Renewable energy and CO_2 policy

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With thanks to Gerard Dijkema and Emile Chappin

Renewable energy in the EU

- 20% of energy from renewables in 2020
  → most opportunities in the electricity sector
- Annual turnover renewable energy sector > 15 billion €
- > 300,000 employees
- fast growth
- but currently still small share

Reasons for stimulating renewable energy

- Security of supply
- Environmental benefits
  - Climate
  - Other environmental aspects
- Develop the learning curve for renewable energy technology
  - Development is a function of installed renewable energy capacity, not of time
  - The sooner we move through the curve, the larger the social benefits
- Stimulate renewable energy industry

How are renewable energy goals achieved?

- EU objectives are translated into national targets.
- CO_2-market → price advantage for renewable energy.
- Consumer demand for ‘green’ energy.

Types of policy instruments

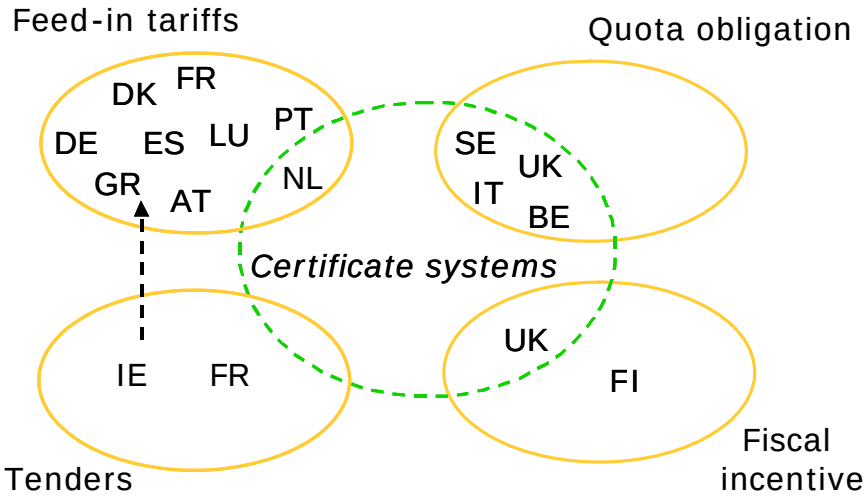
- Price versus quantity...

- Feed-in tariffs: fixed price per unit of supplied energy
- Required percentage renewable energy
  - in supply
  - or in consumption
- Tenders: government purchases renewable energy
- Fiscal incentives

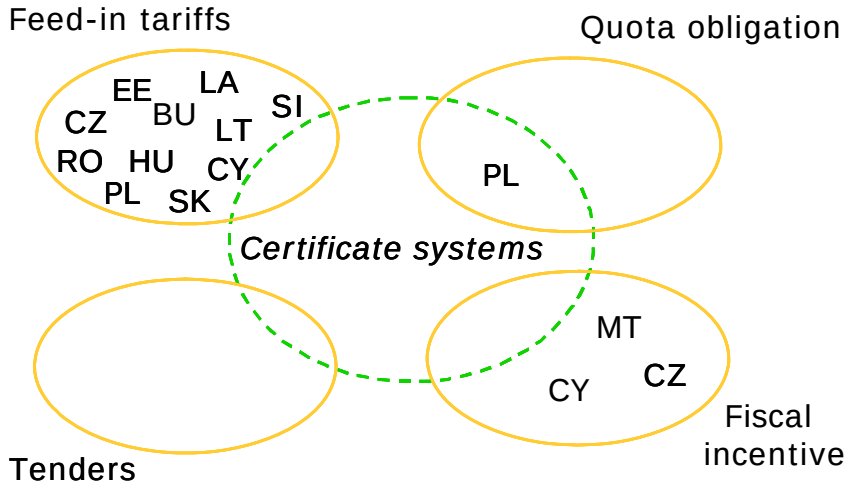
Comparison

	Feed-in	Quota	Tenders	Fiscal incentives
How it works				
Incentives				

Who does what in the EU?



EU-15



EU-10 + BU&RO

Source: Interim Report, OPTRES: Assessment and optimisation of renewable support schemes in the European electricity market (Ragwitz et al., 2006)

Harmonisation of renewable energy policy

- Tool: garantees of origin
  - certificates that indicate how electricity was generated
- Problem: definitions...

Goals:

- Achieve EU goals for renewable energy
- Transparancy
- Cost effectiveness
- Increase trust by investors
- Allow member states certain room for their own policy

Guarantees of origin

- Verification of green origin of product
- Facilitate international market in green energy
- Count contribution of countries to renewable energy targets
- Stimulate renewable energy

Greenhouse emissions continue to increase

- Since 1990, emission fluctuates around 215 billion ton CO_2-equivalents
  - there is no structural reduction.
- EU depends on instruments such as emission trading and projects in developing countries to meet its Kyoto-obligation.
- In the period 1990-2004 the emission of CO_2 increased by 13% to 179 Mton
- So far, the rising CO_2 emissions have largely been offset by reductions in non-CO_2 greenhouse gases.

Problem: emissions are an externality

- “An externality or spillover of an economic transaction is an impact on a party that is not directly involved in the transaction” (http://en.wikipedia.org/wiki/Externality)
- Consumers do not realize full cost of energy
  - they do not use it optimally (waste it)
  - producers have no incentive to reduce externalities (emissions)

Neo-classical economics: internalize social costs in price of product

- Internalize the ‘negative’ external effects’ in production, consumption, the economic system.

- Technical intervention: emission standards, product standards
- Economic intervention: provide *financial* (dis)incentives
  - Objective: influence consumption and production; or the production process
  - Levies/taxes to internalize costs
  - Or subsidies to offset competitive disadvantage of desired alternatives
- Indirect methods: communication, stimulation of innovation

Two classic instruments: price versus quantity

- Price and quantity are the two key variables in (neo-classical) economics
- The idea is to fix one of the two and leave the other to the market
- CO_2 taxation
  - Pigouvian Tax
  - Problem: What is the right tax to achieve a target?
- CO_2 emission trading
  - Creating a market solves part of the information problem (the market generates a price signal)

CO_2-emission trading

- Introduction
- Transition – creating the market
  - Policy
  - Economy
  - Legislation
- Current Practice
  - Trading systems
  - Effect on economic sectors
- What lies ahead – outlook for 2013 and beyond

Climate Policy

- United Nations Framework Convention on Climate Change (UNFCCC)
- Kyoto-protocol (1997) :
  - the industrialized nations have agreed to reduce the emission of greenhouse gases
  - in the time period 2008-2012
  - Reference: emission in 990.
  - European Union: 6.5%, the Netherlands 6%
- Does not stipulate *how* emissions reductions are to be achieved

EU-Directive 2003/87/EC

- Directive 2003/87/EC of the European Parliament and the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC.
- EU: different targets per member state
- Timeline:
  - from 1997: emission trading for NO_x
  - 2005: trade in Member States; “learning period”
  - 2008: trade between Member States; Kyoto-targets
  - 2012: Aviation under EU-ETS
  - 2013: EU-ETS 3rd phase; post-Kyoto

Which activities are subject to the Directive?

- Installations for the conversion of energy
  - Combustion installations > 20 MW (excluding waste incineration facilities)
  - Crude oil refineries
  - Cokes ovens
- Installations for:
  - Metal production form primary ores and secundary materials
  - Production of cement, glass and ceramics
  - Pulp, paper and board manufacture
- From 2012 on: aviation (2008/101/EC)

Economic ratio

- Trading CO_2 emissions is “a generally accepted method to reduce the emission of greenhouse gases at the lowest possible costs”

- When would this hold? Under which conditions?
- When does the price of CO_2 lead to sufficient reduction?

- Neo-classical economic perspective!
  - Create scarcity, and the “invisible hand” of the market will work its way (?)
  - **The market generates a price (= information!)**

CO_2-emission trading – market design

- Objective
  - Industrial society in NL / EU:
    - Reduce CO_2 emission where the costs are lowest “via the invisible hand”
  - Market design
    - Optimal price formation
    - Minimize transaction costs
- Realization
  - Market system
  - New rules and regulation (legislation), roles and institutions

Two possible market designs

- Performance Standard Rate (PSR) system
- Cap and Trade system

Performance Standard Rate (PSR) system

- CO_2 emissions are compared to a reference value:
  - the emission per unit of product (or energy)
  - total emissions not fixed
- Emitter must posses a total of rights equal to the actual emission related to its products
- Start system: determine the reference values (per product or per activity)
- Subsequently: trade in emission rights
- Emitters who emit more than the reference must purchase additional rights, those who perform better may sell rights.

Cap and trade system

- The total volume of CO_2 emissions is fixed (Cap)
  - in EU: cap per Member State
- Each emitter must acquire emission rights for its CO_2 emissions.
  - member states determine allocation method
- Start system:
  - auctioning
  - or free allocation of rights (grandfathering)
- Subsequently: trading of emission rights

Market design issues – both systems

- Transaction costs to get/maintain the system in operation
- New institutions and roles required
- Introduction will lead to a shift in or end to activities

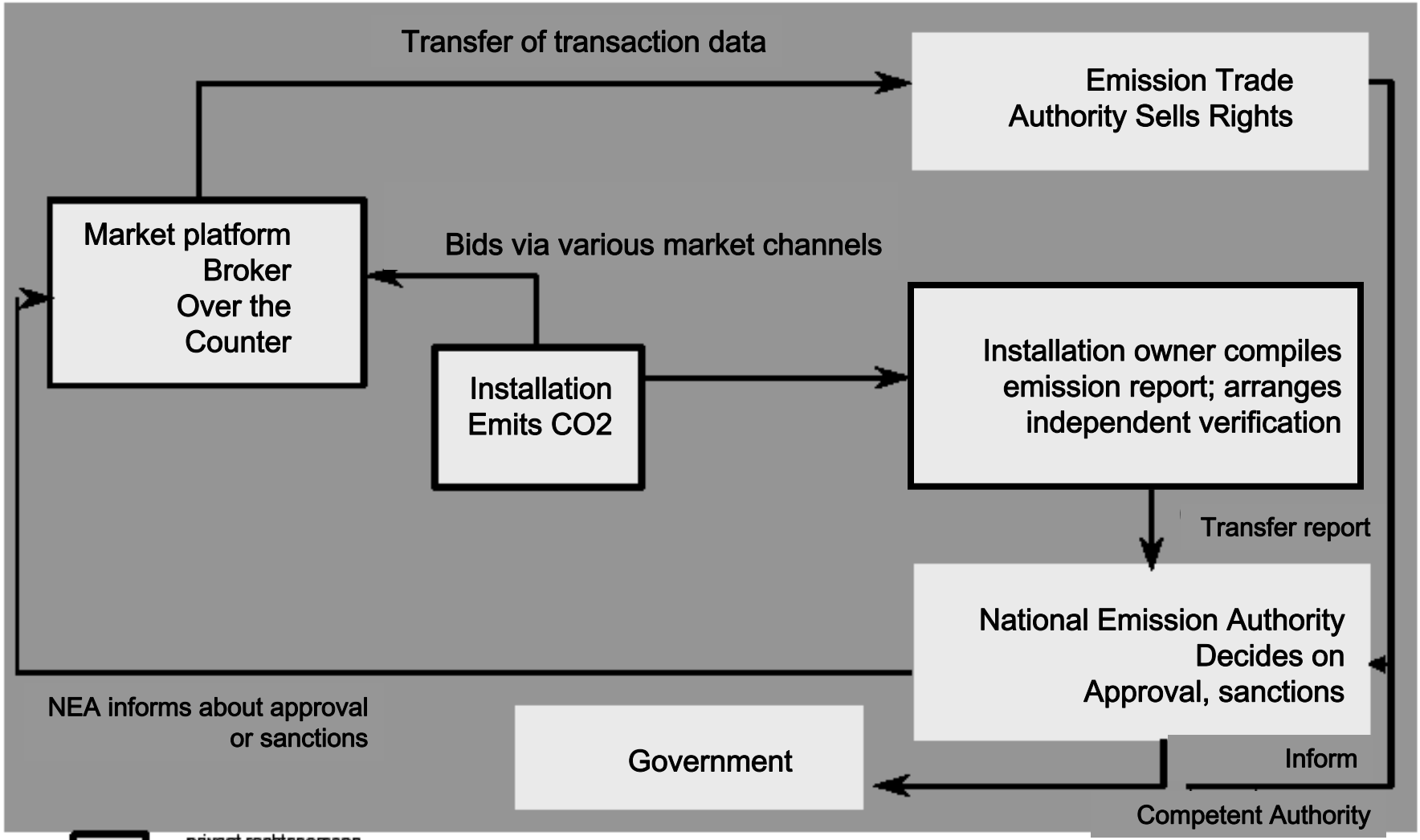
Market design issues - cap and trade:

- Choice of start up arrangements / allocation of rights (which become financial assets)
- How to determine / modify the cap? scarcity = price = response of emittants & stakeholders
- Trade handel between sectors will lead to a change of industrial economic structure;

Market design issues - PSR

- Setting the reference value is de-facto allocation of profit/losses (cash-flow)
- The portfolio of activities in the economy becomes also a function of the (annual) reference value
- Absolute volume growth always remains possible

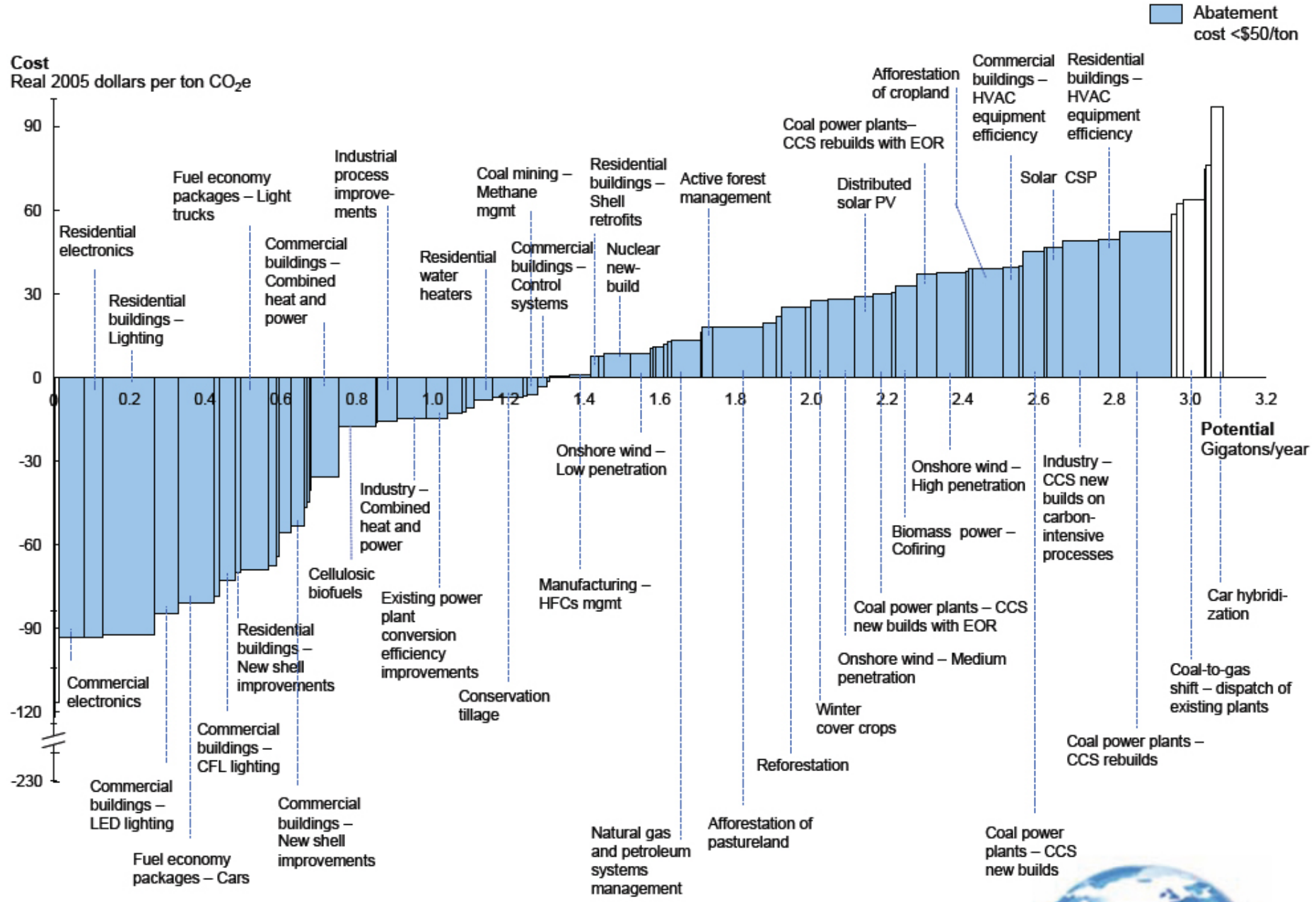
Governance


Transfer of transaction data
Emission Trade Authority Sells Rights
Market platform Broker Over the Counter
Bids via various market channels
Installation Emits CO2
Installation owner compiles emission report; arranges independent verification
Transfer report
National Emission Authority Decides on Approval, sanctions
NEA informs about approval or sanctions
Government
Inform
Competent Authority
privaat rechtspersoon
publiek rechtspersoon

Roles for the government

- Creation of the system: Objectives, participants, principles; ‘free-riders’, criminal behavior etc.?
- Start-up of the system:
  - Create required organizations; (NEA: Dutch Emission Authority).
  - Design allocation system for emission rights
- Trading:
  - Enable and register transactions
  - Monitor emissions and rights
- Supervision and enforcement

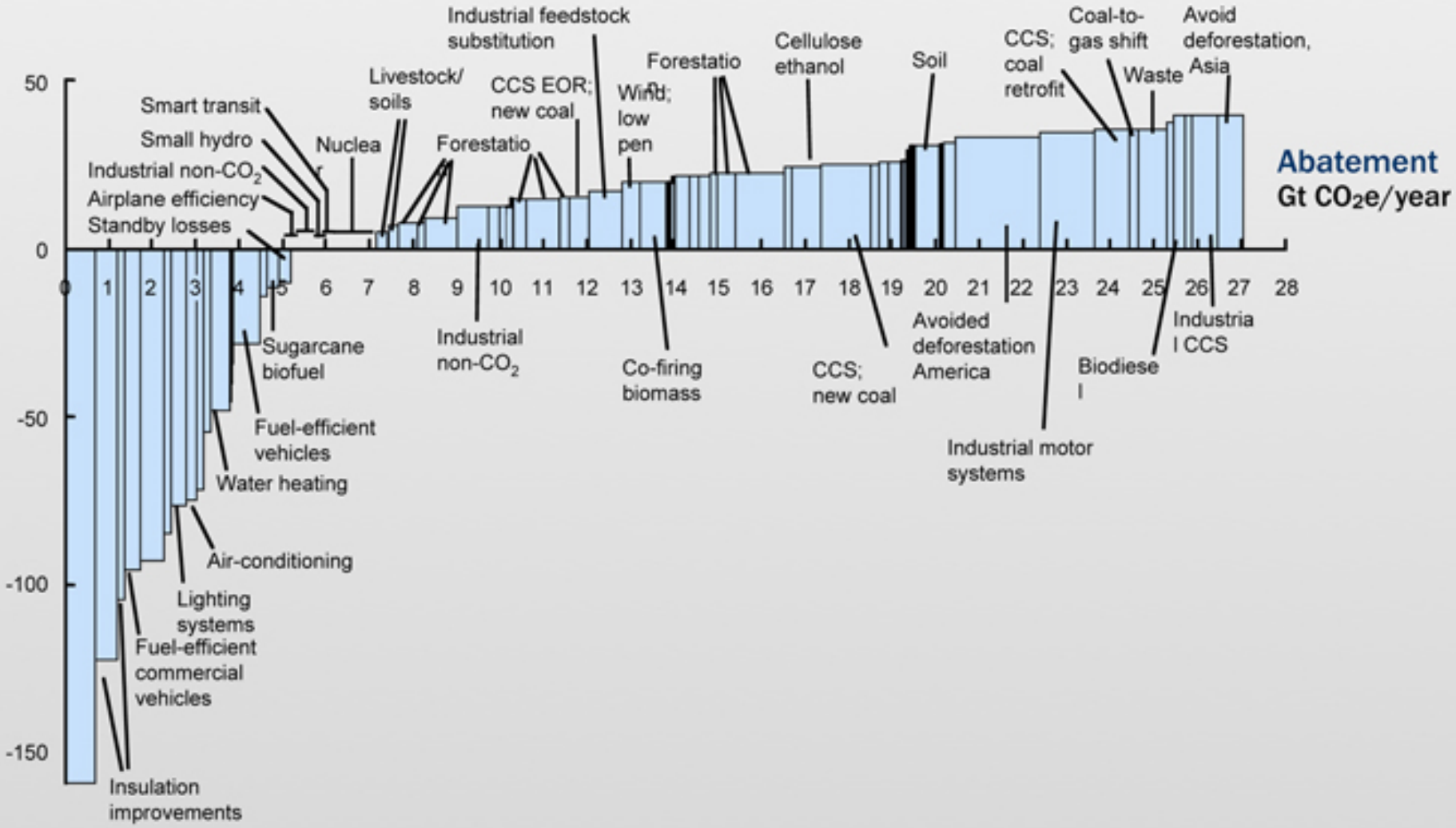
U.S. mid-range abatement curve – 2030



Source: McKinsey analysis

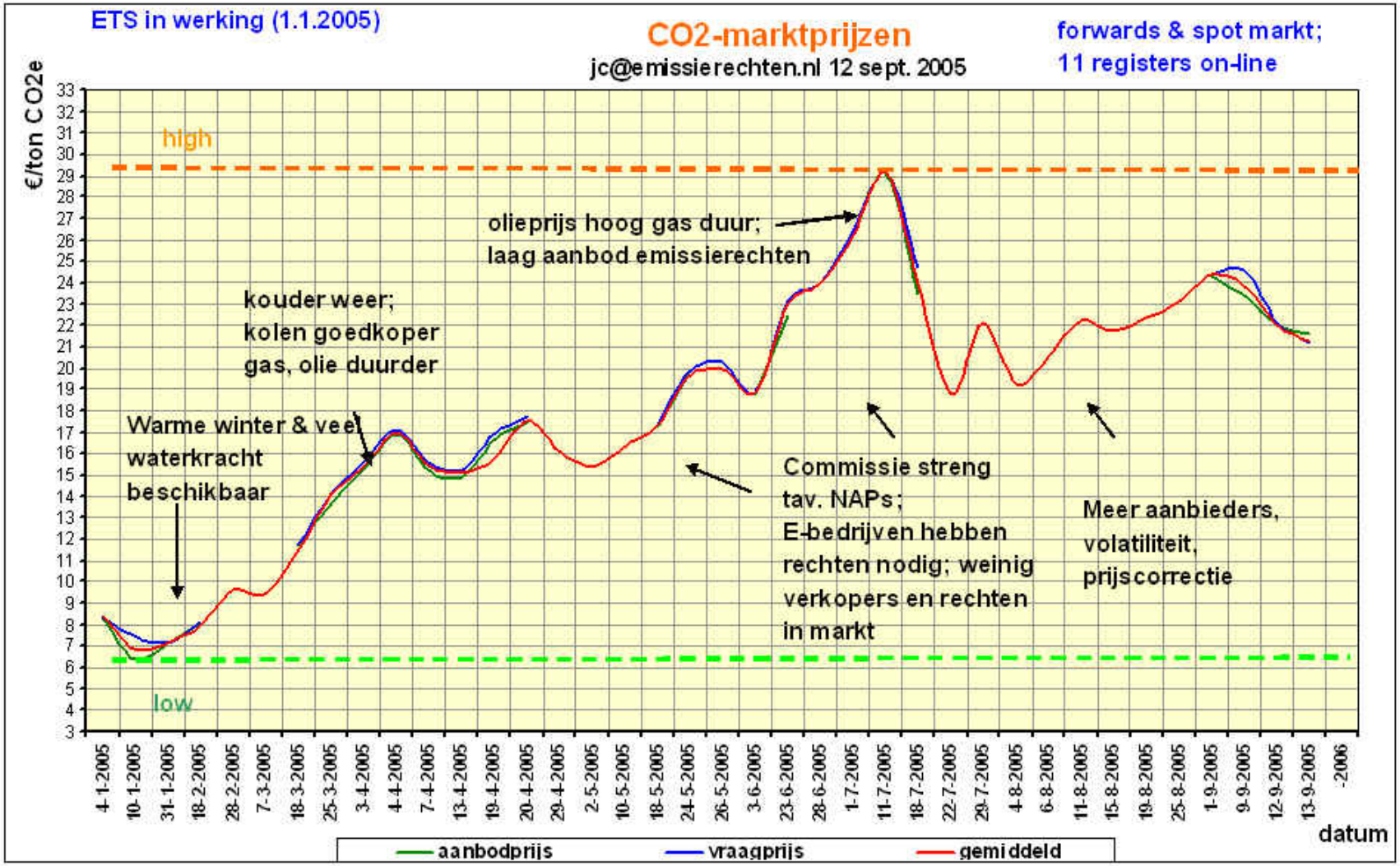
THE COST CURVE PROVIDES A "MAP" OF ABATEMENT OPPORTUNITIES

Cost of abatement, 2030, €/tCO₂e*



* Cubic feet of carbon equivalents.

Source: McKinsey and Vattenfall analysis

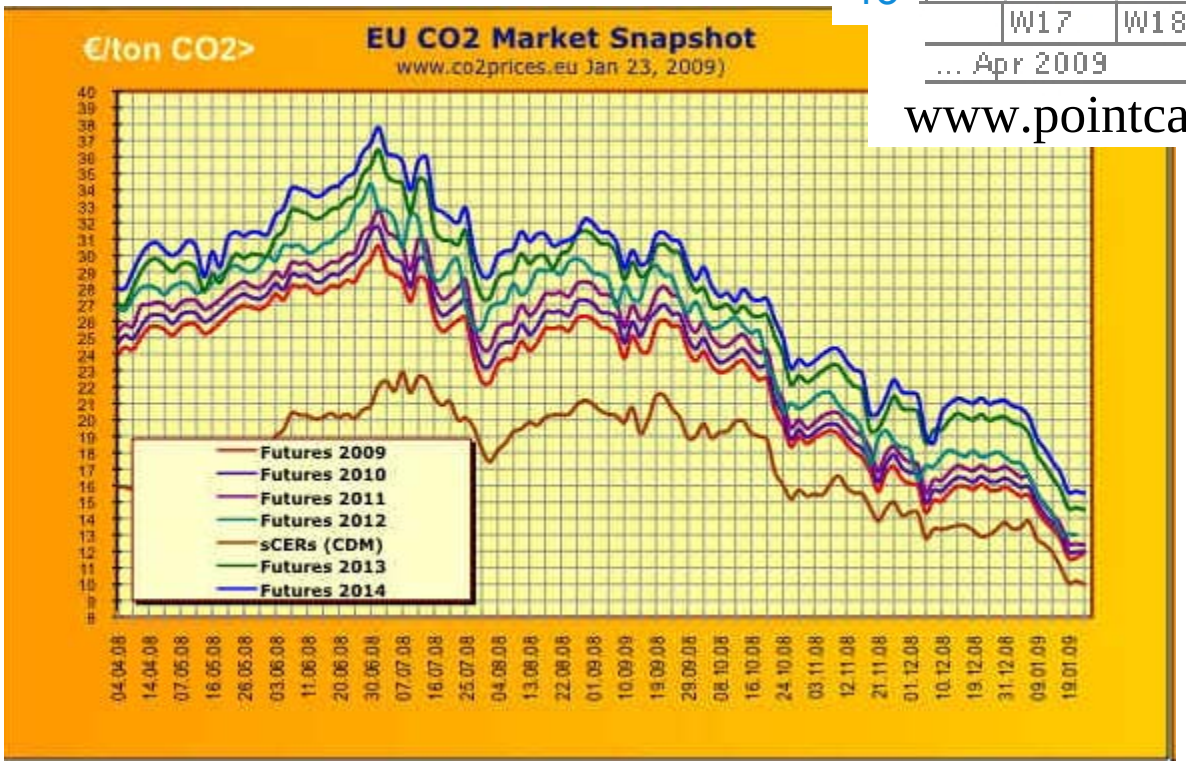


Bron: www.emissierechten.nl

CO_2 Emission rights: prices

- May 14th 2009: OTC= Eur. 14.63

www.pointcarbon.com



Bron: www.emissierechten.nl

ETS after 2012 – EU assessment

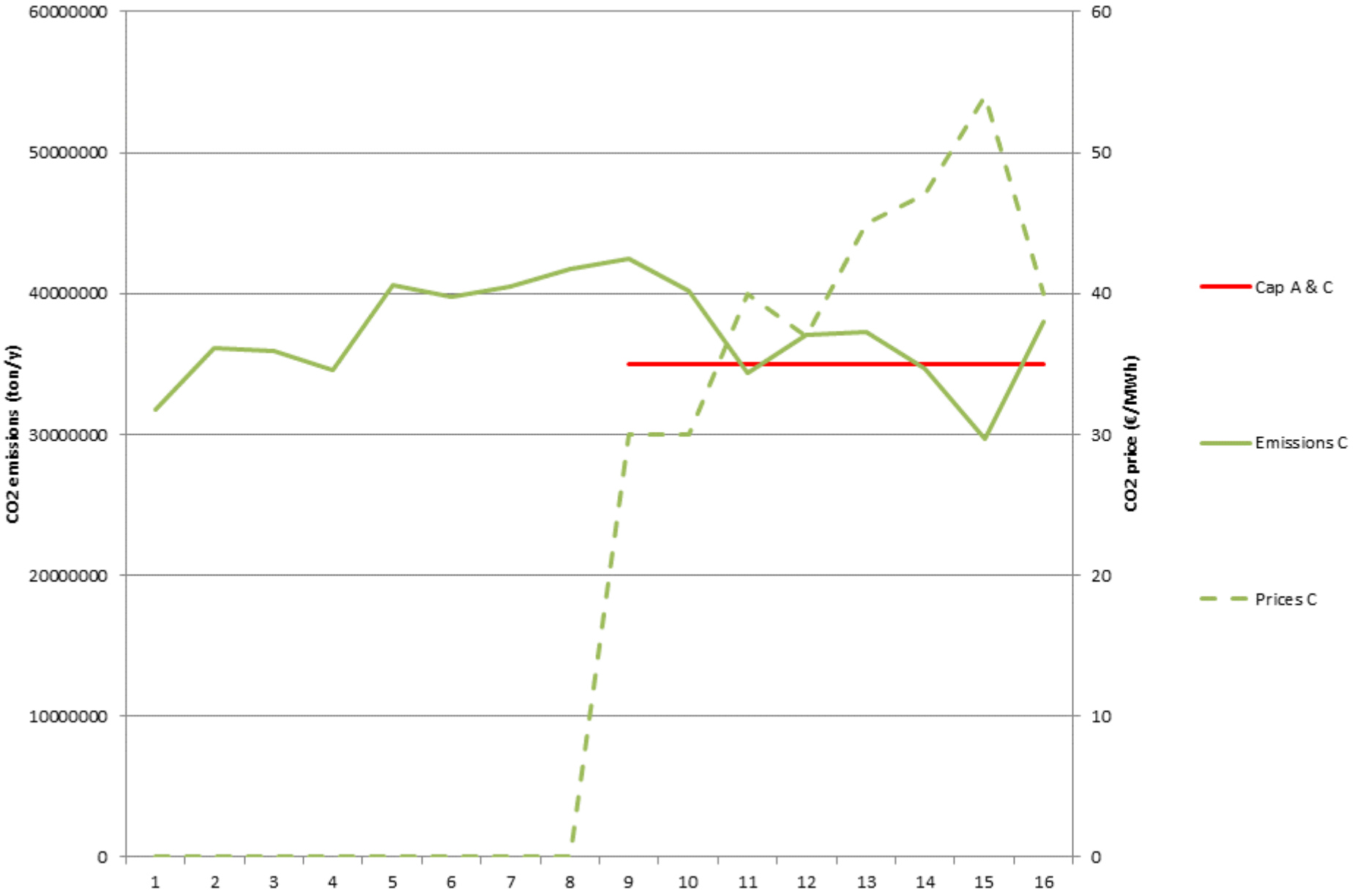
- EU ETS: putting a price on CO_2 *works*
- *excessive allocation* of allowances when verified data became available; “market reactions”
- 2nd phase: cap is set to induce reductions
- variety in National Allocation Systems
- attention to “fair competition” and “market distortion”.

EU ETS after 2012

- to become more efficient:
  - 8 year instead of 5 years
  - constantly reducing cap; 21% by 2020 from 2005
  - allocation: linear increase of auctioning (4%→70%)
- more harmonized:
  - EU-wide cap
  - no National Allocation Systems!
- fairer:
  - new entrants, new Member States

Question

- Does CO_2 cap and trade lead to the desired investments?


60000000
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10000000
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CO2 emissions (ton/y)
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50
40
30
20
10
0
CO2 price (€/MWh)
1
2
3
4
5
6
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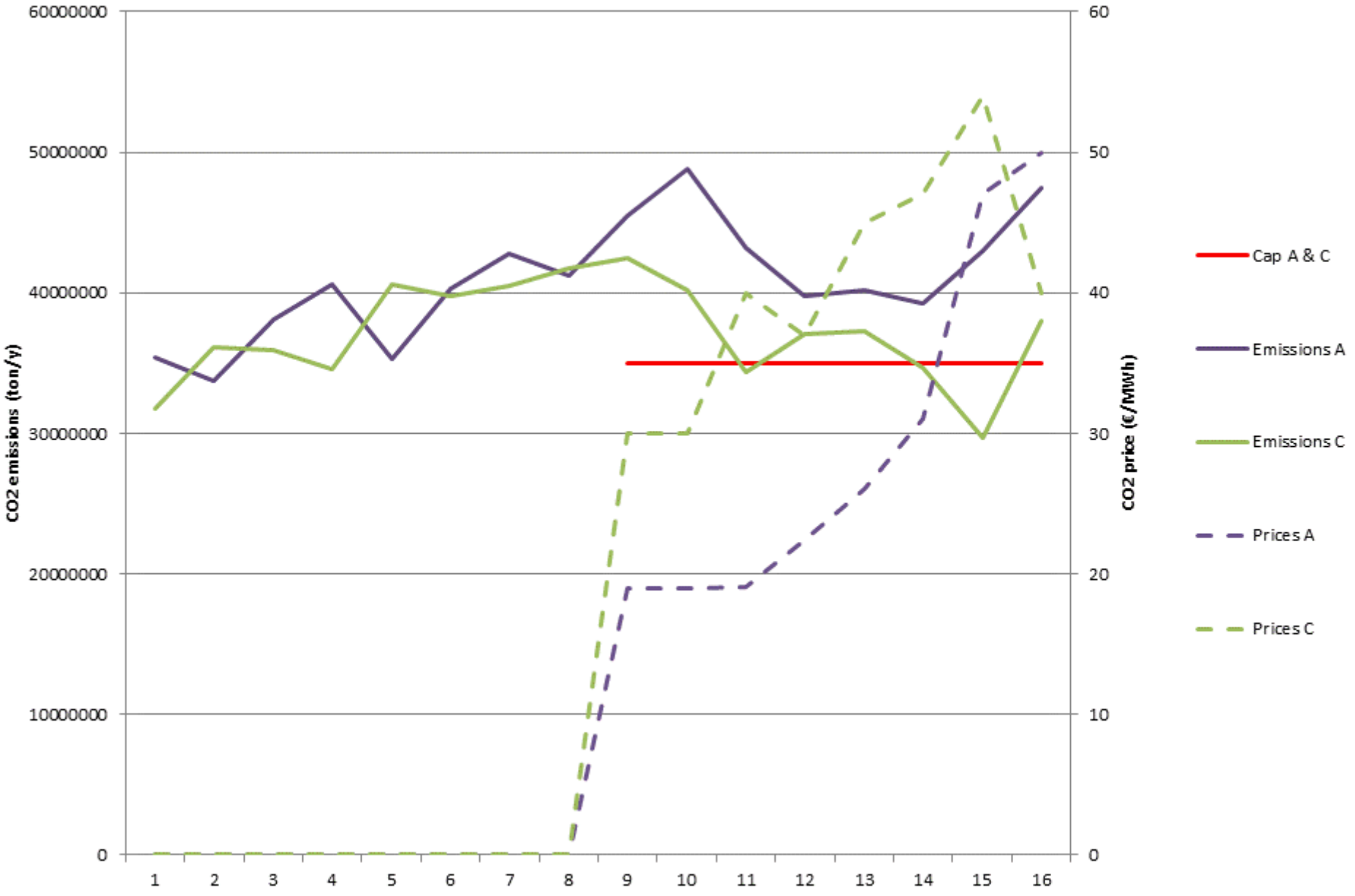
9
10
11
12
13
14
15
16
Cap A & C
Emissions C
Prices C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CO2 emissions (ton/y)
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CO2 price (€/MWh)
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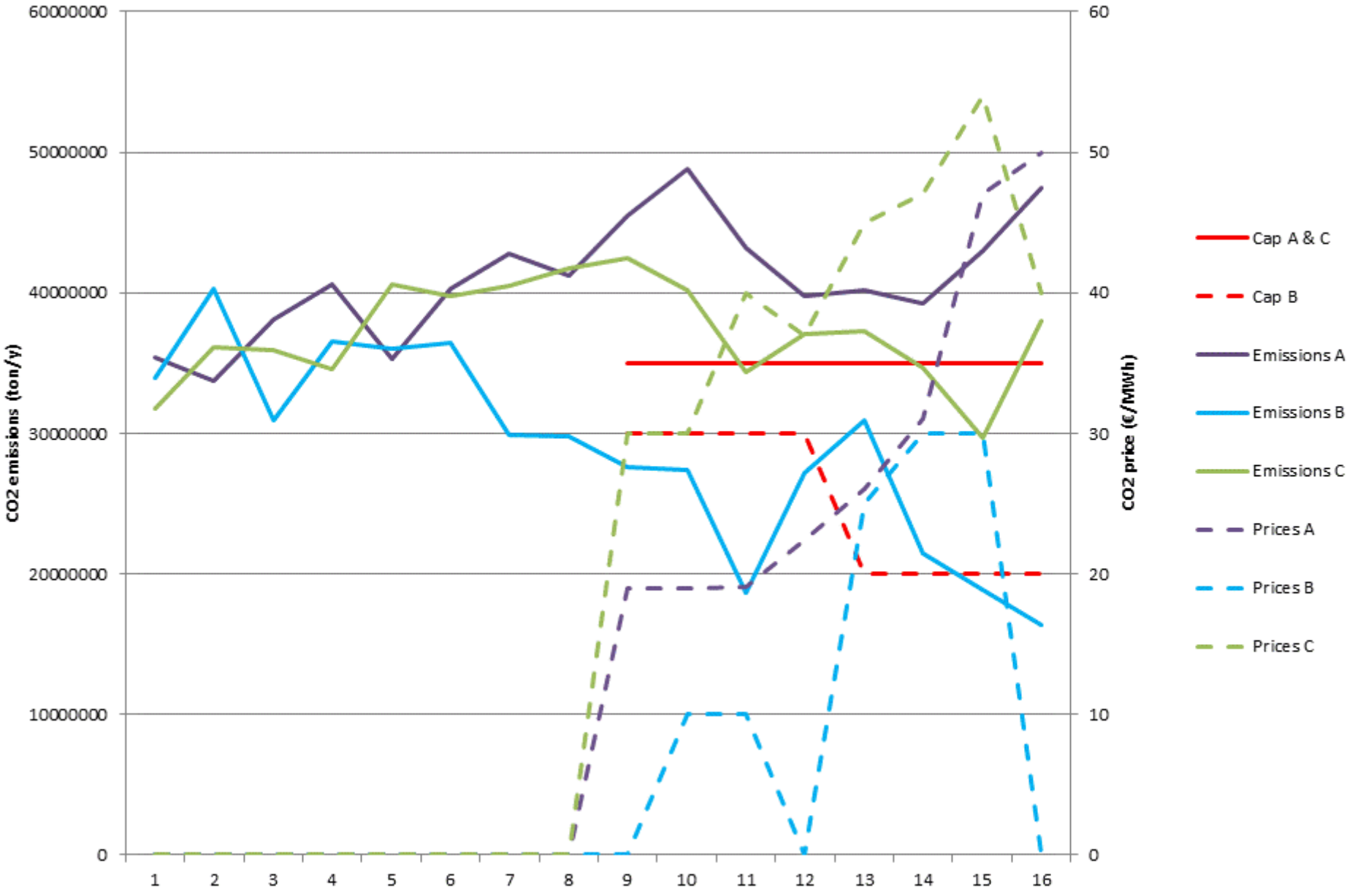
Cap A & C
Emissions A
Emissions C
Prices A
Prices C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CO2 emissions (ton/y)
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CO2 price (€/MWh)
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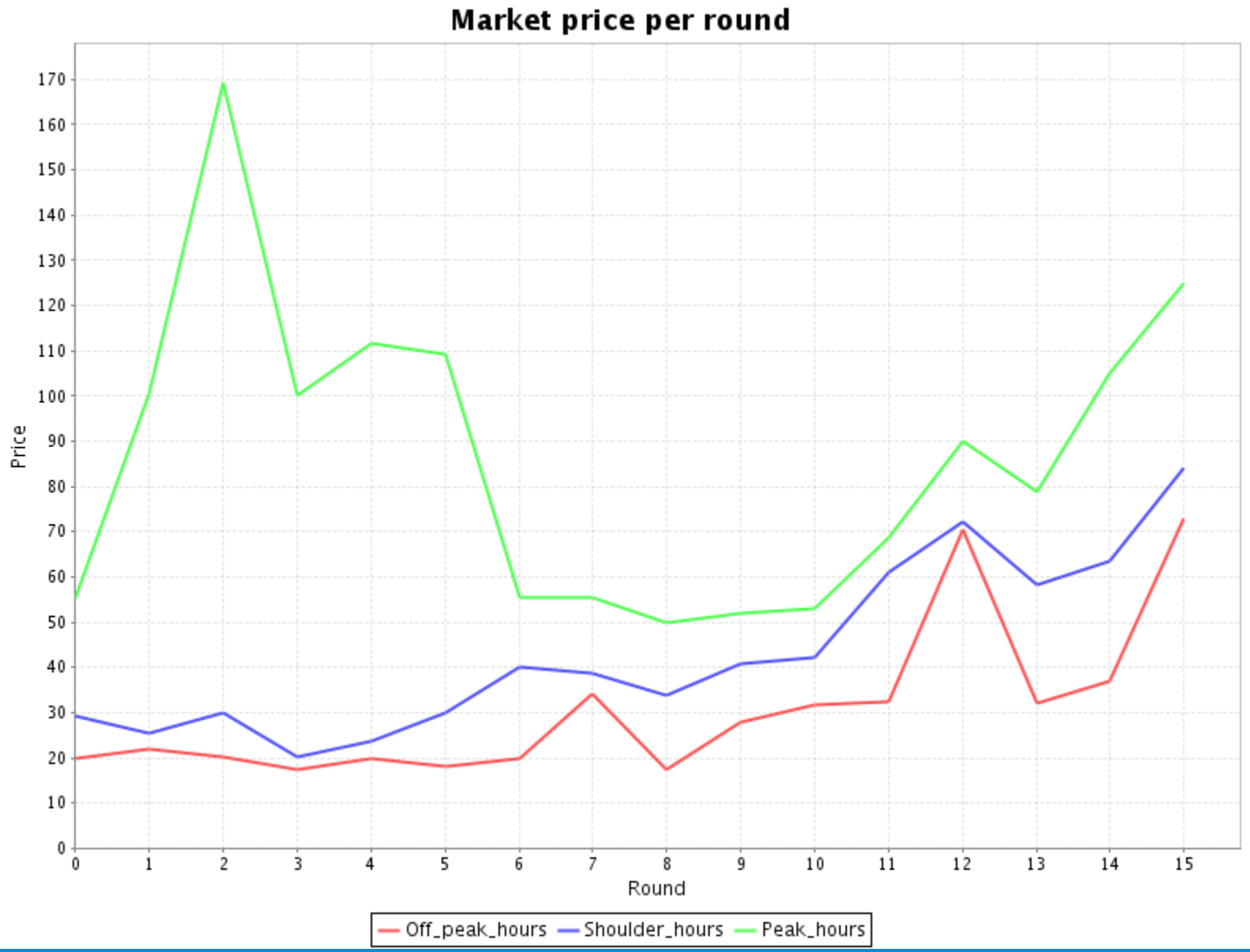
16
Cap A & C
Cap B
Emissions A
Emissions B
Emissions C
Prices A
Prices B
Prices C

Game A


Market price per round
Price
Round
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
0
1
2
3
4
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6
7
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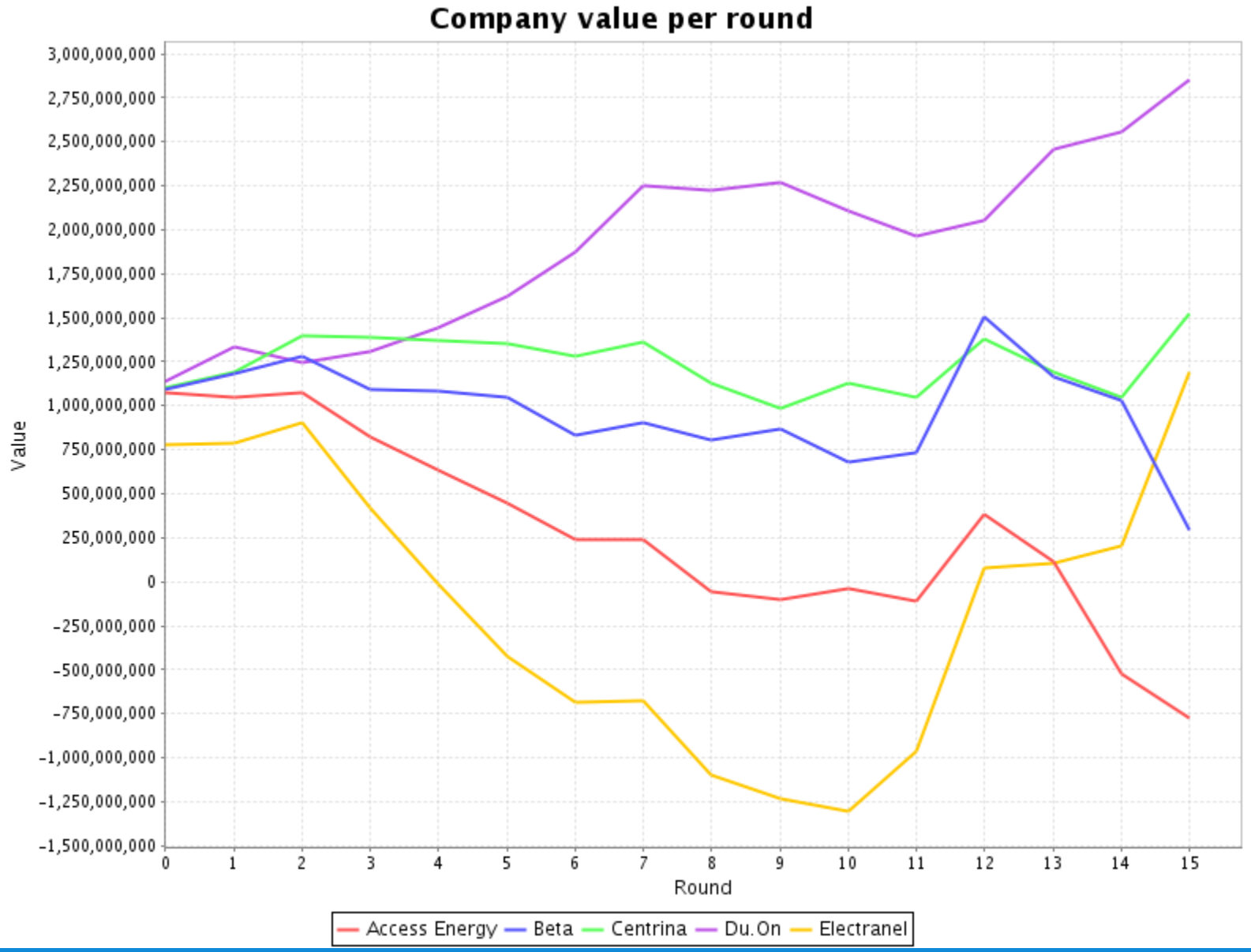
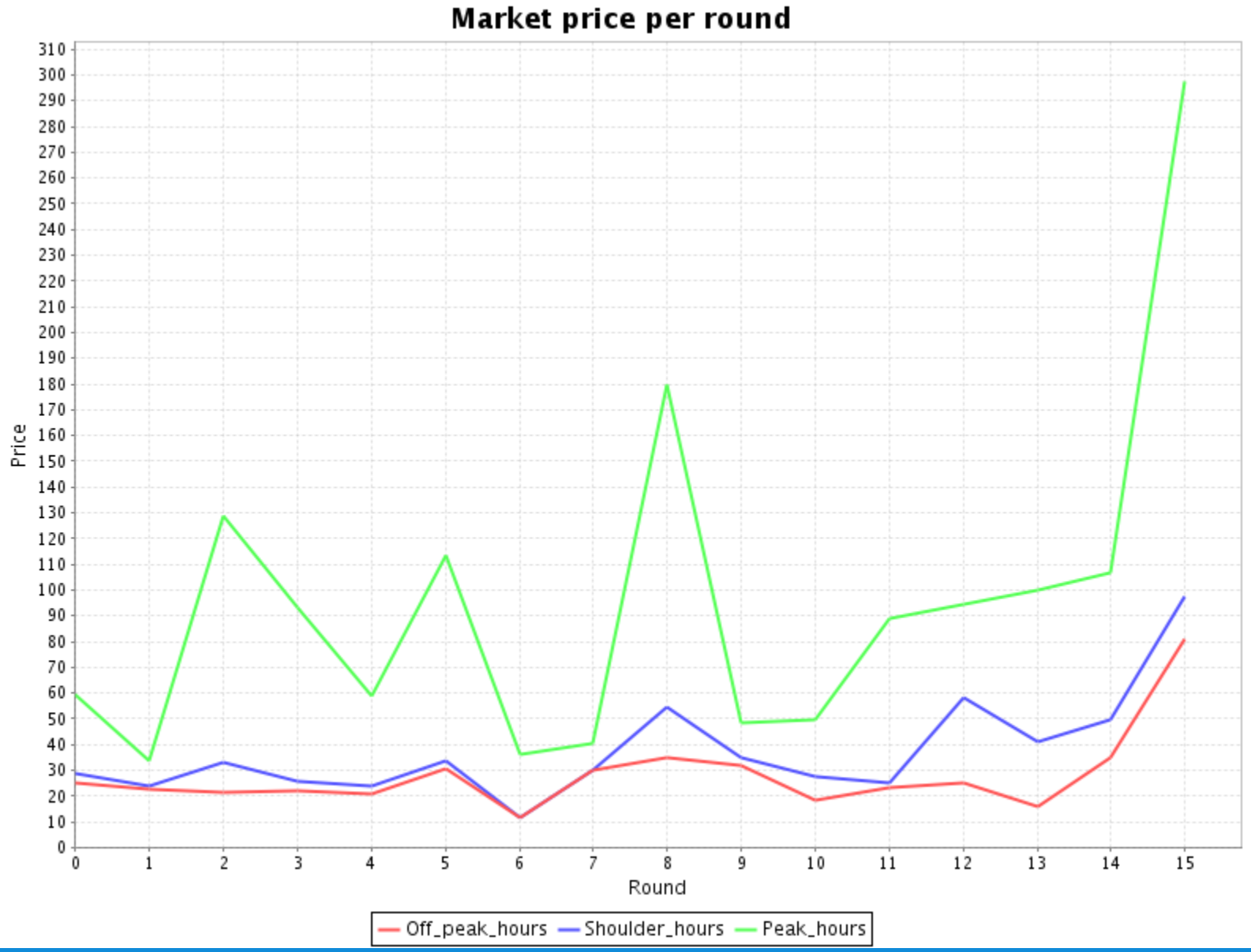
11
12
13
14
15
Off_peak_hours
Shoulder_hours
Peak_hours

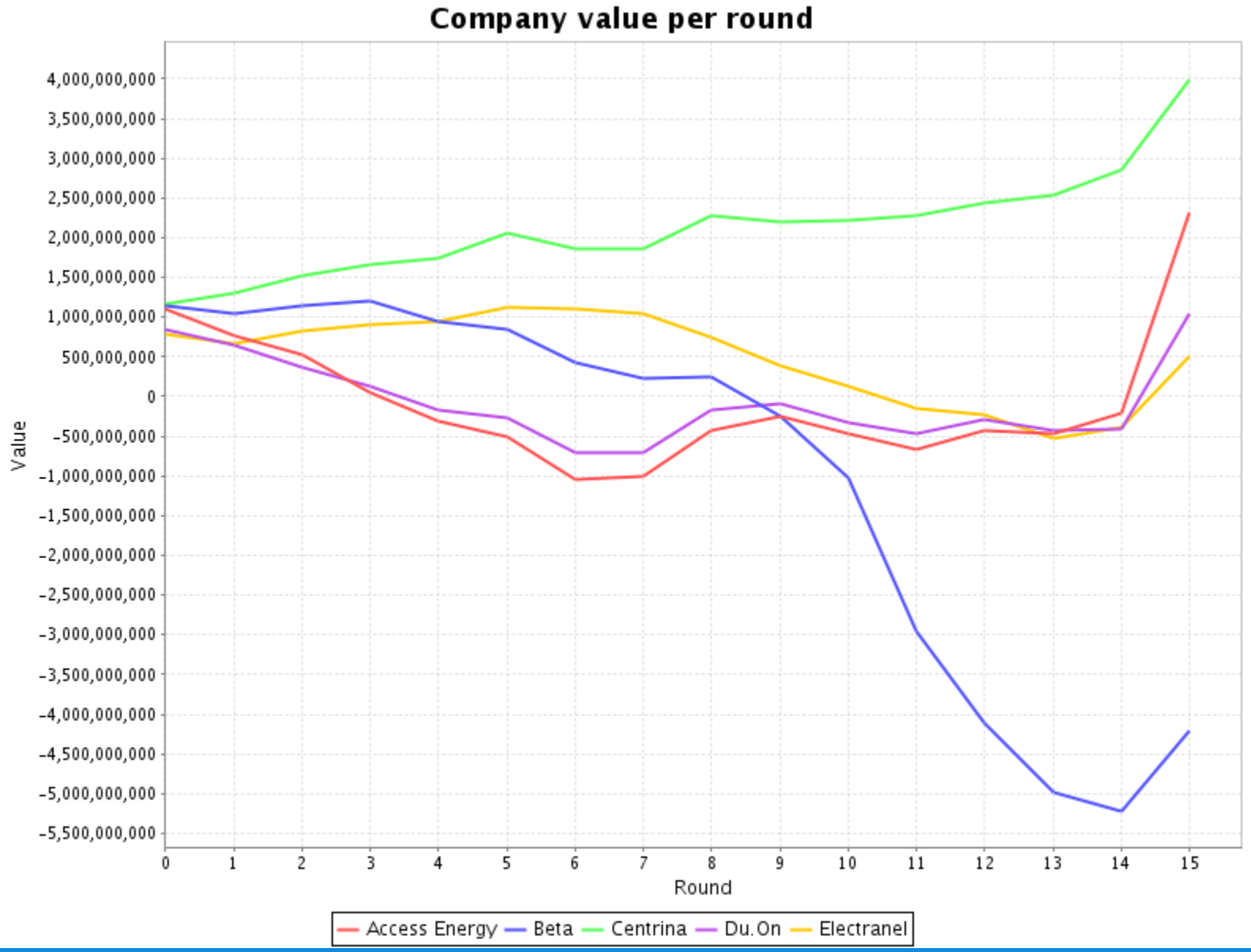
Game A


Company value per round
3,000,000,000
2,750,000,000
2,500,000,000
2,250,000,000
2,000,000,000
1,750,000,000
1,500,000,000
1,250,000,000
1,000,000,000
750,000,000
500,000,000
250,000,000
0
-250,000,000
-500,000,000
-750,000,000
-1,000,000,000
-1,250,000,000
-1,500,000,000
Value
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Round
Access Energy
Beta
Centrina
Du.On
Electranel

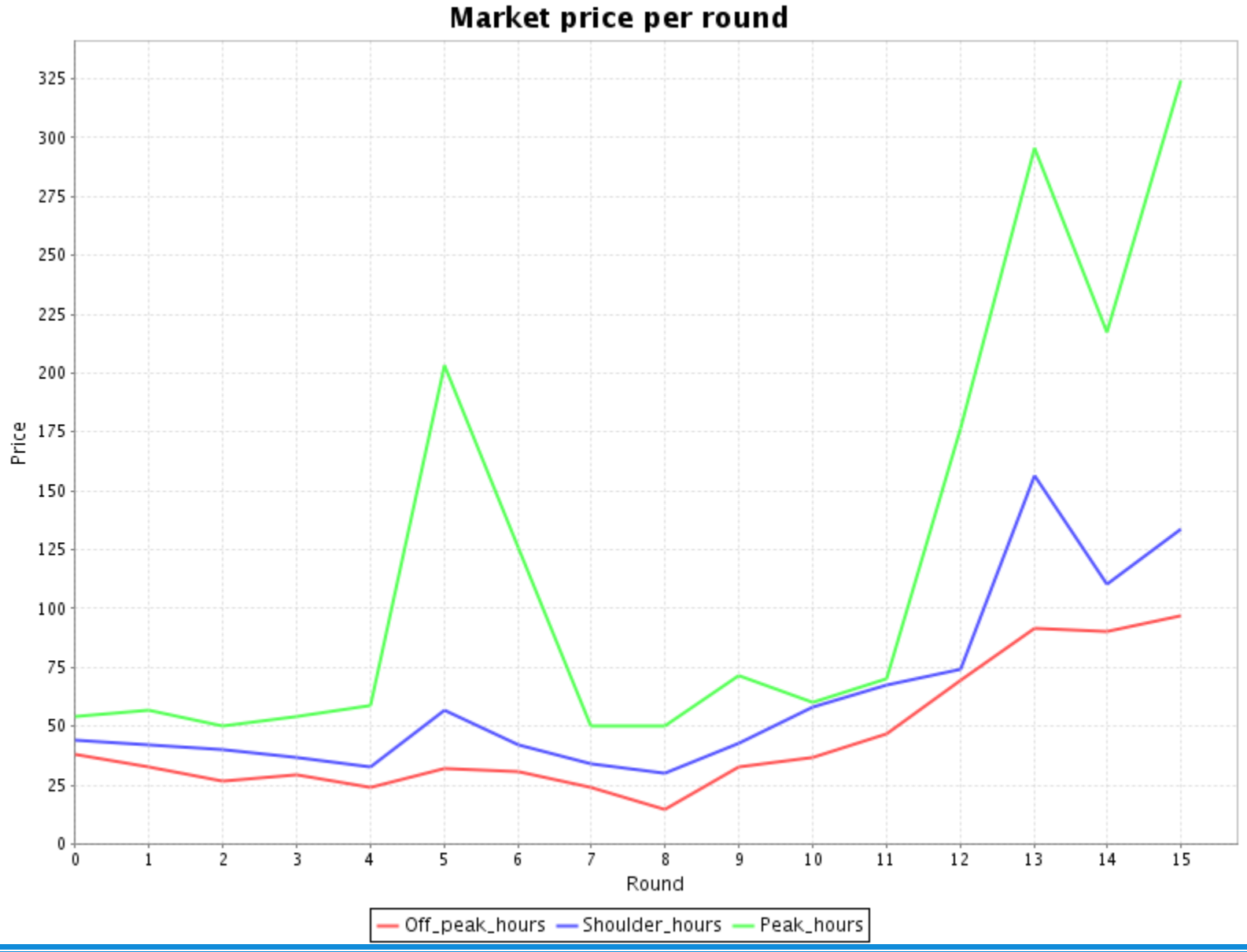
Game B


Market price per round
Price
Round
Off_peak_hours
Shoulder_hours
Peak_hours

Game B


Company value per round
4,000,000,000
3,500,000,000
3,000,000,000
2,500,000,000
2,000,000,000
1,500,000,000
1,000,000,000
500,000,000
0
-500,000,000
-1,000,000,000
-1,500,000,000
-2,000,000,000
-2,500,000,000
-3,000,000,000
-3,500,000,000
-4,000,000,000
-4,500,000,000
-5,000,000,000
-5,500,000,000
Value
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Round
Access Energy
Beta
Centrina
Du.On
Electranel

Game C


Market price per round
Price
Round
0
25
50
75
100
125
150
175
200
225
250
275
300
325
0
1
2
3
4
5
6
7
8
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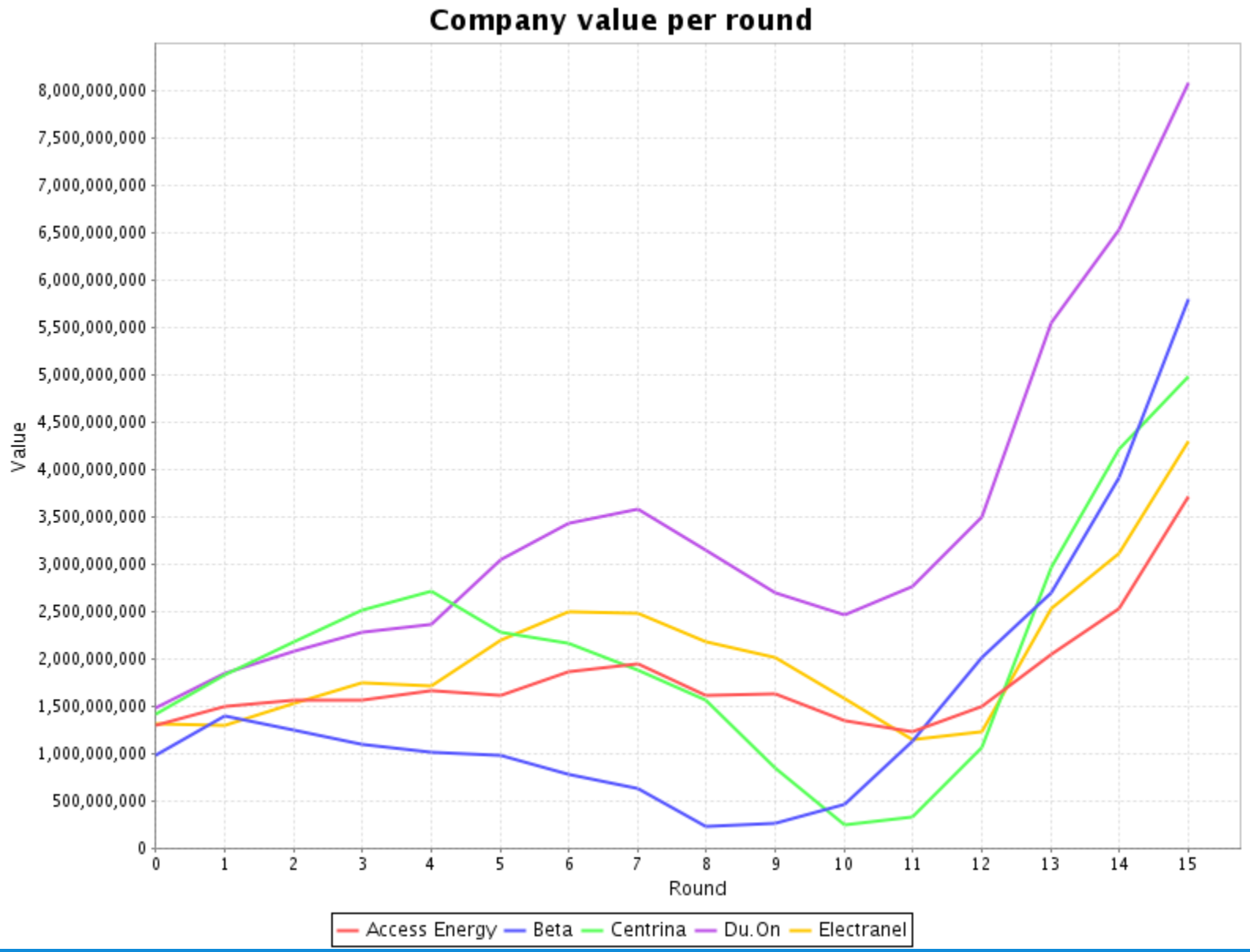
12
13
14
15
Off_peak_hours
Shoulder_hours
Peak_hours

Game C


Company value per round
8,000,000,000
7,500,000,000
7,000,000,000
6,500,000,000
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5,000,000,000
4,500,000,000
4,000,000,000
3,500,000,000
3,000,000,000
2,500,000,000
2,000,000,000
1,500,000,000
1,000,000,000
500,000,000
0
Value
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Round
Access Energy
Beta
Centrina
Du.On
Electranel

Dynamic environment

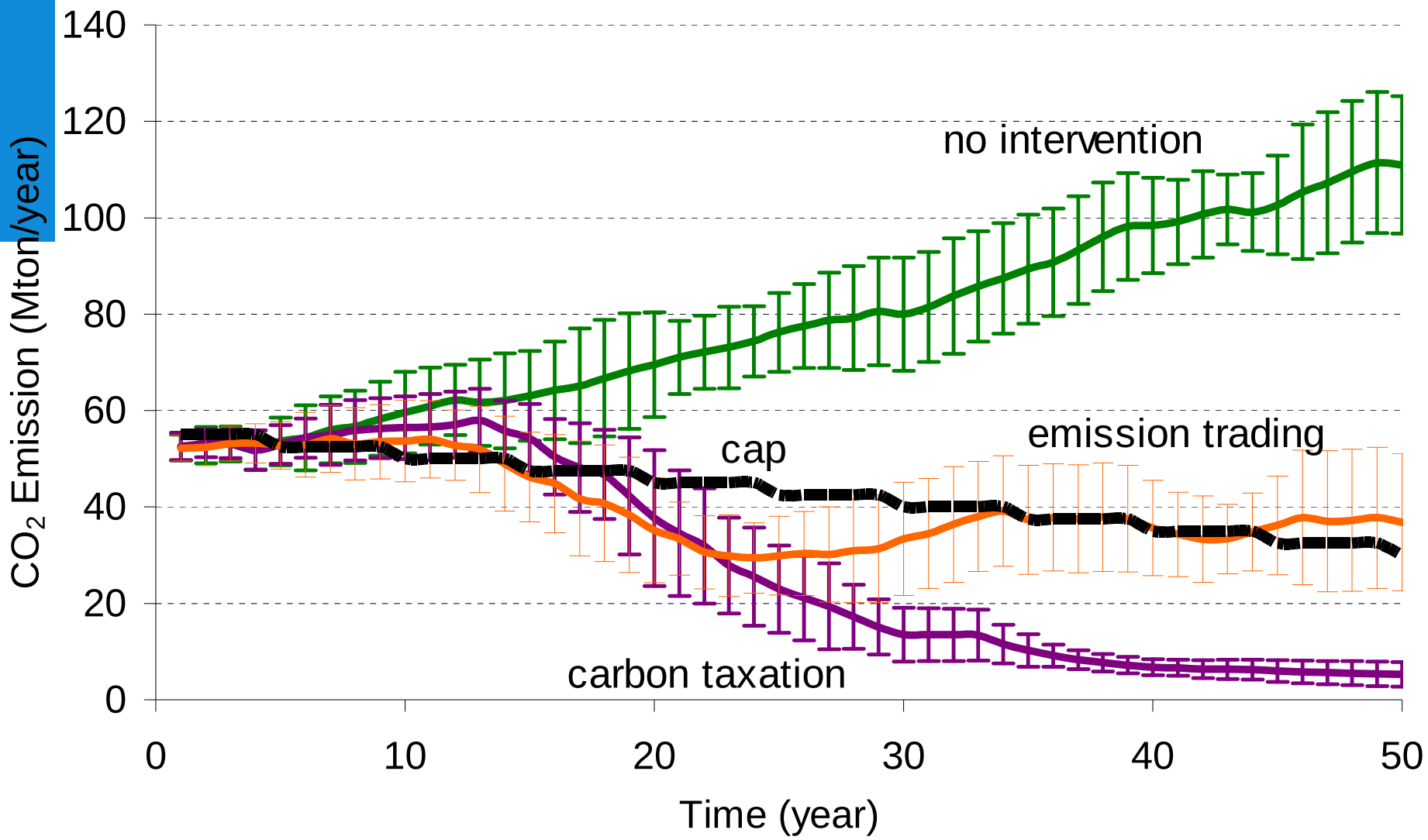
- Changing rules:
  - market integration
  - renewables policy
  - CO_2 policy
  - perception of nuclear energy
  - etc.

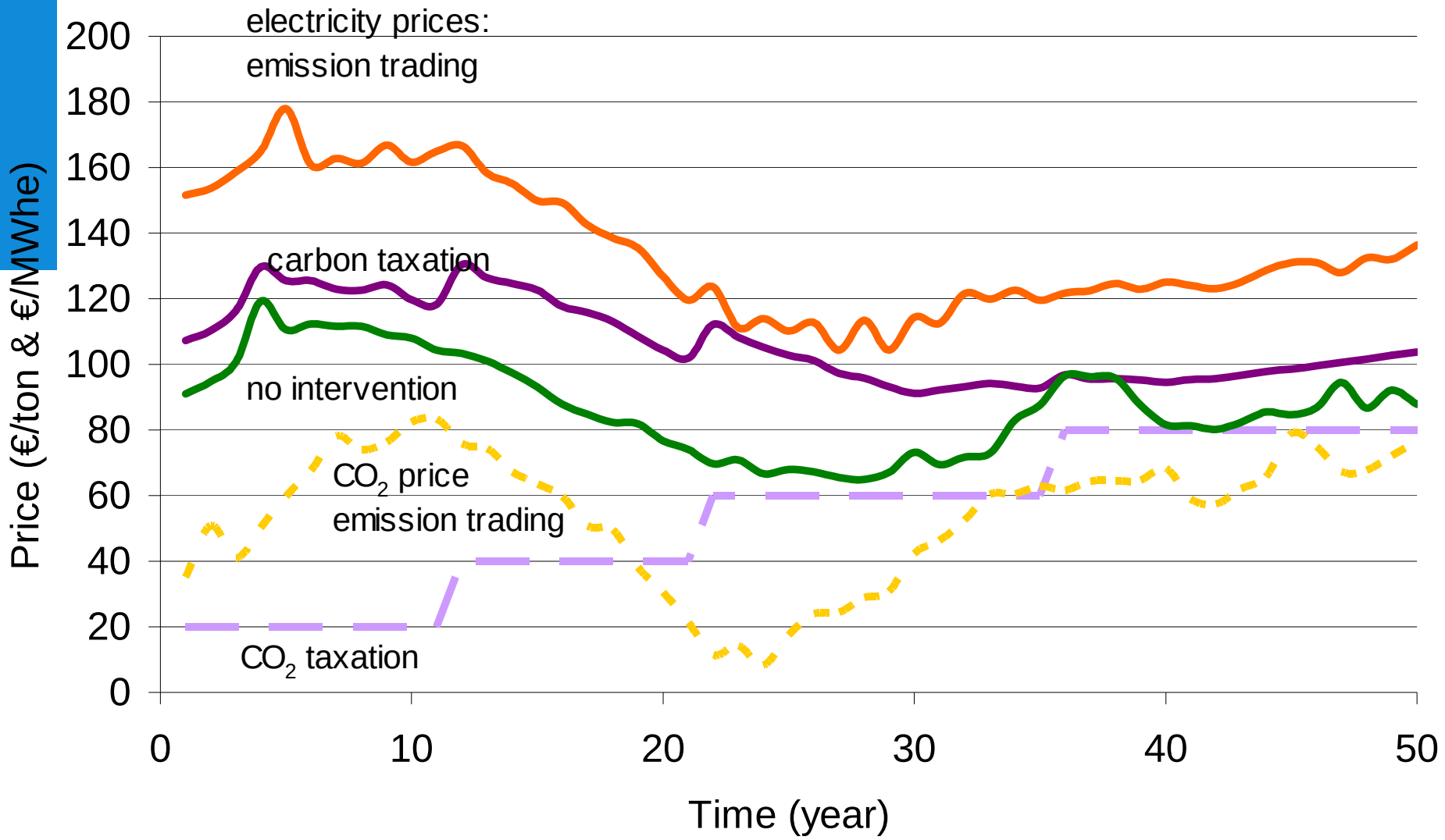
- Focus on impact of CO_2 policy:
  - investment under changing circumstance

    →a long-term transition

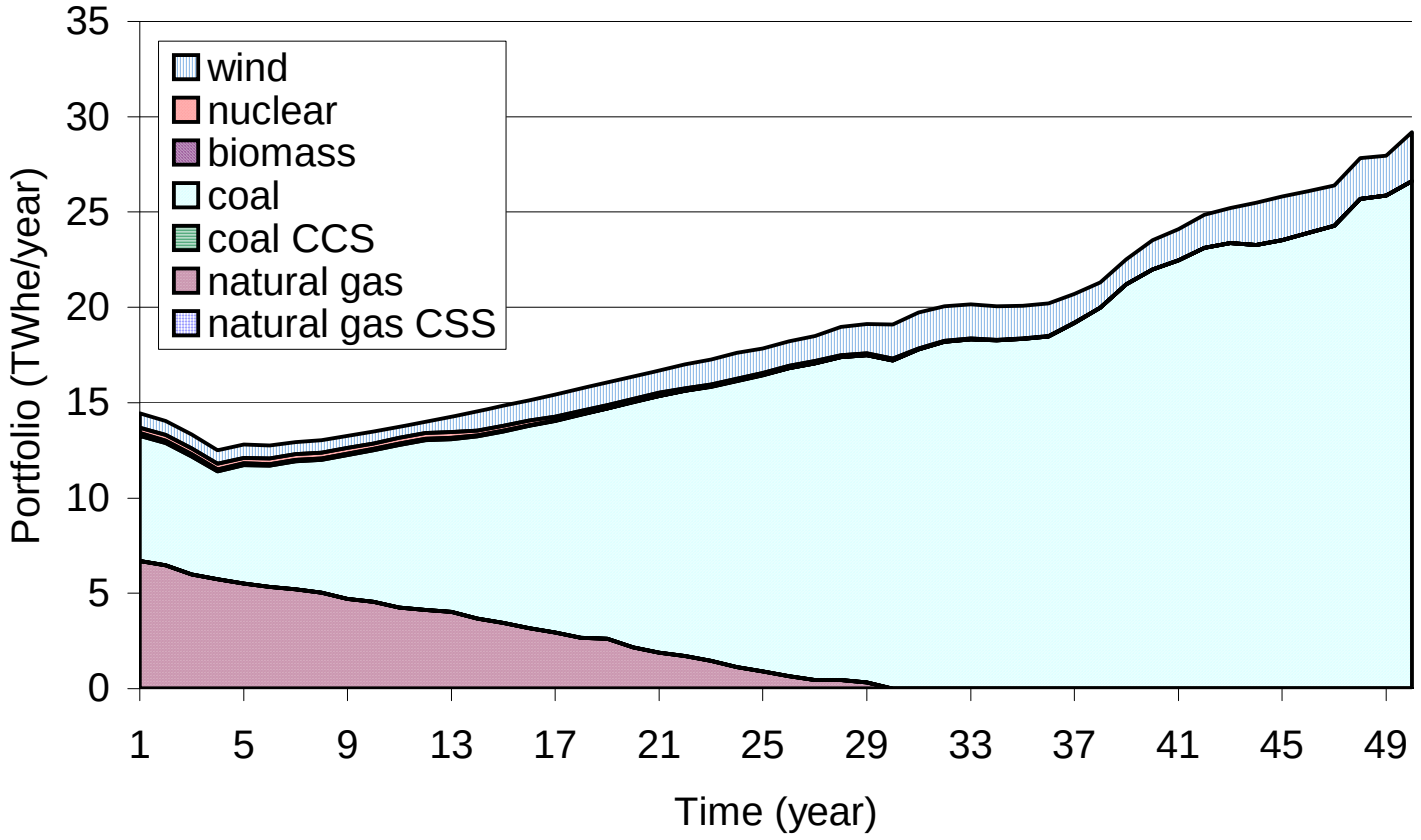
Question

- From your experience in the game, which CO_2 policy do you think would be better:
  - the current European cap-and-trade policy
    - fixed number of emission allowances, market determines allowance price
  - a CO_2 tax
    - fixed price for CO_2, emitters decide whether to reduce emissions

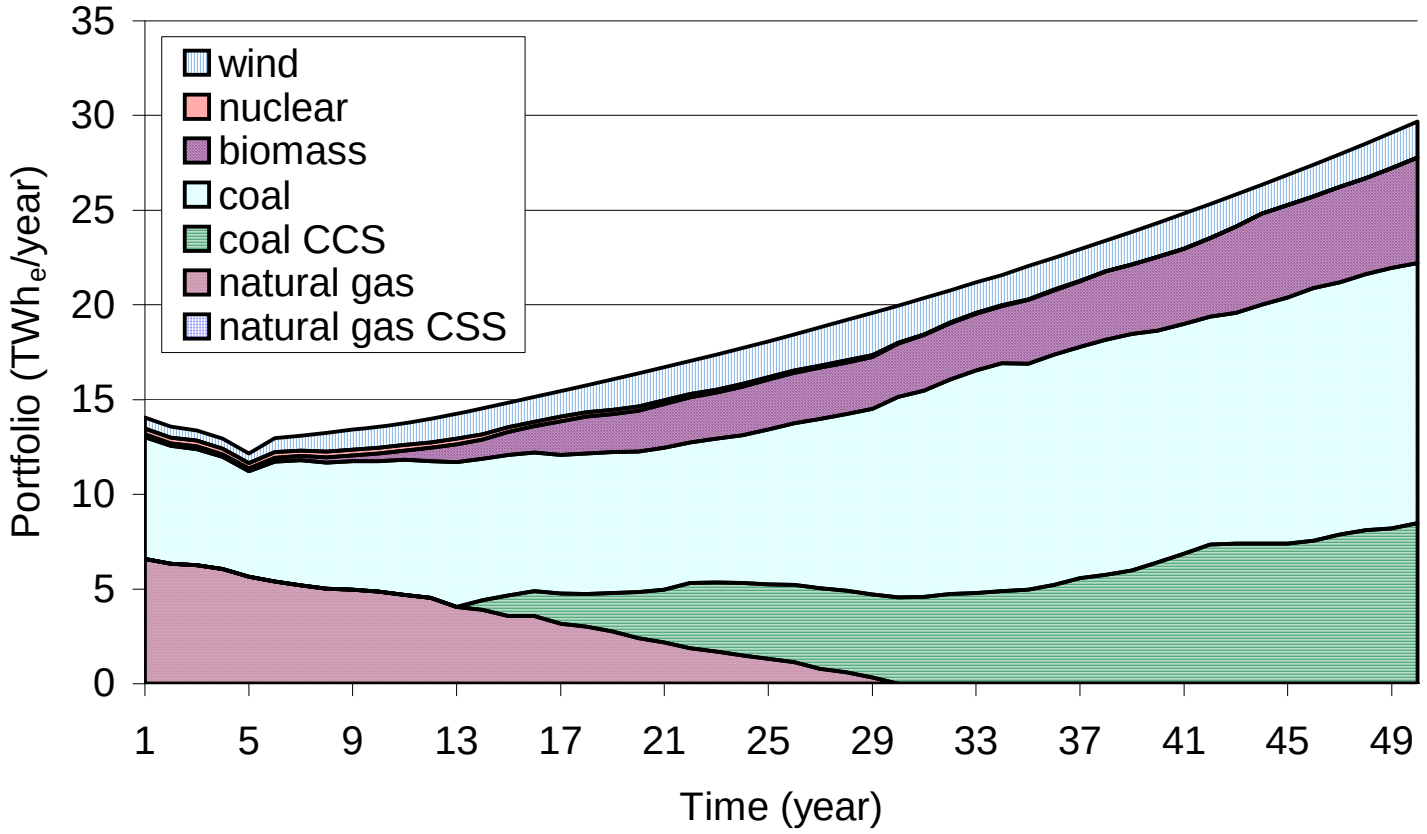

140
120
100
80
60
40
20
0
CO_2 Emission (Mton/year)
0
10
20
30
40
50
Time (year)
no intervention
cap
emission trading
carbon taxation


electricity prices:
emission trading
carbon taxation
no intervention
CO_2 price
emission trading
CO_2 taxation
Price (€/ton & €/MWhe)
Time (year)
0
20
40
60
80
100
120
140
160
180
200
0
10
20
30
40
50

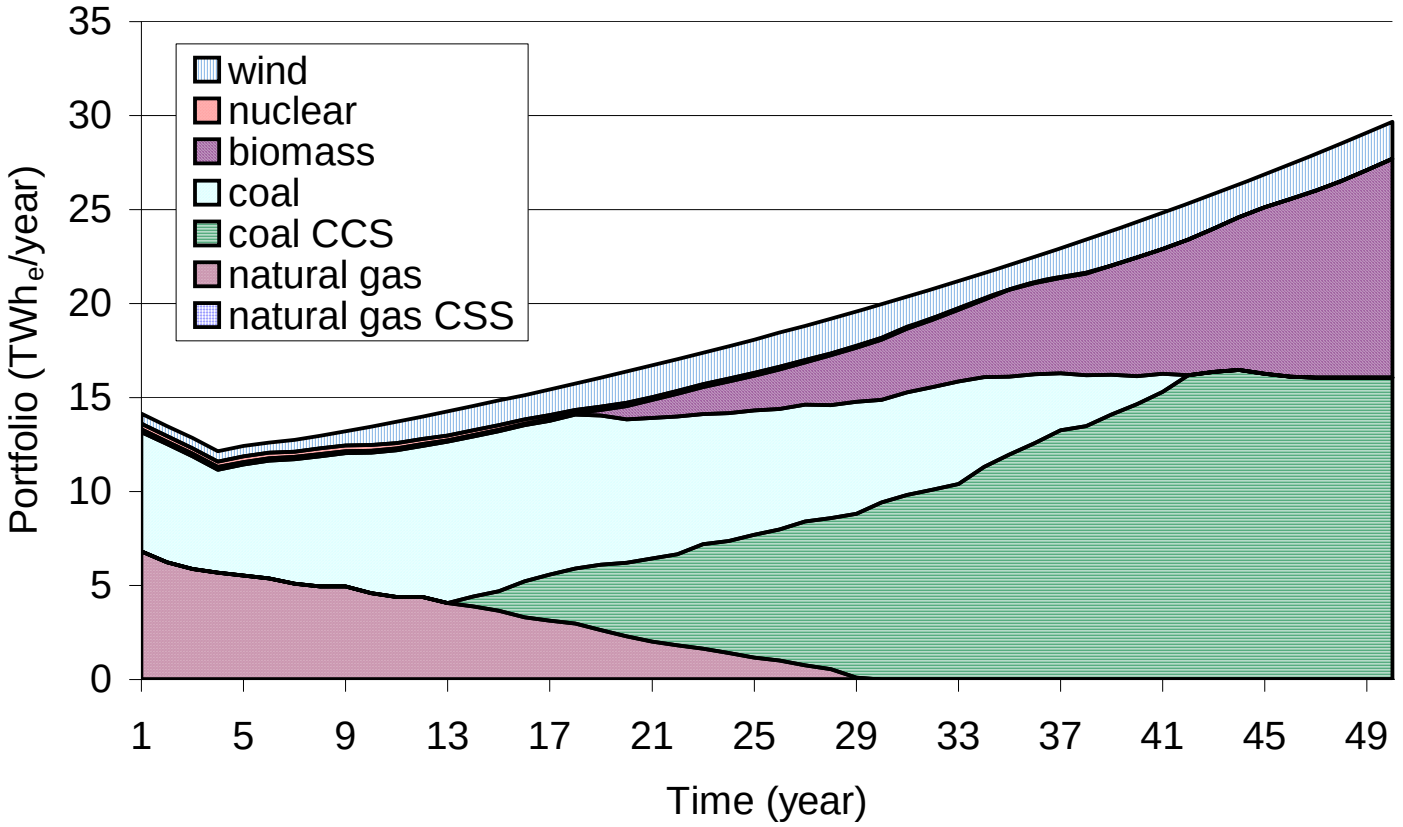
Impact is caused by difference in portfolio evolution – no intervention



Impact is caused by difference in portfolio evolution – emission trading



Impact is caused by difference in portfolio evolution – carbon taxation



Conclusions

- Emission reduction:
  - Carbon policies deliver in the long run.
  - The first 10-15 years, CO_2 emissions continue to increase
  - Without intervention, emission levels grow dramatically
- Electricity prices / investment risk:
  - Higher investment risk can cause an investment cycle under emission trading.
  - Carbon taxation leads to lower electricity prices than emission trading.
- Both instruments create pain today.
- Affordable and competitive low-CO_2 electricity generation options must become available on a large scale.