MRV(Measuring, Reporting and Verification)
&
Practical Exercise
- Calculating GHG Emissions

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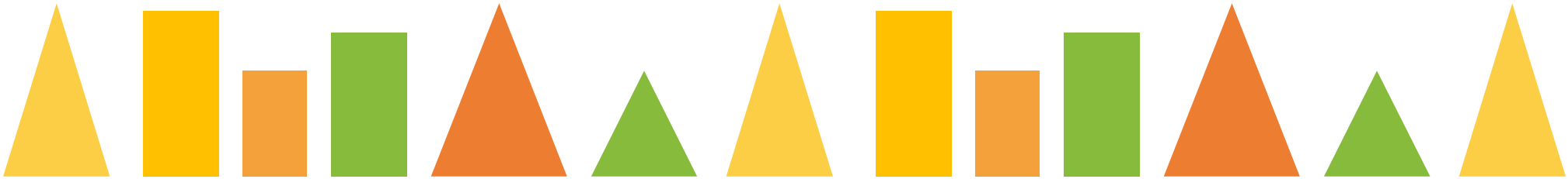

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3 **1st Round**

Calculate GHG Emissions
Trade Emissions
Participate in Auction and more

4 **MRV**

Details on MRV

5 **2nd Round**

1 Intro

Practical Exercise - Calculating GHG Emissions

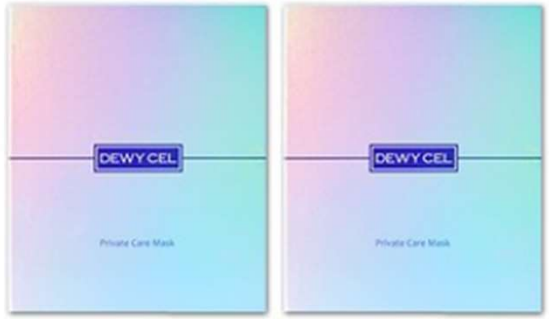
- Best way to learn is to “learn by doing” so we’re going to start with “Practical Exercise” before learning about MRV.

  “Playing Game” is the best way to practice

  It’s FUN and you can get Hands-on Practice~!

1 Intro

Of course, there are Great prizes~!



2 Game Rule

SUMMARY

- Divide into 6 Groups of Eight People.
- Give statistics and situations to calculate GHG emissions
- Trade Carbon Emissions
- Participate in Auctions
- Earn Money and get Prizes~!

Country A

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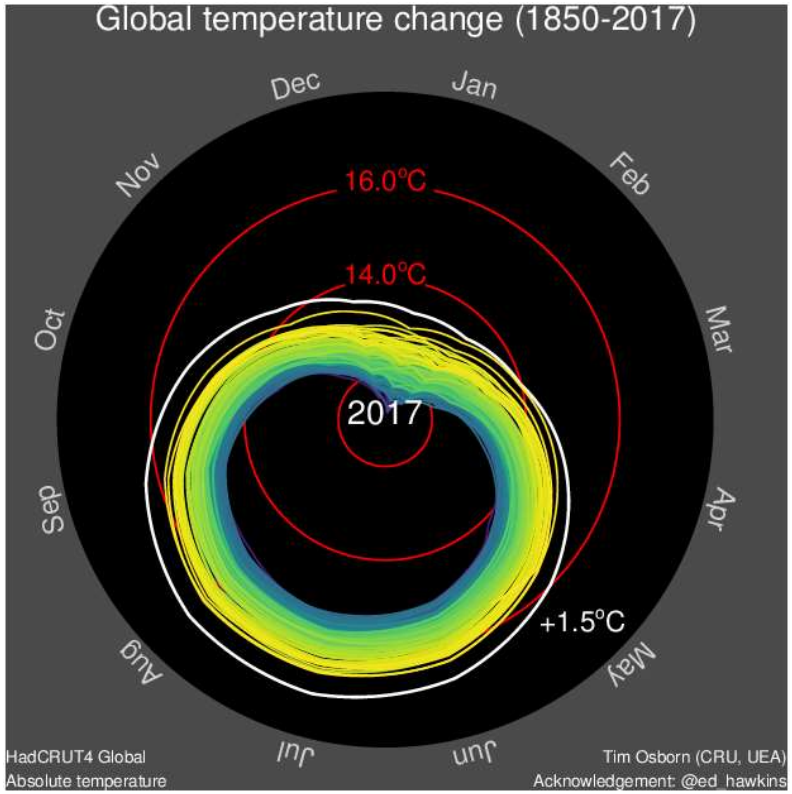

Statistics to calculate GHG

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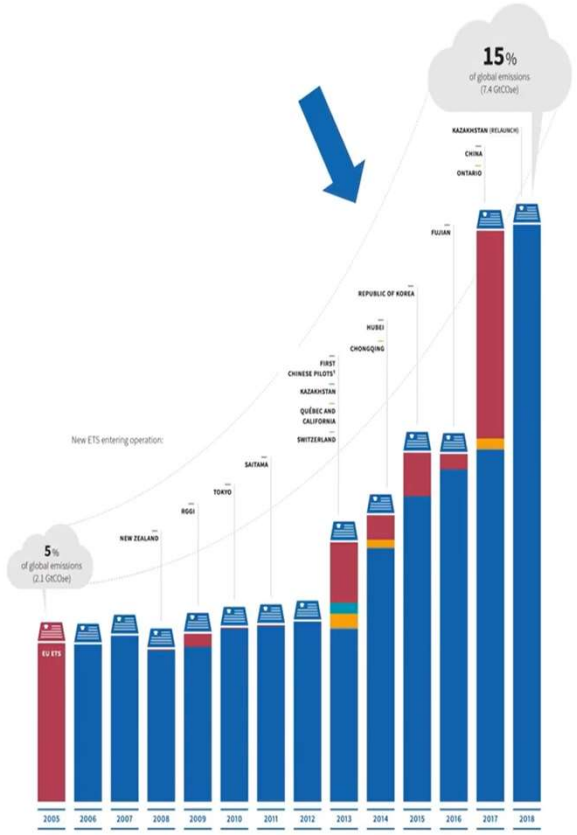
- **Earn Money and get Prizes~!**

2 Game Rule

How ETS(Emission Trading Scheme) works

- There are many policies to reduce GHG emissions but according to ICAP, ETS covers 15% of global emissions and it’s growing rapidly.

- Surveys show that the EU ETS has raised companies’ awareness of their carbon costs and mitigation potential, which has led to behavioral changes. From 2005 to 2013, the sectors covered by emissions trading have reduced their emissions by 13%.



Source: ICAP

2 Game Rule

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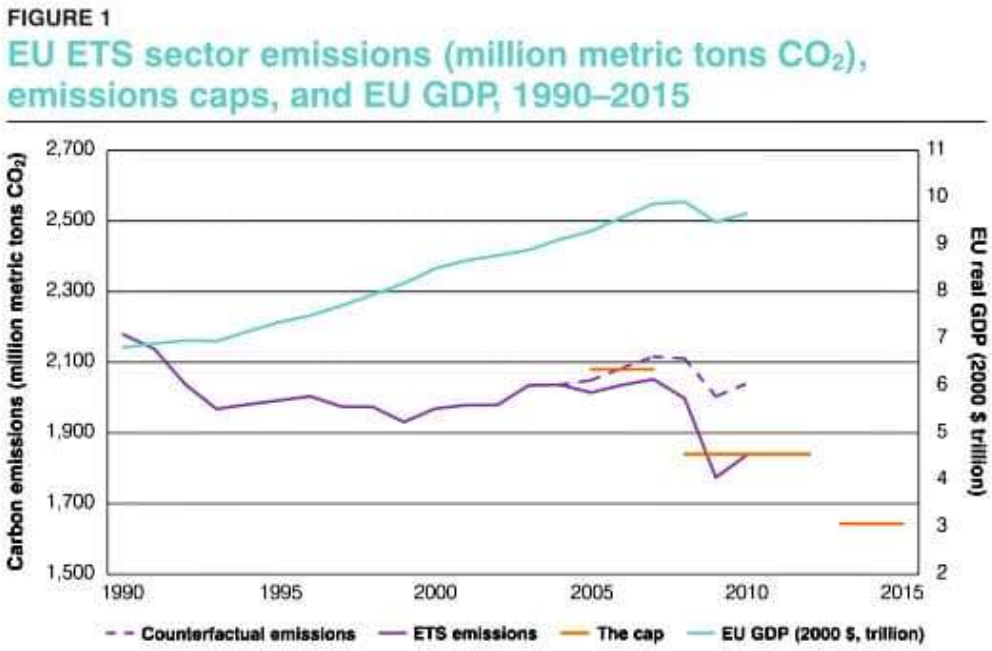
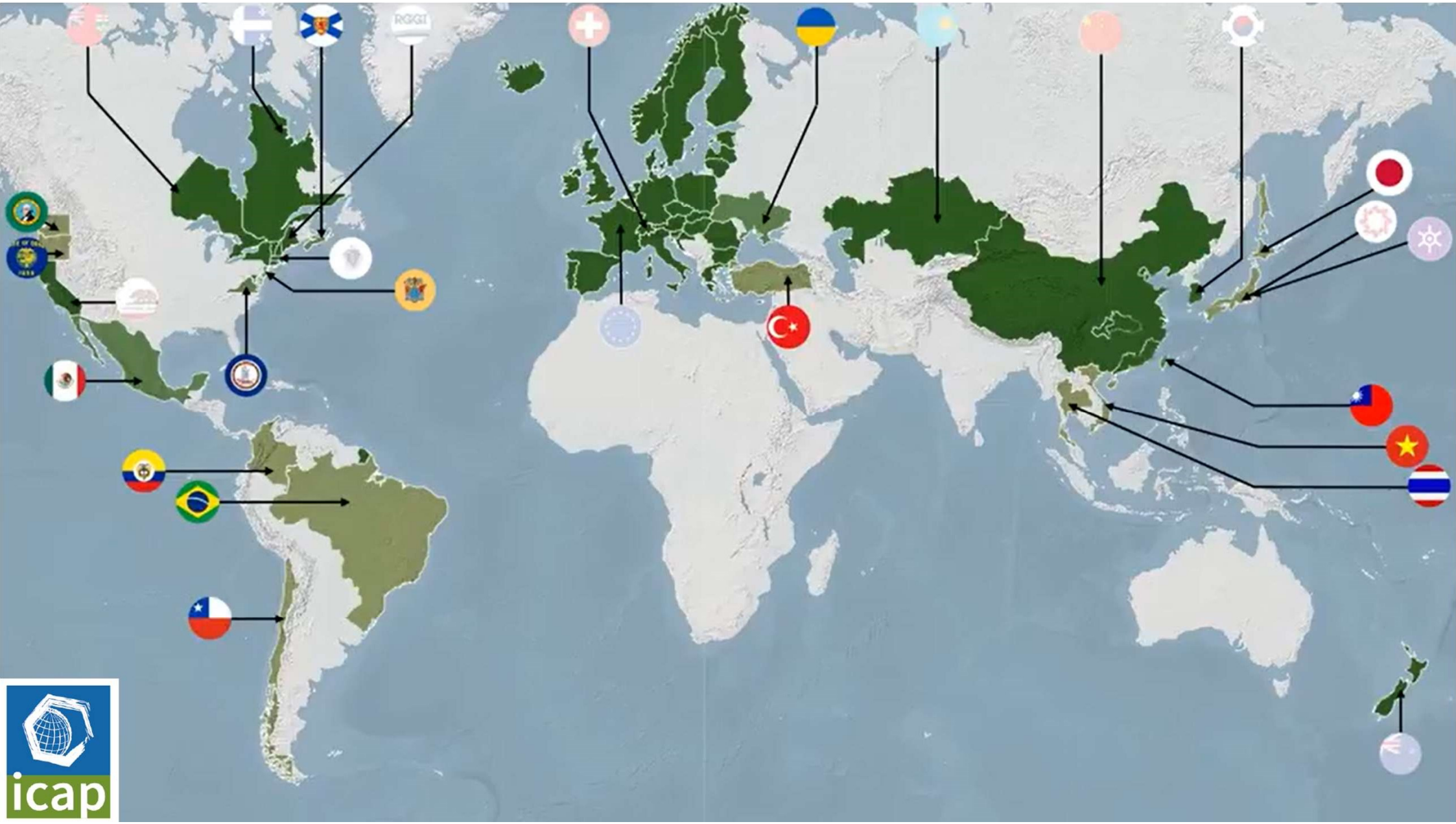
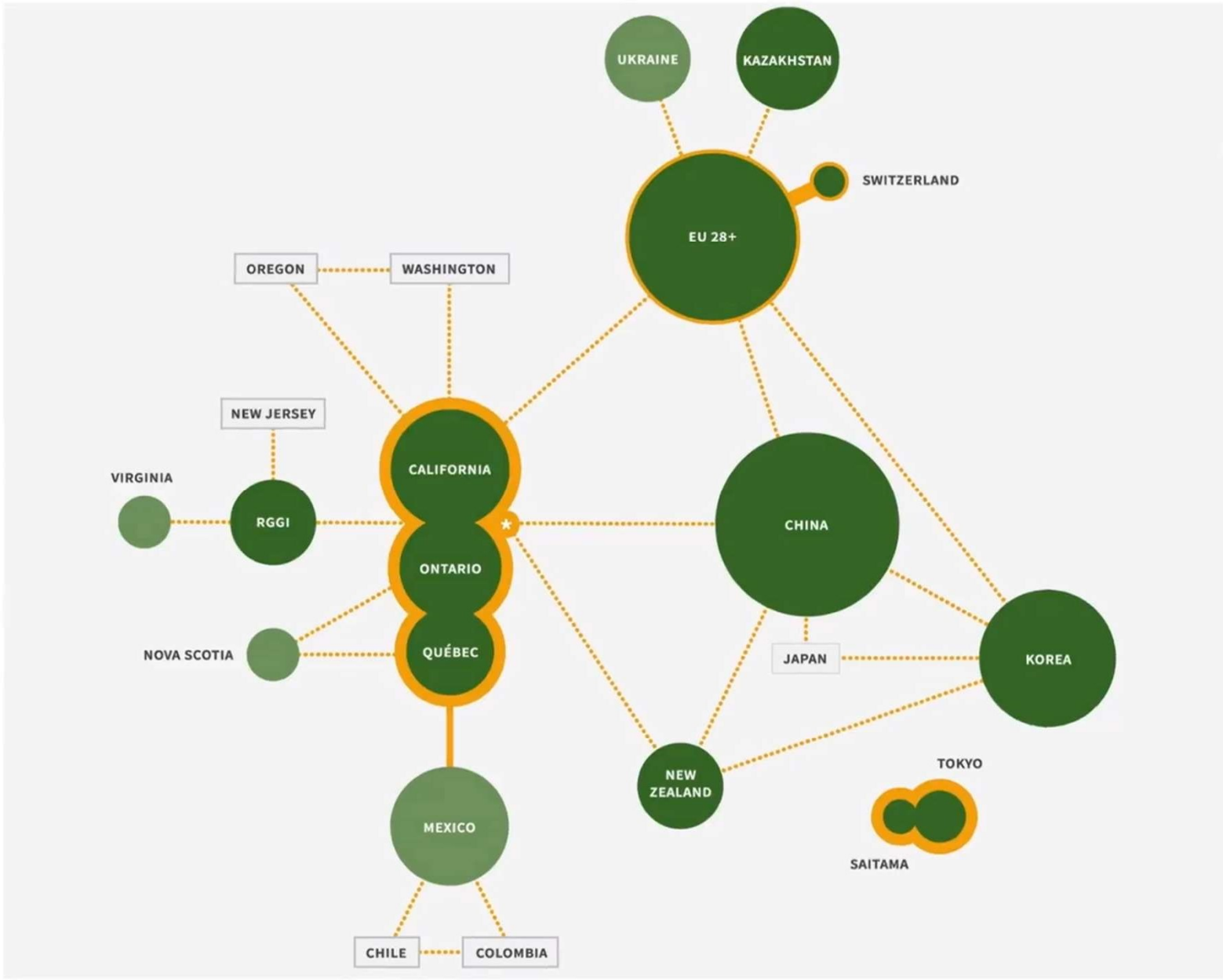


Source: Environmental Defense Fund


RGGI
icap

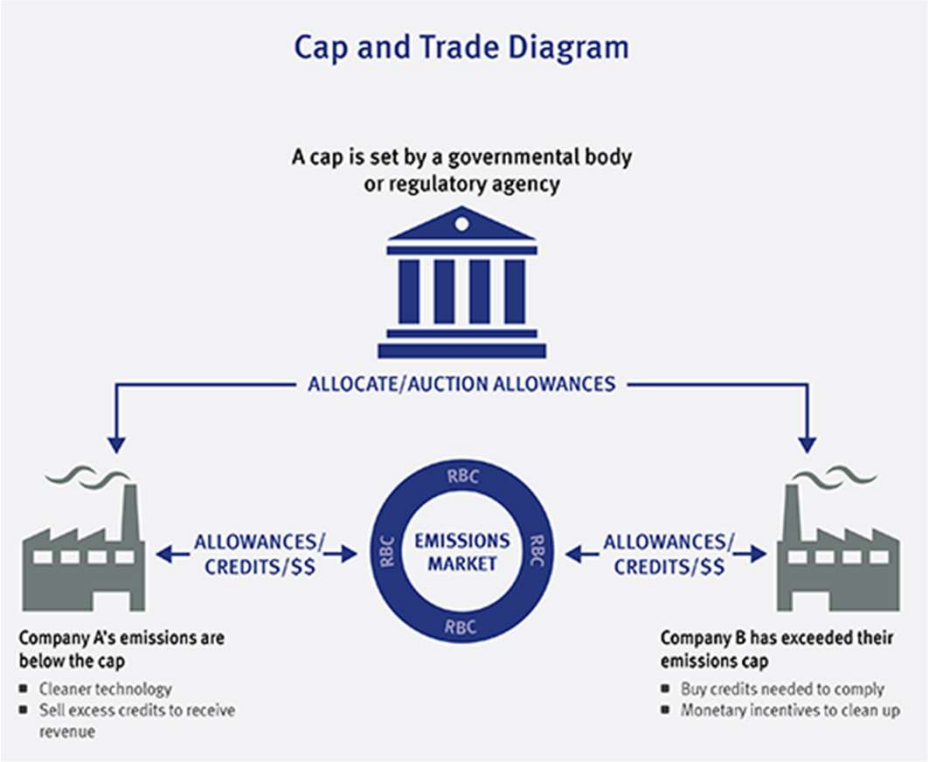
Carbon Market Connections



2 Game Rule

How ETS works : ① Allocation

- # of allowance allocated to the company means how much emissions the company is allowed to emit each year.
- Allowances are allocated before the year begin(usually for multiple years) based on either historic emissions(Grandfathering) or benchmark(ex)tCO2eq/production).
- Some allowances are given for free or for charge using auctions.



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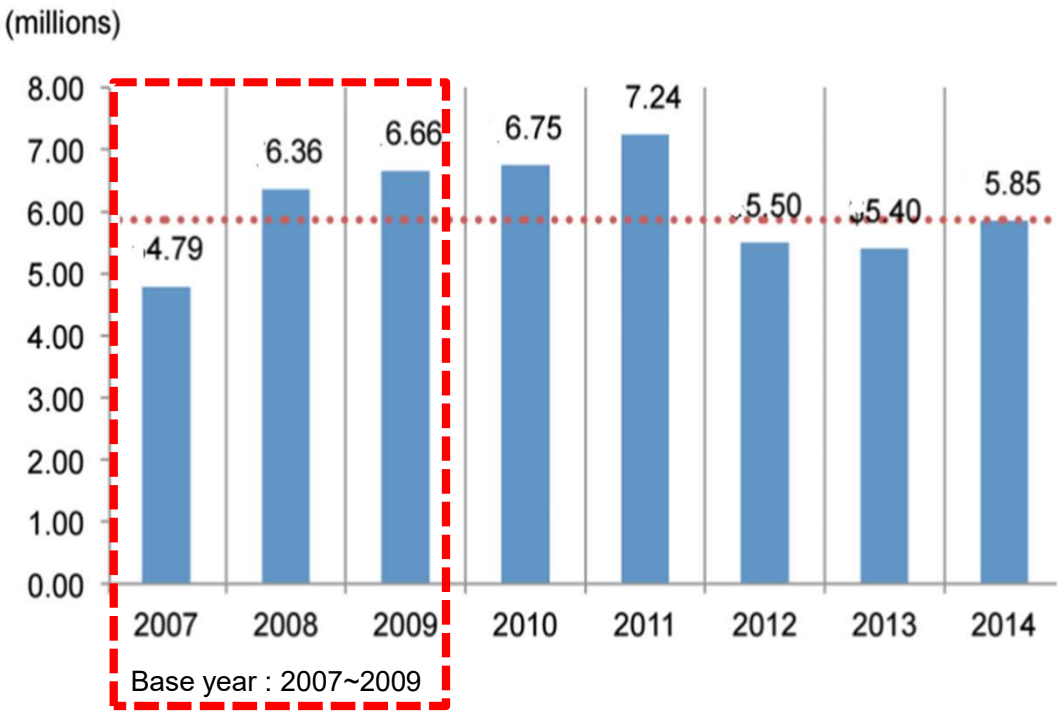
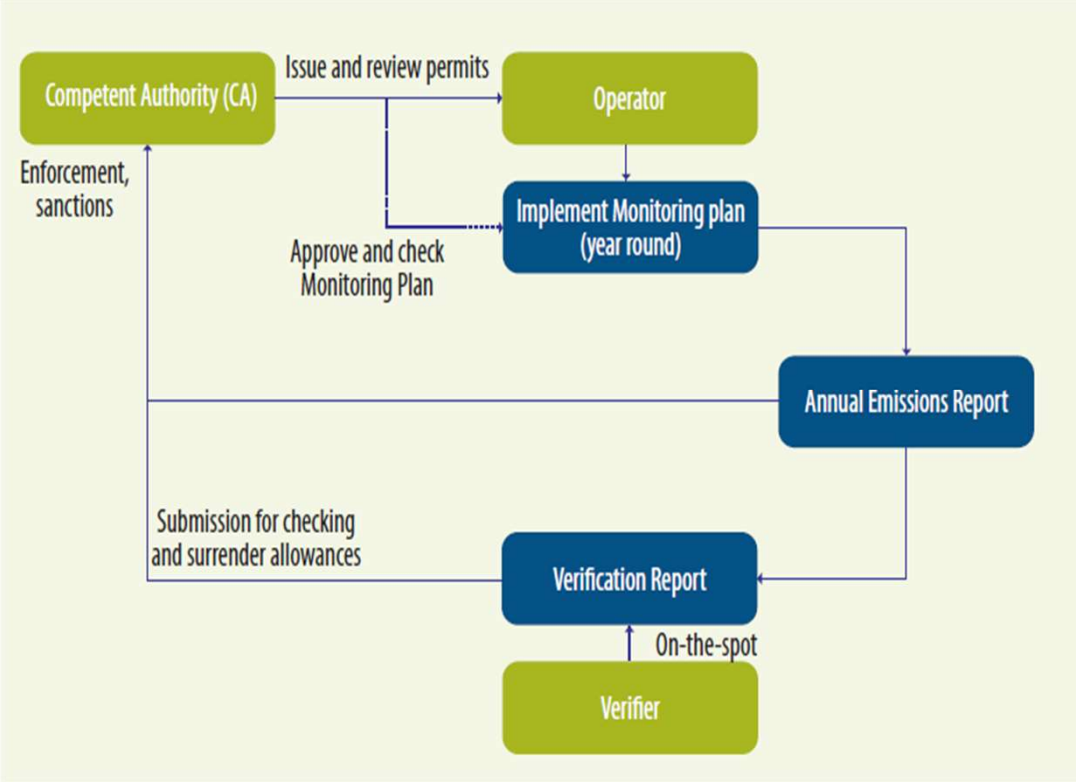


2 Game Rule

How ETS works : ② MRV and Compliance

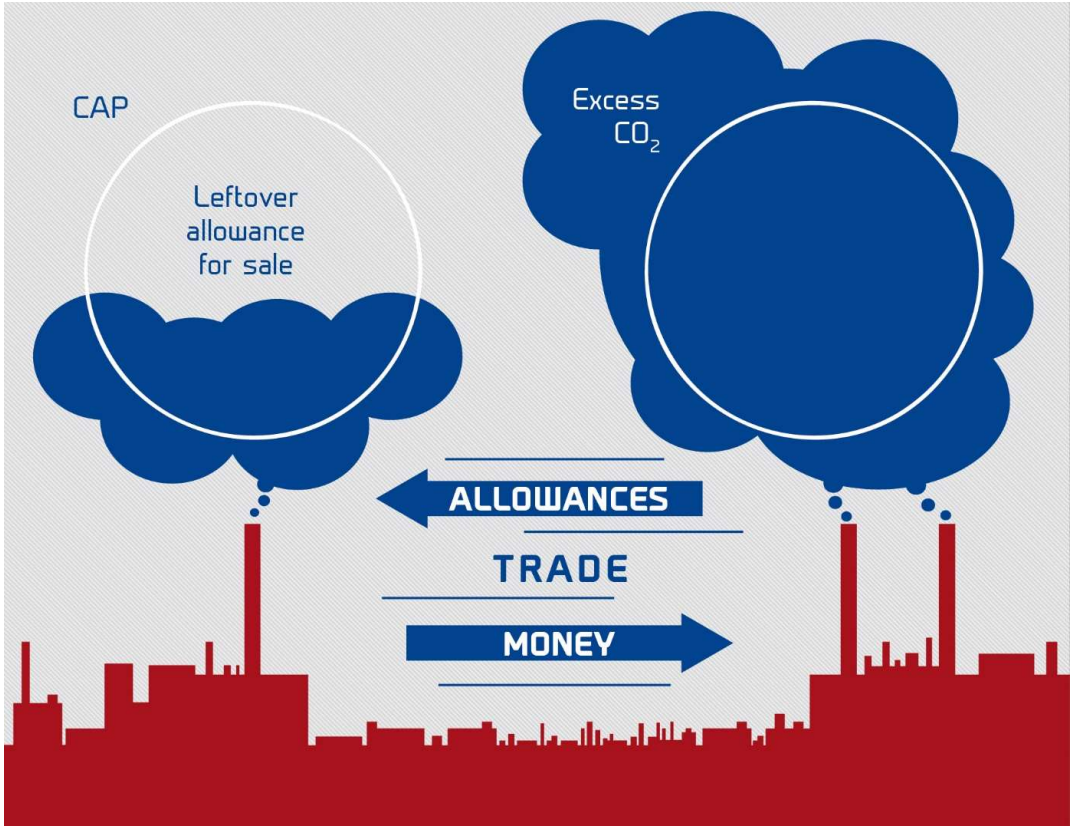
- Competent Authority : Government organizations responsible for the implementation of the ETS
- Operator : Compliance entities(company or facility) that are covered in ETS
- Verifier : checks annual emissions and issues verification report



2 Game Rule

How ETS works : ③ Trade

- If your emission is less than the “CAP = allowance” then you can sell the leftover allowance
- On the other hand, if your emission is more than the CAP, you need to buy.



2 Game Rule More details about the GAME

- We'll play for total of four seasons.(10min per season) 1st round will be spring and summer. We study some MRV, and 2nd round will be autumn and winter.
- Maximum amount of money that the player can use for the whole game will be given.
- For each season, I suggest four people calculate GHG emissions, two people trade, and two people auction. Rotate the roles after every season so that everyone can try each role.

2 Game Rule More details about the GAME

Allocation

- Allowance for the year will be given for free before the game begin and it’s fixed.
- Total emissions from four seasons should not exceed the allowance.
- If it does, you either have to buy(trade) more allowance from others or buy from auction to cover the emission.
- If your emission is still above the allowance at the end of the game, you have to pay the penalty surcharges of three times the average market price per tonne exceed.

2 Game Rule More details about the GAME

Calculating GHG Emissions

- You will start by calculating GHG emissions for each season using “Tier 1” approach from 2006 IPCC Guidelines.

(Sample problems will be given below for POP quiz)

2 Game Rule More details about the GAME

Trading

- After or during calculation of emissions, you can freely trade allowances.
- Players will approach each other and make a deal.
- If the deal is made bring the contract to me together.
- You will get a special coupon for future use per each deal so trade as many times as you can. First deal made will be prized three coupons!

(Base market price will be given below for POP quiz)

2 Game Rule More details about the GAME

Auction

1. Before bidding starts, total volume of the auction and minimum price will be given.
2. Each player will bid number of allowance and price. (you can win maximum of 30% of total volume)
3. Determination of auction clearing price

- Bids are sorted in descending order of the price bid
- Bid volumes are added, starting with the highest bid; the price at which the sum of volumes bid matches or exceeds the volume of allowances auctioned, shall be the auction clearing price
- All bids with a price higher than the auction clearing price are successful.
- If the total bid is less than the total volume then everyone’s successful with the lowest price bid being the clearing price.
- Tied bids will also be given.(If this happens total volume will be raised accordingly)

CASE 1

〈Auction Condition〉

– Total volume : 100,000 tonne, Minimum price : 20

〈Bid Result〉

Country	Bid volume	Bid price	Clearing Price	Successful Volume
A	30,000	23	23	30,000
B	30,000	21	23	–
C	20,000	25	23	20,000
D	50,000	24	23	50,000
E	10,000	22	23	–
F	20,000	20	23	–

CASE 2

〈Auction Condition〉

– Total volume : 100,000 tonne, Minimum price : 20

〈Bid Result〉

Country	Bid volume	Bid price	Clearing Price	Successful Volume
A	40,000	23	23	30,000
B	30,000	21	23	–
C	20,000	25	23	20,000
D	50,000	24	23	50,000
E	10,000	22	23	–
F	20,000	20	23	–

CASE 1

<Auction Condition>

– Total volume : 100,000 tonne, Minimum price : 20

<Bid Result> Total volume will be raised to 120,000 tonne

Country	Bid volume	Bid price	Clearing Price	Successful Volume
A	30,000	21	21	30,000
B	30,000	21	21	30,000
C	20,000	25	21	20,000
D	20,000	24	21	20,000
E	20,000	22	21	20,000
F	20,000	20	–	–

CASE 2

<Auction Condition>

– Total volume : 100,000 tonne, Minimum price : 20

<Bid Result> Total volume will be reduced to 80,000 tonne

Country	Bid volume	Bid price	Clearing Price	Successful Volume
A	30,000	25	21	30,000
B	10,000	24	21	10,000
C	20,000	27	21	20,000
D	10,000	26	21	10,000
E	10,000	21	21	10,000
F	20,000	19	–	–

2 Game Rule More details about the GAME

Result

- The winner will be the player with the most money left.

- Final $ = Originally given $
  (minus) cost from buying(trade) emission (plus) revenue from selling(trade) emission
  (minus) auction cost
  (minus) non-compliance penalty (three times the average market price per tonne exceed)
- Average market price = total transaction cost from trading and auction / total emissions traded and auctioned

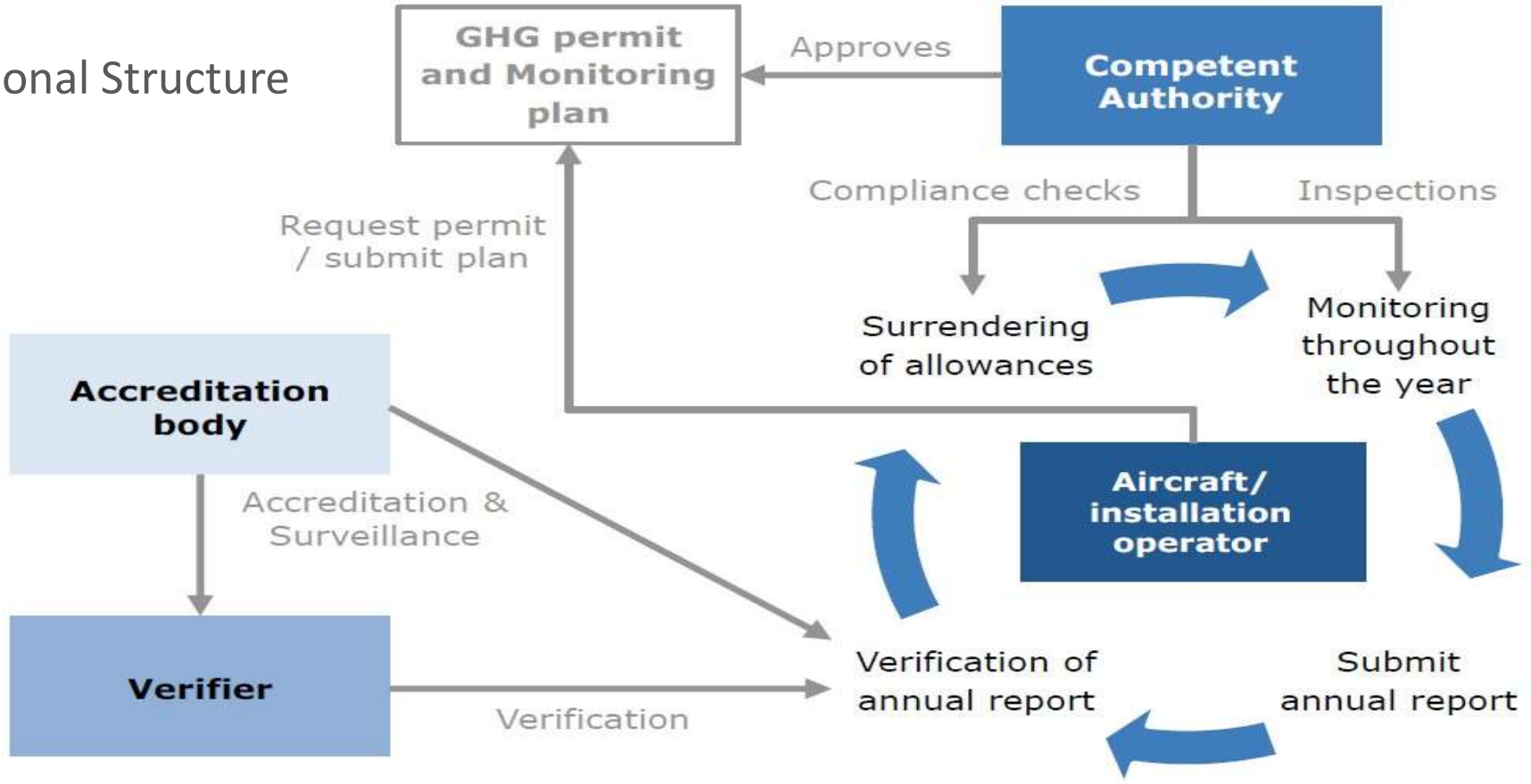
- 1st player will get the prize!

3 1st Round

LET’S BEGIN~!

4 MRV (Measuring, Reporting and Verifying)

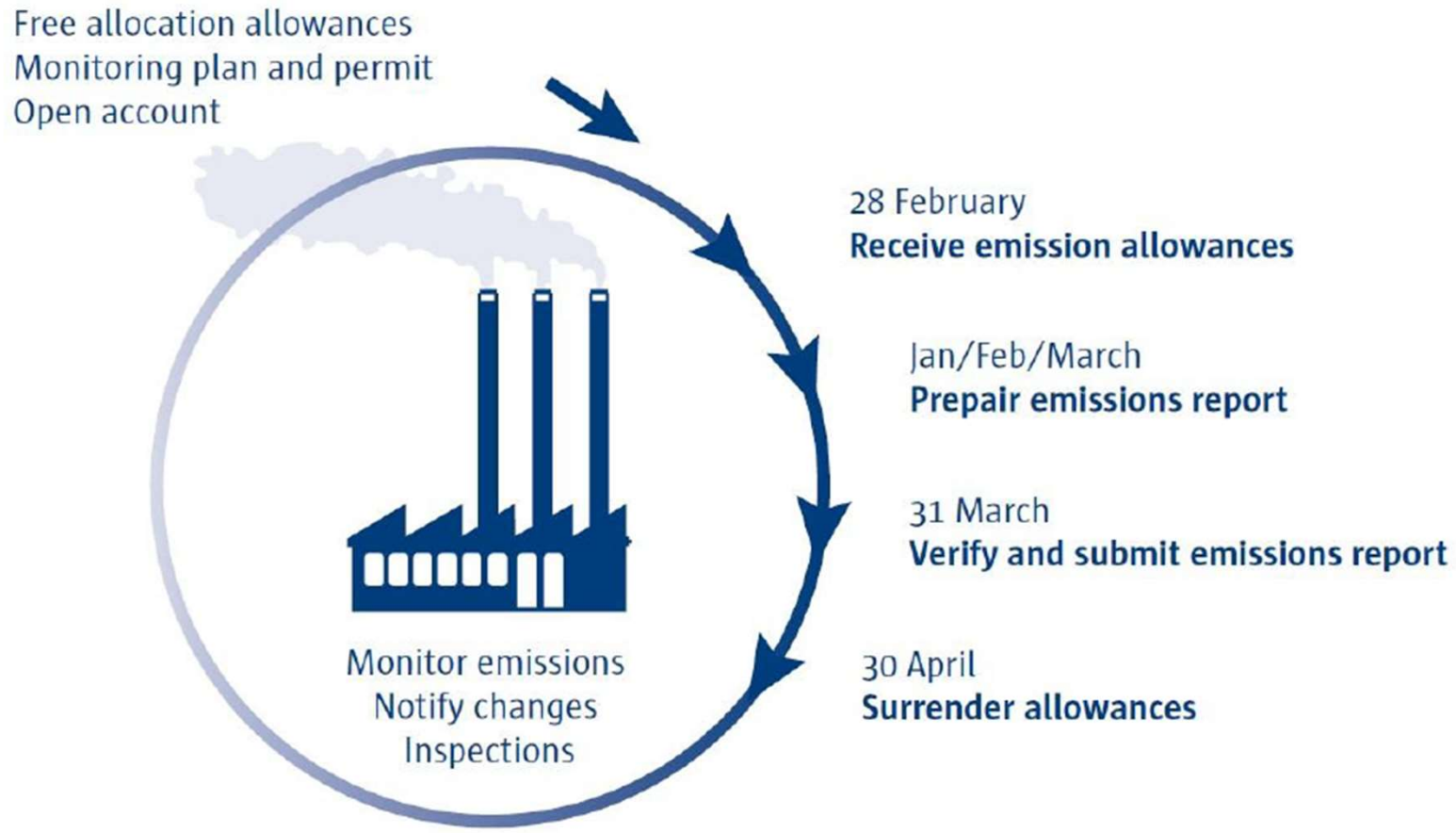
1. Organizational Structure



Source: Adapted from: European Commission EU ETS "Monitoring and Reporting Regulation" Guidance Document 1

4 MRV (Measuring, Reporting and Verifying)

2. Compliance Cycle (EU ETS)



4 MRV (Measuring, Reporting and Verifying)

3. Measuring emissions

- Essential part of ETS
- Part of compliance cycle
- Monitoring plan by emitter: how to measure and report emissions during the year
- Monitoring = calculation and/or – sometimes - direct measurement

4 MRV (Measuring, Reporting and Verifying)

Monitoring plan

Description of monitoring methodology
Approval before GHG is emitted
Installation specific application of monitoring requirements
Operator responsible for content
Basis for reporting, verification and inspection

4 MRV (Measuring, Reporting and Verifying)

General monitoring principles

All emissions within the boundary included
“A tonne must be a tonne”
Completeness
Consistency, comparability, transparency
Accuracy
Integrity of methodology
Continuous improvement
Cost-effectiveness

4 MRV (Measuring, Reporting and Verifying)

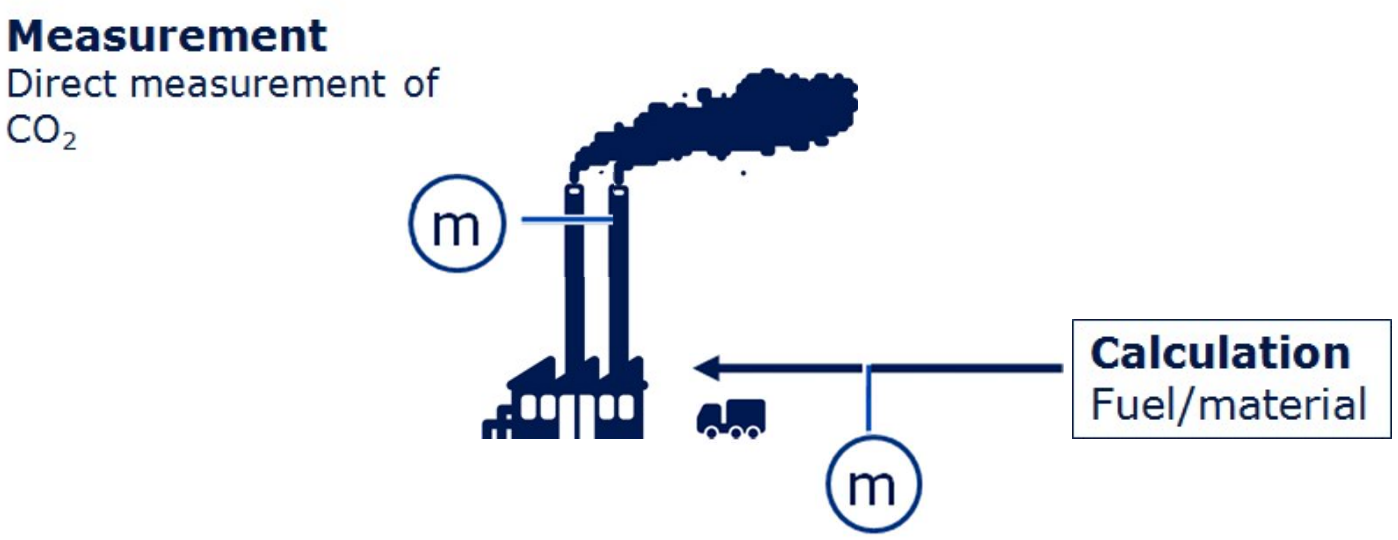
Supporting documents at submission of MP

Uncertainty assessment
Risk assessment
Sampling plan that formally approved

All must be checked before approval

4 MRV (Measuring, Reporting and Verifying)

4. Monitoring CO2 emissions



4 MRV (Measuring, Reporting and Verifying)

Measurement based approach

Determination of hourly emissions:
Σ GHGconcentration [g/Nm3] * Flue gas flow [Nm3]

In practice: only relevant if calculation is impossible
Very rarely applied in EU and Korea

4 MRV (Measuring, Reporting and Verifying)

Calculation based approach

1. Standard methodology (combustion):

CO2-emissions (t) = amount * LHV * EF * OF

LHV = Lower Heating Value (energy content, e.g. TJ/Nm3)

EF = Emission factor (e.g. Tonne CO2/TJ)

OF = Oxidation factor (fraction which is oxidised)

Specific methodologies for process emissions

2. Mass balance approach

For all incoming and outgoing fuels/material/products:

Carbon (t) = amount * carbon content

CO2-emissions (t) = (carbon IN – carbon OUT)* 3.664

Relevant for activities where products contain carbon from input, e.g. steel, chemicals

4 MRV (Measuring, Reporting and Verifying)

Standard methodology

1. Oil refinery, process gas
> 500,000 t CO2 → category C
Amount: very accurate measurement equipment required
Emission factor: from daily sampling & analysis
Calorific value: from daily sampling & analysis

2. Food processing installation (boiler), natural gas
< 25,000 t CO2 → category A
Amount: invoice from supplier, less strict uncertainty assessment
Emission factor: default value
Calorific value: default value

4 MRV (Measuring, Reporting and Verifying)

Data management and control

Step 1. Regular maintenance and control
Collection of primary input data
Risk: measurement device out of order
Step 2. Back up facilities, regular control
Registration of primary input data
Risk: data is not registered
Step 3. Control & corrective actions
Registration of primary input data in emissions report
Risk: data are incorrect

4 MRV (Measuring, Reporting and Verifying)

5. Annual Emission Report

4 MRV (Measuring, Reporting and Verifying)

5. Annual Emission Report

Identification and signatures	Detailed data per source stream	Emissions [tonne CO_2]
• Permit ID • Name and address • The operating person • Signatures of the operator and of the verifier	• Type of source stream • Amount of fuel or material • Emission factors • Net calorific value • Oxidation factor • Carbon content • …	• CO_2 per source stream (fuel type and/or material) • CO_2 transmitted and received • CO_2 totals

4 MRV (Measuring, Reporting and Verifying)

6. Role of Verifier

Role of verifier

Check implementation of monitoring plan
Check data in emissions report

Verifier

Legal entity/person accredited by a National Accred. Body
Contracted by the operator

4 MRV (Measuring, Reporting and Verifying)

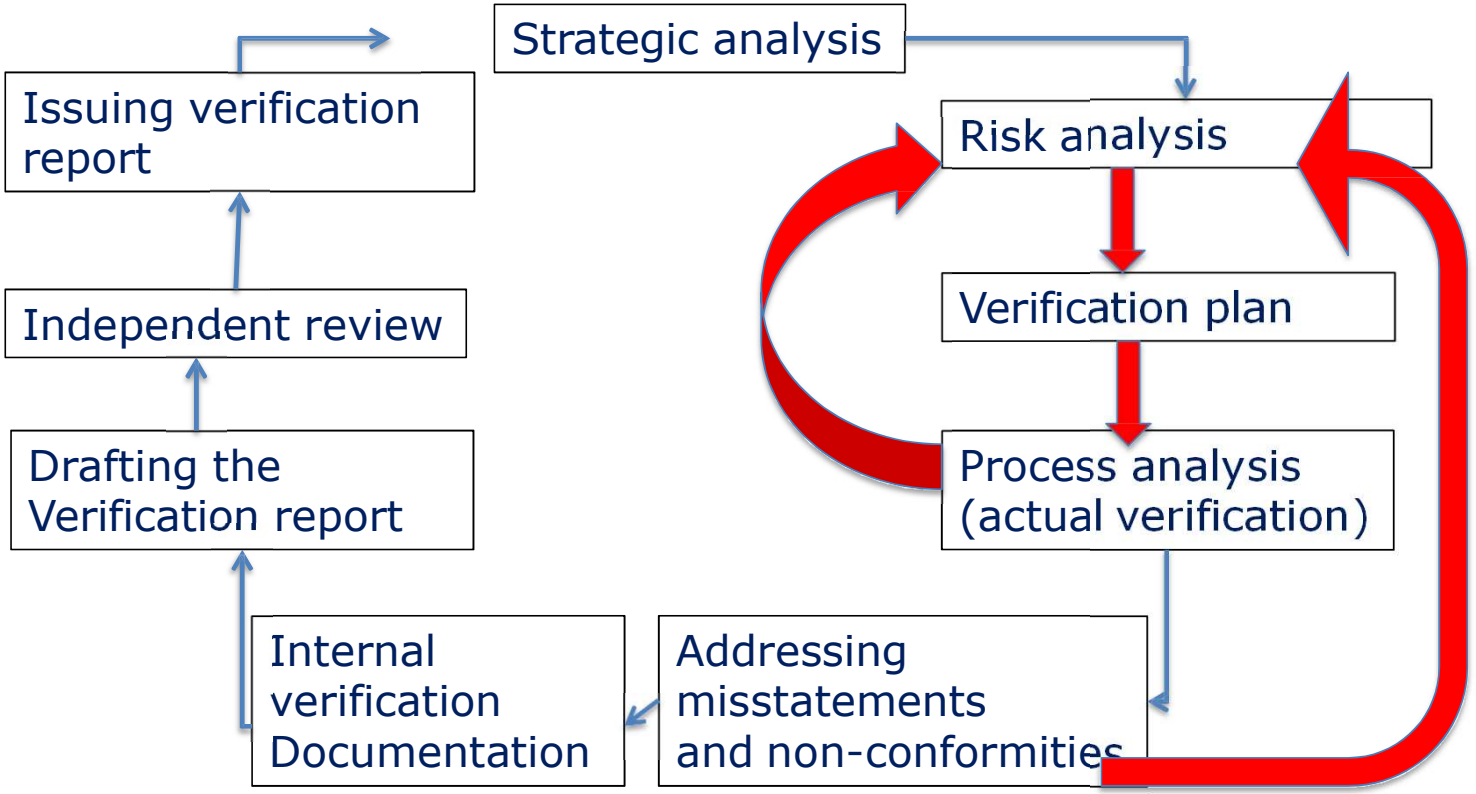
Verification principles

Objective: ensure that data are monitored and reported according to the Monitoring and Reporting Regulation (validated MP)

Reliability: correct and free from material misstatements
Independence: from operator and competitive authority
Professional scepticism
Reasonable level of assurance
Materiality
Scope of verification

4 MRV (Measuring, Reporting and Verifying)

Steps in the verification process



4 MRV (Measuring, Reporting and Verifying)

Lessons learnt from running ETS

Regular industrial practice not (always) sufficient
Pre-checking of monitoring methodology essential
Sufficient time for preparation is needed
Operators need extensive guidance on monitoring
Equal treatment vital, but hard to achieve
Importance of communication to and from industry and verifiers
Role of verification should not be underestimated
From compliance assistance to enforcement
Energy efficiency stimulated by monitoring & allocation
Share experiences and knowledge with stakeholders

4 MRV (Measuring, Reporting and Verifying)

Other Challenges

1. Initial stage

Correct identification of all relevant operators and installations

Ensuring use of correct category limits and full reporting; cannot rely on verification only

Building up of necessary expertise in supervisory

2. Over cycle

Developing knowledge and expertise in installations, with verifiers, in supervisory authority: technical, communication skills

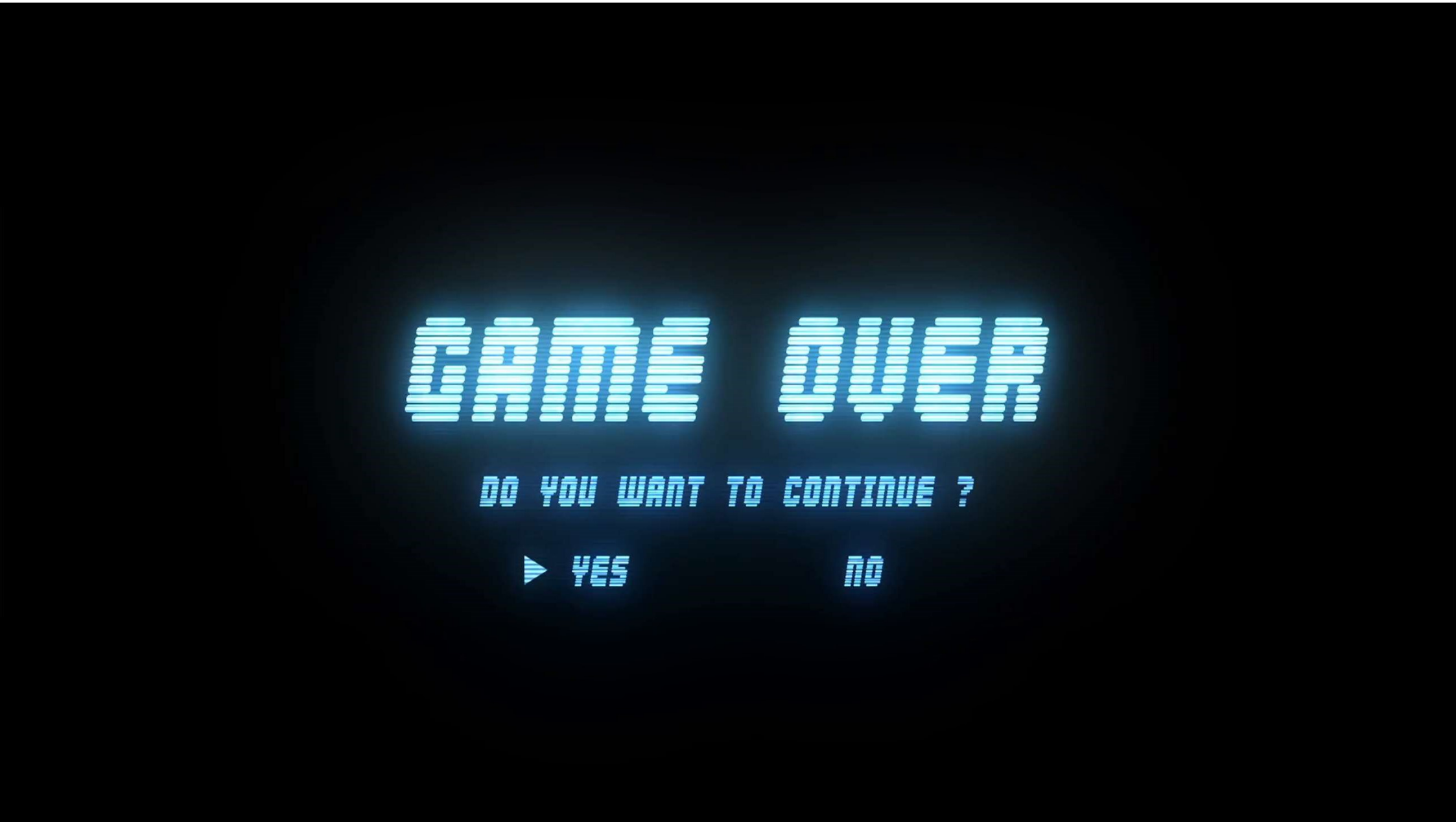
Optimal use of IT systems for reporting to be improved

Making the system cost-effective: differentiate MRV obligations between large and small emitters

Reducing complexity of rules and alleviating administrative burdens will be needed later

5 2nd Round

LET’S GET READY TO RUMBLE AGAIN~!


GAME OVER
DO YOU WANT TO CONTINUE ?
YES
NO

THANK YOU