Allocation matters – so what can we do about it?

Strategies for the electricity sector 2008-2012

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Content

EU ETS allocation and the power sector

- Power generation accounts for c.2/3 of EU ETS emissions and the response of the power sector is central to both Kyoto compliance and to the price of EU ETS allowances
- This study aims to:
  - Explain current allowance prices and impact on electricity price
  - Look at how allocation affects prices, operation and investment
  - Draw out implications for policy in Phase II and beyond
- The executive summary will discuss
  - Price impacts
  - Distortions from allocation
  - Recommendations
  - Higher-level conclusions on allocations approaches for longer term

Determinants of CO_2 allowance prices

- Current CO_2 allowance prices are higher than expected
  - Major abatement option was expected to be switch from coal to gas in power generation
  - Rising gas prices have made switch more costly
- Future development
  - Projected gas prices remain high but uncertain, dependent on progress of liberalisation,
  - Confidence in future of emissions trading decisive
    - ensures investment in energy efficiency (demand and supply)
    - creates market for CDM and JI projects to import allowances
    - increases investment in carbon free generation technologies
  - This creates emission reductions to reduce CO_2 price

Impact of CO_2 allowance prices on electricity prices

- In countries with liberalised markets and competition:
  - Empirical evidence confirms that generators add opportunity cost of allowances to energy offers
  - Simulations show that a CO_2 price of 20Euro/tCO_2 increases the average electricity prices by 10-16 Euro/MWh
- In countries without competitive retail prices:
  - Regulation or threat of regulation can prevent pass through of opportunity costs to domestic consumers
  - If governments intervene to prevent pass through to industrial contracts, then transparency/liberalisation further reduced
  - Likely to undermine incentive structure of ETS towards efficient investment and operation as CO_2 prices are not internalised

Distortions from updating on existing facilities

- Repeated allocation process means that today's production will enter baseline of future allocations ("updating"):[1]
  - Attempts to avoid updating would create many complexities and perverse incentives as governments deal with "special cases"
  - With updating today's behaviour is influenced by future allocations, risking distortions
- Three updating methods assessed in this study:[2]
  - Emission based updating
  - Uniform benchmark based on electricity production levels
  - Fuel-specific benchmark based on combination of electricity production levels and fuel used
- In all cases updating inflates emissions and/or allowance prices, creates distortions between sectors/countries and increases abatement costs
- Fuel specific and emission based updating reward production with CO2 intensive technologies, increasing emissions/CO2 prices and abatement costs
- Emission based allocation reduces the incentives to improve efficiency of existing plants

1) Various governments have declared that today's emissions will not be basis for Phase II allocation.
2) The commission and member states aim to increase the use of benchmarks.

Distortions from closure conditions applied to existing facilities

- When closed power stations receive no more allowances ("contingent" allocation):
  - Can lead to unwarranted life-time extensions
  - Thereby increasing system costs and allowance prices
- Problem can persist in countries even if NAPs has no explicit closure conditions if operators expect to receive no allowances in future after closure
- This is a fundamental difference between the EU ETS and successful cap and trade programs in the USA (SO2 Acid Rain Program) where a one-off allocation remained unaffected by closures of power stations

Distortions from new entrant allocation

- Allocation plans grant free allowances to new entrants partly to compensate for distortions created by closure conditions
- If new entrant allocation is fuel or technology-specific
  - Creates incentives to build the more CO2-intensive technology
  - Leading to inefficient investment in carbon-intensive plants and extra costs
- If new entrant allocation is based on uniform benchmark
  - Acts as a capacity payment supporting all new investment
  - Can reduce electricity prices as it reduces scarcity premium
  - But requires new entrant reserve to be large enough, as well as low barriers to entry, access to fuels (e.g. gas), and regulatory certainty about future allocation

There is no ‘easy fix’ for allocation to existing facilities. Reducing the degree of free allocation will reduce social costs and perverse incentives.

- In liberalised markets, evidence of opportunity cost pass through has been established
- State aid compliance (proportionality rule) may require significant reduction of free allocation to power generators in phase II
- Therefore, should limit allocation to compensate for reduced profits arising from implementation of ETS
- Remaining allowances should be
  - auctioned, or
  - allocated to consumers (would require change to Annex III)

An inherent logic must drive allocation rules for new entrants towards capacity-based benchmark across EU

- Avoid that individual country or all countries implement fuel or plant specific new entrant allocation:
  - It creates incentives to build CO2 intensive technology, leading to inefficient abatement and extra costs
  - Can increase electricity prices in all countries
- Any new entrant allocation should be capacity based (eg. t CO2/kW)
  - Similar to capacity payment, supports new investment
  - Can reduce electricity prices as it reduces scarcity premium
- Combine with continuing reform of EU electricity market
  - Reducing costs of entry reduces mid and long term electricity prices
  - Sufficient size of new entrant reserve, competitive markets, free entry, access to other fuels (e.g. gas), regulatory certainty about allocation

Deciding now on efficient post 2012 allocation method improves today's investment and operation decisions

- Allocation should move towards uniform benchmark
  - Use benchmark to reward investment in efficiency improvements
  - Make it uniform, so that:
    - updating shifts marginal costs of all plants by the same amount and does not distort dispatch
    - investment decisions 2005-2012 are not biased towards technologies with higher future allocation
  - Avoid minimum run conditions and explicit closure rules
- Reduce volume of free allocation
  - This minimises today's distortions from updating
  - This ensures post 2012 electricity prices will represent full costs
    - Increases profitability of generation and energy efficiency investment today
    - Reduces today's electricity price
- <u>Only a credible government attracts investment. This requires a consistent long-term strategy which is reflected in phase II allocation decisions.</u>

The pursuit of long-term objectives using instruments that have to adapt to shorter term cycles requires institutional independence

- Governments decide on the distribution of free allowances
  - Unlike SO_2/NOx in US, not lump sum because of 5 year cycles
  - Therefore, market repeatedly exposed to government intervention
  - This creates uncertainty for investment (technology choice, timing), and distorts operation and consumption decisions
- Historically monetary policy was in government hands
  - But political process too short-sighted for long-term commitment
  - Complex economic interactions difficult to manage in political process
  - Therefore, independent central banks were created

➢ <u>Minimise government influence on ETS via allocation process, e.g. creating institutional independence.</u>

The 'terms of reference' for allocation institutions should focus on a specific clearly articulated objective, not a diverse collection of conflicting goals

- Allocation process aims to achieve security of supply, secure industry support, and compensate for forgone profits
  - Political process with multiple objective creates complex NAPs
  - NAPs create perverse economic incentives (section 4 and 5)
  - Investment delayed/distorted because future NAPs unpredictable
- Historically monetary policy had multiple objectives
  - Governments could not credibly commit to low inflation target as market knew employment and GDP growth are important
  - Therefore, they had to compromise more on GDP growth and employment to convince market of low inflation objective
  - Central banks now have one objective: control inflation

➢ <u>Use allocation process only to compensate existing installations for the reduction in profitability under ETS</u>

A consistent long-term strategy creates investment security

Phase out free allocation

- Reduces distortions created by political allocation process
- Eliminates investment uncertainty from unknown future allocation
- Eliminates ‘early action problem’ created by future updating
- Enhances European competitiveness as auction revenue/free allocation to consumers reduces industry taxation

Get all countries to implement emissions trading

- High allowance costs only in some countries for a long time are likely to effect energy intensive industries
- Large free allocation to these industries likely inefficient
- Fall back option – border tax adjustment for CO2 content to create level playing field among industries in all countries

Analysis

- Executive summary
- Key drivers for CO2 price
- Pass through to electricity price
- Effect of allocation to existing facilities
  - Perfect grandfathering
  - Contingent on availability
  - Uniform benchmarking using moving base
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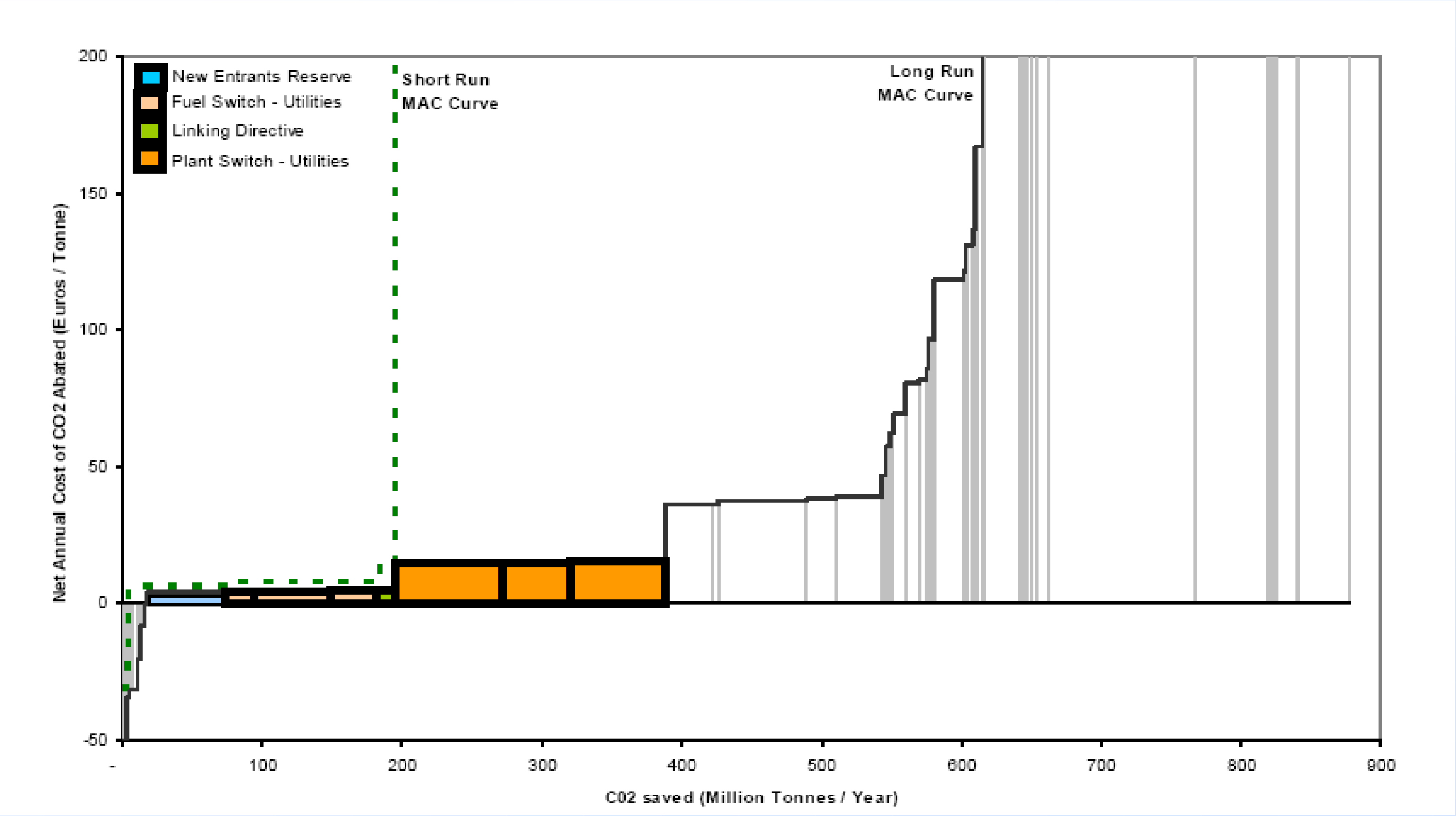
Coal to gas shift was expected to deliver CO2 reductions

Marginal Abatement Cost Curve 2006



Source: Enviros Carbon Balances Model, University of Utrecht, ICARUS database

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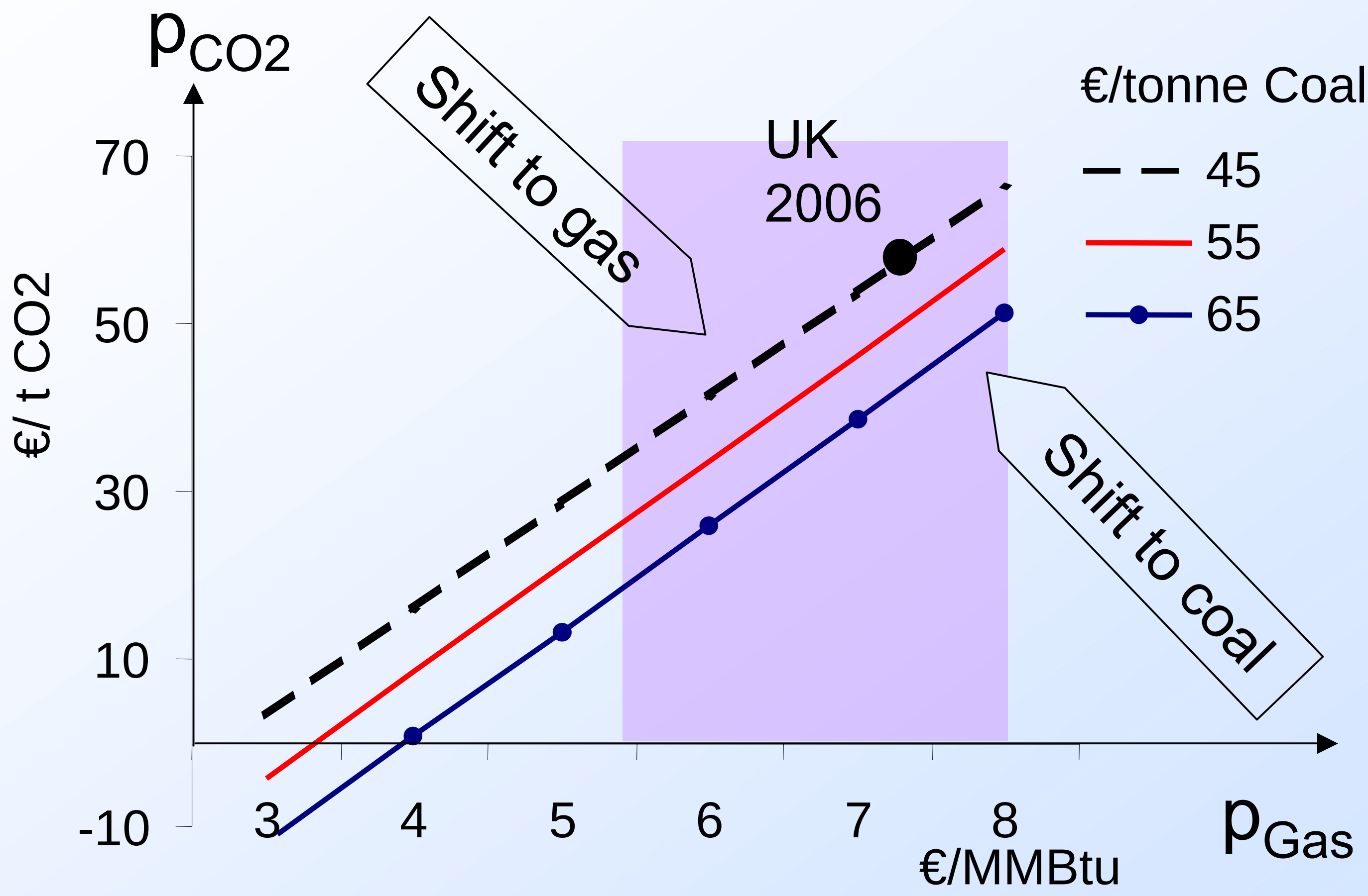
CO2 price required to shift coal to gas operation



Assumption: CCGT 50% and coal 36%, CO2 emissions CCGT .36 t/MWh, coal .9 t/MWh

$p_{gas}/.5 + p_{C02}*.36 = p_{coal}/.36 + p_{CO2}*.9$

Forward prices suggest gas prices will stay high (e.g. UK national balancing point)

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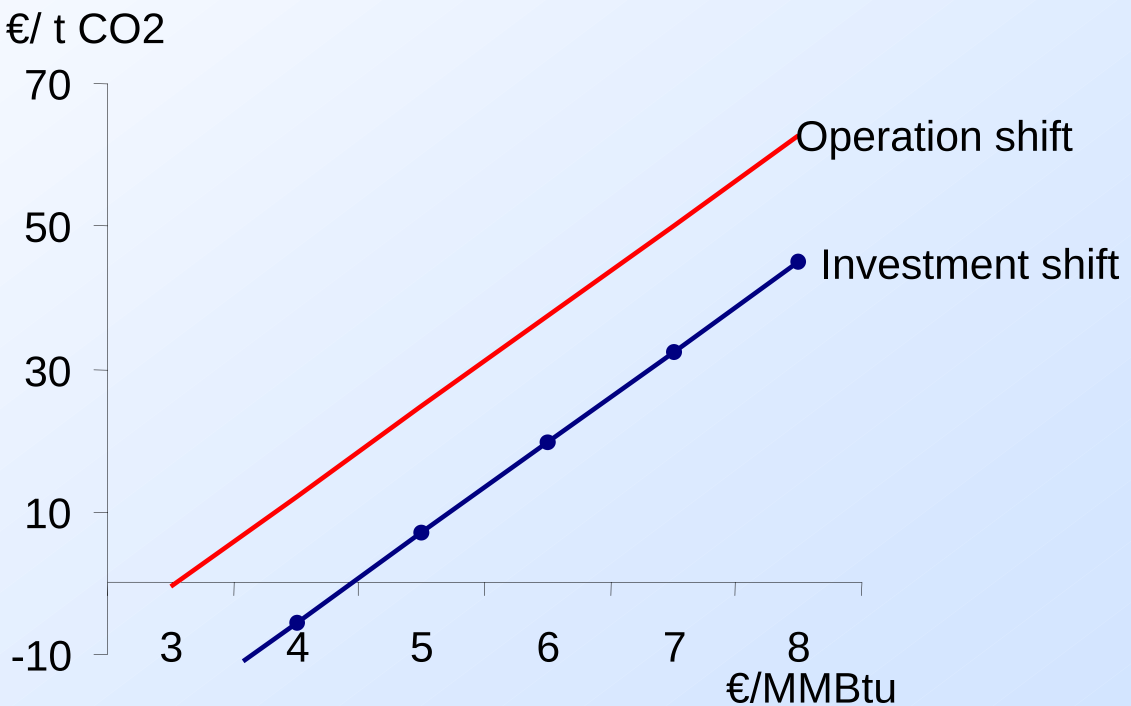
Efficient investment lowers the CO2 price

- Assume CCGT 100€/KW, CCGT 50€/KW annual fixed
- Both technologies would run 60% load factor, coal 50 €/tonne
- Changing investment pattern allows for lower CO2 price

Co2 price required to shift to gas investment



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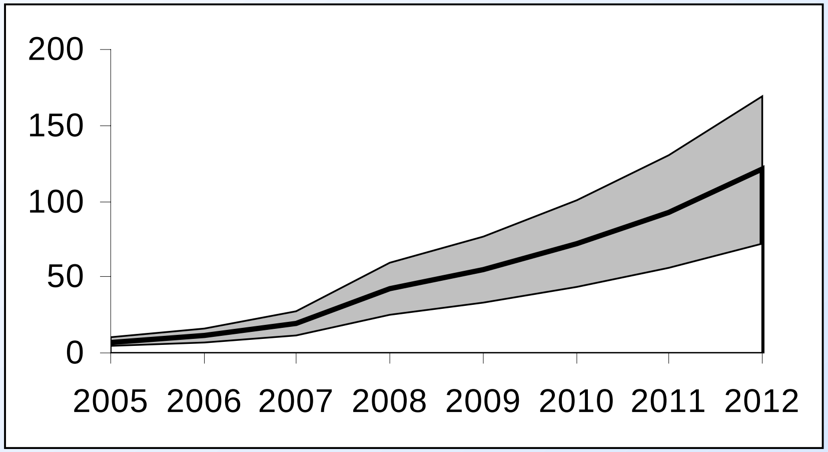
Emission reductions through International linkages

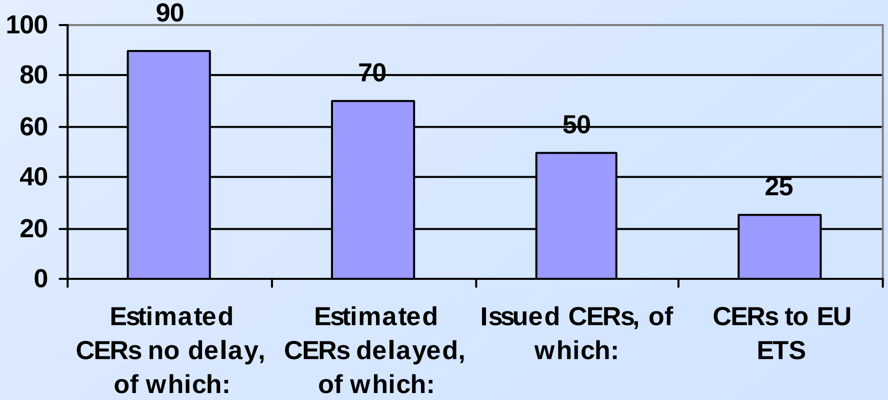
- Additional inflows from CDM, JI, AU from Russia/Ukraine
- How many of these will be used in covered sector?
- Japan, Canada?
- Phase I, no expectation of significant volumes
- Phase II, uncertainty about post 2012 delays investment, because 2-3 years of CERs don't suffice to finance projects
- Large volumes unlikely before second half of phase II
- Existing studies based on lower expectations of CO2 price

Mio. t CO2 expected from JI/CDM



Source: G. Turner 22.2.2005

Mio. t CO2 in 2007 into ETS



Source: Jorund Buen, Point Carbon director, telephonic interview on 6 July 2005

Emission reductions from renewables

- Accelerated deployment could reduce power sector emissions
- Given investment uncertainty and high capital costs unlikely to happen outside of support mechanisms
- At current fuel prices cost effective from national perspective
- Internalisation of CO_2 prices in power price reduces public subsidy requirements
- Could play core part in reducing power sector emissions and CO_2 price

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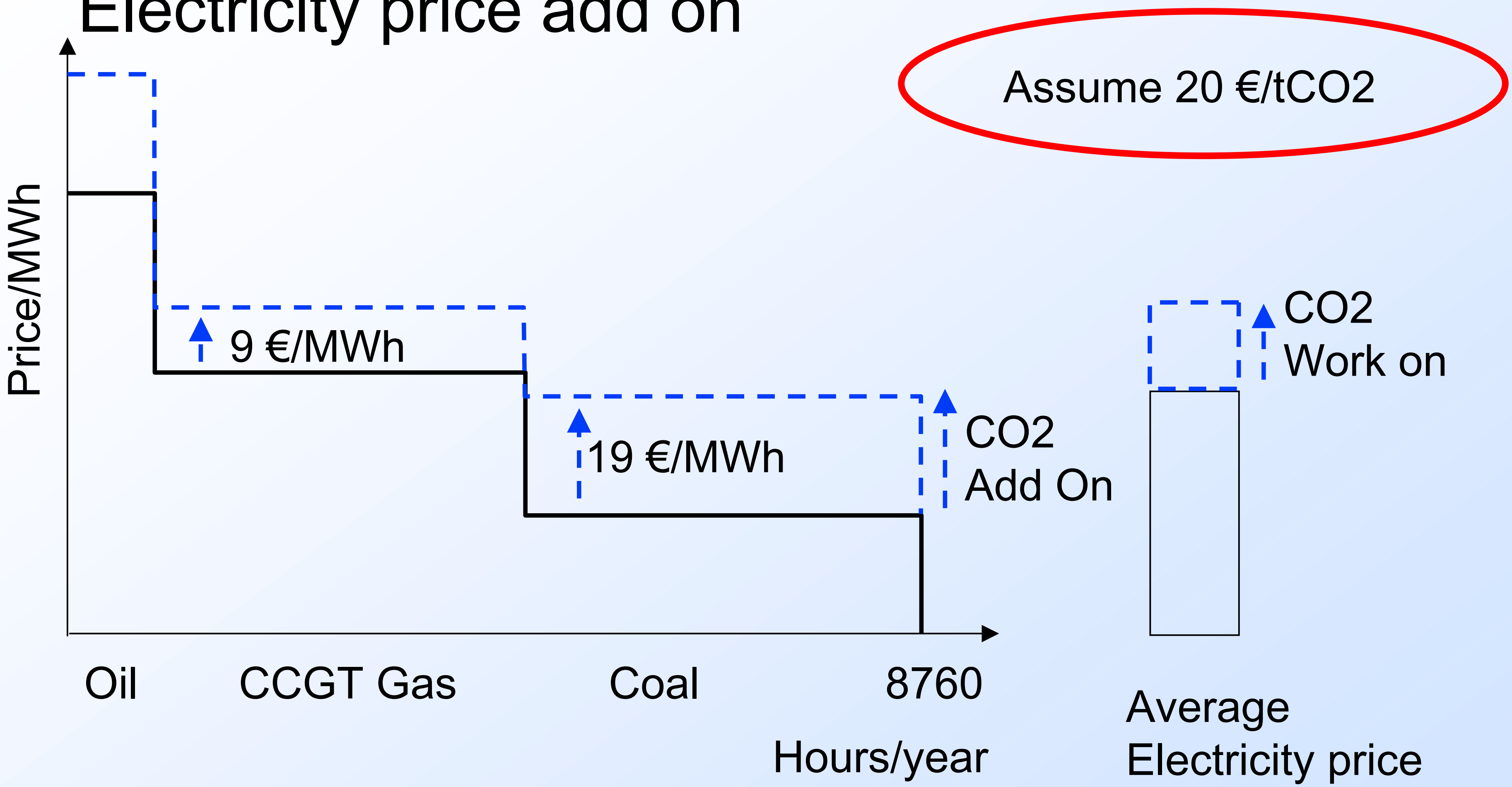
Regulate prices to avoid pass through

- EDF just signed public service contract and is committed to keep uniform electricity tariffs and not to raise electricity tariffs above inflation rates during the next five years. (25/10/2005)
- Belgium (regulatory threat), Spain (retail price regulation), Ireland (explicit regulation of CO_2 price pass through), Italy (regulatory threat??)
- Electricity prices most affected, where companies are in a more competitive environment· Nordic market, UK, Germany, Netherlands.
- Regulated prices undermine liberalisation and prospects for companies to follow incentives to implement CO_2 reductions
- To what extent does it help energy intensive industry?
  - Only energy intensive industry with international competition affected
  - Special contracts, as identified in Spain*
  - Political interference in market creates regulatory uncertainty

* Commission, Energy Sector Inquiry (2005)

Electricity price add on



- With fixed generation structure: work on = time averaged add on[1]
- Demand elasticity can reduce work on

1 See Keats and Neuhoff (2005) for discussion of changing merit order.

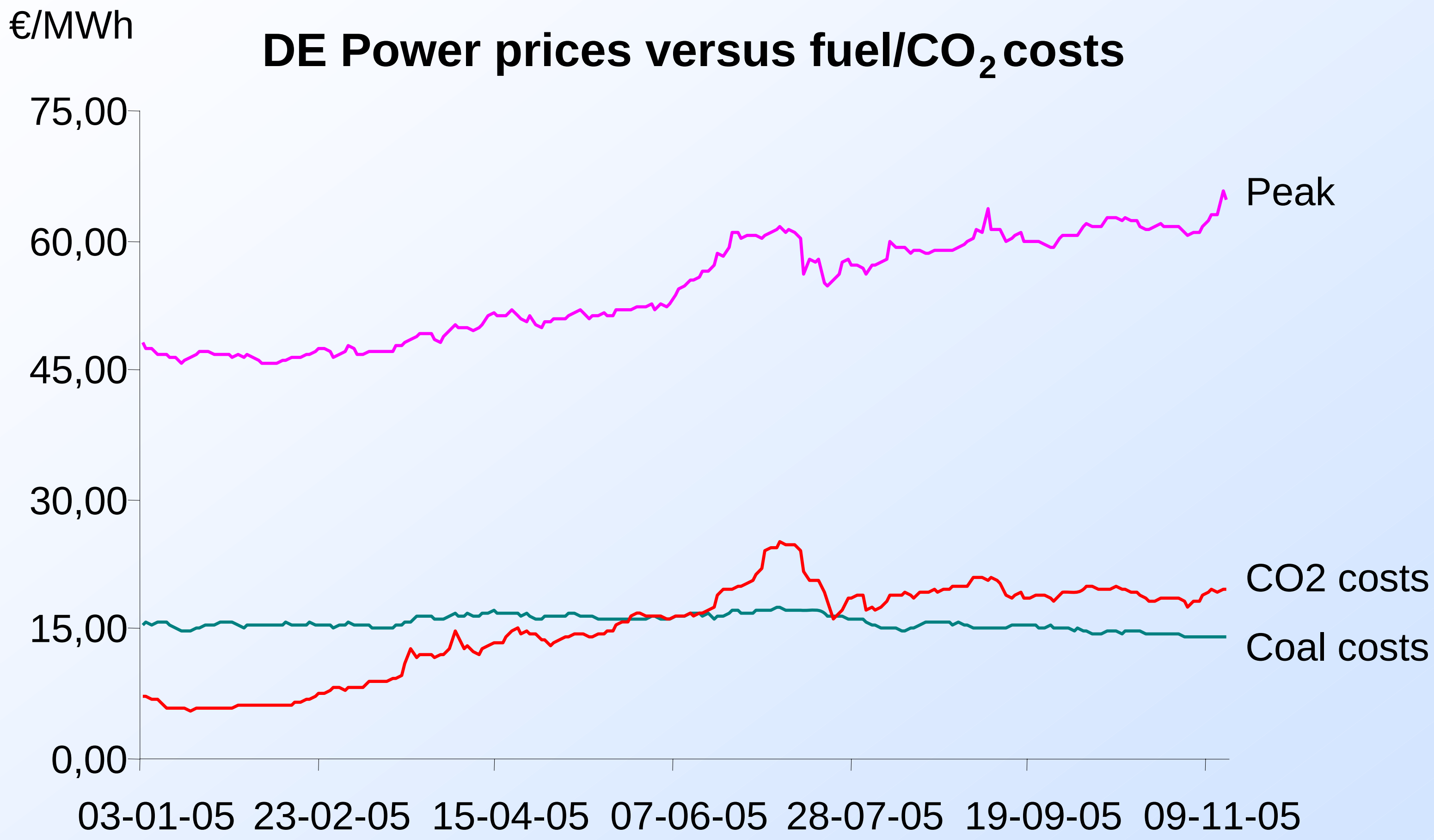
Work on rate in different systems

- 0.5 €/MWh / (€/tCO2) – for continental Europe (0-50 €/tCO2)[1]
- Our Simulation (impact of 20 €/tCO2) 2005-2007:

	Germany	Netherlands	England &Wales	Scotland
Euro/MWh	16.58	14.51	13.01	13.54

1 Reinaud (2005)

Evolution of Germany 2006 forward prices



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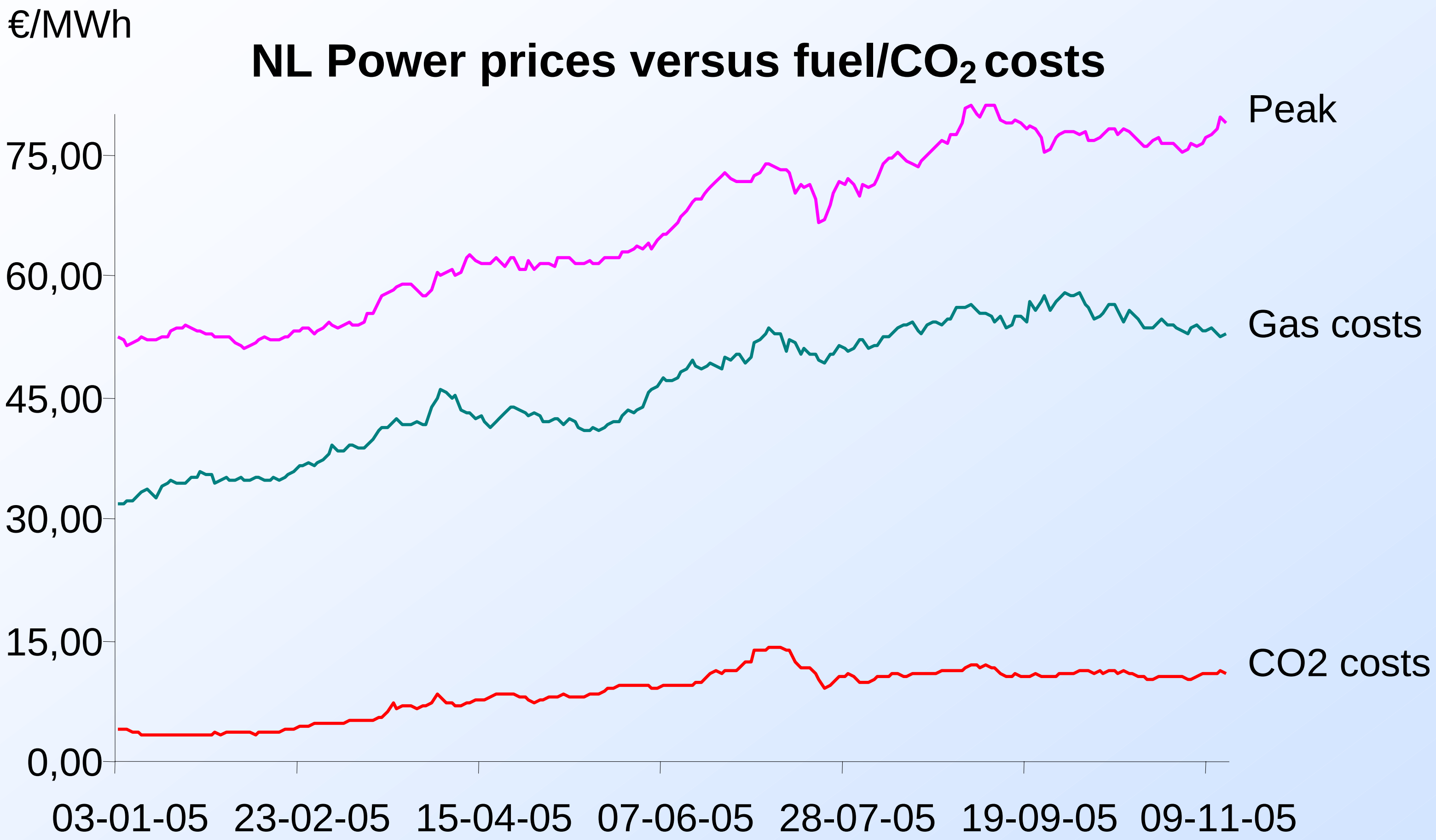
Evolution of Dutch 2006 forward prices



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Estimation of pass through rates

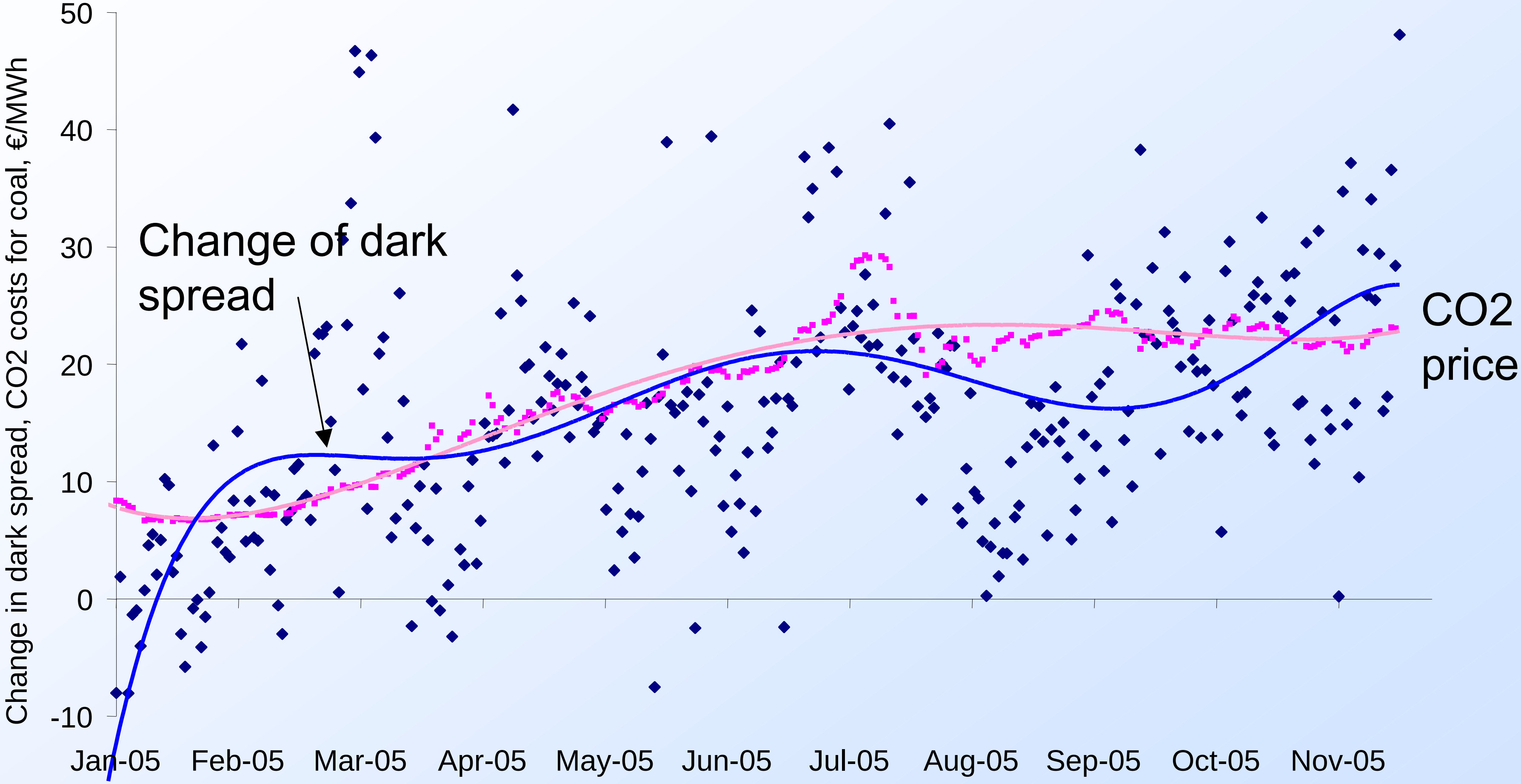
Comparison of estimated pass-through rates over various periods (PW, in %)

Country	Period	Fuel (efficiency)	Original (1 Jan – 1 Aug)	Update (1 Jan – 15 Nov	1st period (1 Jan – 1 July)	2nd period (1 July – 15 Nov)
Germany	Peak	Coal (40%)	69	73	69	91
	Off-peak	Coal (40%)	42	40	40	41
NL	Peak	Gas (42%)	44	64	46	57
	Off-peak	Coal (40%)	47	49	48	52

The existence of pass through was confirmed interviews with 5 Dutch power generators. (Sijm e.a. 2005)

The regression assumes constant pass-through rates. Initial treshholds (e.g. due to previous mark ups) or other non-linear behaviour is likely. This might explain that higher NL off peak pass through rate are estimated for the period Jan-Nov than for both Jan-July and July-Nov separately.

Add on = increase of dark spread 2004-2005



Linear approximation of the points gives an add on rate that increased from 83% to 93% over the period. It might even be suppressed by minimum run conditions implied by German NAP

EEX for electricity and CO_2 prices, we looked at daily prices at 3pm to eliminate ramping costs and scarcity prices and focus on marginal cost of coal plants, DTI for coal prices (assumed global market) 1£=1.46 €, 40% efficiency of plant..

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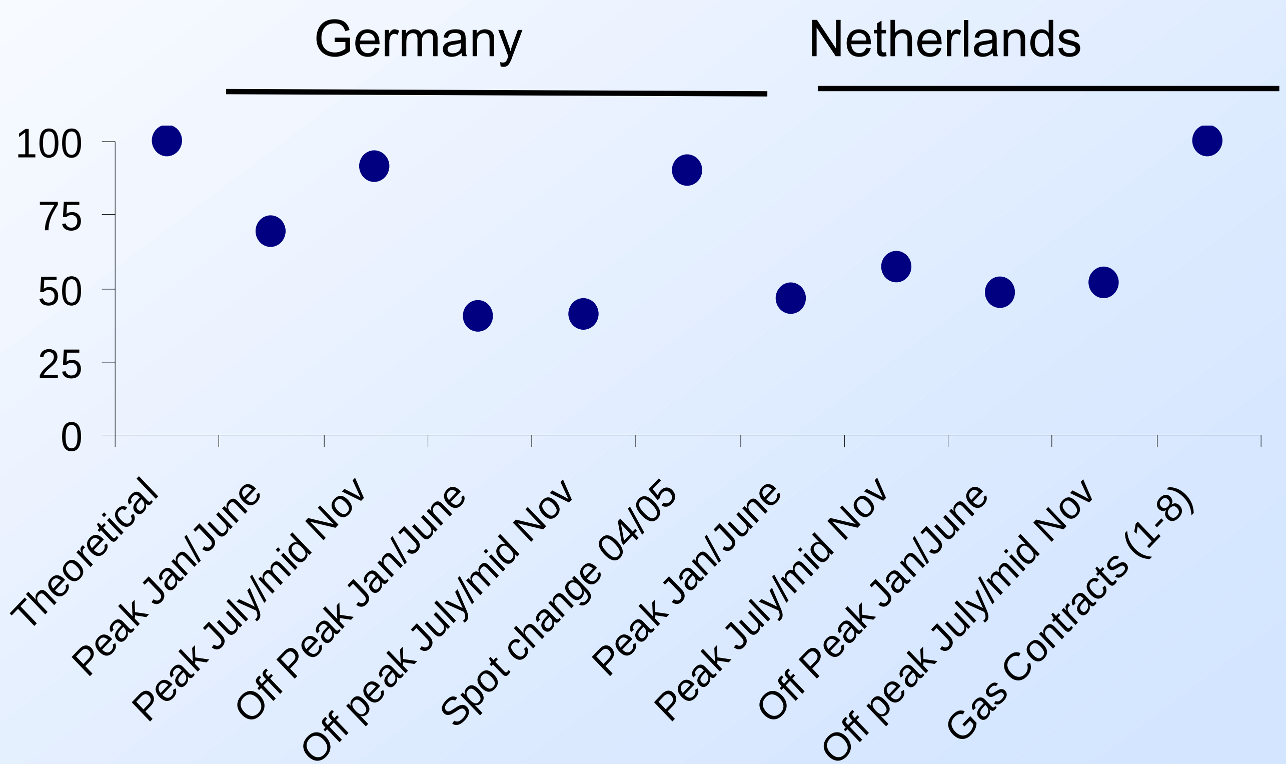
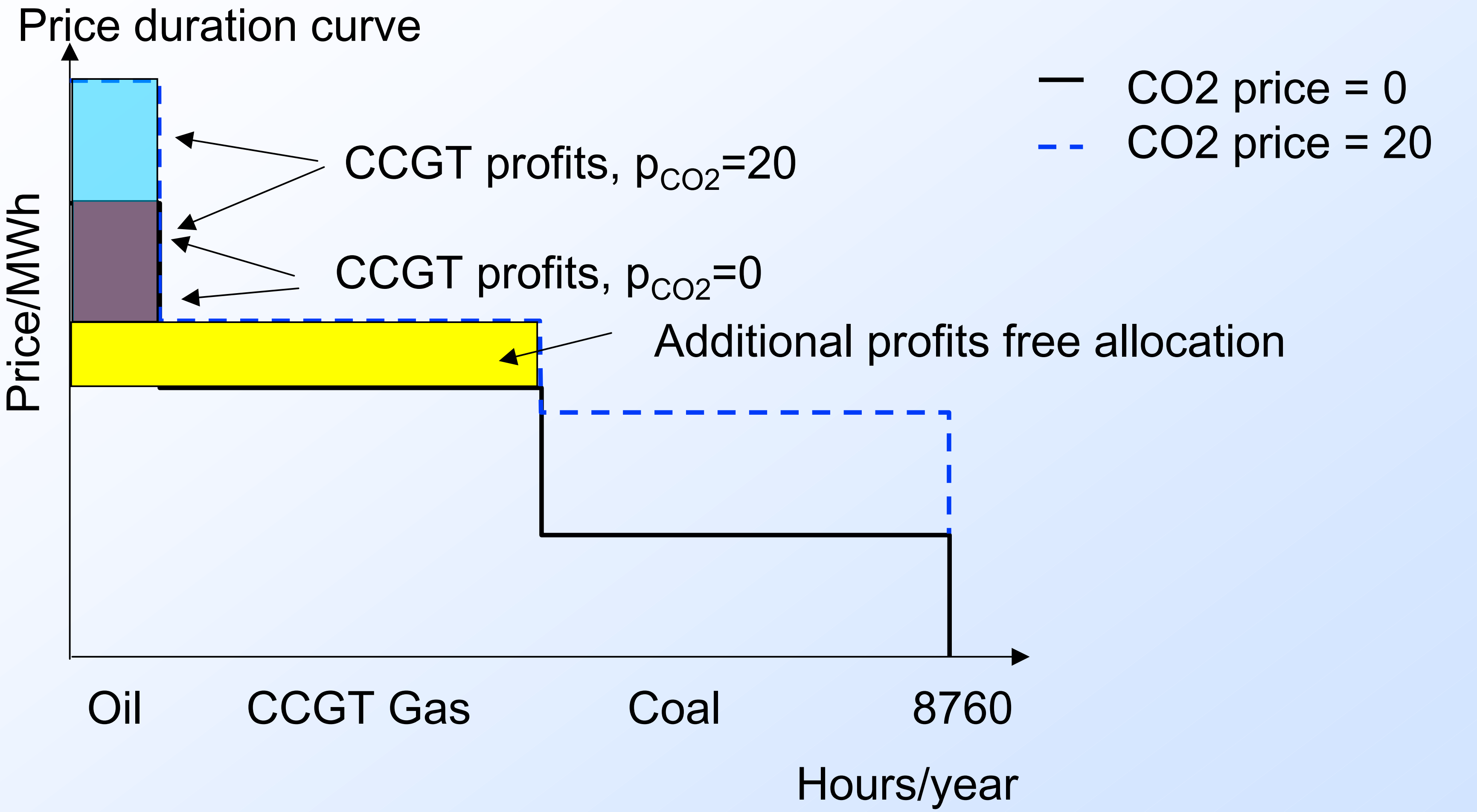
Empirical relevance – do we observe add on?

Cost pass through = $\frac{\text{Observed add on}}{\text{Competitive add on}}$



Impact on profitability CCGT



- If emissions below average of higher cost technologies
  - Profits increase even without free allocation
  - Additional benefits from free allocation

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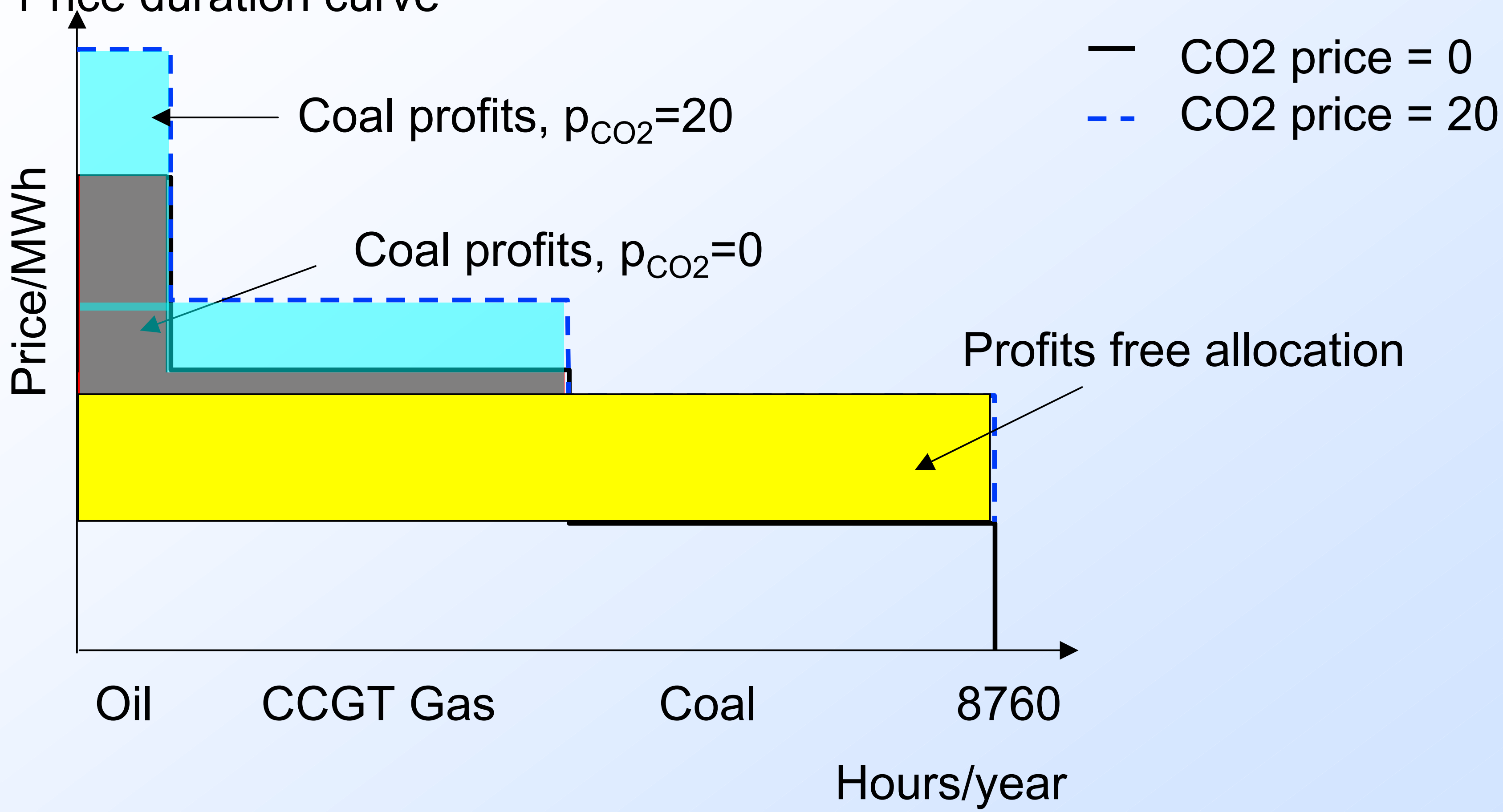
Impact on profitability coal plant

Price duration curve



- If emissions above average of higher cost technologies
  - Profits decrease without free allocation
- More than compensated by free allocation

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Oligopoly pricing

- Frequently argued that oligopolies can pass through less opportunity costs
- Confirmed with models assuming linear demand
- If we assume constant elasticity of demand opposite is true.[1]

1 Neuhoff et.al. (2005)

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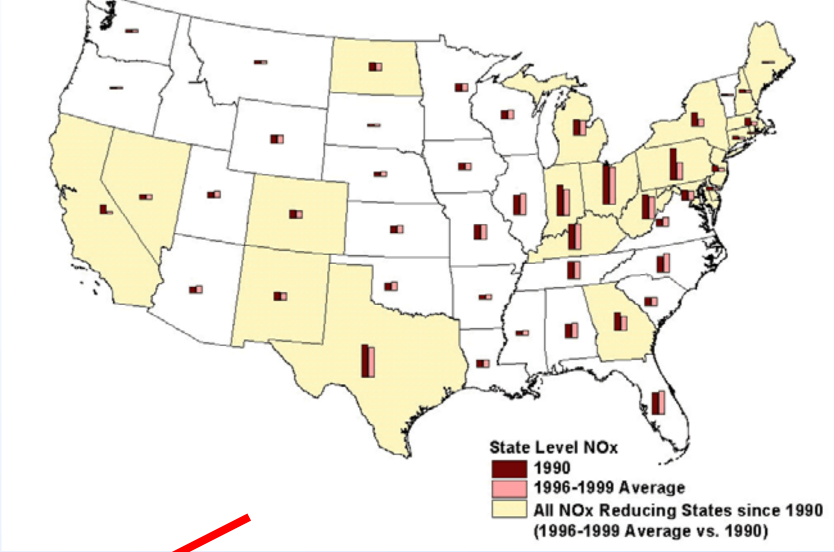
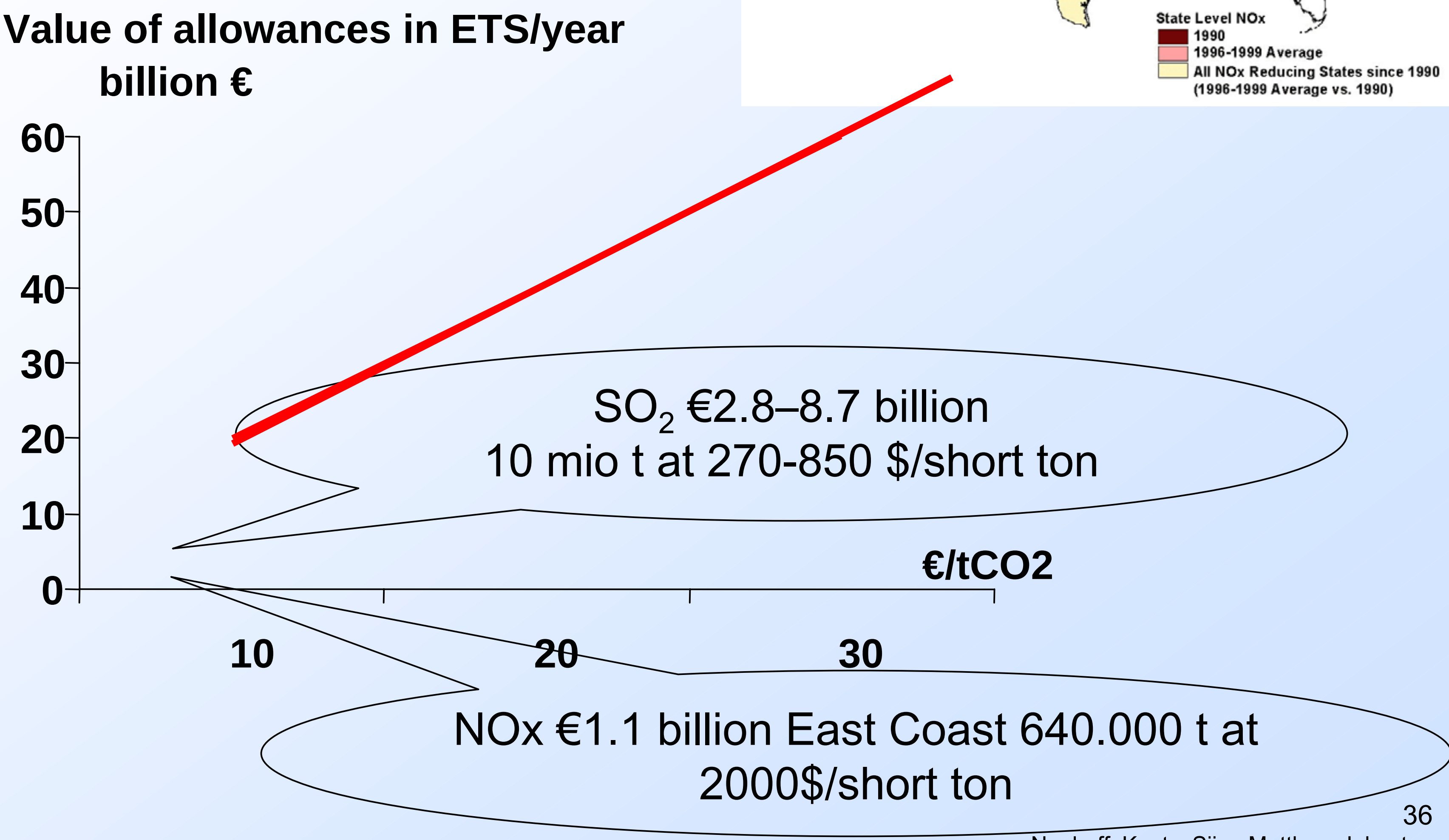
Definition Perfect Grandfathering

- One off allocation based on fixed historic reference period usually for long time frame
- New entrants don't receive allowances
- Allowance allocation independent from operation
- Retain allowances at closure
- Motivation:
  - Get industrial support to participate in scheme
  - Compensate for costs of regulation
- Successful implementation in US SO_2 and NOx programs[2]
- Creates appropriate price signals[1]
- Political concerns between growing and declining sectors
  - (easier if it would only be one sector)
- Same efficiency but different rent allocation than auction

1 Harrison, Radov (2002), 2 Reinaud (2003) free allocation acts as transfer of rents from government/taxpayer to producer.

Value of ETS allowances bigger than in US cap and trade programs





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EU citizens more likely to object to free allocation

- EU has lower private ownership and equity ownership than US*

Country/Region	Population with more than 50kE private ownership excluding property	Equity ownership
USA	50%	60%
West Europe	15%	18%

- Therefore people perceive to benefit less from free allocation
  - Perception matters – reality might be pension fund ownership
  - To what extend are different utilities publicly owned?
- As windfall profits start to materialise
- Companies anticipate regulatory intervention
  - Change in future allocation
  - Windfall profit tax
- To prevent such intervention they might reduce the wholesale prices
  - Discriminates against new entrant
  - Can result in inefficient operation/investment choice

* Survey commissioned by Wall Street Europe, GfK Custom Research Worldwide, Sep/Oct 2004, 14383 people in 18 countries

Does industry expect windfall profit taxes?

"Standard & Poor's considers that generators operating in the U.K., Nordic Countries, Germany and Italy will continue to generate windfall profits in the first-phase of the EU ETS (2005-2007), with higher emissions prices translating into higher windfall profits in most cases. In the second phase (2008-2012), utility companies may see some reduction in free allowance allocation because of concerns related to windfall profits. A windfall profit tax remains an option, and could come into force should political pressure continue to grow."

Infrastructure Finance Ratings Climate Change Credit Survey, A Study Of Emissions Trading, Nuclear Power, And Renewable Energy, Commentary article Greenhouse Gas Regulation Creates Upward Pricing Pressure And Windfall Profits For European Utilities, Publication date Oct 7, 2005, Primary Credit Analyst Tobias Hsieh, New York; Secondary Credit Analyst Peter Kernan, London.

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Contingent allocation

- Policy uncertainty about future climate targets
  - Allocation limited to 5 year periods
- Equity concerns restrict allocation to existing units
- Use the asset or lose allocation: most NAPs stop allocation as soon as plant shut down
  - Return all unused allowances (Pl)
  - Retain half of remaining annual allowances (It)
  - Retain remaining annual allowances (D, UK)
  - Receive allowances for rest of period (NL, Se)

Source: Burtraw et.al.

Impacts of contingent allocation

- Old power plants stay on system to receive allowances[1]
- Reduces scarcity of generation capacity and power price
- Reduces investment in new/efficient plant
  a) Higher variable cost of operation
  b) Increases CO_2 price -> inc. cost
- Net effect? -> numerical simulation

1 Harrison, Radov 2002,

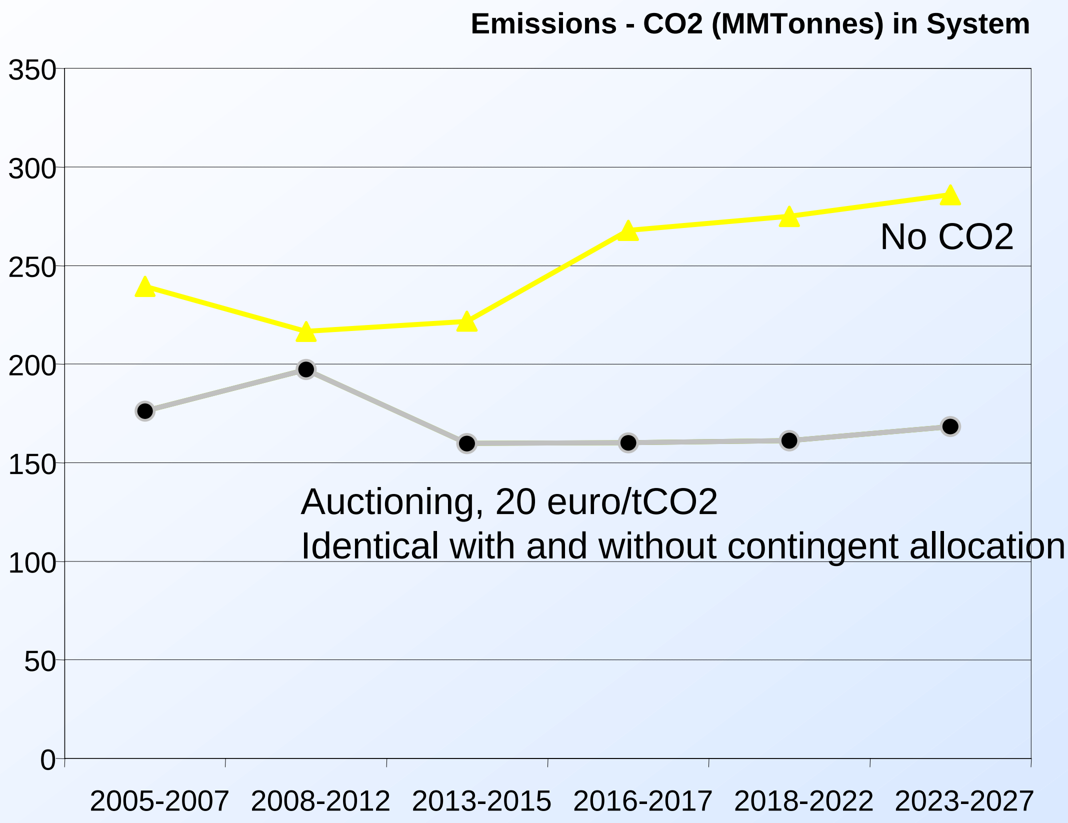
Numerical simulation – contingent allocation to existing units only (GB)

Contingent allocation (tCO2/MWyr) by period

Prime Mover	**2005-07**	**2008-12**	**20013-17**	**2018-22**	**2023-27**	**2028-2032**
Combined Cycle	1,893	1,515	1,136	757	379	0
Combustion Turbine	473	379	284	189	95	0
Hydro	0	0	0	0	0	0
Internal Combustion	947	757	568	379	189	0
Nuclear	0	0	0	0	0	0
Renewable	0	0	0	0	0	0
Scrubbed Coal	2,840	2,272	1,704	1,136	568	0
Scrubbed Steam Turbine	1,420	1,136	852	568	284	0
Unscrubbed Coal	2,840	2,272	1,704	1,136	568	0
Unscrubbed Steam Turbine	1,420	1,136	852	568	284	0

~144 million tCO2 per year in 2005-2007

Numerical simulation – contingent allocation to existing units only – GB only



- No noticeable impact on CO_2 emissions of prices from contingent allocation -> depends on fuel/CO_2 prices?
- Windfall gains accrue to incumbents

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Contingent allocation vs. perfect grandfathering

CO_2 price	Inflated if new tech. delayed
Fuel Choice and consumption	Delayed invest could delay fuel shift, lower electricity prices could increase consumption
Technology choice and investment	Delays investment in new (efficient) generation
Minimising costs for consumers	Old power stations might reduce scarcity value and prices
Fairness among generators	Perceived to be fair
Fairness among member states	√

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Structure

Uniform benchmarking using moving base line

- Allocation to existing facilities based on[1]:
  - Production in recent reference period
  - Multiplied with emission factor that is uniform in country
- As before, contingent on existence of facility
- Additional effect from moving base line
  - Increased production today
  - Increases allocation in future period
  - Reduces today's marginal generation costs (reason discounted effect of updating)

1 Commission suggested further investigation before EU-wide application in second phase (EU commission, 2006).

Individualistic national perspective

- Moving base line reduces marginal generation costs[3]
  - By equal margin for all technologies
- Effect on operation:
  - Reduces electricity prices (lower opportunity costs)[1,2,3,4]
  - If demand elastic, increases elec. consumption

  -> higher national CO_2 emissions
- Effect on investment:
  - Moving base line reduces marginal costs of existing generation
  - This reduces new entrant revenue proportional to operation h/year
  - This biases investment towards high variable cost technologies
  - AND delays investment
  - Thus resulting in higher scarcity value of electricity (electricity prices)

-> Net effect on electricity price and CO_2 emissions unclear

1 Ahman, Zetterberg (2003), 2 Harrison, Radov (2002), 3 Reinaud (2005), 4 Burtraw, Palmer, Bharvirkar, Paul (2002) argue that this effect could compensate the value of free allocation

Harmonised national perspective

- We assume fixed CO_2 budget for Europe
- Threat to budget violation pushes up CO_2 prices

- Lower electricity prices would increase demand and production
  - CO_2 prices rise until emissions constraint satisfied by:

    A) Demand reduction induced by increased marginal cost[2]

    B) Shift towards lower emitting generation technologies[1]

    C) Imports of allowances via JI, CDM

    D) Additional AU s bought by governments from Russia, Ukraine

-> Possible reduction of electricity price through moving base line.

In Phase II mainly via A) as B) excluded by high gas prices, C small effect and D politically difficult.

-> Inflated CO_2 price faced by other sectors distorts their abatement decision.

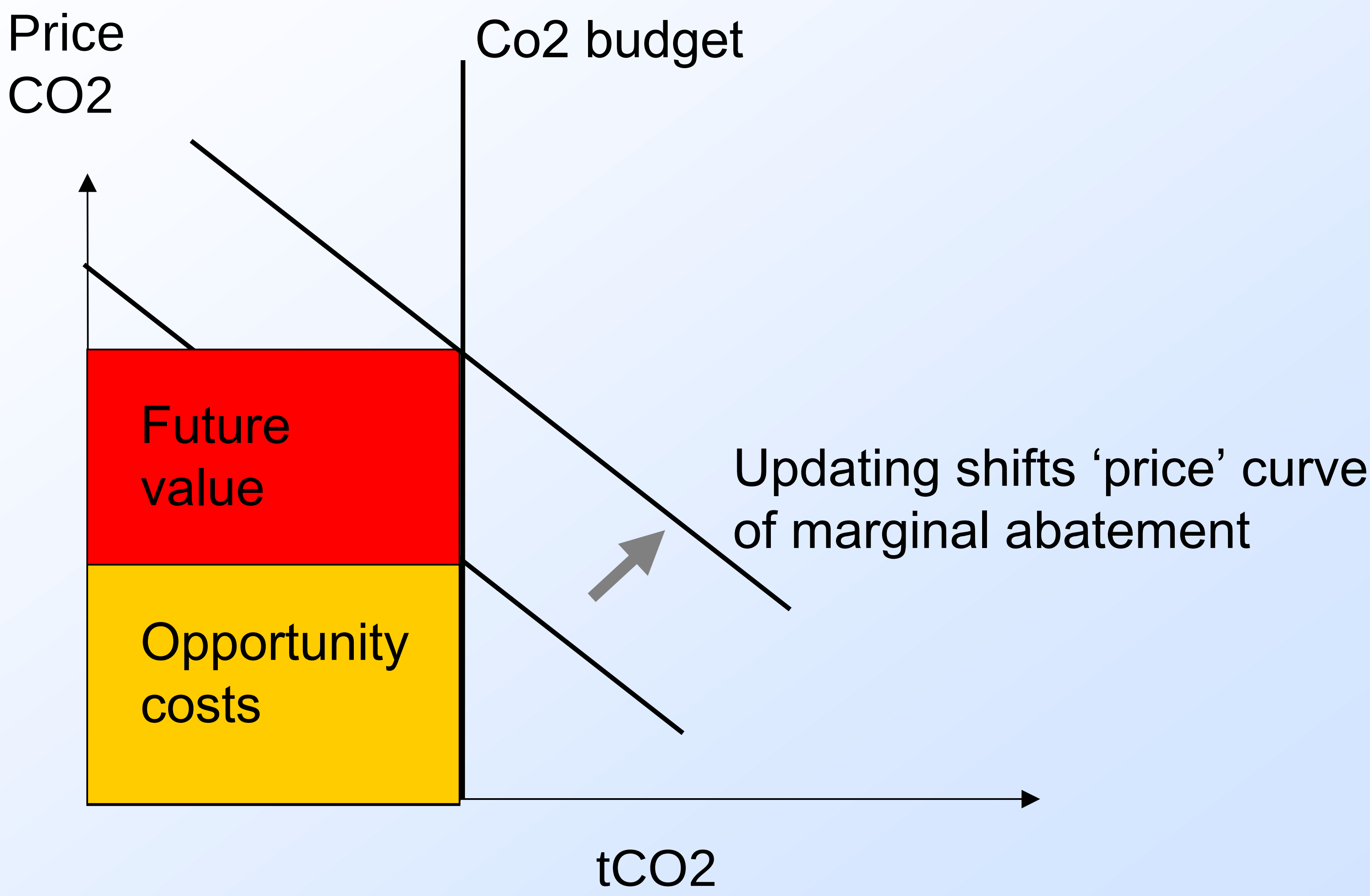
1 Harrison,Radov, 2002, argue that the same emission reductions could be achieved at lower costs by consumption reduction
2 Boeringer and Lange (2005)

Heterogeneous European perspective

- Companies facing benchmarking with moving base line (home)
  - Have lower marginal costs
- Effect on operation:
  - Electricity prices reduced at home, increase elec. demand
  - This increases CO_2 production at home
  - This pushes up CO_2 price and marginal elec. costs in EU
  - This reduces electricity demand in EU
  - Net impact
    - CO_2 price increase
    - At home lower elec. prices, in rest EU higher elec. prices[1]
    - Sufficient transmission capacity would equalises prices
    - Inefficient production choice increases social costs

1 Harrison, Radov (2002) indicate competitiveness issues created by updating.

Illustration of distortions from updating



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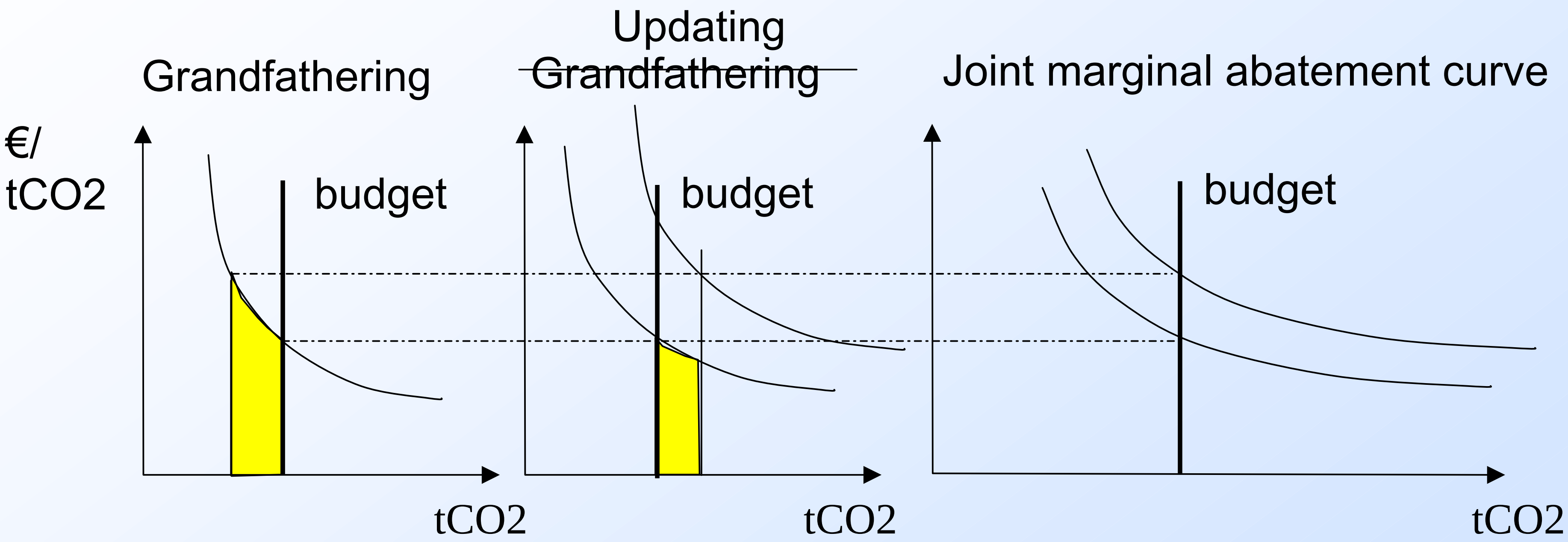
What happens if only one country updates?

Marginal abatement curves for two identical countries…



Extra abatement costs > Avoided abatement costs

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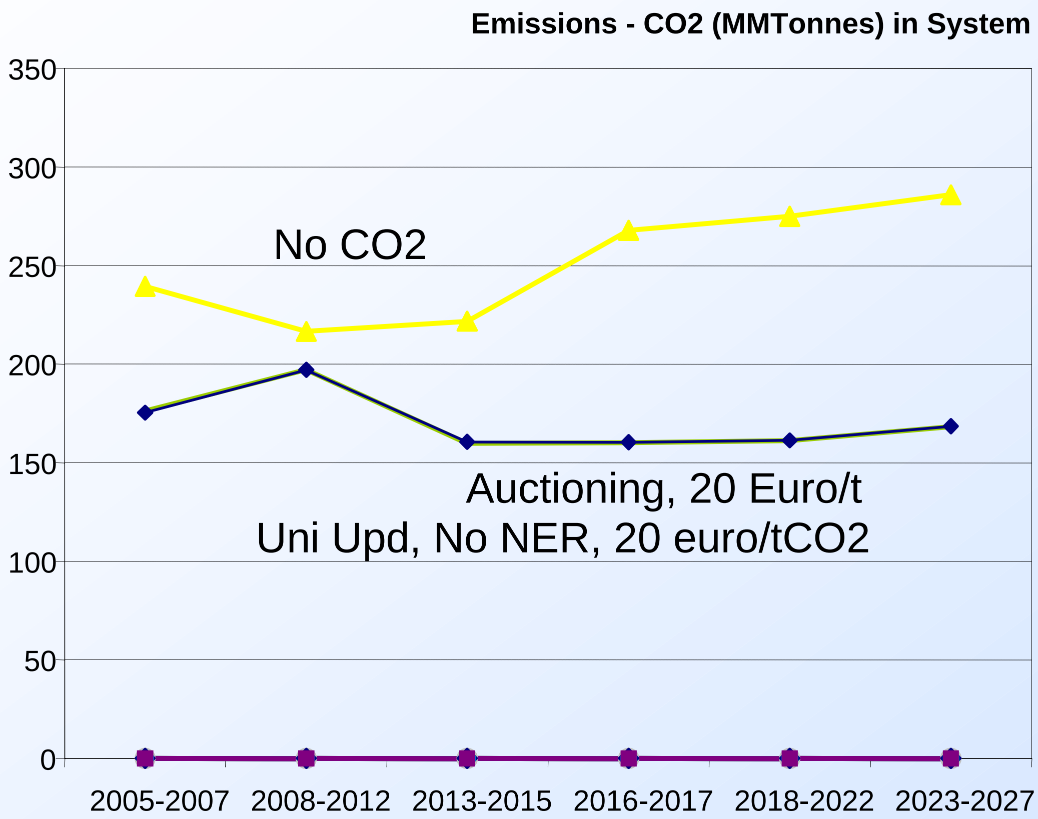
Numerical simulation - uniform benchmarking with moving baseline

*Updating emission earnings rates (per MWh) ** ***applies to new as well as existing units***

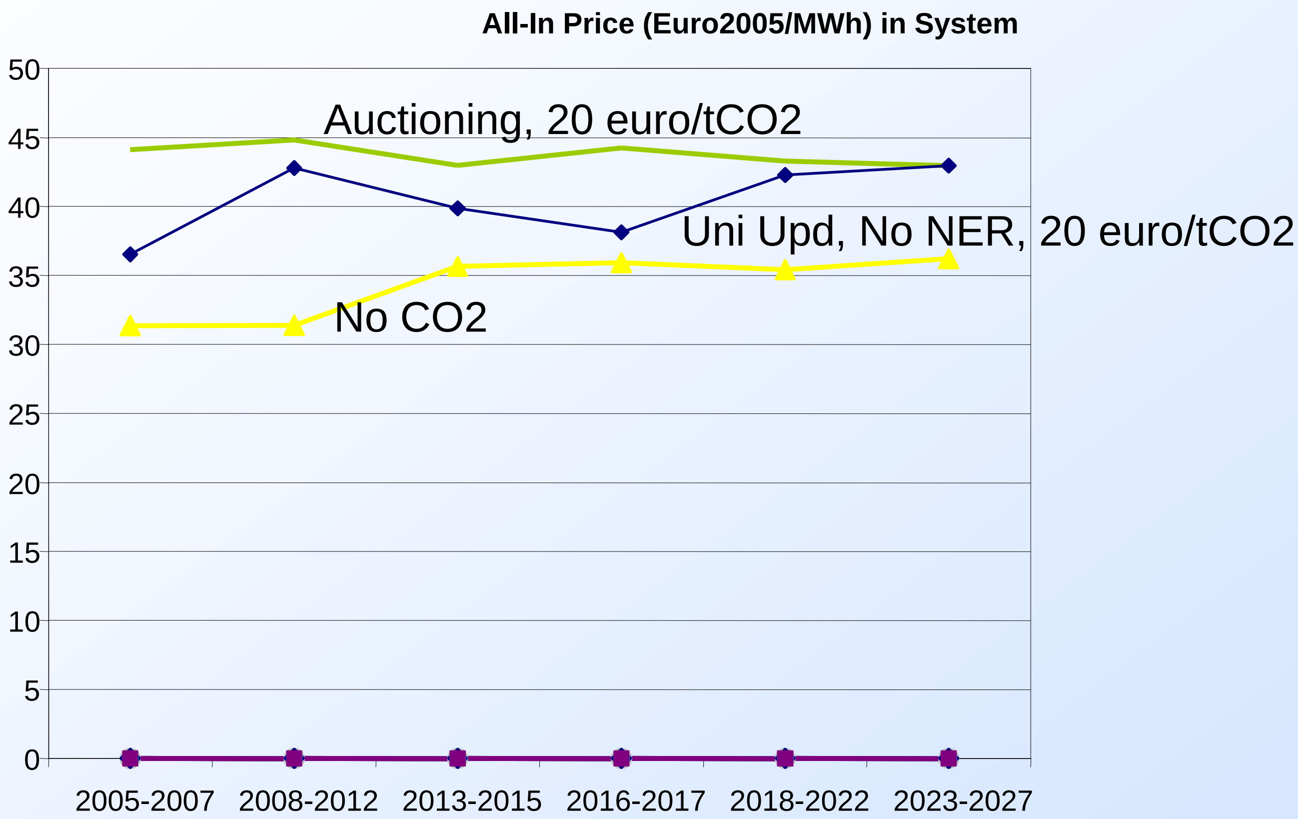
Compliance date	Allowances earned ($tCO2_t/MWh_{t-1}$)
2005-2007	0.350
2008-2012	0.280
2013-2017	0.210
2018-2022	0.140
2023-2027	0.070
2028-2032	0.000

Numerical simulation - uniform benchmarking with moving baseline - GB only



- Uniform updating resulted in very small increase in CO_2 emissions when compared to auctioning case

Numerical simulation - uniform benchmarking with moving baseline - GB only



- Same cannot be said about the impact on price of electricity

Neuhoff, Keats, Sijm, Matthes, Johnston

Uniform benchmarking with moving base line vs. perfect grandfathering

CO_2 price	Inflated - if elec. demand elastic
Fuel Choice and consumption	Might delay fuel shift
Technology choice and investment	Delays investment in new (efficient) generation
Minimising costs for consumers	With elastic electricity demand equal to free allocation, otherwise cost reductions for consumers
Fairness among generators	High emitters want more allowances
Fairness among member states	If applied heterogeneously, inefficient and unequal allocation of abatement between member states

Structure

- Executive summary
- Key drivers for CO2 price
- Pass through to electricity price
- Effect of allocation to existing facilities
  - Perfect grandfathering
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Fuel specific benchmarking using moving base line

- Similar to Uniform benchmarking
- But different allocation rates for different fuels
- Coal receives more future allowances
- Therefore coal marginal costs are reduced more than of gas, renewables and nuclear

Individualistic national perspective

- Effects of uniform benchmarking, in addition:
- Operational impact:
  - Shift towards operation of coal (or fossil fuel)
  - Increases CO_2 emissions[1]
- Investment impact
  - Stronger incentives for coal might delay retirement
  - Results in higher CO_2 emissions

1 Zetterberg, IVR 2004

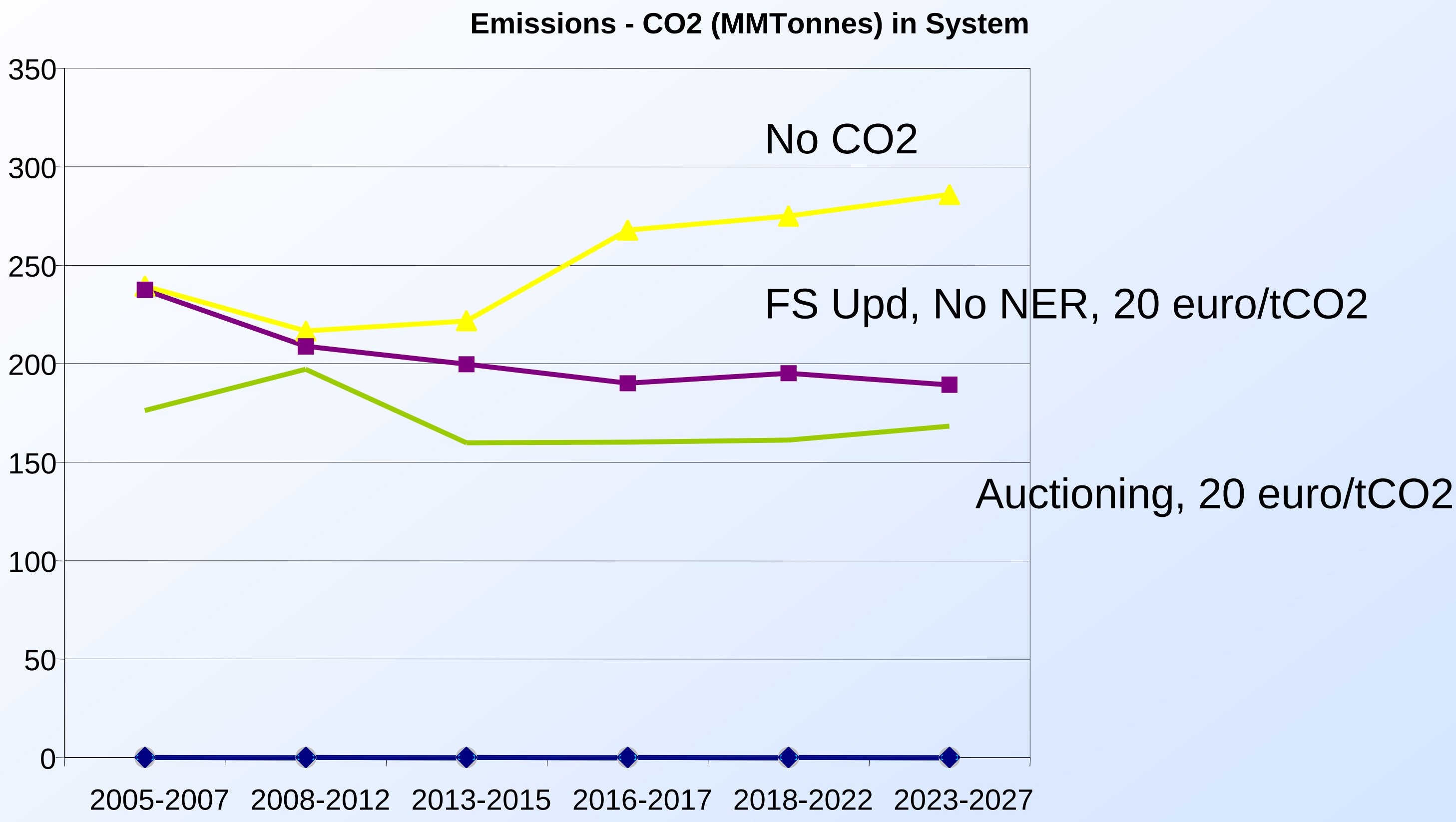
Numerical simulation – fuel specific benchmarking with moving baseline

*Updating emission earnings rates (per MWh) ** ***applies to new as well as existing units***

Compliance date	Techn	Allowances earned ($tCO2_t/MWh_{t-1}$)
2005-2007	CCGT & CT only	0.350
2008-2012	CCGT & CT only	0.280
2013-2017	CCGT & CT only	0.210
2018-2022	CCGT & CT only	0.140
2023-2027	CCGT & CT only	0.070
2028-2032	CCGT & CT only	0.000
2005-2007	Other CO2 emitting	0.750
2008-2012	Other CO2 emitting	0.600
2013-2017	Other CO2 emitting	0.450
2018-2022	Other CO2 emitting	0.300
2023-2027	Other CO2 emitting	0.150
2028-2032	Other CO2 emitting	0.000

Neuhoff, Keats, Sijm, Matthes, Johnston

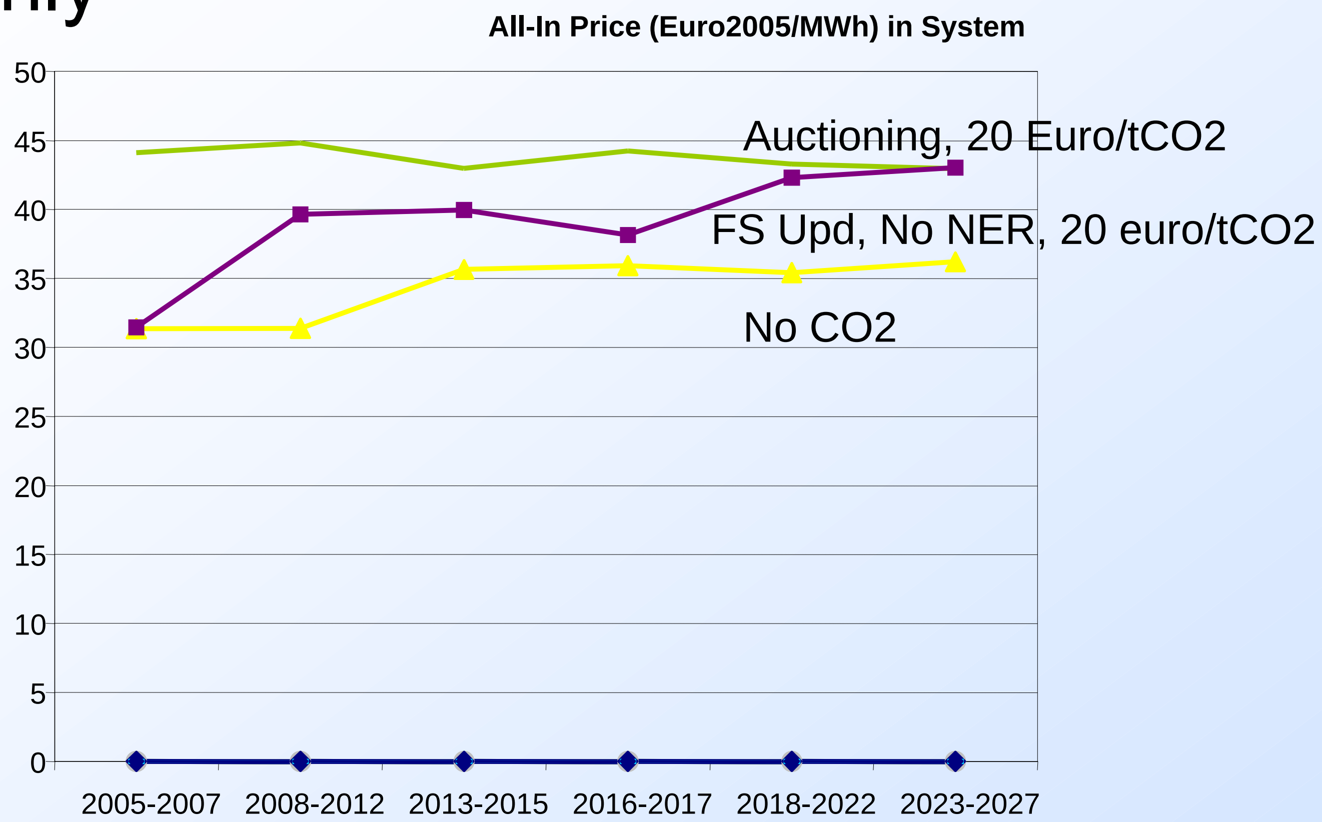
Numerical simulation – fuel specific benchmarking with moving baseline- GB only



- Uniform updating resulted in significant increase in CO_2 emissions when compared to auctioning case

Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – fuel specific benchmarking with moving baseline - GB only

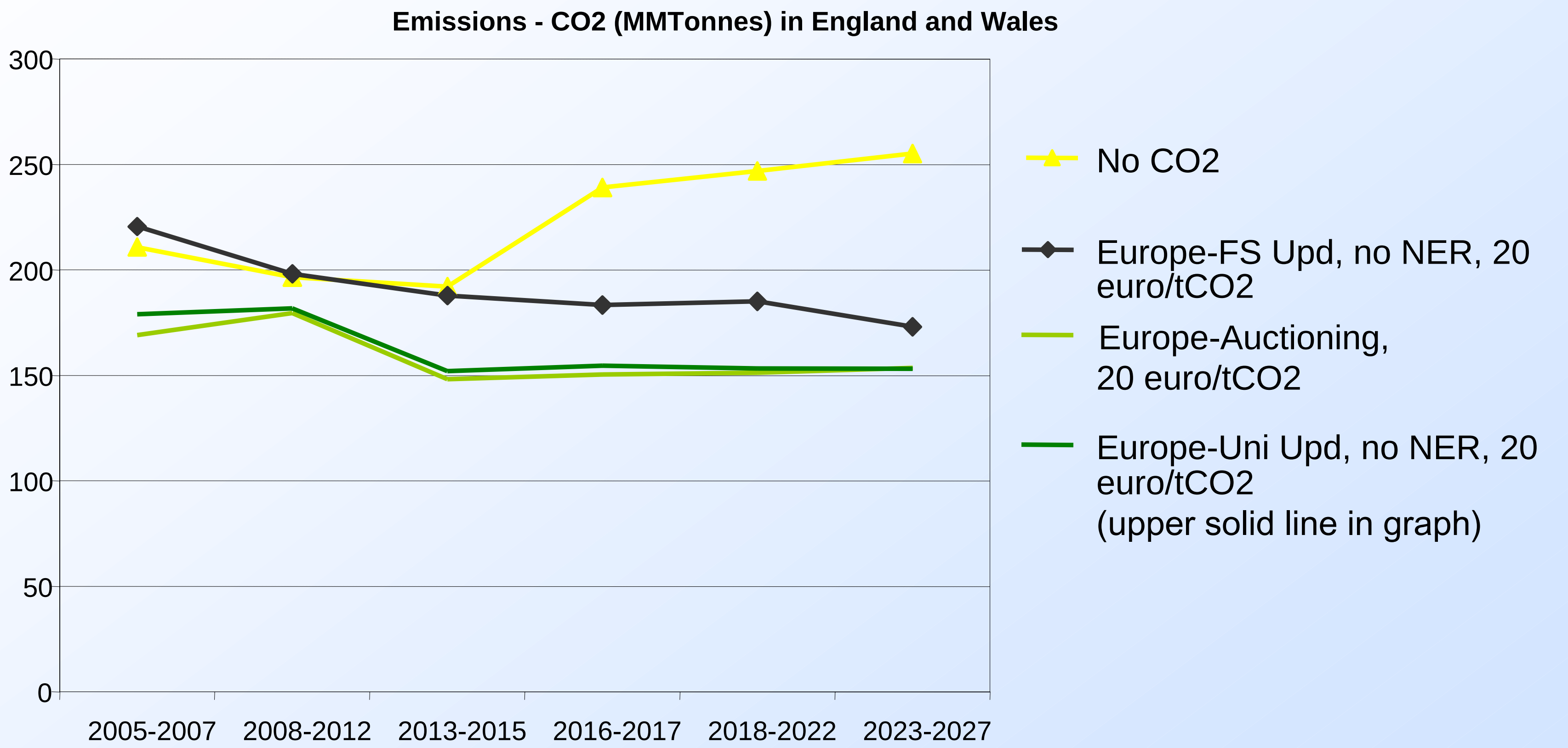


- Dampening impact on price of electricity is greater than in uniform updating case

Harmonised national perspective

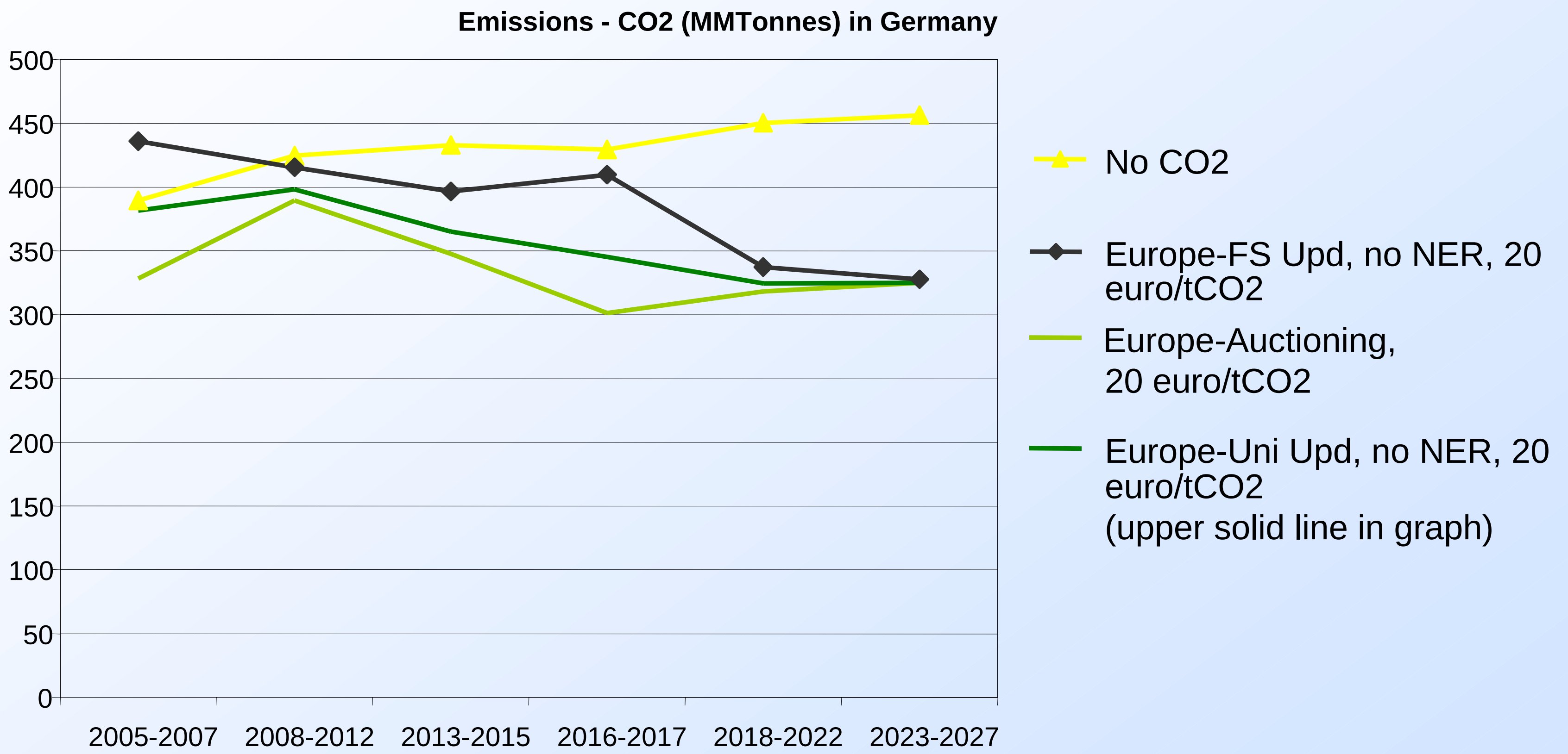
- More incentives for coal production -> higher inflation of CO_2 price than under uniform benchmarking
- Consumer prices higher than in auction case
- Social costs are higher than in auction case

Numerical simulation, uniform and fuel specific benchmarking with moving baseline, England&Wales

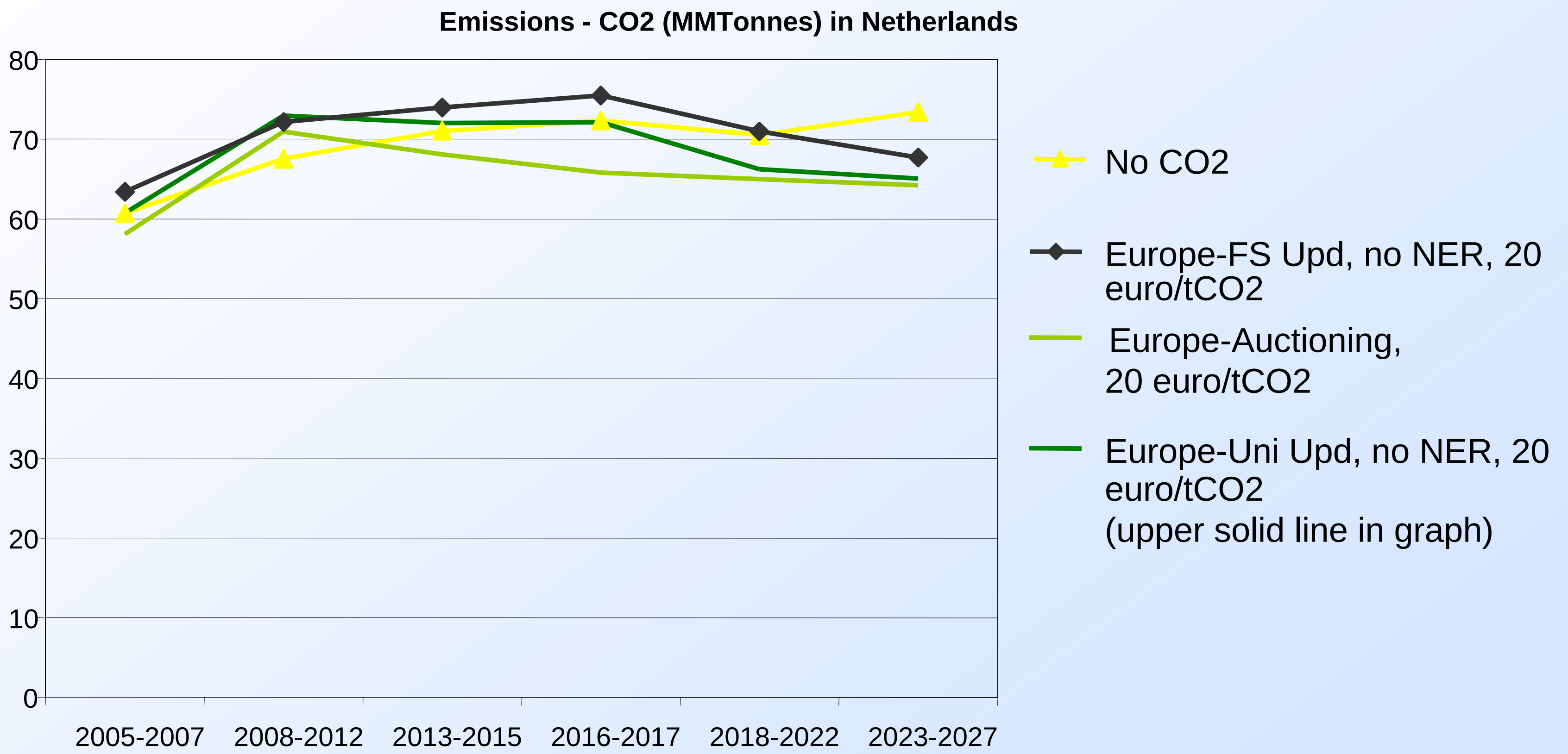


Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – uniform and fuel specific benchmarking with moving baseline - DE

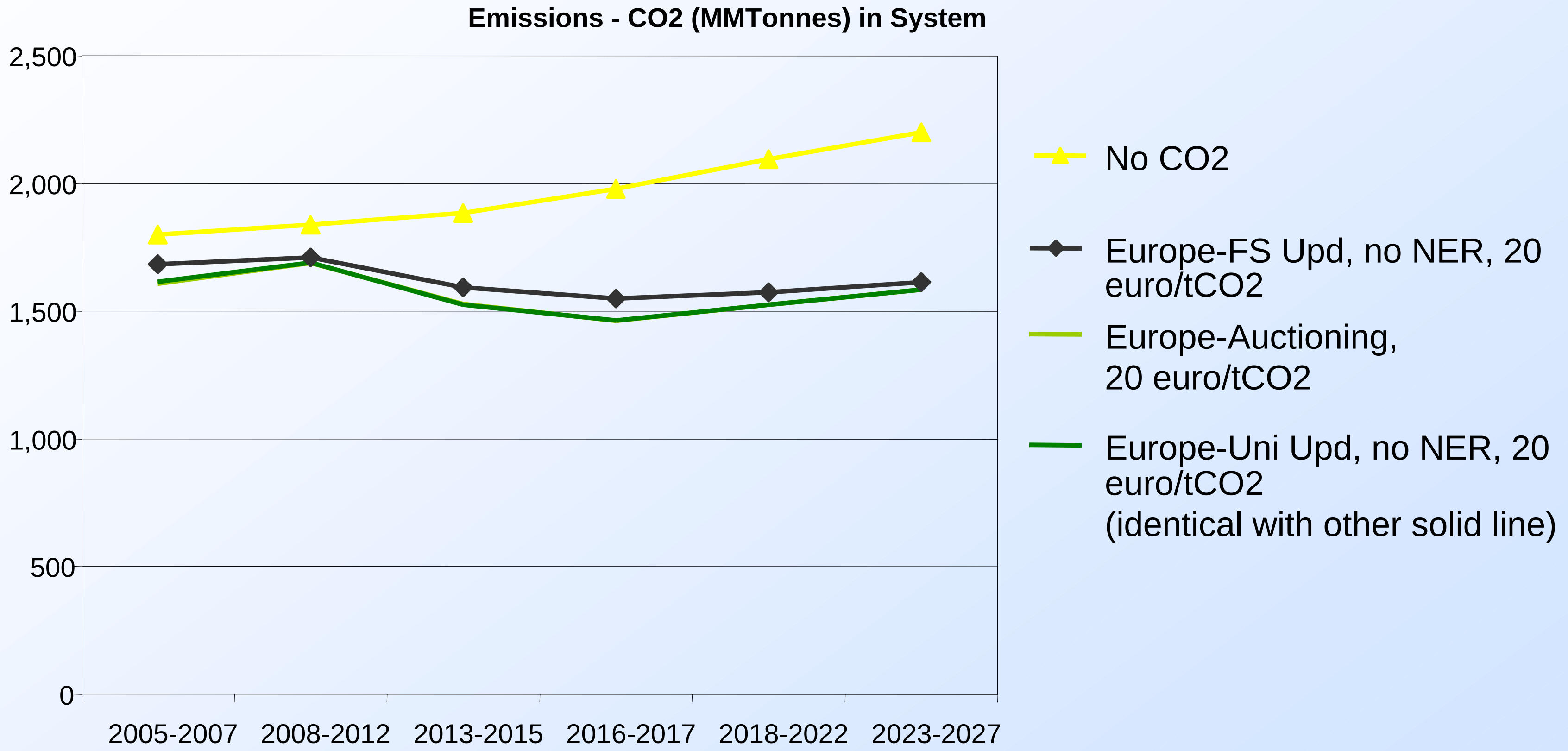


Numerical simulation – uniform and fuel specific benchmarking with moving baseline - NL



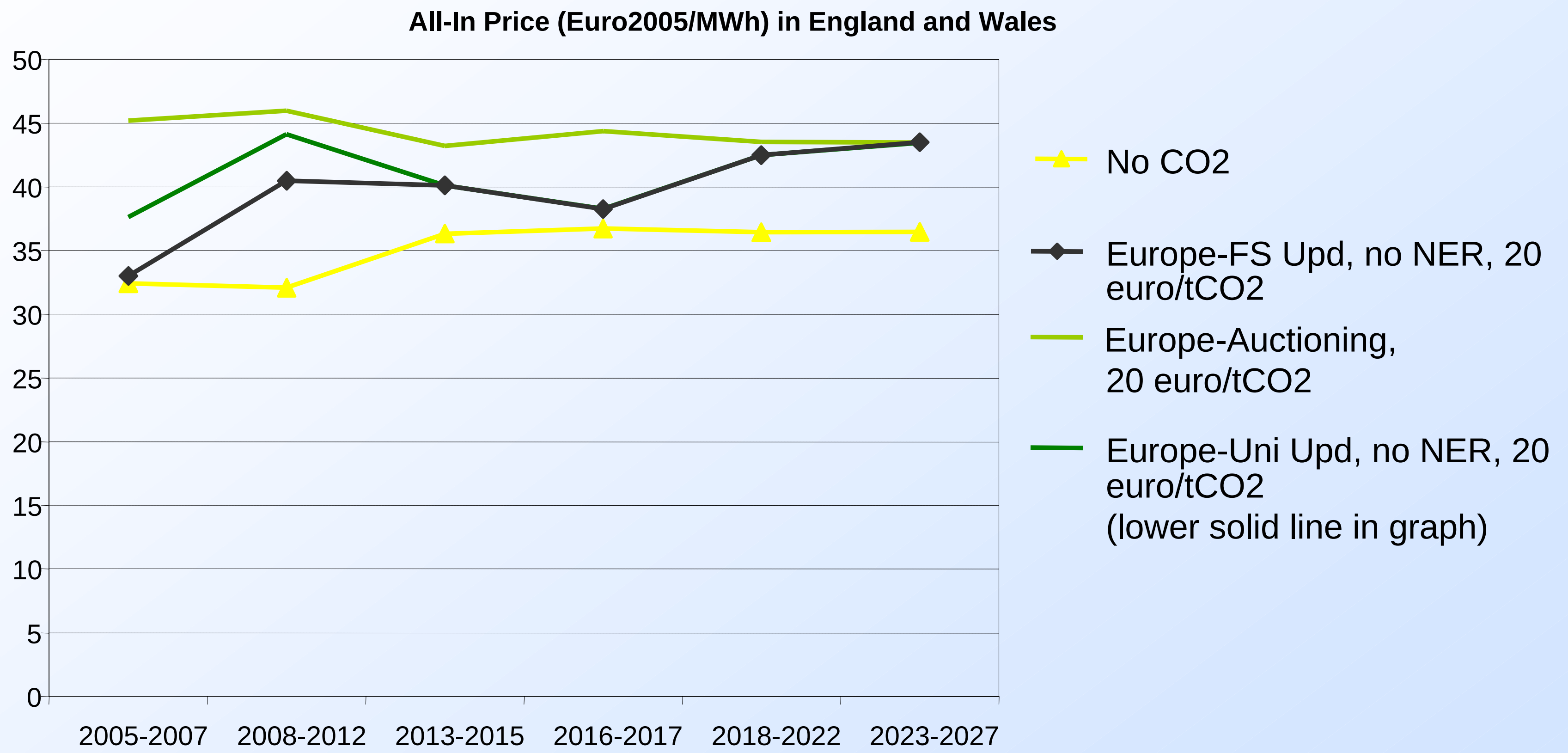
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – uniform and fuel specific benchmarking with moving baseline - Europe



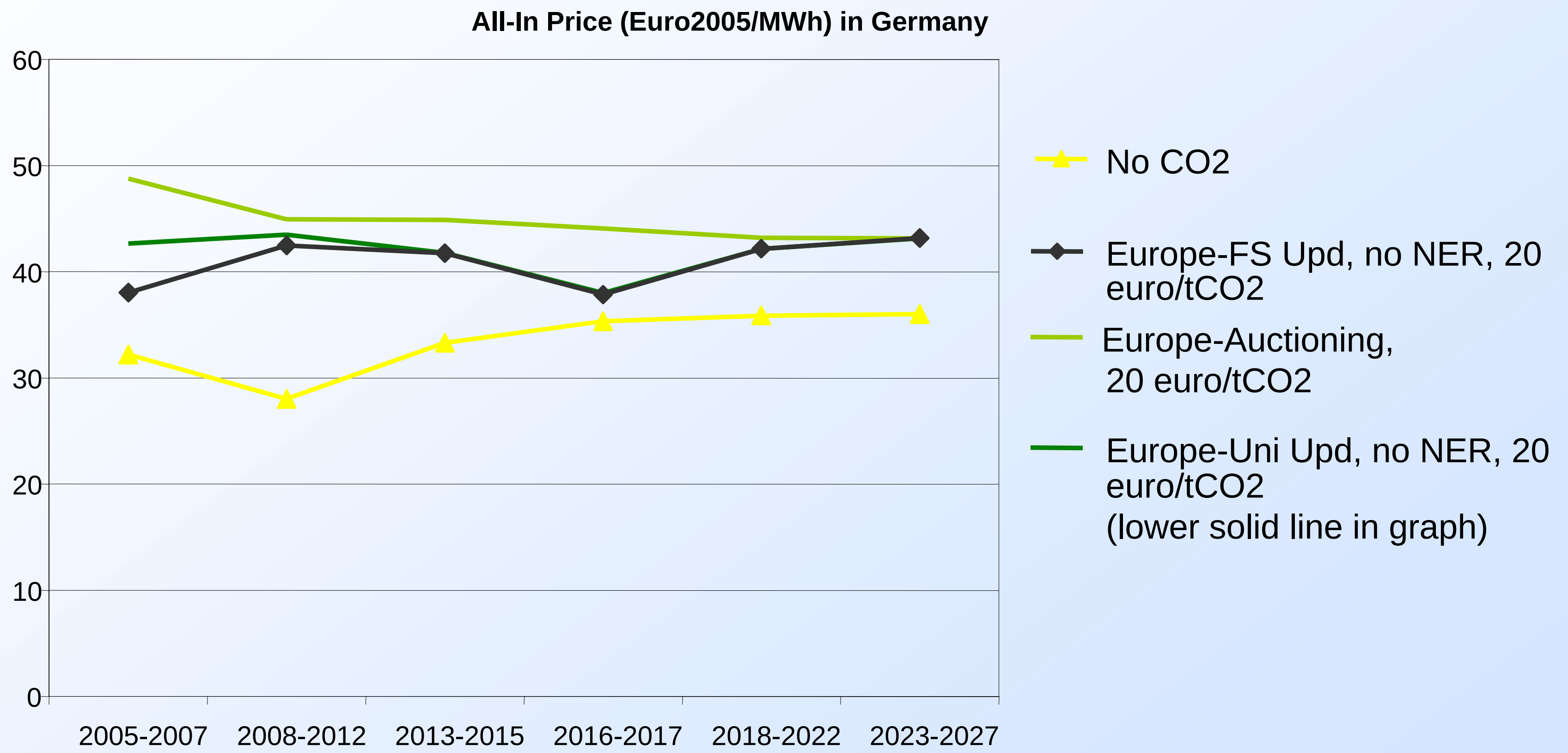
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – uniform and fuel specific benchmarking with moving baseline - GB



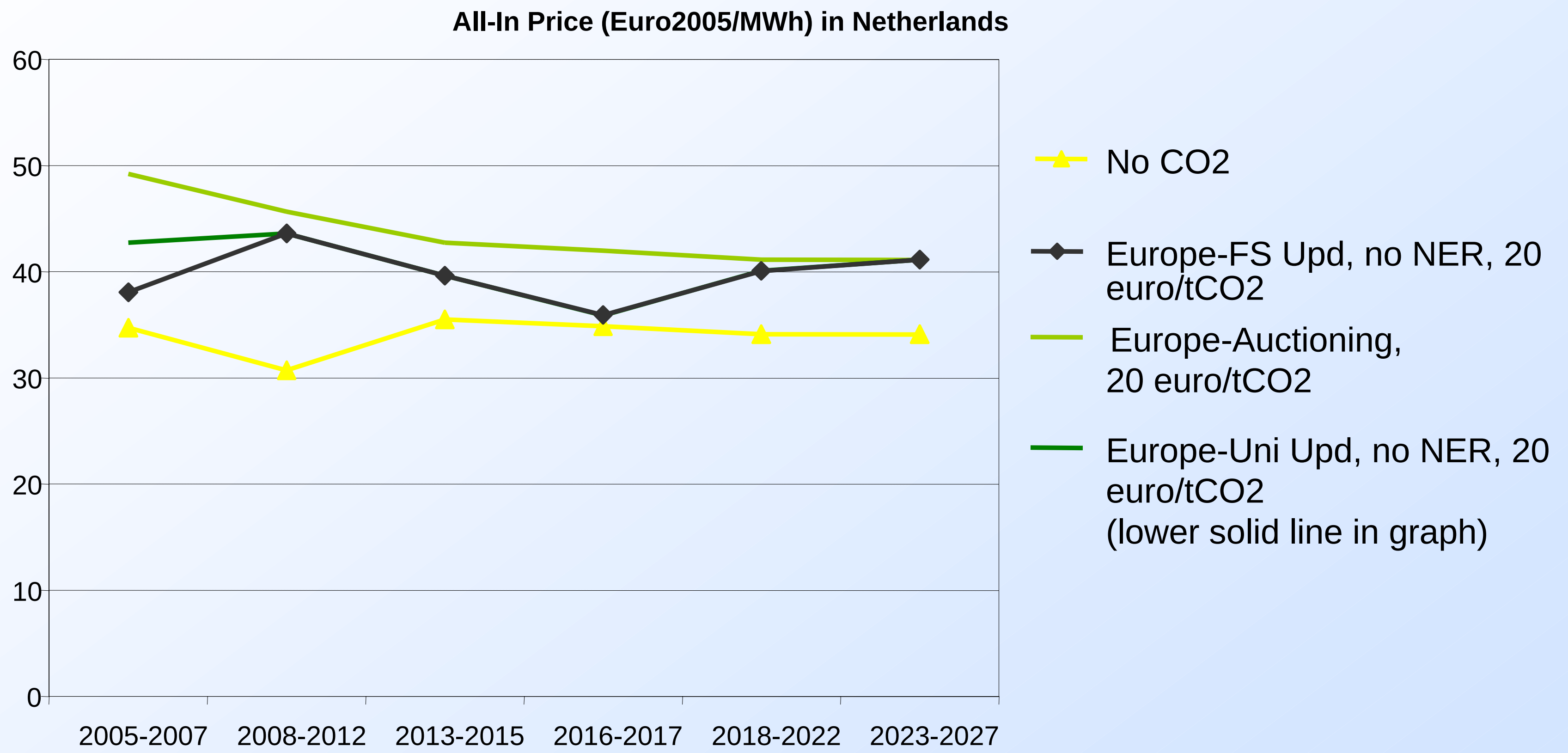
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – uniform and fuel specific benchmarking with moving baseline - DE



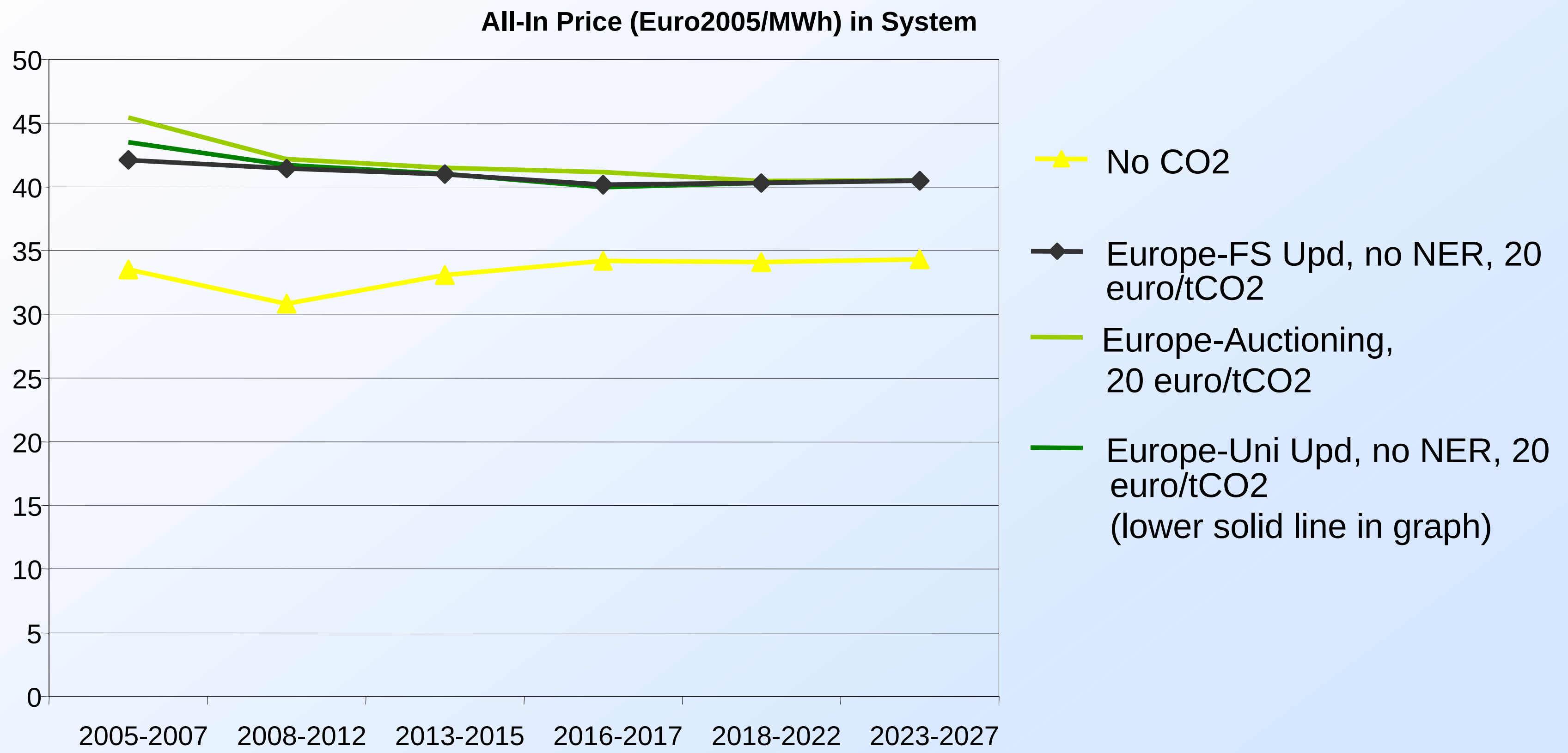
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – uniform and fuel specific benchmarking with moving baseline - NL



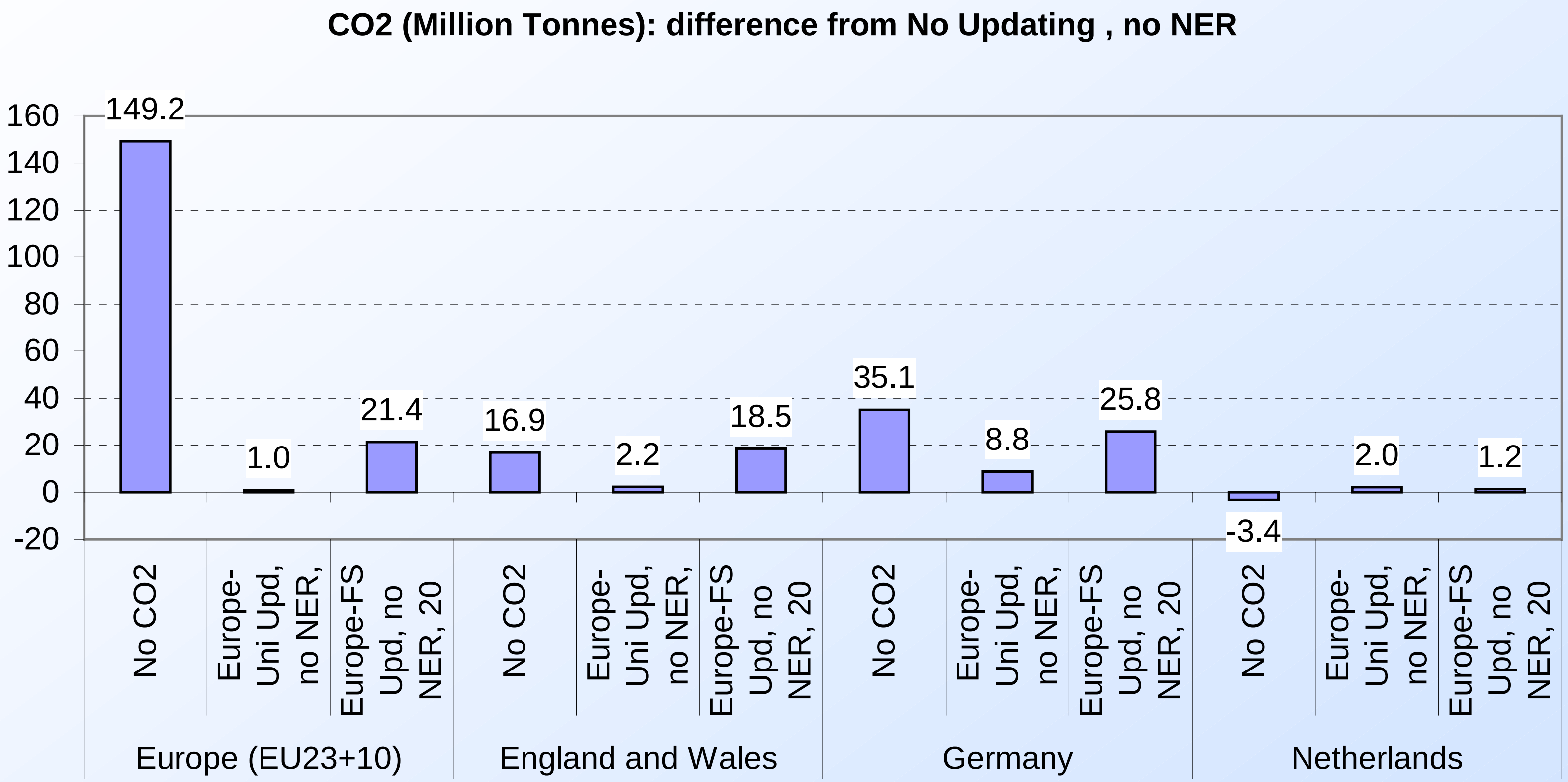
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – uniform and fuel specific benchmarking with moving baseline - Europe



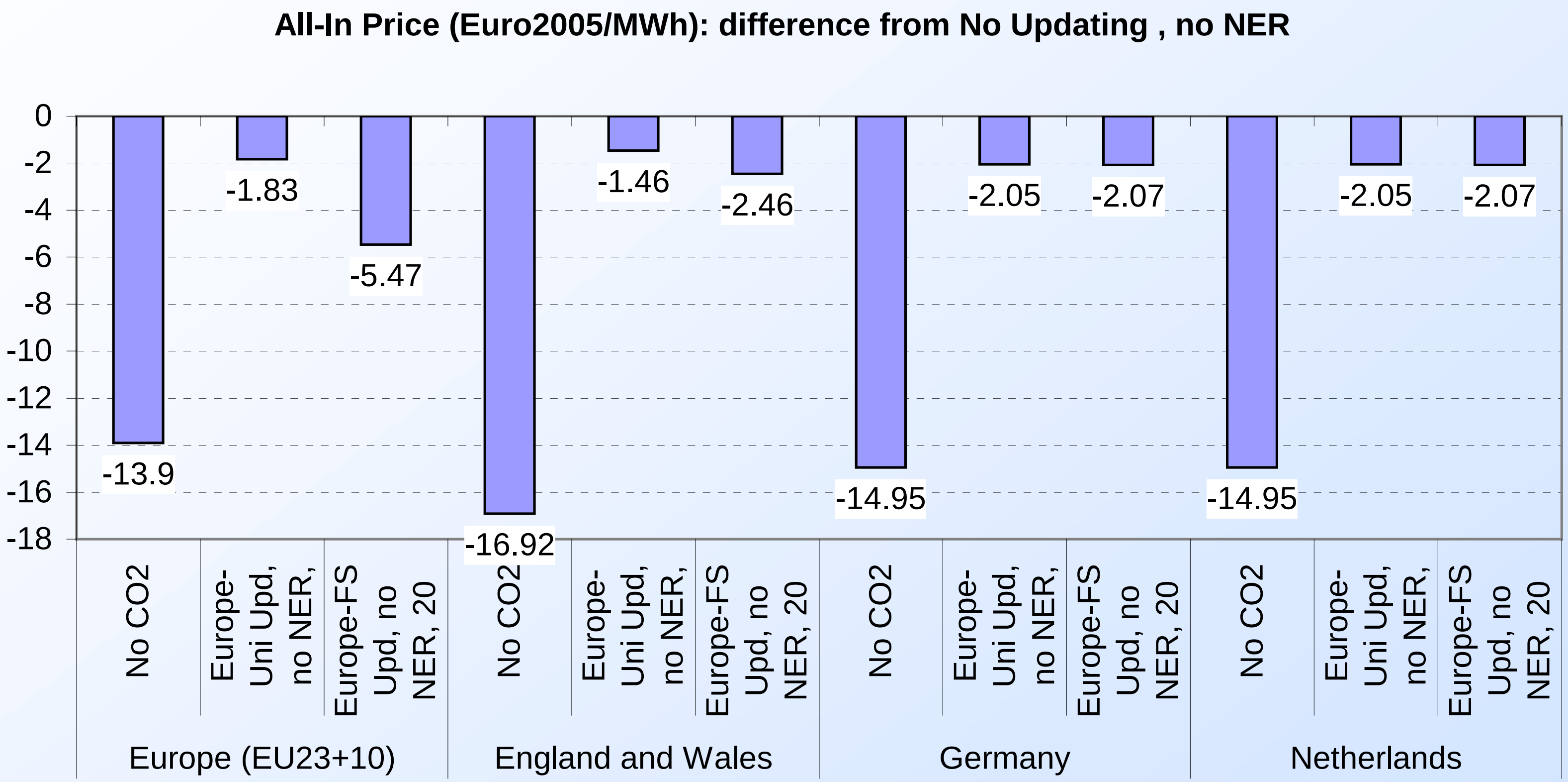
Neuhoff, Keats, Sijm, Matthes, Johnston

Impact of allocation on CO2 emissions in 2008-2012



Neuhoff, Keats, Sijm, Matthes, Johnston

Impact of allocation on the price of Electricity in 2008-2012



We assumed a fixed CO2 price. Increased CO2 emissions through allocation distortions are likely to increase the CO2 and electricity price.

Neuhoff, Keats, Sijm, Matthes, Johnston

Evaluation fuel based benchmarking, moving baseline vs. perfect grandfathering

CO_2 price	Increased CO_2 price
Fuel Choice and consumption	Inefficiently high use of Coal
Technology choice and investment	Delays investment in new (efficient) generation
Minimising costs for consumers	Coal focus inflates CO_2 emissions and therefore CO_2 and electricity price
Fairness among generators	Biases towards coal
Fairness among member states	If applied heterogeneously, inefficient and unequal allocation of abatement between member states

Structure

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Observation – real world grandfathering

- Allowances are only allocated for limited period,
  - approximated by contingent allocation
- Moving baseline used to calculate 'historic' emissions
  - Historic emissions are fuel related
  - therefore similar effects to fuel based benchmarking with moving base line
  - fuel based benchmarking retains incentives for efficiency improvements within fuel category, unlike grand-fathering

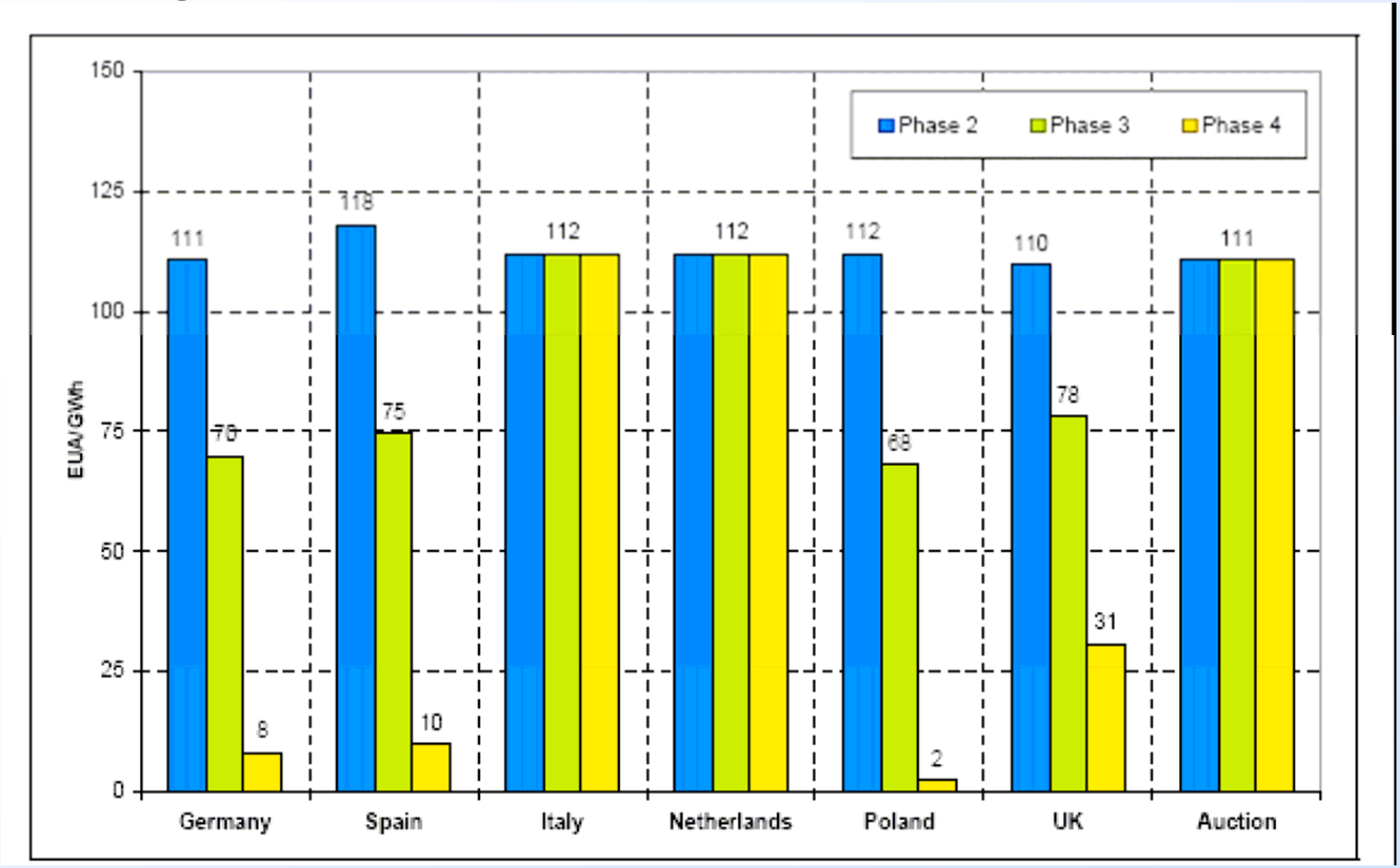
Increasing complexity

- Distributional/competitiveness concerns induce policy makers to add additional rules to NAPs
- These create additional distortions that need to be addressed[1]

- Example:
  - Allocation to existing plants might bias towards existing plants
  - Therefore new entrant allocation is discussed

1 The guidance document of the commission (2006) emphasis the need for simplicity.

Benefits from ETS from efficiency improvements in existing hard coal power plants under an updating approach



Source: Matthes e.a. (2005)

Structure

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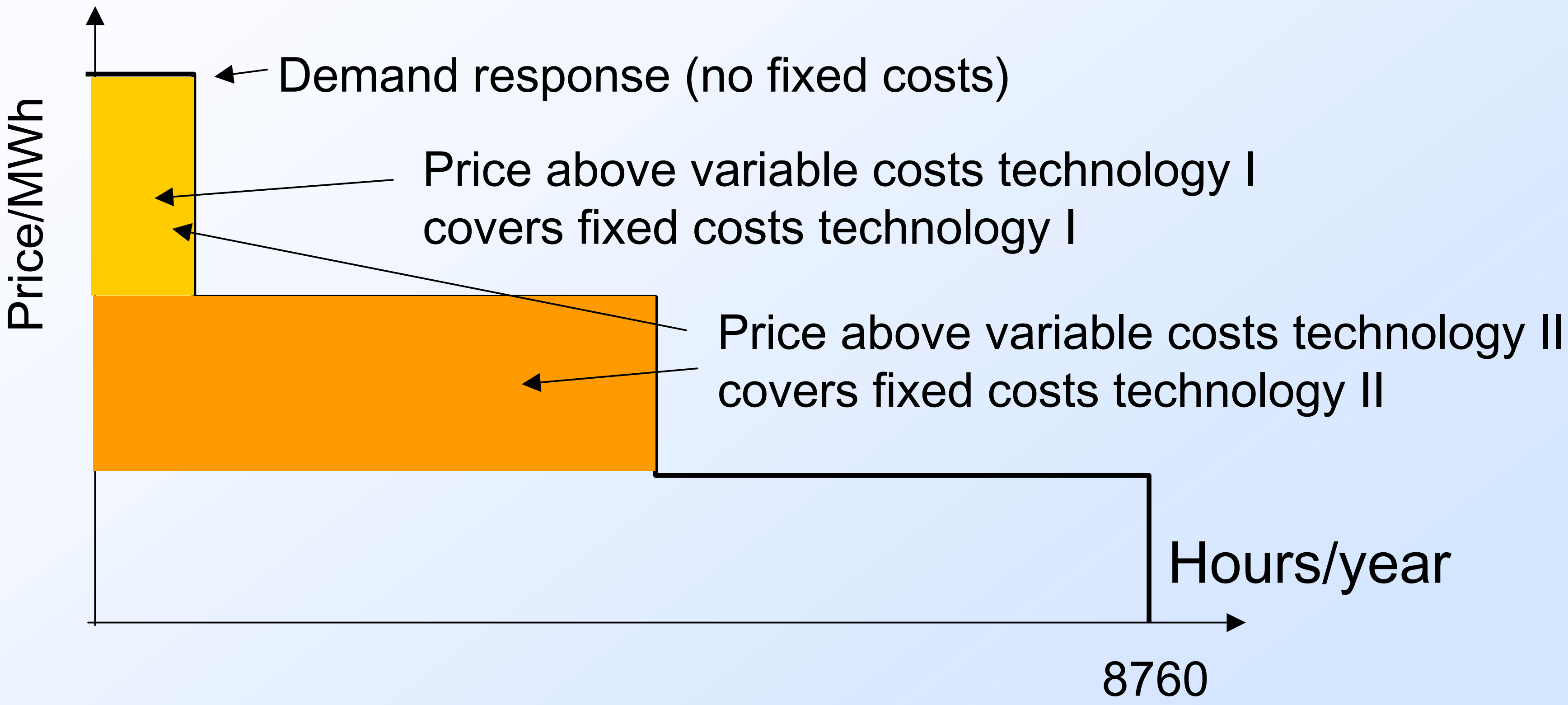
New entrant allocation, uniform benchmark

- New facilities receive allowances for defined period[1]
  - Based on projected output or fixed cap factor (NL)
  - Multiplied with uniform emission rate (CCGT)
- Frequently motivated by ‘fairness’ relative to existing facilities
  - From an economic perspective not required, as all new facilities have to buy allowances[2]
  - Qualified, if non incumbent entrants have difficulties to get finance without free allocation[3]
- Sometimes motivated to compensate for delays of shift towards new (efficient) investment caused by closure rule

1 Recommended by commission (2006) as option for national allocation plans.
2 Pederse (2000). Ahman, Zetterberg (2003); 3 Ahman, Butraw, Kruger, Zetterberg (2005)

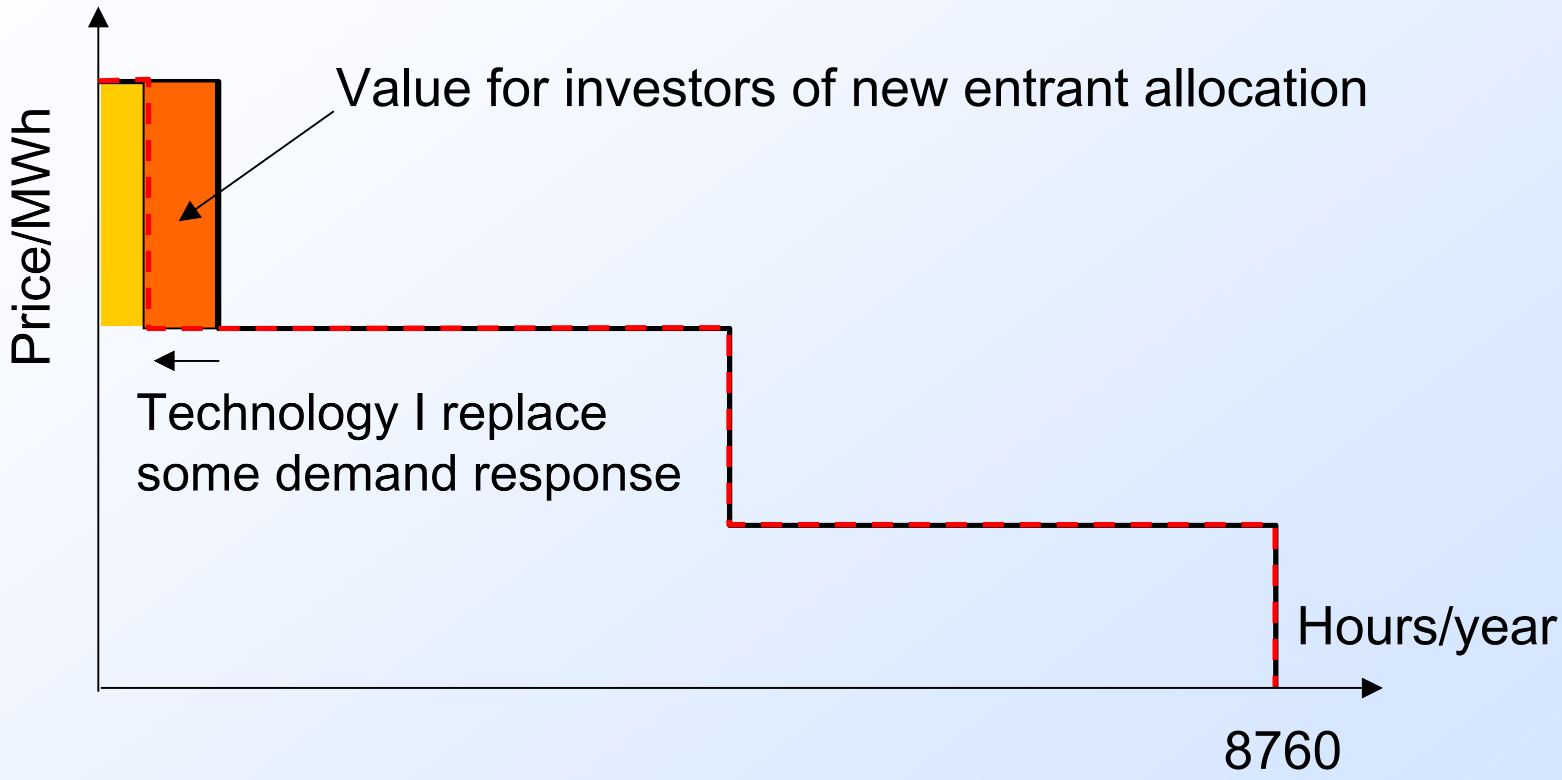
Illustration of investment equilibrium

- Infra-marginal rents cover fixed costs



Neuhoff, Keats, Sijm, Matthes, Johnston

Impact of small new entrant allocation (uniform benchmark)

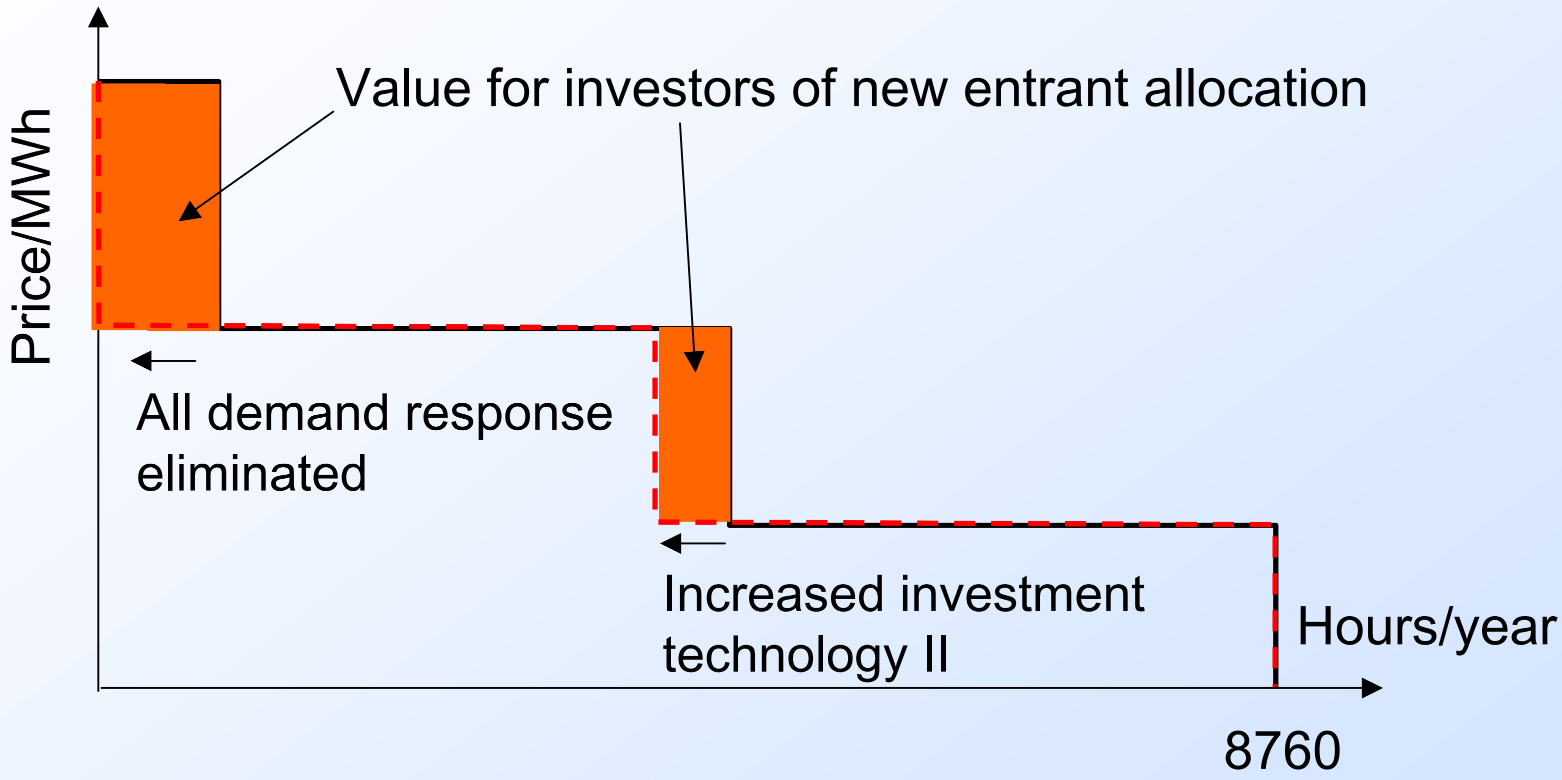


In competitive equilibrium mod:

- P_{elec} reduced by value of new entrants allocation to investors
- Subsidy to new investment is wasted: generation costs > consumer value
- Emissions increased by (slightly higher) demand

Neuhoff, Keats, Sijm, Matthes, Johnston

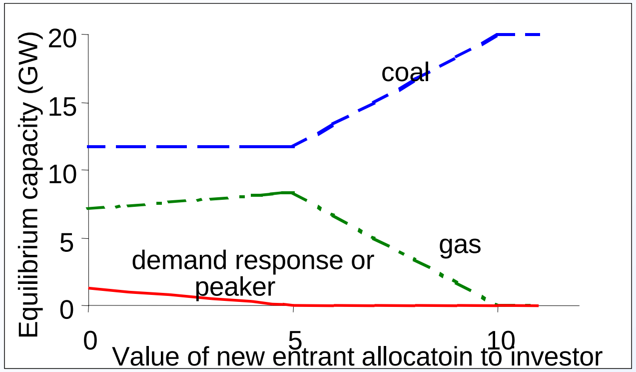
Impact of higher new entrant allocation (uniform benchmark)



- Further reduction of electricity price
- More subsidy wasted on choice of tech. II instead of tech I
- If technology II coal, technology I gas -> emissions increase

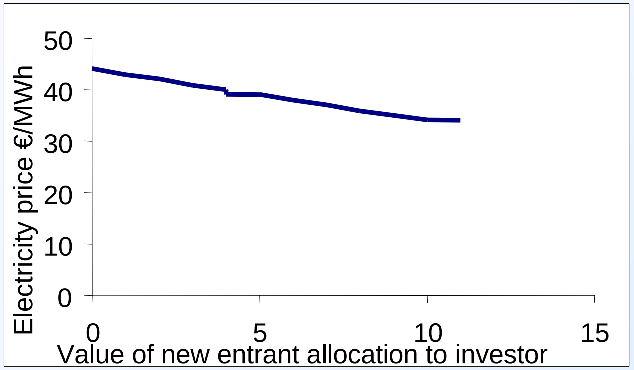
Neuhoff, Keats, Sijm, Matthes, Johnston

National perspective, uniform new entrant allocation



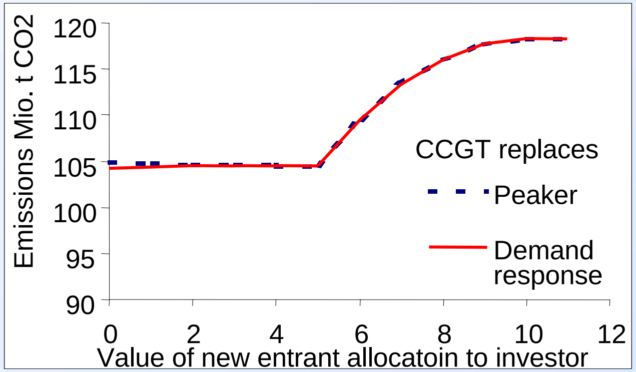
Installed capacity

- Demand response/peaker replaced by CCGT
- At high levels of subsidy coal replaces CCGT



Electricity prices

- Decrease due to capacity subsidy



Emissions

- Increase if demand response replaced by CCGT
- Decrease if CCGT replaces peaker
- Increase if at high subsidy coal replaces gas
- Demand elasticity not modelled

Neuhoff, Keats, Sijm, Matthes, Johnston

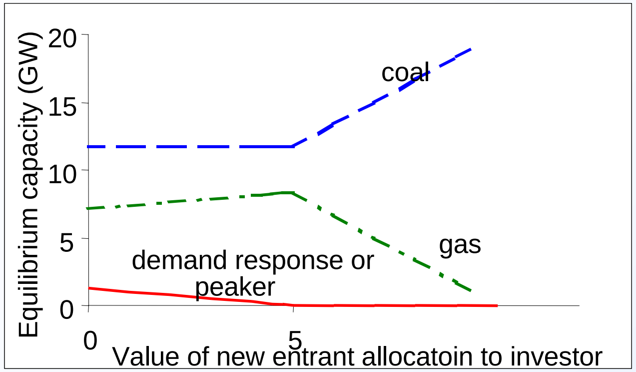
National perspective – what is the impact of NEA

- At current prices 47 €/kW/a or 5.4 €/MWh[1]
- Allocation only for 4-8 years: 2 – 3.4 €/MWh[2]
- Risk aversion of investors further reduces impact:
  - Discount to reflect uncertainty about future CO2 price
  - Replacement of old peaking capacity eliminates assurance of high marginal costs if high cost plants are running
- Impact limited, if equilibrium requirements not satisfied:
  - Free entry with access to grid, gas and balancing
  - Competitive marginal cost pricing including demand response
  - Constraint on new entrant reserve not binding[3]
- Time lag of new entrant allocation
  - Effect only materialises with delay[4]
  - Min 4-5 years until investment in market

1 60% capacity factor, 0.45 tCO_2/MWh * 20 €/tCO_2 2 distributed over 20 years project, 10% discount
3 Reinaud (2003) argues that government buying allowances (outside of ETS) to cover new entrant requirement could reduce CO2 scarcity price; 4 Ilex 2004

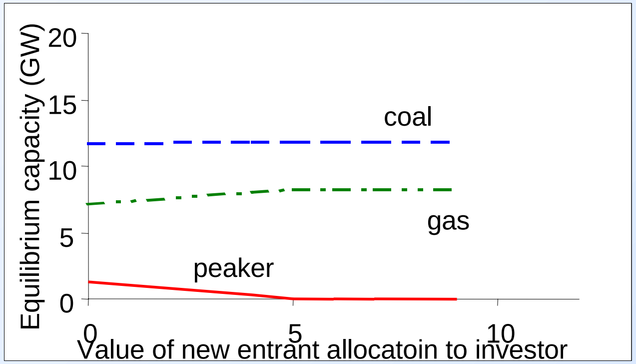
Neuhoff, Keats, Sijm, Matthes, Johnston

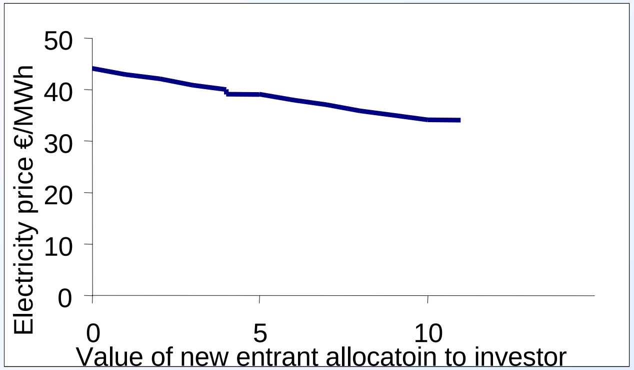
National v.s. harmonised perspective



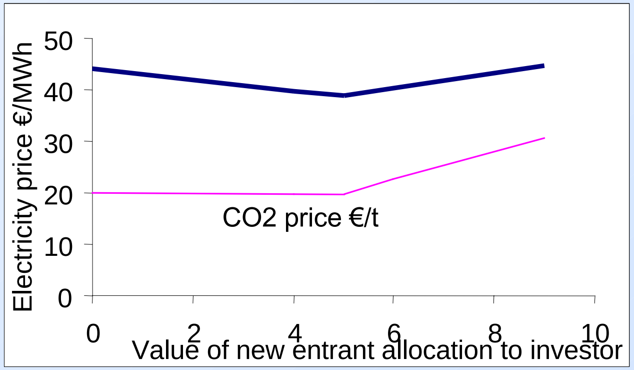
Installed

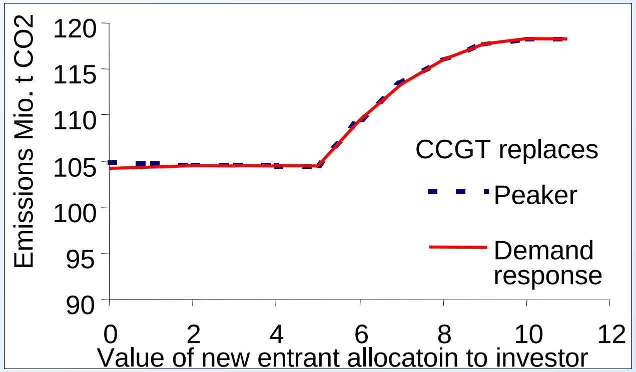
Capacity





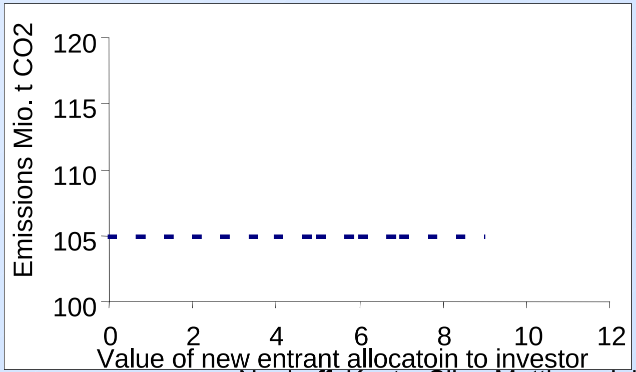
Price





CO2

emissions



Neuhoff, Keats, Sijm, Matthes, Johnston

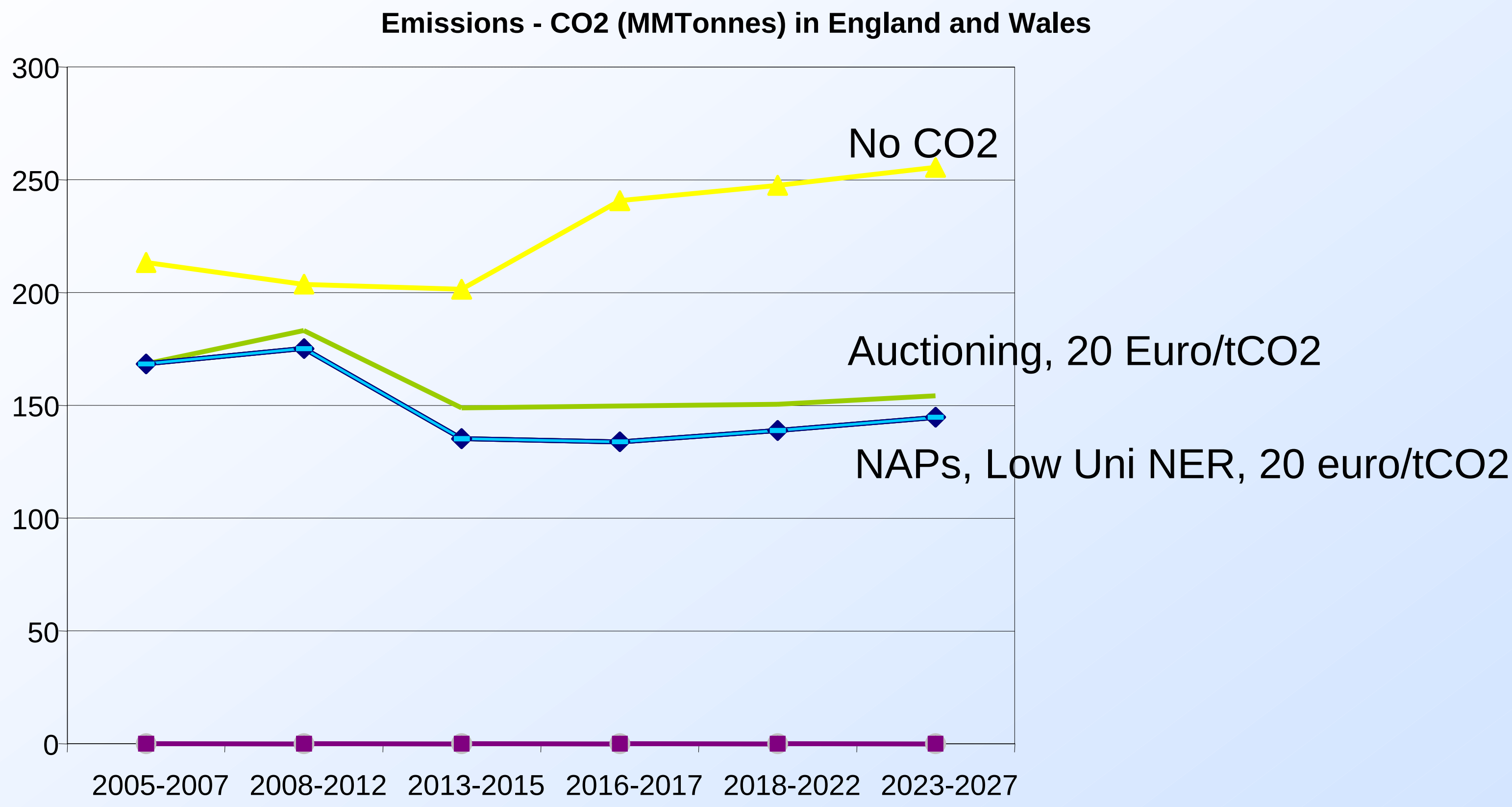
Numerical simulation – new entrant allocations based on new CCGT

*NER allowance rate (per MW installed) ****applies only to new builds***

Date of entry	Techn	tCO2/MWy	Capacity factor
2005-2007	CCGT & CT only	1,840	60%
2008-2012	CCGT & CT only	1,472	
2013-2017	CCGT & CT only	1,104	
2018-2022	CCGT & CT only	736	
2023-2027	CCGT & CT only	368	
2028-2032	CCGT & CT only	0	

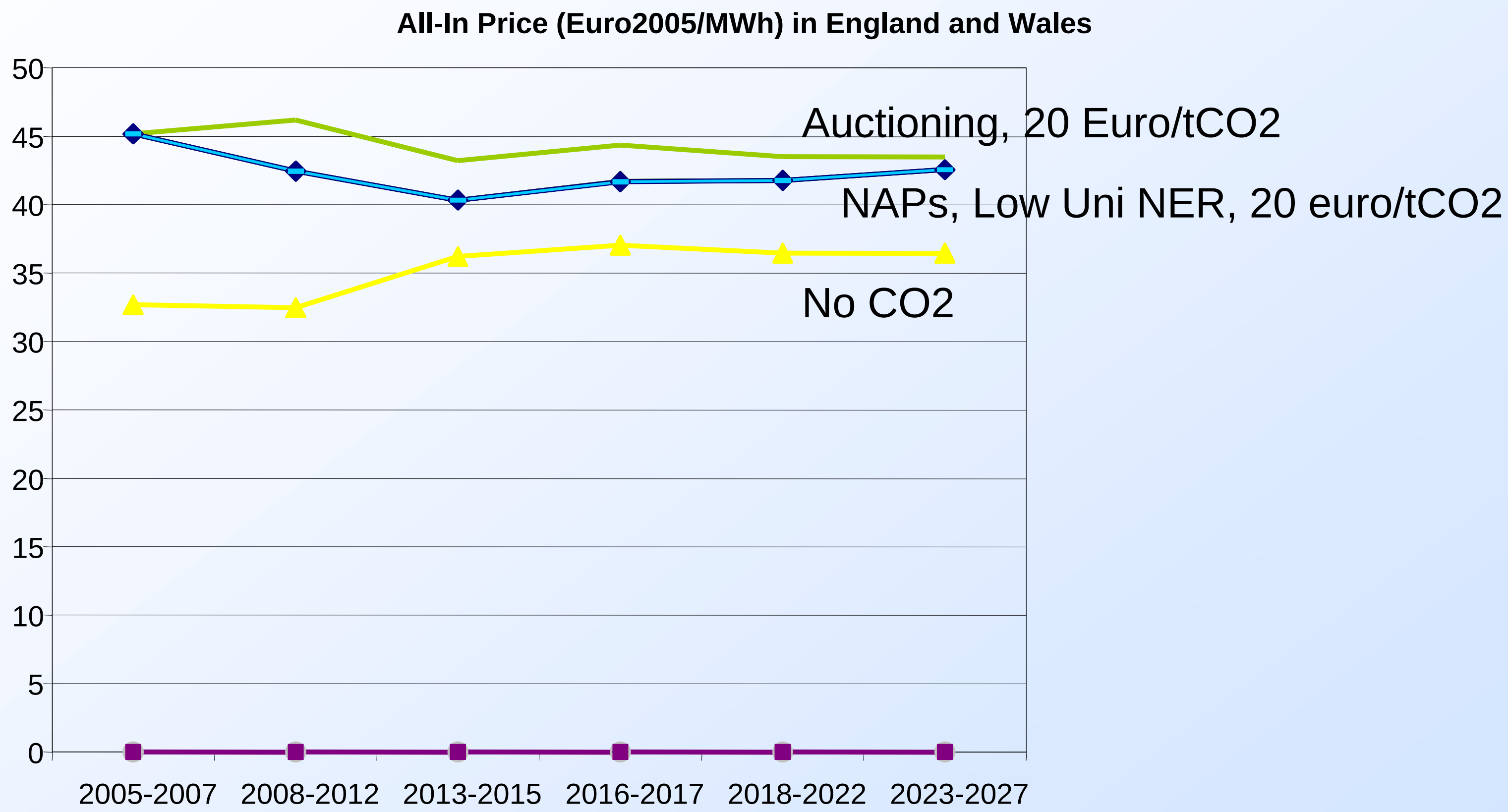
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – new entrant allocations based on new CCGT



- No new coal comes online. This results in lower CO_2 emissions for the same CO_2 price than under auctioning

Numerical simulation – new entrant allocations based on new CCGT



- Contingent allocation seems to play no role unlike the NER

Numerical simulation – "low" new entrant allocations (uniform was CCGT only)

*NER allowance rate (per MW installed) ****applies only to new builds***

Date of entry	Techn	tCO2/MWy	Capacity factor
2005-2007	CCGT & CT only	1,840	60%
2008-2012	CCGT & CT only	1,472	
2013-2017	CCGT & CT only	1,104	
2018-2022	CCGT & CT only	736	
2023-2027	CCGT & CT only	368	
2028-2032	CCGT & CT only	0	
2005-2007	Coal only	3,942	60%
2008-2012	Coal only	3,154	
2013-2017	Coal only	2,365	
2018-2022	Coal only	1,577	
2023-2027	Coal only	788	
2028-2032	Coal only	0	

Heterogeneous perspective

- Differing new entrant allocation can create distortions for locational choice.[1]

1 Baron, Bygrave 2000,

Uniform benchmark, new entrant allocation, and moving base line for existing plant

- Effect on operation:
  - Moving base line reduces marginal costs of existing plants.
  - Some less efficient old plants run instead of new entrant.
  - CO_2 emissions increase,
  - and electricity price is reduced.
- Effect on investment:
  - The moving base line of allocation to existing facilities
    - biases investment towards high variable costs,
    - and delays investment, thus increasing electricity prices.
  - The new entrant allocation
    - Subsidises investment of technology with highest variable costs
    - Electricity prices are reduced, thus increasing CO_2 production.
    - Emissions increase further if technology CO_2 intensive.
- In harmonised national perspective
  - Increased incentive for CO_2 emissions, increase CO_2 price.
  - This increasing electricity price – the net effect is unclear.

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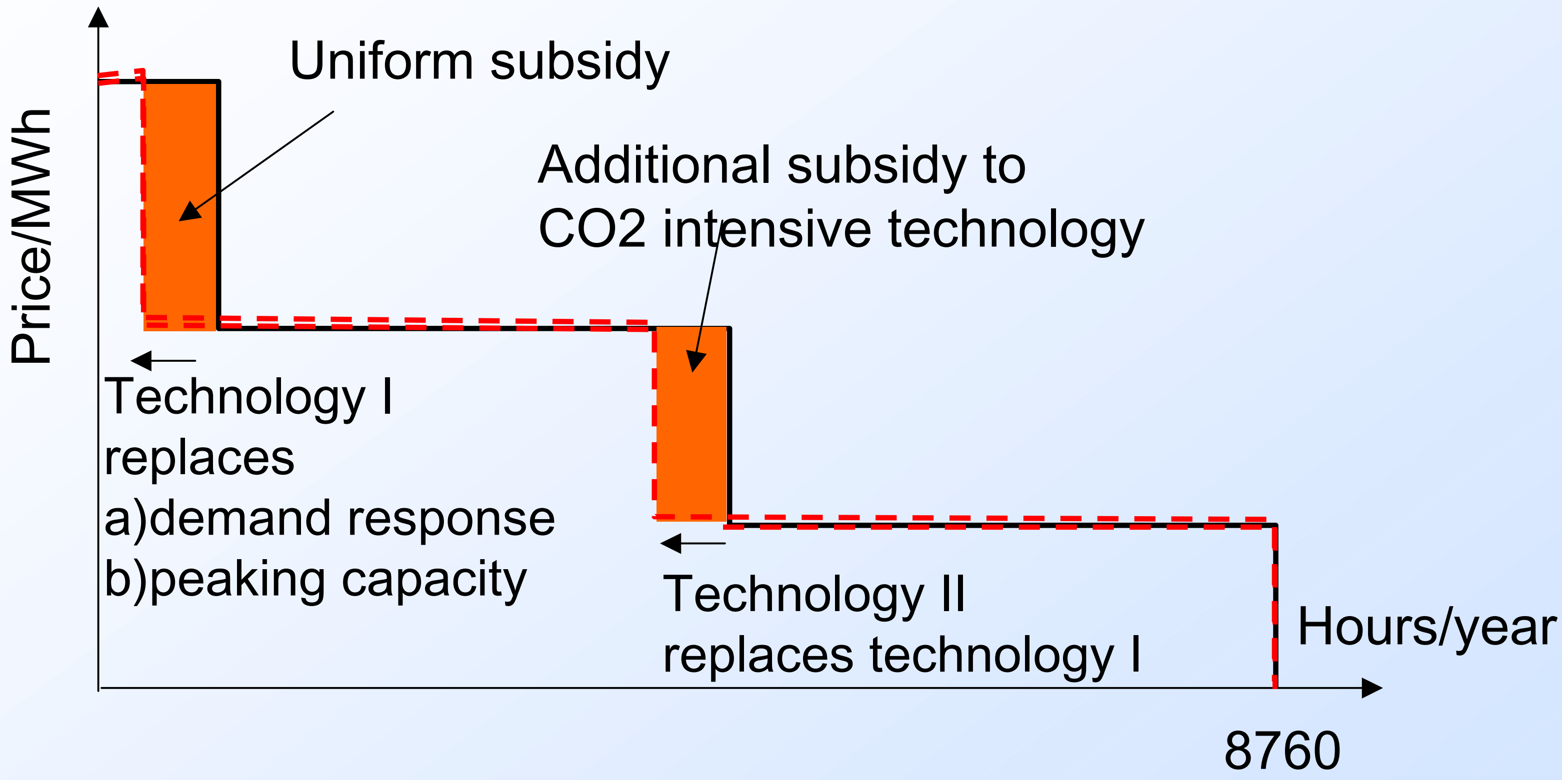
New entrant allocation, fuel specific benchmark

- Some NAPs offer new entrants that burn CO2 intensive fuels more allowances than other entrants (Fr, D, Pl)[1]

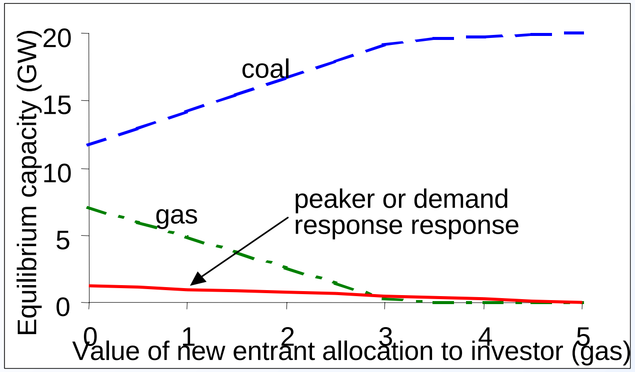
1 Fuel independent NE allocation: Luxemburg, Sweden, UK, It (power sector), Dk

Impact of fuel specific new entrant allocation



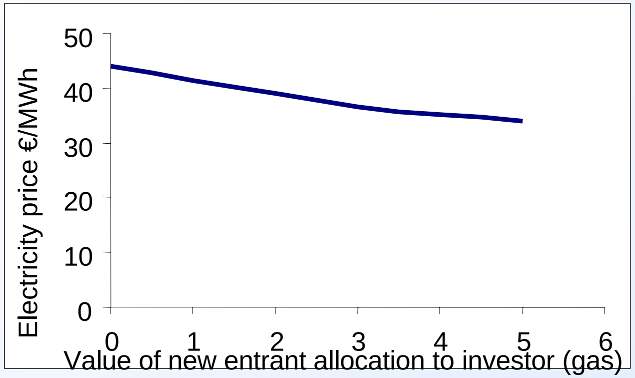
Neuhoff, Keats, Sijm, Matthes, Johnston

Fuel based benchmarking new entrant allocation



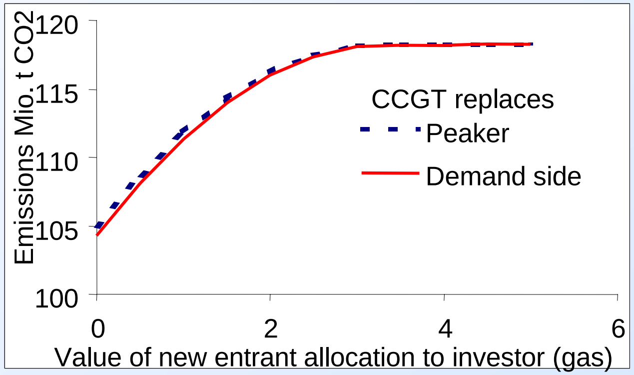
Installed capacity

- Coal replaces gas and peaker



Electricity price

- Reduced as before



Emissions

- Increase

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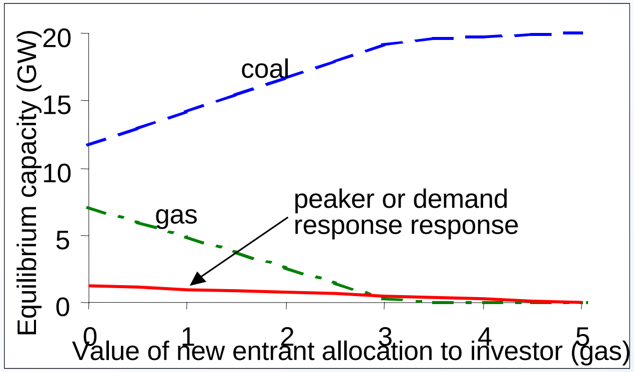
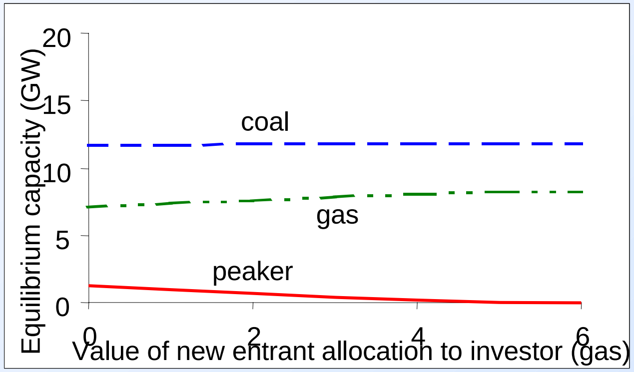
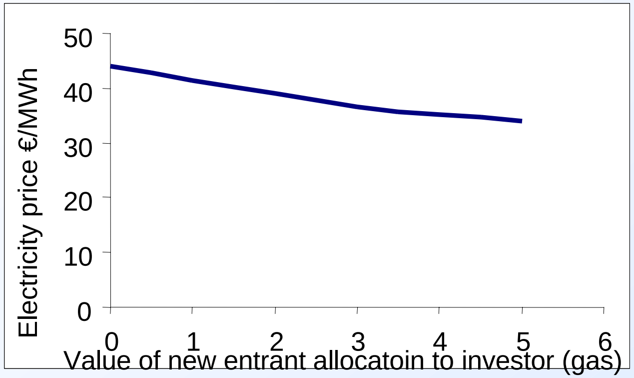
National vs. harmonised perspective



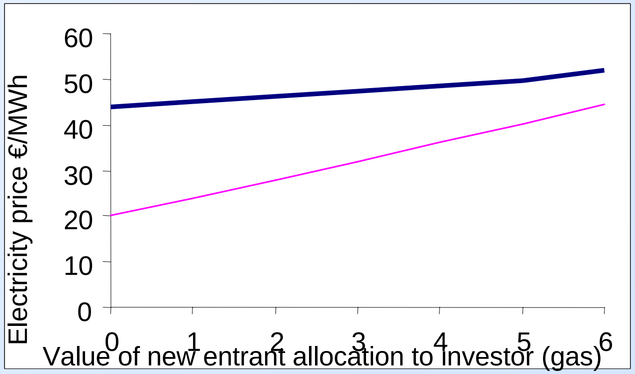
Installed capacity

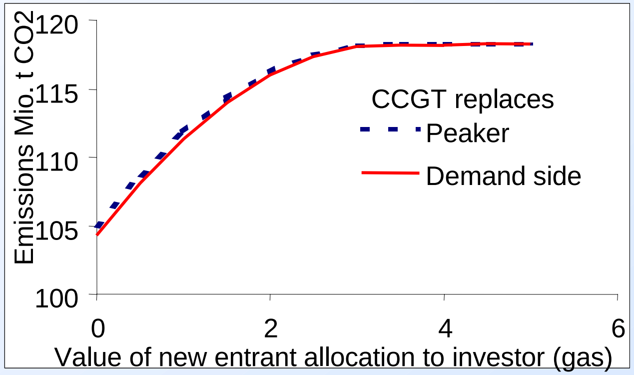




Electricity, CO2 Price

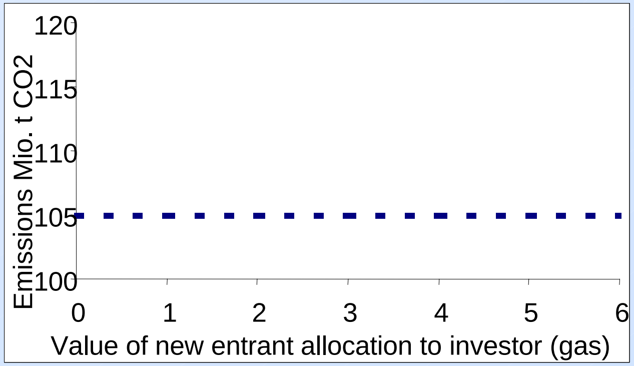
- CO2 price increase to compensate coal incentive





Emissions

- Constant due to cap



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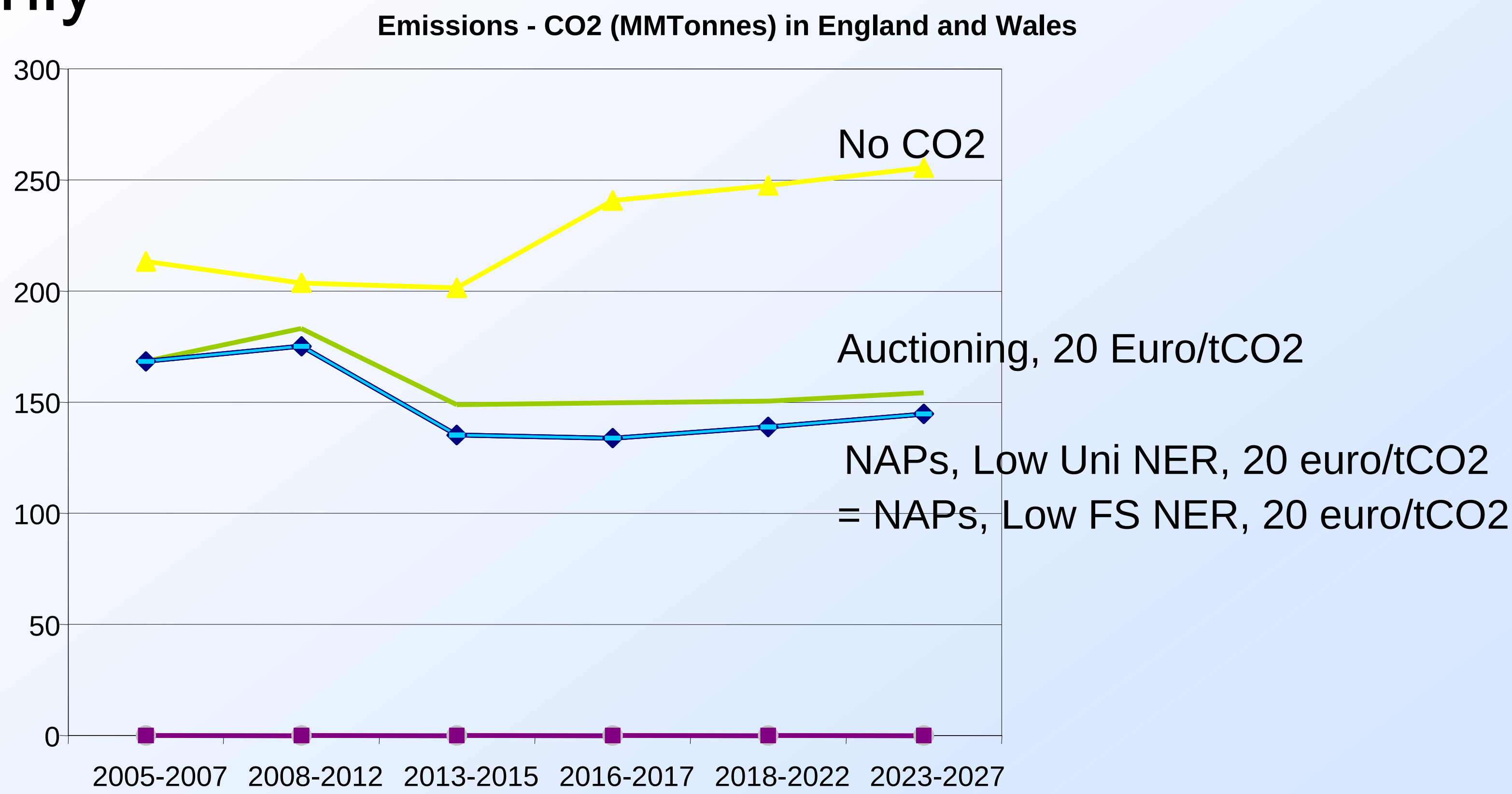
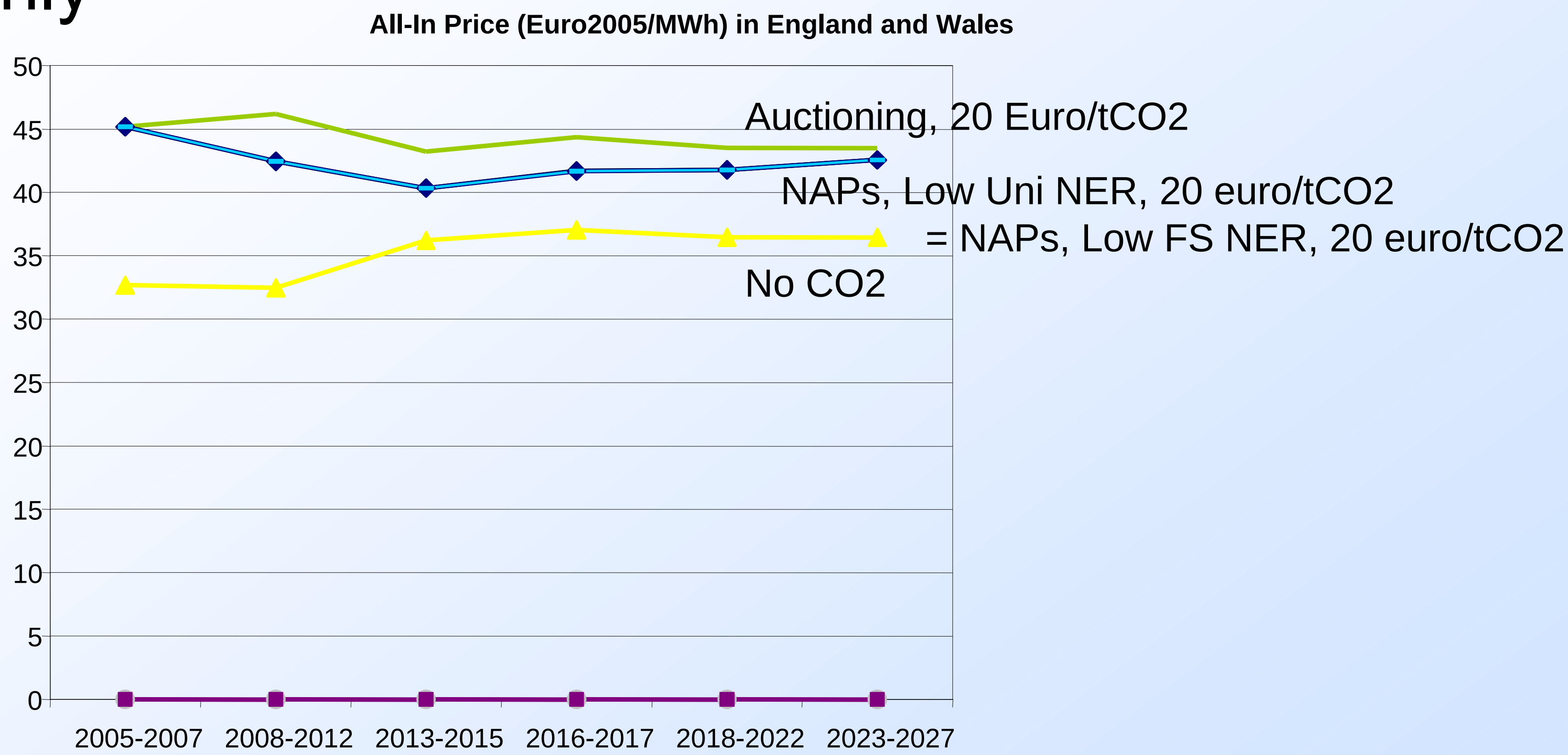
Numerical simulation – NEA based on “low” uniform and fuel specific benchmark – GB only



- Despite the higher allocation to new coal-fired plants under the fuel specific allocation, no new coal comes online. Emissions of CO2 are therefore the same as in the uniform NEA case

Numerical simulation – NEA based on “low” uniform and fuel specific benchmark – GB only



- Even with a more generous NEA there is no coal build. Fuel specific and Uniform NEA results are the same

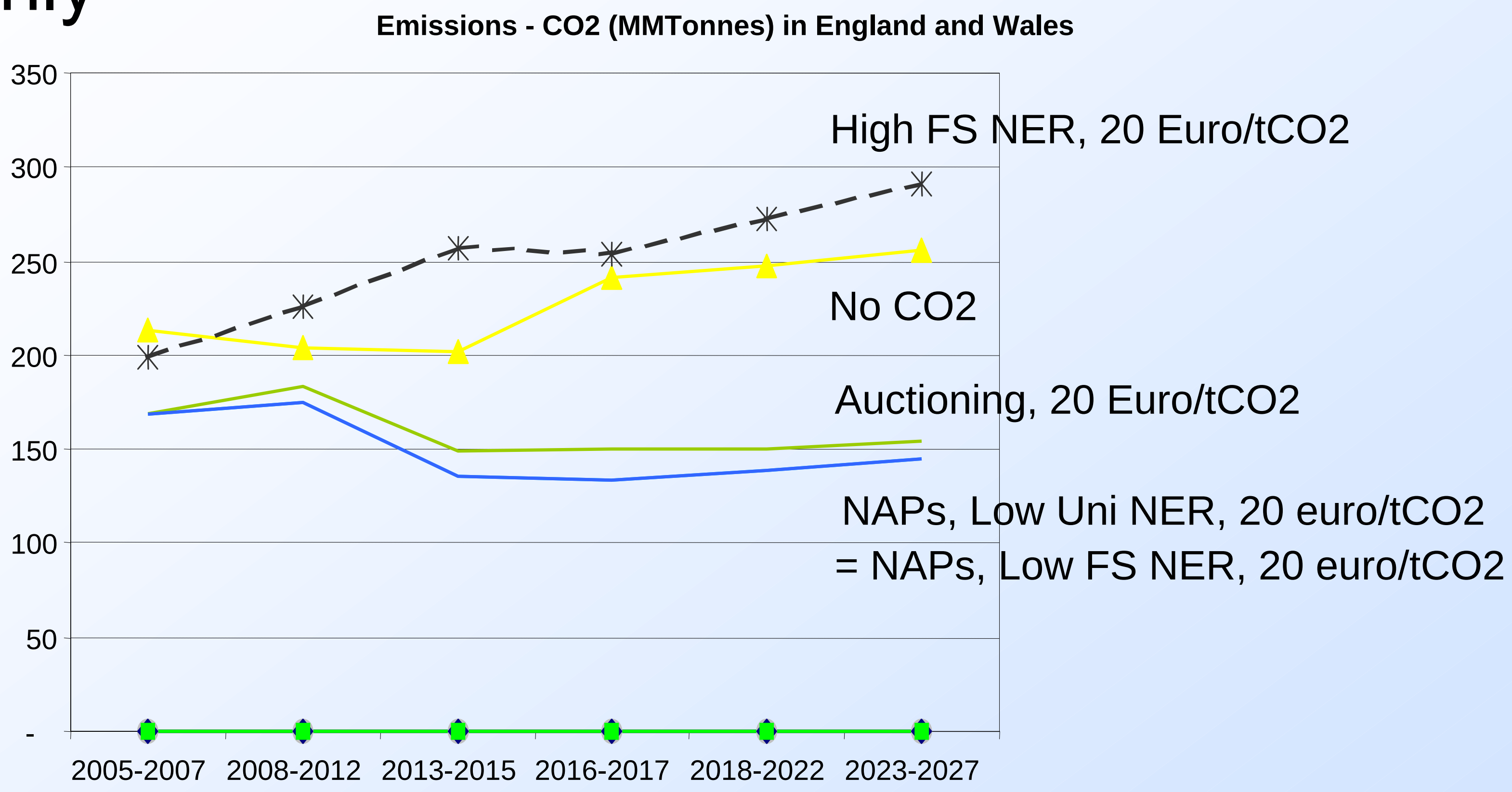
Neuhoff, Keats, Sijm, Matthes, Johnston

Numerical simulation – “high” new entrant allocation + high gas price (4.85Euros/MMBTu)

*NER allowance rate (per MW installed) ****applies only to new builds***

Date of entry	Techn	tCO2/MWy	Capacity factor
2005-2007	CCGT & CT only	1,840	60%
2008-2012	CCGT & CT only	1,840	
2013-2017	CCGT & CT only	1,840	
2018-2022	CCGT & CT only	1,840	
2023-2027	CCGT & CT only	1,840	
2028-2032	CCGT & CT only	1,840	
2005-2007	Coal only	3,942	60%
2008-2012	Coal only	3,942	
2013-2017	Coal only	3,942	
2018-2022	Coal only	3,942	
2023-2027	Coal only	3,942	
2028-2032	Coal only	3,942	

Numerical simulation – NEA based on “high” fuel specific benchmark and gas prices – GB only



- With higher gas prices and more generous NEA, coal plants will get built and may operate at high load factors resulting in higher CO2 emissions than the no CO2 case

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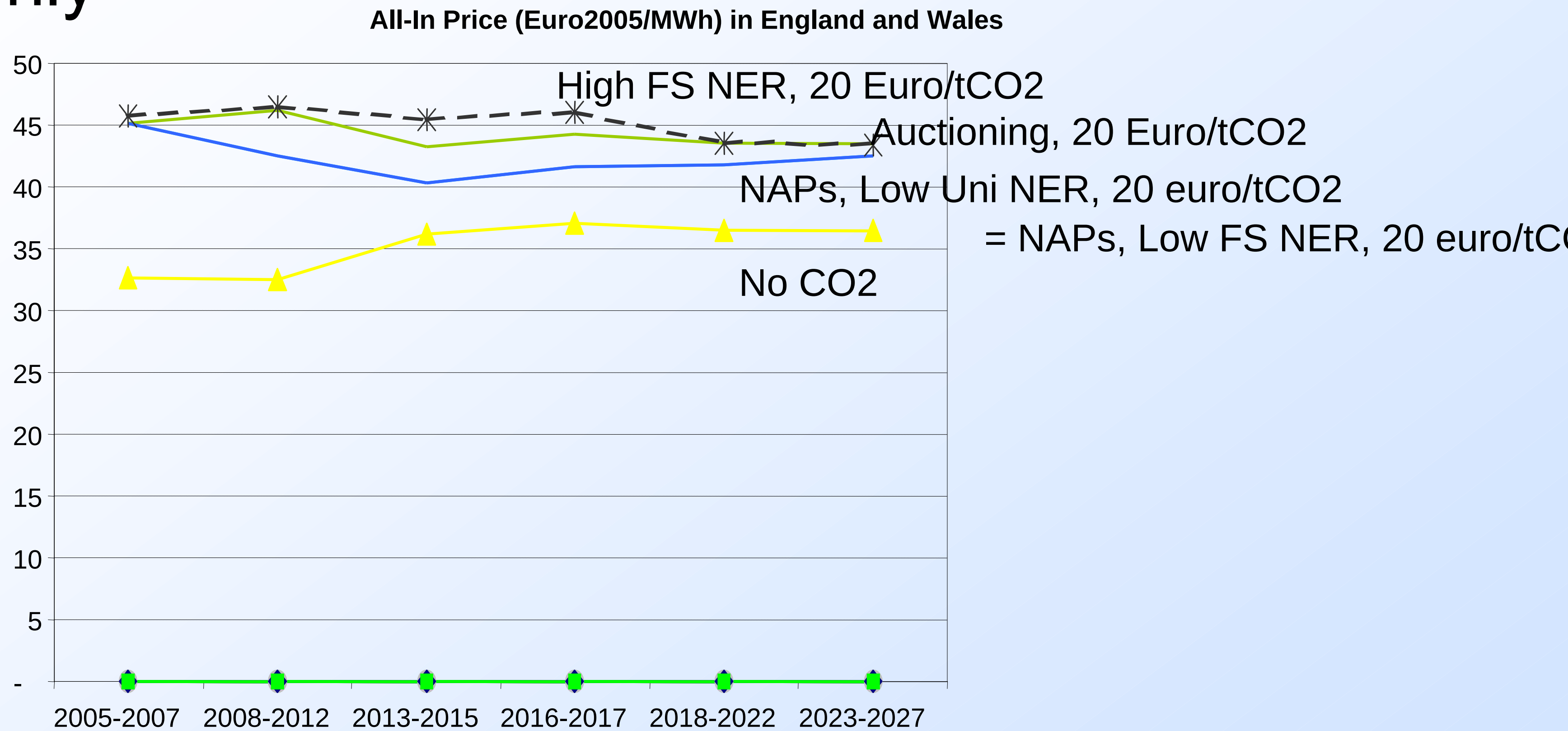
Numerical simulation – NEA based on "high" fuel specific benchmark and gas prices – GB only



- Because gas prices are high, electricity prices remain higher as well

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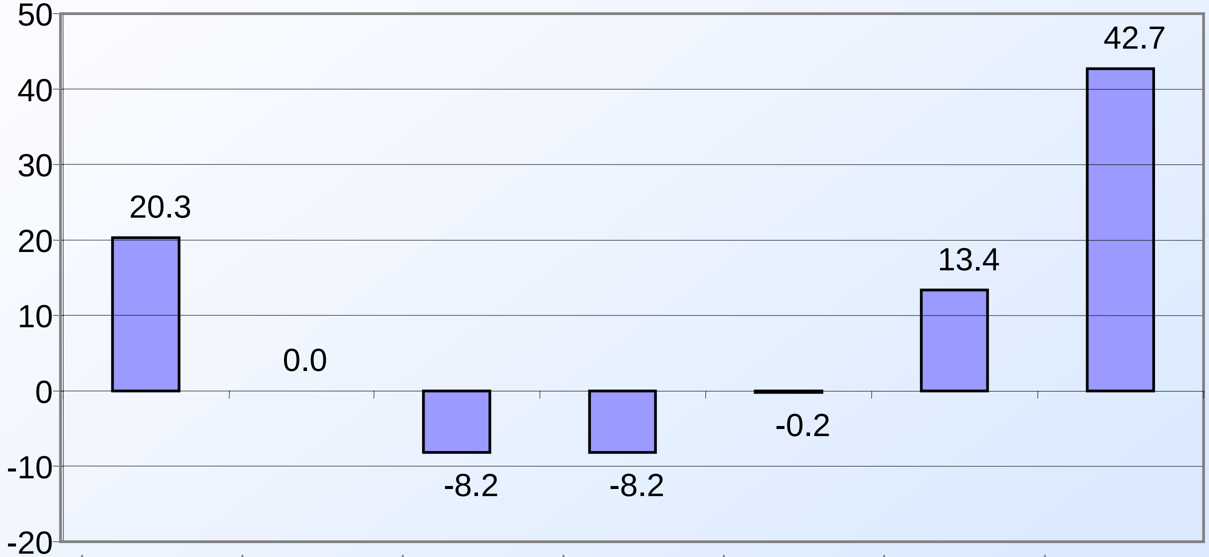
Impact of allocation on CO2 emissions in 2008-2012

CO2 (Million Tonnes) in England and Wales: difference from No Updating, no NER



CO price	0	20	20	20	20	20	20
Gas price							high
Updating					uniform	fuel sp.	
Entrant alloc.			uniform	fuel sp.			fuel sp. stays high

- In the base case new entrant allocation (even fuel specific) accelerated the shift to gas. Higher gas prices (5 Euro/mmbtu) and continued high fuel specific new entrant allocation invert this result.
- With demand side response new entrant allocation creates additional emissions (not modelled).

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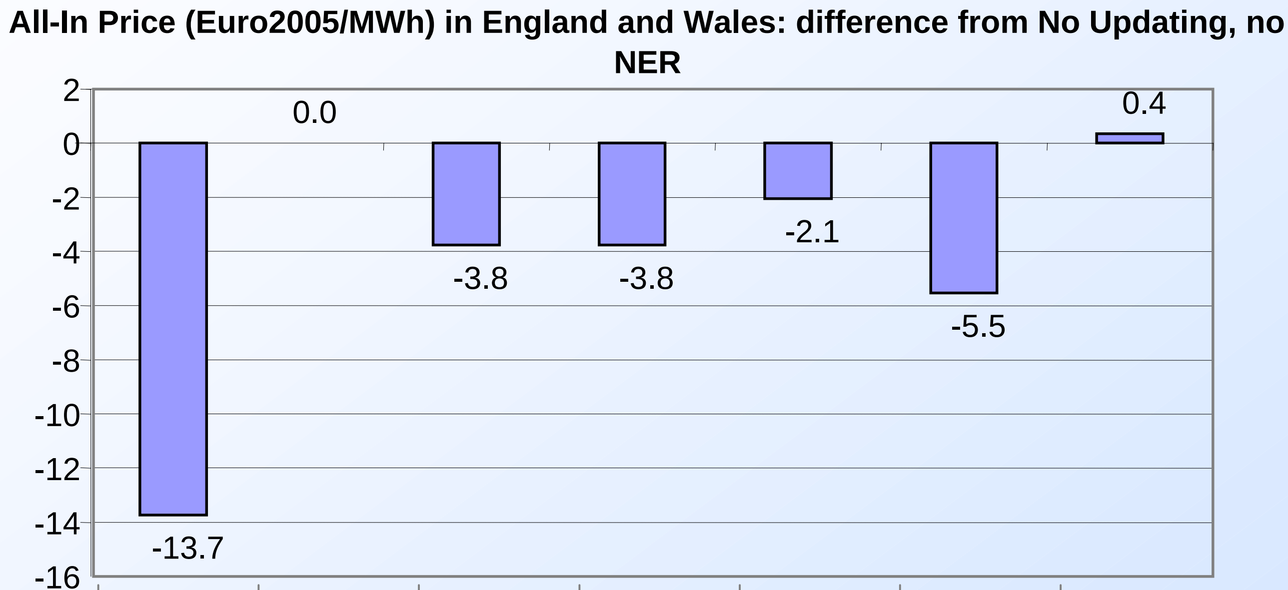
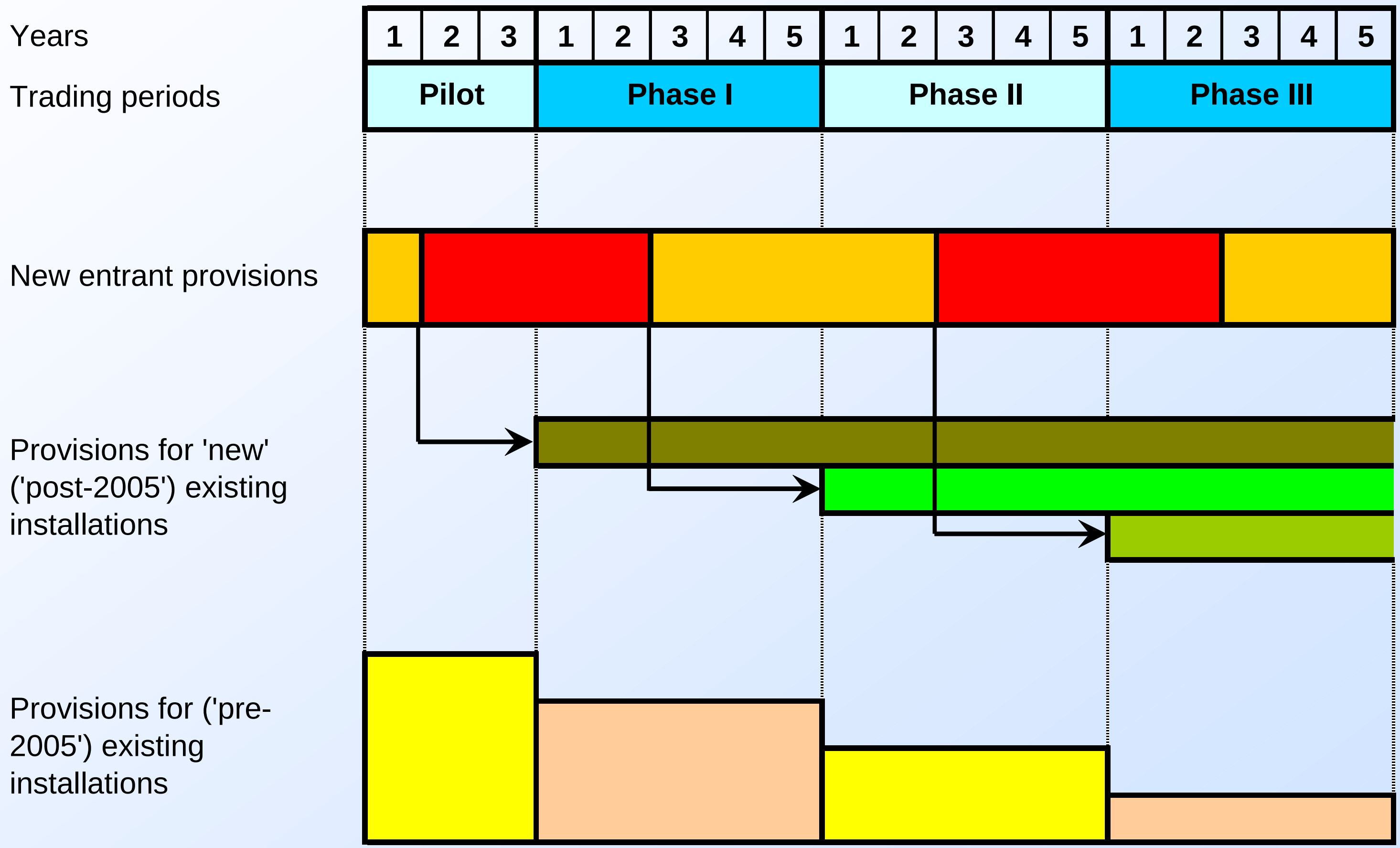
Impact of allocation on the price of Electricity in 2008-2012



CO price	0	20	20	20	20	20	20
Gas price							high
Updating					uniform	fuel sp.	
Entrant alloc.			uniform	fuel sp.			fuel sp. stays high

Neuhoff, Keats, Sijm, Matthes, Johnston

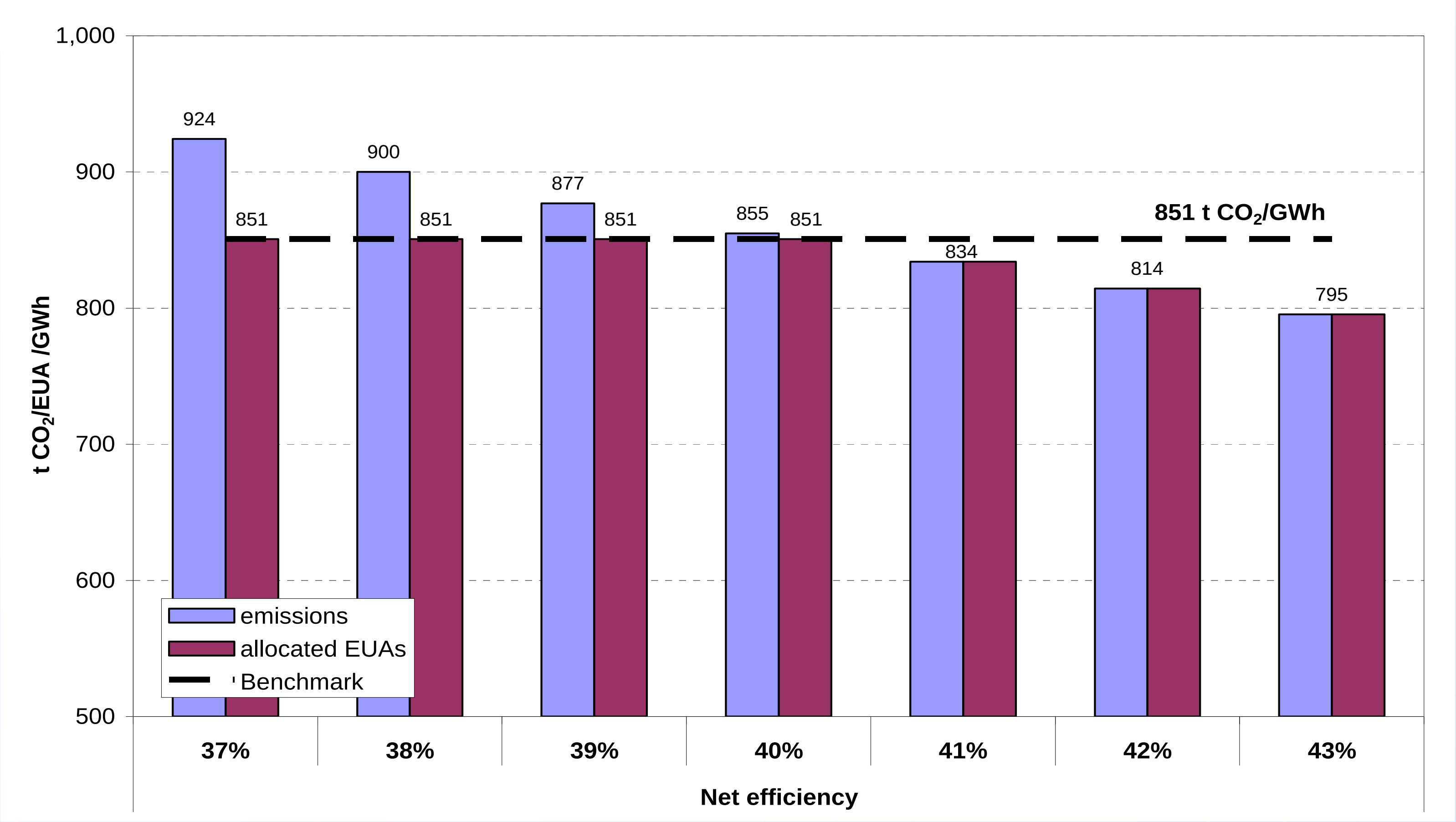
Subsequent treatment of new entrants has to ensure they are treated uniformly



Source: Matthes e.a. (2005)

Additional distortions if efficiency gains have to be returned

Efficiency cut in the Dutch NAP; comparison of emissions and allocation to hard coal power plants with different efficiencies

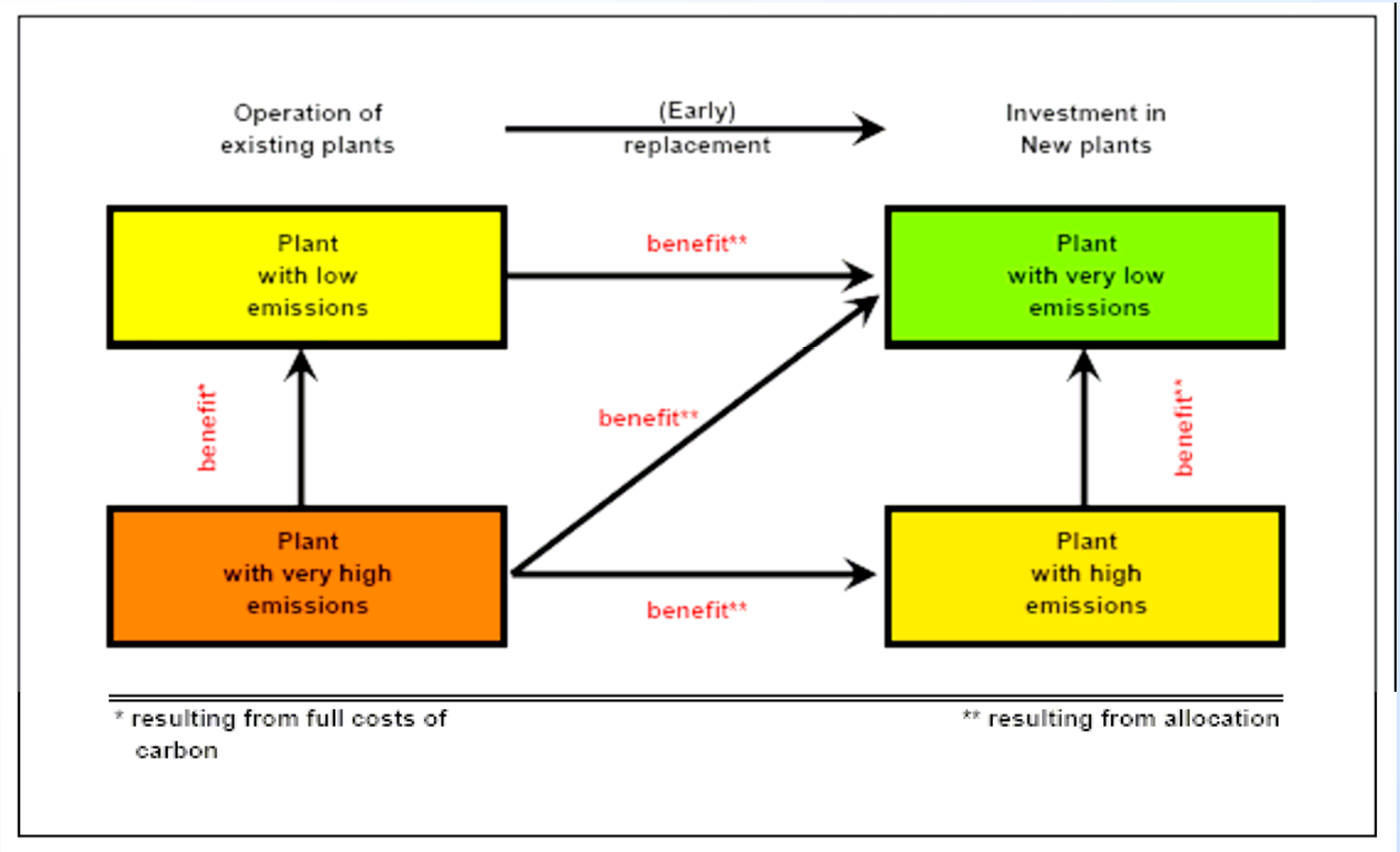


Source:Öko-Institut calculations based on data provided by ILEX

Conclusion new entrant allocation

- Serves as (risky) capacity payment
  - Can reduce scarcity values of electricity and prices
  - Effect limited with uncompetitive markets (gas, electricity) and risk about future allocation
  - Effect eliminated if limits on new entrant allocation binding
- Uniform benchmark:
  - If value too high (or fuel costs change) can incentivise excess investment and increased CO_2 emissions
  - Distortions in technology choice remain, if entrants expect that they will later receive allowances based on grandfathering/fuel specific benchmarking
- Fuel specific benchmark: Induces inefficient technology choice, resulting in increased emissions/higher CO_2 prices
  - To ensure that at least incumbents build some efficient technology Poland and Germany implemented transfer rules

Complexity of fine tuning incentives under free allocation



Source: Matthes e.a. (2005)

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Free allocation and state aid

- Does free allocation conflict with state aid considerations under EC law?
  - If it is established that opportunity costs are passed through, then it seems clear that aid is granted that goes far beyond that expected simply from the free allocation of allowances in in the first place.

- Distinguish different relevant circumstances for state aid purposes:

  - would continued free allocation on the basis laid down in the current Directive conflict with EC state aid rules?

  - what state aid constraints are there in amending the allocation mechanism in the Directive (e.g. to allow free allocation to consumers in one form or another)?

Commission's attitude towards state aid (I)

- General point 1: Commission's attitude towards aid for environmental purposes (Commission Guidelines, 2001):
  - ensure the competitive functioning of markets; …
  - while integrating environmental protection requirements into competition policy (in particular, focusing upon the *internalisation of costs* of environmental impacts).

⇨But, the Commission is prepared to allow aid:

(a) in certain specific circumstances in which it is not yet possible for all costs to be internalised by firms and the aid can therefore represent a temporary second-best solution by encouraging firms to adapt to standards; and

(b) where the aid may also act as an incentive to firms to improve on standards or to undertake further investment designed to reduce pollution from their plants.

Commission’s attitude towards state aid (II)

- *However*, note that the Commission’s attitude has hardened in its 2001 Guidelines (para. 20), even re this type of aid:

- “aid should no longer be used to make up for the absence of cost internalisation. If environmental requirements are to be taken into account in the long term, prices must accurately reflect costs and environmental protection costs must be fully internalised. Consequently, the Commission takes the view that aid is not justified in the case of investments designed merely to bring companies into line with new or existing Community technical standards”.
- This is because the ‘polluter pays’ principle, the notion of internalising such costs and the use of market instruments has now long been promoted by EC environmental policy – companies have had long enough to adapt (Guidelines, para. 19).[1]

Evaluation of state aid – justification (I)

- General point 2: assuming that there is aid involved, it must be *justified* on some accepted ground if the grant of such aid is to be compatible with the common market.

- *Environmental grounds* will be vital here (see Commission Guidelines, paras. 72-73), falling within the headings of:
  - ‘projects of common European interest’ (Article 87(3)(b) EC) (“the aid must be necessary for the project to proceed, and the project must be specific, well defined and qualitatively important and must make an exemplary and clearly identifiable contribution to the common European interest”), or
  - ‘aid to facilitate the development of certain economic activities or of certain economic areas, where such aid does not adversely affect trading conditions to an extent contrary to the common interest’ (Article 87(3)(c) EC).

  [Note that higher rates of aid can be authorised by the Commission under Article 87(3)(b) EC.]

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Evaluation of state aid – justification (II)

- Specific considerations concerning aid to facilitate 'investment in in energy': see Commission Guidelines, para. 32:

"Investments to promote renewable sources of energy are deemed equivalent to environmental investments undertaken in the absence of mandatory Community standards. It should also be borne in mind that measures in support of renewable sources of energy are one of the Community's environmental priorities and one of the long-term objectives that should be encouraged most. The rate of aid for investment in support of these forms of energy is therefore 40 % of eligible costs.

The Commission takes the view that renewable energy installations serving all the needs of an entire community such as an island or residential area should also benefit. Investments made in this connection may qualify for a bonus of 10 percentage points on top of the basic rate of 40 % of eligible costs.

The Commission considers that, where it can be shown to be necessary, Member States will be able to grant investment aid to support renewable energy, up to 100 % of eligible costs. The installations concerned will not be entitled to receive any further support".

Evaluation of state aid – justification (III)

- Unfortunately, the specific provisions in the Guidelines concerning measures (etc) for reducing greenhouse gases pre-date the EC ETS Directive (see Commission Guidelines):

"70. In the absence of any Community provisions in this area and without prejudice to the Commission's right of initiative in proposing such provisions, it is for each Member State to formulate the policies, measures and instruments it wishes to adopt in order to comply with the targets set under the Kyoto Protocol.

71. The Commission takes the view that some of the means adopted by Member States to comply with the objectives of the [Kyoto] Protocol could constitute State aid [see, e.g., the Commission's subsequent Decision on the UK's own national ETS, prior to the EC Directive] but it is still too early to lay down the conditions for authorising any such aid".

- And, also unfortunately, the Commission's Decisions on the NAPs notified under the EC ETS Directive make no more than cursory and passing reference to the state aid question in relation to the allocation of emissions allowances under the Directive, so no detailed guidance here either.

Evaluation of state aid – justification (IV)

- Continuing free allocation to 'installations' only, as under the Directive – does this raise state aid problems?
  - given the evidence discussed above concerning the pass through of opportunity costs, then …

(i) Such allocation is acknowledged by the Commission to amount *prima facie* to state aid (see its various Decisions on NAPs notified for approval under the EC ETS Directive);

(ii) Thus, the aid needs to be notified to the Commission, and found to be justifiable – would rely upon environmental justification grounds;

(iii) Not impossible, in principle, to bring allocation of allowances under the environmental grounds discussed above … *yet* it seems strongly arguable that the extent of the extra benefit received (due to passing through opportunity costs) would amount to a benefit that is disproportionate to any environmental gains made through the EC ETS.

State aid - proportionality principle (I)

- Applying the principle of **proportionality** to such situations:

- this is a general principle of EC law, inherent in the EC Treaty;
- it thus applies as a matter of law to the actions of the EC institutions (here, the Commission in approving state aid) and to those of the Member States (when implementing or derogating from EC law).

⇨ Although the Commission has adopted its own Notice on *de minimis* aid and on thresholds of permissible aid (see the slide State Aid (5), above) …

⇨ the EC courts are not bound by such Commission guidelines.

Thus it is possible for proposed aid to be within the Commission's 'permissibility' thresholds **and yet** still contrary to the principle of proportionality.

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State aid - proportionality principle (II)

- Application of proportionality:

- establish justifiable goal to be achieved [here, environmental protection by reducing CO_2 emissions];
- is the measure [free allocation of allowances] suitable and *necessary* for achieving that goal?
- is the measure *proportionate* in achieving that goal? I.e., event though the measures do achieve the justifiable goal, do they involve an excessive negative concomitant effect?

- Key question is the *standard* [i.e. intensity] of review in asking what is an 'excessive' negative effect:

- i.e. does it have to be minimum negative effect possible, while still achieving the goal, or is a less strict standard appropriate?

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Implications of proportionality principle (I)

- In this scenario of allowances allocation, the argument is that the *policy choice* taken [i.e. free allocation] by the EC and/or the Member States is itself disproportionate:

- in such cases, courts (including the ECJ) tend not to review such choices too intensively, usually looking to see whether manifest error or manifest inappropriateness has been made out;

- However, note that in the state aids context we are also dealing with the *rights* of individuals to operate on a competitive market place without distortions due to aid granted by the State, which has not been approved by the EC:

- where individual rights are concerned, courts are usually likelier to conduct a more intensive review of the measure in question.

Implications of proportionality principle (II)

- Here, the key point is that free allocation under the current regime effectively grants a windfall benefit to recipients of allowances, which is not related to the environmental gains that the EC ETS aims to secure: this is a good basis for an argument that such aid may be disproportionate;

- To ensure that such problems are not raised as against any successor scheme, care should be taken to avoid such windfall benefits and accurately to link the allocation of allowances (and the benefits from receiving such allowances) with the environmental gains to be made from the EC ETS.

Allocation to consumers

- Directive requires free allocation of 90% of allowances
- Only Article 3 and Annex I of the Directive specify allocation to installations
- Annex III can be amended using comitology procedure
- If successful, this would allow (partial) allocation to consumers:
  - E.g residents register with trust fund;
  - Trust fund receives free allowances, sells them and then pays residents.
- Benefits of allocation to domestic consumers:
  - Tailor allocation to power sector only to compensate losses;
  - Thus avoid risk of regulatory intervention (windfall profit tax);
  - Avoids state aid problems;
  - Increase support of consumers for ETS;
  - Ensures compatibility with Border Tax Adjustment[1]
- Benefits of allocation to industrial consumers:
  - To compensate for competitive effects
  - Harmonisation required
  - If marginal emission rate > average emission rate incomplete compensation for power price increase.

1 Ismer, Neuhoff (2004)

Allocation to consumers, state aid considerations

- Amending the Directive to allow allocation of allowances to consumers – state aid constraints here?

- if the problems raised by the pass through of opportunity costs can be clearly established, and if allocation to consumers can be shown to combat its problems …

- then there seems no reason why the same environmental justification grounds would not be applicable to the allocation of allowances to consumers: the environmental goals to be achieved would still clearly be justifiable, and the prevention of the 'pass through problem' should mean that the benefit conferred is not disproportionate to the environmental gains made (subject, of course, to detailed working out of the system for allocation to consumers).

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