖ Some concerns about ETS

- Volatility of carbon emission price → Carbon Derivatives provide hedging needs
- ETS operation is complex and costly → Carbon Derivatives can replace the role of spot market

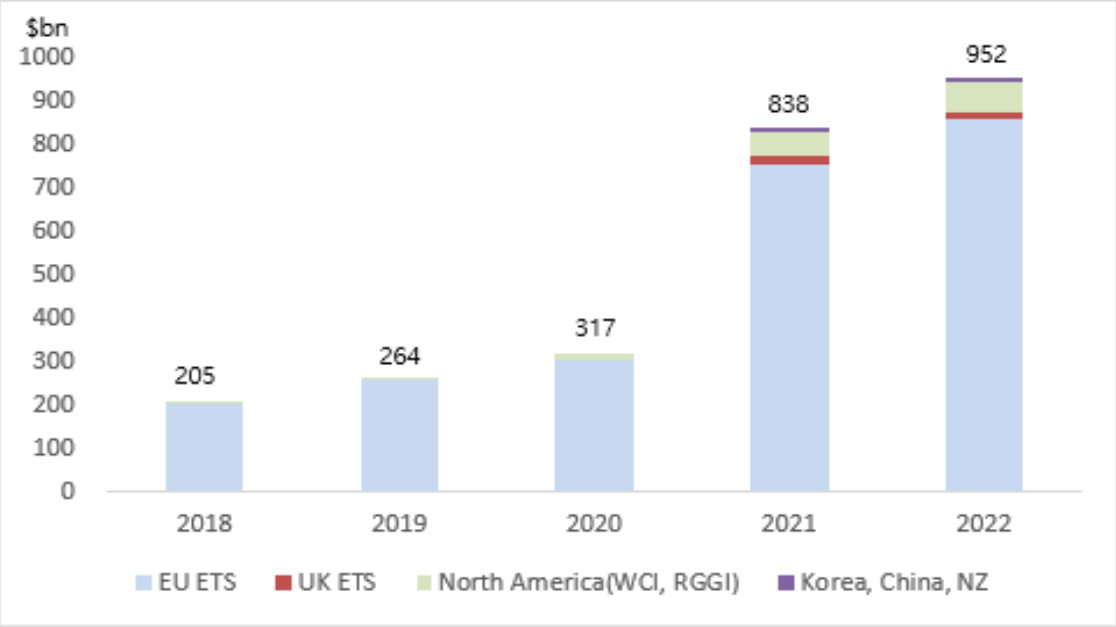


Global ETS market is growing fast

❖ Trading volume of global ETS hits new record

- In 2022, global ETS trading volume is $952, which has increased by 4.6 times compared to 2018
- EU ETS accounts for about 90% of global ETS market
  - EU ETS derivatives trading amount is about 10 times the spot EU ETS trading volume
- South Korea's ETS account for about 1% of global ETS market
  - There is no ETS derivatives market in Korea

Trends of Global ETS turnover by region



Source: refinitive

Korea ETS market is also growing fast and promising

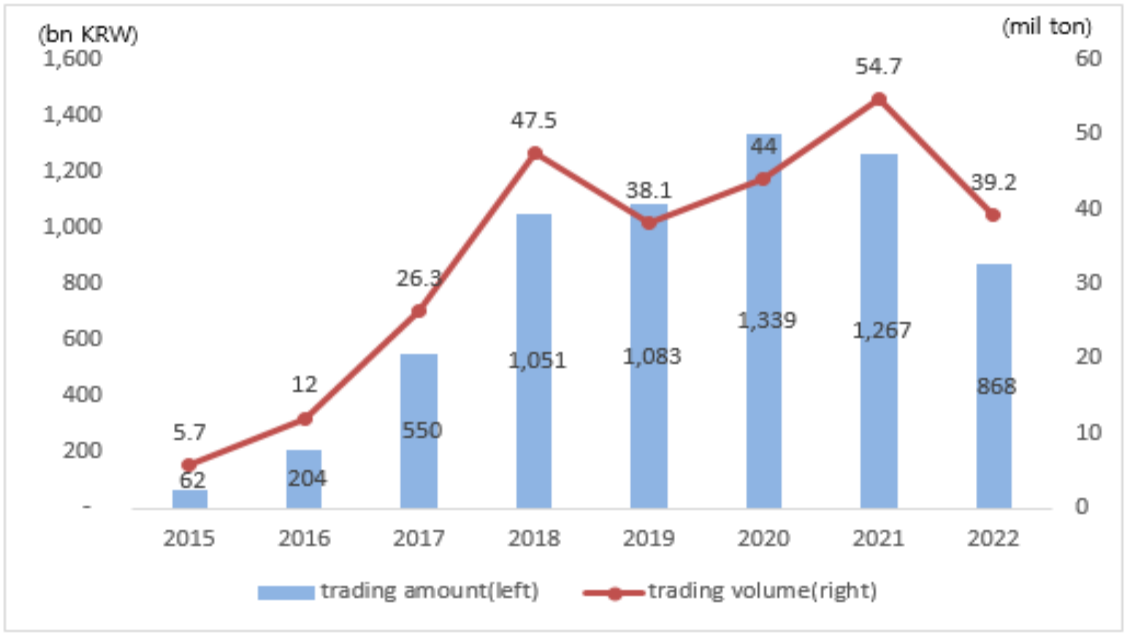
❖ Korea ETS market has grown fast

- Total trading amount has increased by 14 times: 62 bn KRW('15) → 868 bn KRW('22)
- Total trading volume has increased by 7 times: 5.7 million ton('15) → 39.2 million ton('22)

❖ Korea ETS market is promising

- Korea government announced that we will decrease NDC of 2030 by 40% compared to 2018
- Korea government plans to expand participants and introduce carbon derivatives by 2025

Trends of Korea ETS's trading amount and volume



Source: Korea Ministry of Environment

Europe Carbon Derivatives Market is fast growing

❖ **Europe carbon emission futures market is very active**

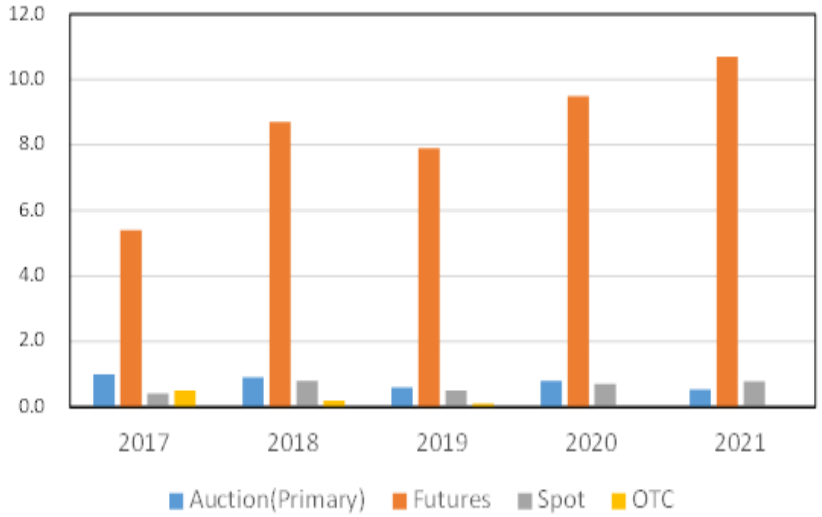
– The average monthly trading volume in 2021 has increased by 2 times compared to 2017

❖ **European carbon futures market is about 10 times the size of carbon spot market**

– Europe carbon futures market : Europe carbon spot market ≒ 9 : 1

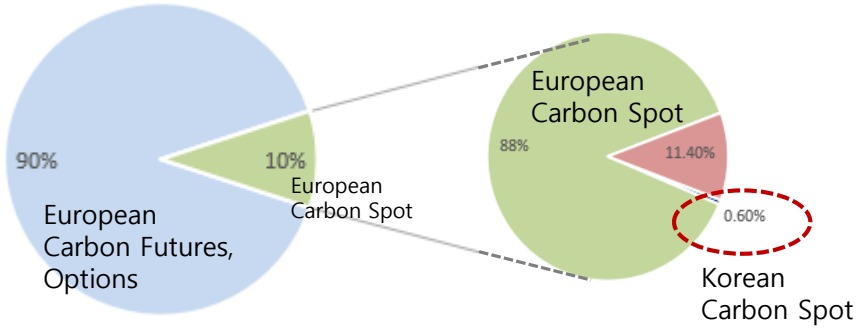
– Europe carbon spot market : Korean carbon spot market ≒ 150 : 1

Trading Volume of EU Carbon Market



Source:German Auctioning of Emission Allowances Periodic Report

Comparison of carbon market in Europe & Korea

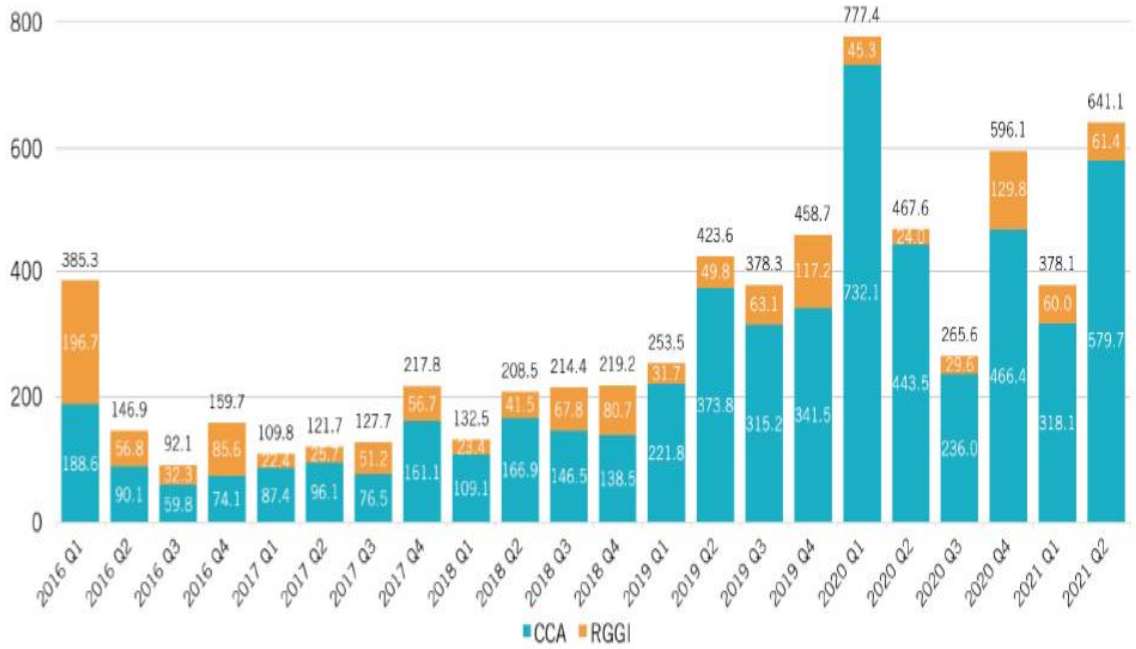


North America's Carbon Derivatives Market is growing

- **CCA (California) trading volume is fast growing**
  - In 2nd quarter 2021, CCA futures and options volume was 579.7 thousand lots, which had increased by 6 times compared to 2016

- **RGGI (Northeast US) trading volume is steadily growing**
  - In 2nd quarter 2021, RGGI futures and options volume was 61.4 thousand lots

North America's CCA & RGGI's Derivatives Volume



Source: ICE, ISDA

Why K-ETS, Carbon Derivatives are promising? – NDC

❖ **Enhanced NDC(National Determined Contribution) Target(26.3% → 40%)**

– Korea Government decided to reduce GHG emissions by 40% by 2030 compared to 2018

Adjusted Greenhouse Gas Emission Reduction Targets in Korea (million tons of CO2)

Category	2018	2030
Transition	259.6	145.9(△45.9%)
Industry	260.5	230.7(△11.4%)
Building	52.1	35.0(△32.8%)
Transportation	98.1	61.0(△37.8%)
Agriculture etc.	24.7	18.0(△27.1%)
Hydrogen	-	8.4
Carbon Sinks	-41.3	-26.7
CCUS	-	-11.2
Overseas Carbon Offset Programs	-	-37.5
Total	**686.3**	**436.6(40%)**

Source: Korea Government

Why K-ETS, Carbon Derivatives are promising? Regulation

- **EU: CBAM(Carbon Border Adjustment Mechanism)**
  - EU Importers are required to purchase a CBAM Certificate based on GHG emission inherent in the imported goods
  - It's scheduled to be piloted at the end of 2023, and will be fully expanded by 2026

- **US: SEC's obligation to disclose carbon emissions**
  - Listed companies are required to disclose GHG emissions from 2024
    - Mandatory: Scope1, Scope2
    - Voluntary: Scope3
  - To reduce carbon emissions, listed companies in US will purchase carbon emission products

- **Global: ISSB under IFRS**
  - ISSB plans to mandate emissions disclosure for Scope1 & Scope2
  - ISSB will consider requiring Scope3 disclosure for companies that meet certain criteria
  - Financial Institutions are required to disclose the carbon emissions of companies that have provided loans or invested in (transition) industry

Economic Benefits of Carbon Derivatives Market

Overview of Global Carbon ETD Proudcts

❖ Carbon Emission Allowances Futures & Options are mainly listed

- EUA, CCA, RGGI futures & options are listed and actively traded on major exchanges in Europe and US such as ICE, EEA, NYMEX, NASDAQ
- EUA, CCA, RGGI futures & options account for more than 95% of total transaction of carbon derivatives products

Global Carbon ETD Products

Exchange	Listed Products
ICE Europe(EU)	EUA Futures, CER Futures, UKA Futures, EUAA Futures EUA Options, EUA Futures Options, CER Options
EEA(EU)	EUA Futures, EUAA Futures, EUAOptions
NASDAQ Oslo (EU)	EUA Futures, EUA Options
ICE U.S.	CCA Futures, RGGI Futures, CCA Options, RGGI Options
NYMEX (EU & U.S.)	EUA Futures, RGGI Futures, CCA Futures, GEO Futures EUA Options, RGGI Options

Source: ICE, ISDA

Overview of Global Carbon Emission Futures Market

❖ **Carbon ETD market outperforms the carbon spot market**

- EU & US carbon futures and options trading amount are significantly outperforming carbon spot trading amount
- EU('21): futures market(80~85%), options market(5~10%), spot market(6%), auction(5%)

Overview of Global Carbon Emission Futures Market

	EUA futures	CCA futures	RGGI futures
Trading number ('23.3)	977,381 Lots (1Lots=1,000EUA)	165,033 Lots (1Lots=1,000CCA)	31,282 Lots (1Lots=1,000RGGI)
Trading ratio to spot market	About 15 times	About 2~3 times	
price ('23.5)	90~95$(US)	28.5$(US)	13$(US)
Global share of spot market	About 90%	About 5~6%	

Source: KCMI

Economic Benefits of Carbon Derivatives

Price Discovery

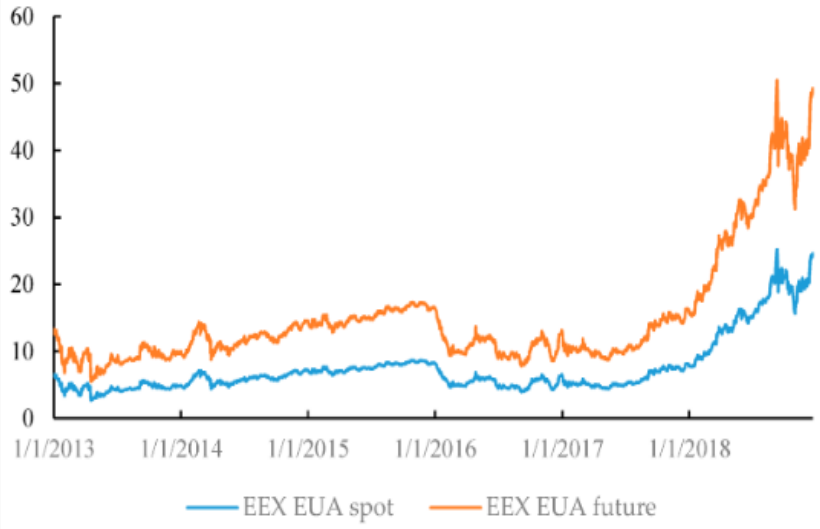
❖ **EUA futures & options contribute to price discovery of EUA spot market**

- Many empirical studies have shown that current EUA futures prices are statistically significant in predicting tomorrow's EUA spot prices
  - Stenfan & Wellenreuther(2020), G. Ibikundle et al. (2016)

❖ **EUA futures prices show 'contango'**

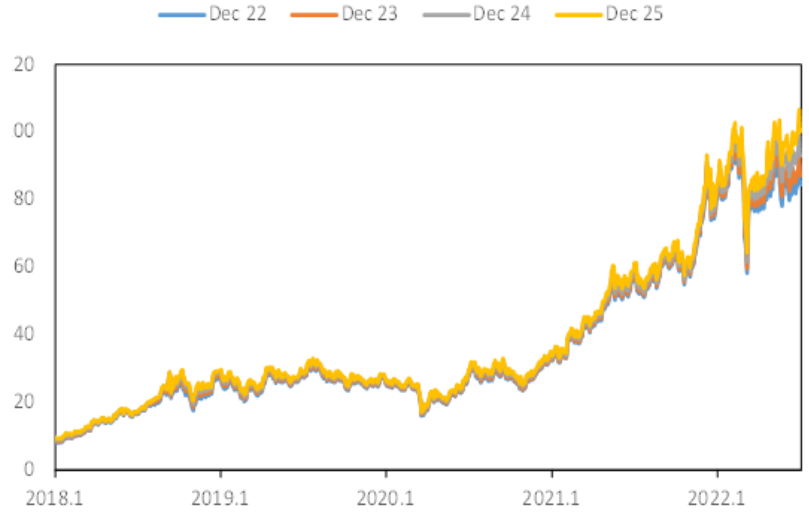
- It was observed that the longer the maturity, the higher the EUA futures price
- When this contango occurs, the long-term EUA futures prices and spot prices tend to rise

Trend of EUA futures price and spot price



Source: ECX, H. Chen et al. (2020), "The Linkages of Carbon Spot-Futures: Evidence from EU-ETS in the Third Phase"

Trend of EUA futures price by maturity



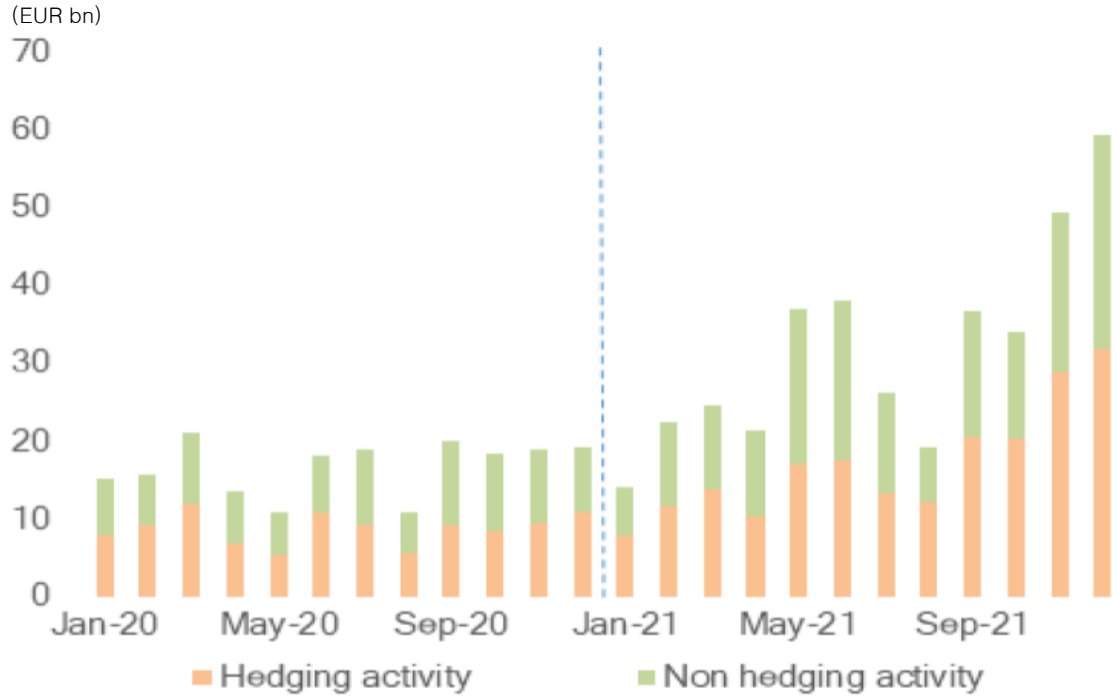
Source: ICE, Korea Capital Market Institute

Risk Management

❖ Hedging demands for carbon derivatives are increasing

- The trading activity of hedging in EUA carbon derivatives markets is steadily increasing
  - Buying Futures Strategy: Companies with insufficient EUA can hedge the risk of rising carbon price by buying EUA futures
  - Selling Futures Strategy: Companies with remaining EUA can hedge the risk of a decline in carbon price by selling EUA futures

Trading amount of EUA derivatives market by hedging purpose



Source: ESMA

Contribution to Market Efficiency

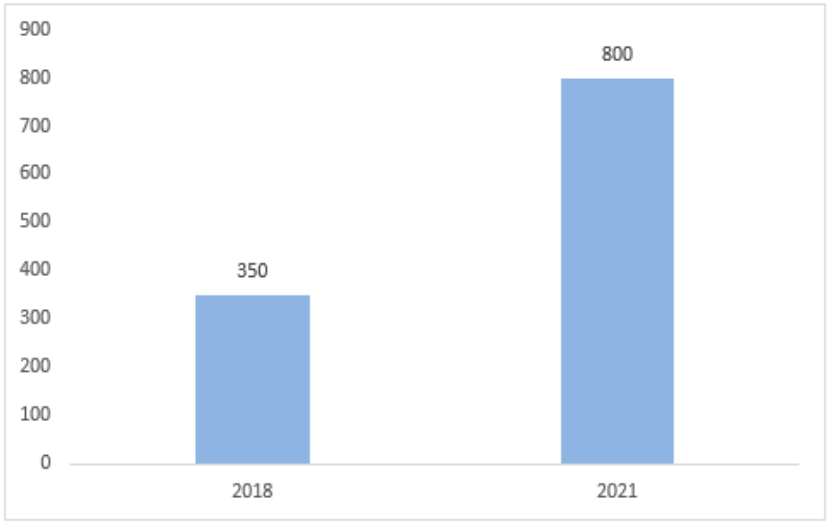
❖ EUA futures help carbon information to be priced quickly

- As speculative, arbitrage, and hedging purpose participants participate in the EUA futures market, carbon information is quickly reflected in prices
- Actually, the number of participants in EUA futures market has increased from 350 in 2018 to 800 in 2021

❖ Significant decrease in bid-ask spread

- As EUA futures market are actively traded, the bid-ask spread decreased from 0.2% in 2018 to 0.02% on 2021

Number of Participants in EUA futures market



Source: Korea Capital Market Institute

Bid-Ask Spread of EUA futures market

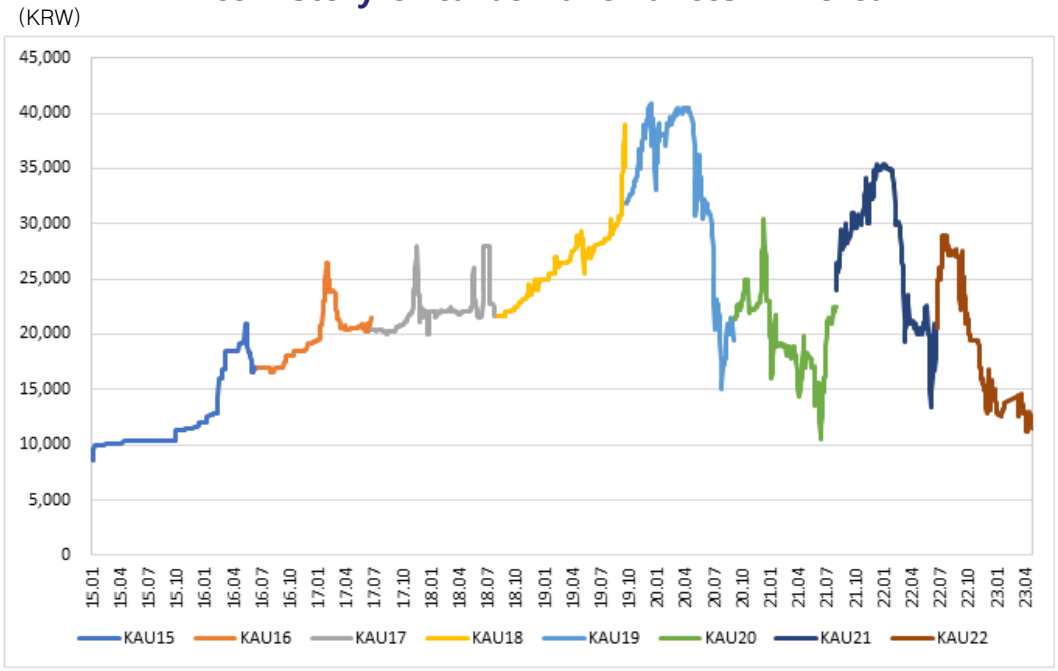
Source: Oxera(2022), Korea Capital Market Institute

Volatility Mitigation

- **Carbon ETD derivatives can mitigate the volatility of spot price**
  - When futures are actively traded, we can facilitate two-way(long/short) transactions between different participants, which can help reduce price volatility

- **The volatility of K-ETS market is higher than EU-ETS, WCI & RGGI**
  - Annualized volatility: K-ETS(about 50%) / EUA(35~40%) / RGGI(40~45%)

Price history of carbon allowances in Korea



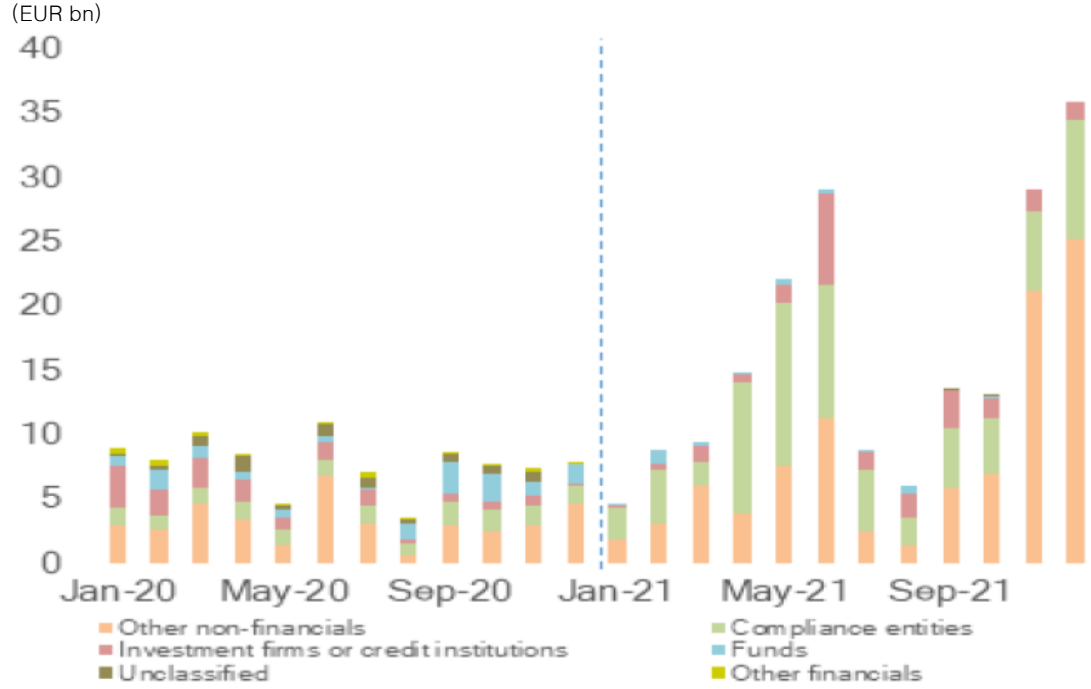
Source: KRX

Increased Liquidity

❖ Positive feedback effect of liquidity

- As the number of participants in EUA futures market increase, EUA futures market is getting more liquidity and efficiency
- Improved liquidity and efficiency induce more heterogeneous participants in EUA futures market
- Ordinary(ex: non compliance entities, individuals) investor's trading amount accounts for 70% of all trading amount of EUA futures

Trading amount of EUA futures market by investor types



Source: ESMA

Necessity to Activate Derivatives of Carbon Emission Allowances

Contribution to GHG Reduction

Activate Carbon Derivatives Market

Introducing Carbon Derivatives	Introducing Carbon Products	Regulatory Improvement
- List KAU Futures by '24~25 - List KAU Options - CCP clearing for KAU swaps	- List KAU ETFs - List KAU ETNs - List KAU linked ELS, ELD	- Enhance Financial Stability - Restrict Unfair Trading - Improve Market Stabilization - Meet Global Standards

Introducing Various Carbon Derivatives Products

KAU Futures ····· ✓ List KAU Futures with different maturities by ‘24~25

KAU Options ····· ✓ List KAU Options for complete carbon market

CCP Clearing of Swaps ····· ✓ Induce OTC KAU swaps to be cleared through KRX-CCP

Policy Recommendations for specification of KAU futures

	EUA Futures	KAU Futures
Underlying Asset	EUA	KAU
Unit of Trading	Allowances	Allowances
Contract Size	1,000 EUA	1) 100 KAU 2) 1,000 KAU
Minimum Trading Size	1 Lot	1 Lot
Settlement	Physical Delivery	1) Physical Delivery 2) Cash Settlement
Contract Series	Up to 7 December, Up to 9 quarterly & 2 month contracts	Quarterly covering all KAU vintages
Trading Hours	08:00~18:00 (CET), Mon-Fri	09:00 ~ 12:15, Mon-Fri
Minimum Price Fluctuation	0.01 Euro per ton	Same to K-ETS
Maximum Price Fluctuation	No Limits	No Limits

Introducing Various Carbon Financial Products

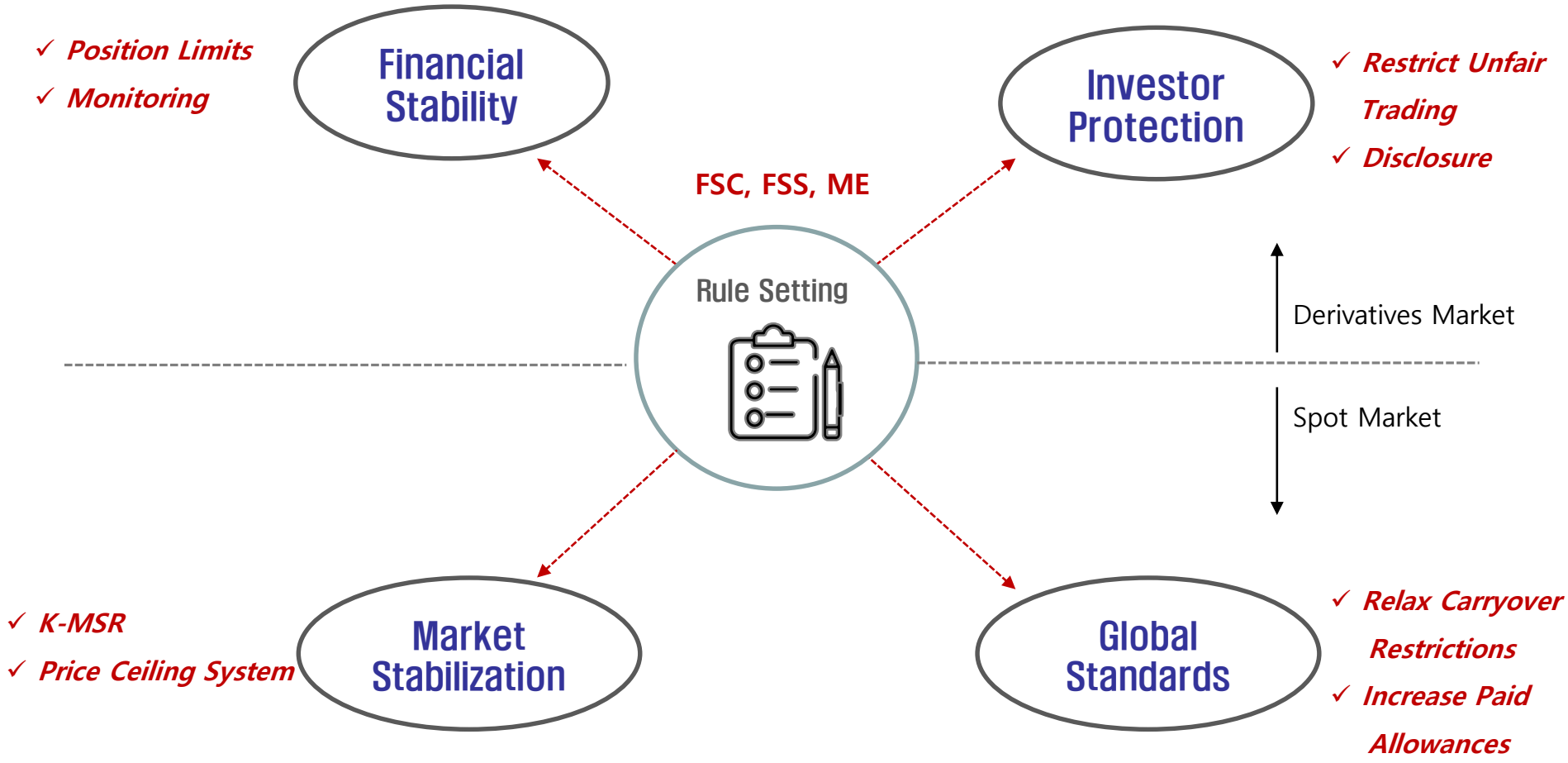
KAU ETFs ✓ Expand demands for carbon emissions to investors

KAU ETNs ✓ Give investment strategies without tracking error

KAU ELS, ELD ✓ Provide innovative carbon products linked to KAU

Contribute To Net Zero Portfolio

Improve Regulatory Framework



Thank you very much.