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Emissions trading and innovation in the German electricity industry

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Emissionshandel für Treibhausgase: Rückblick und Ausblick
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Motivation

- The pace of technological advance has been described as “the single most important criterion on which to judge environmental policies” (Kneese/Schulz 1978)
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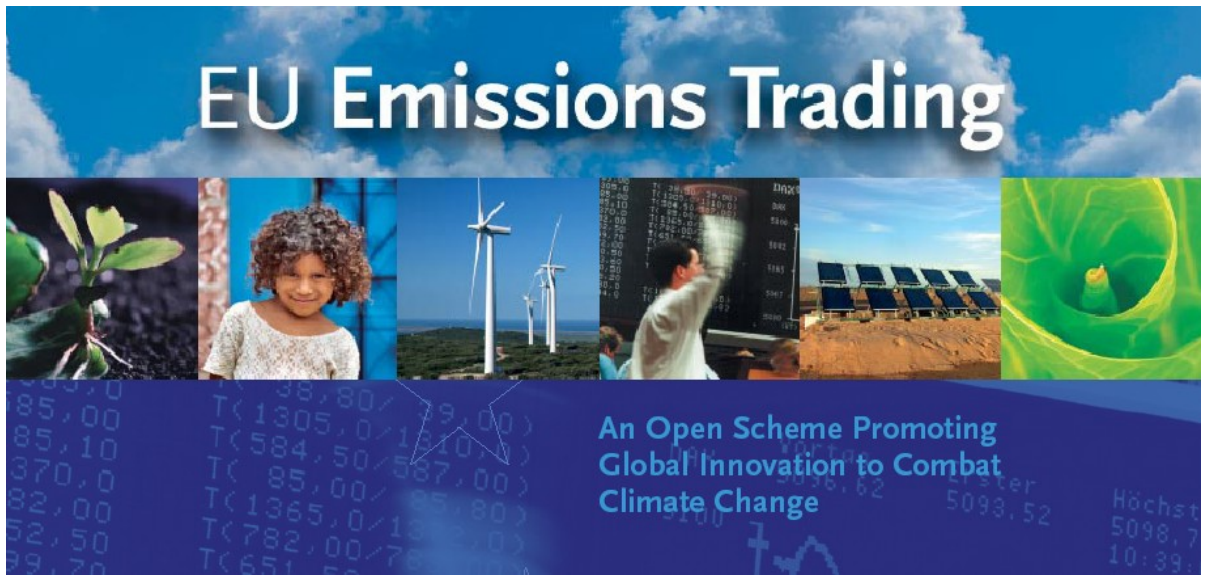

Design of the investigation

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- Aim: determine innovation effects of emissions trading in the German electricity industry

- Approach: panel analysis
  - Survey 1: 2004 before the start of the EU ETS
  - Survey 2: 2007 after 2.5 years of experience
  - Identify differences induced by emissions trading

- Representative sample: 20 companies

- Addressed issues
  - (Innovation Strategies)
  - (Institutional innovations)
  - Changes in operation
  - Investment strategies
  - Design options

Finding – changes in operation

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- 60% of the companies reported of changes in their merit order
  - Increased co-firing of biomass and substitute fuels
  - Shift from coal to gas (temporarily)
  - Hard coal plants were shut down on weekends, more starts per year than before 2005
  - Shifts from lignite to hard coal
  - Shifts form older to newer plants
- Shifts were reversed after prices dropped to zero
- Focus on efficiency rather than availability
- 40% did experience no changes in their merit order
  - Must run installations (cogeneration)
  - Only plants with similar technologies & fuels
  - Just one power plant
- Expected allowances prices
  - 2005-2007: € 11 to € 15/EUA (real: € 12 to € 13/EUA)
  - 2010: € 20 to € 25/EUA (2008 futures: € 20/EUA)
  - 2020: € 21 to € 30/EUA, 2050: € 28 to € 40/EUA

Findings – investment strategies (1)

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- CO_2 price is the third most sensitive factor of investment decisions (after the fuel and electricity prices)
- Discussion on power plant investment has considerably intensified since 2004, new generation capacities up to 40 GW are in the pipeline, some are already under construction
- Convoy type of construction: two or three similar plants at different sites
- International utilities: locate coal power plants in Germany because it is considered as specifically coal friendly
- Current investment cycle
  - Intensified through the introduction of emissions trading
  - In Germany as well through the 14 year rule
  - Investment cost for coal power plants have soared from € 820 per kW in 2004 to € 1,500 per kW in 2007

Findings – investment strategies (2)

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- Efficiency improvements in 80% of the companies, several triggered by emissions trading
  - installing more efficient frequency-controlled feed pumps
  - replacement of bladings
  - expansion of co-firing capacities
  - shortening of revision cycles (rather efficiency than availability)
  - Malus rule caused investments of € 70 million to raise the efficiency of 6 coal power plants to 36%
- Improved competitive positions of technologies
  - Renewables: biomass, wind
  - CCS (particularly larger companies)
- Project based mechanisms
  - Efforts of large companies substantially increased
  - Large budgets assigned
  - Additional departments with up to 20 staff
  - Focus: acquisition of low-cost credits (possibly development of projects)

Findings – design options (company perspective)

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- Options most important to own company

Initial allocation	21%
Overall cap	20%
Consideration of CHP	15%
New entrants	14%
Base year, early action	↓
Transfer rule	↓

- Options which would trigger innovation in own company
  - Overall cap
  - Initial allocation
  - New entrants

- Share of companies reduced which believe that emissions trading would not trigger innovation in their company

Findings – design options (industry perspective)

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- Innovation promoting design from an industry perspective
  - Cap: the more stringent, the more innovation
  - Auctioning: the higher the share, the more innovation
  - Allocation to incumbents: fuel rather than uniform benchmarking
  - Allocation to new entrants: fuel rather than uniform benchmarking
  - Treatment of closures: return allowances immediately
  - Duration of trading periods: 15 years
  - Specific rules: only CHP
- Options most important for innovation from an industry perspective
  - Cap 19%
  - Allocation to new entrants 18%
  - Reliable, international climate regime 14%
  - Duration of trading periods 14%
  - Share of auctioning 13%
- Transfer rule overestimated

Allowance prices and trading volume

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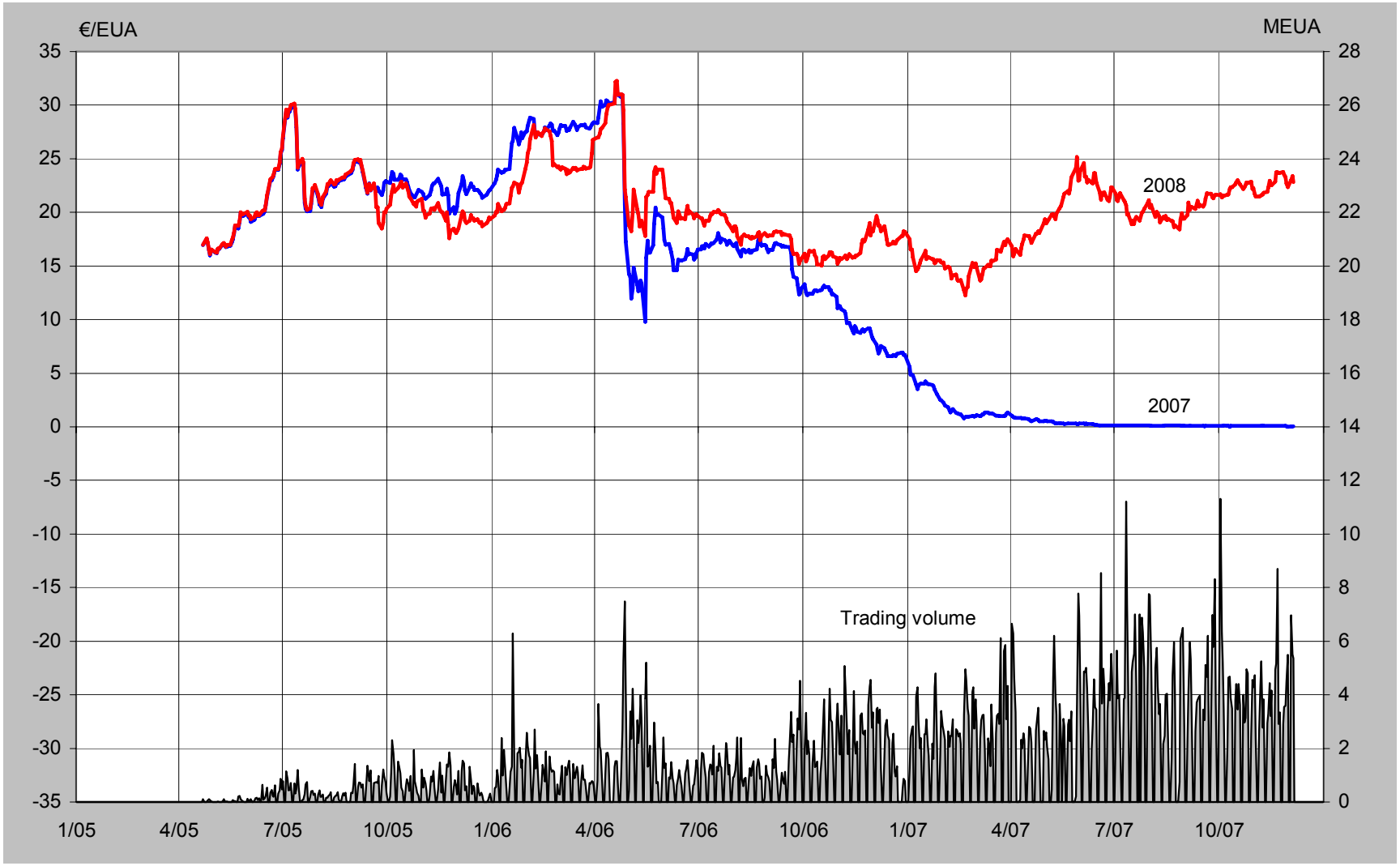

Sources: ECX 2007

Change in fuel consumption compared to the base period

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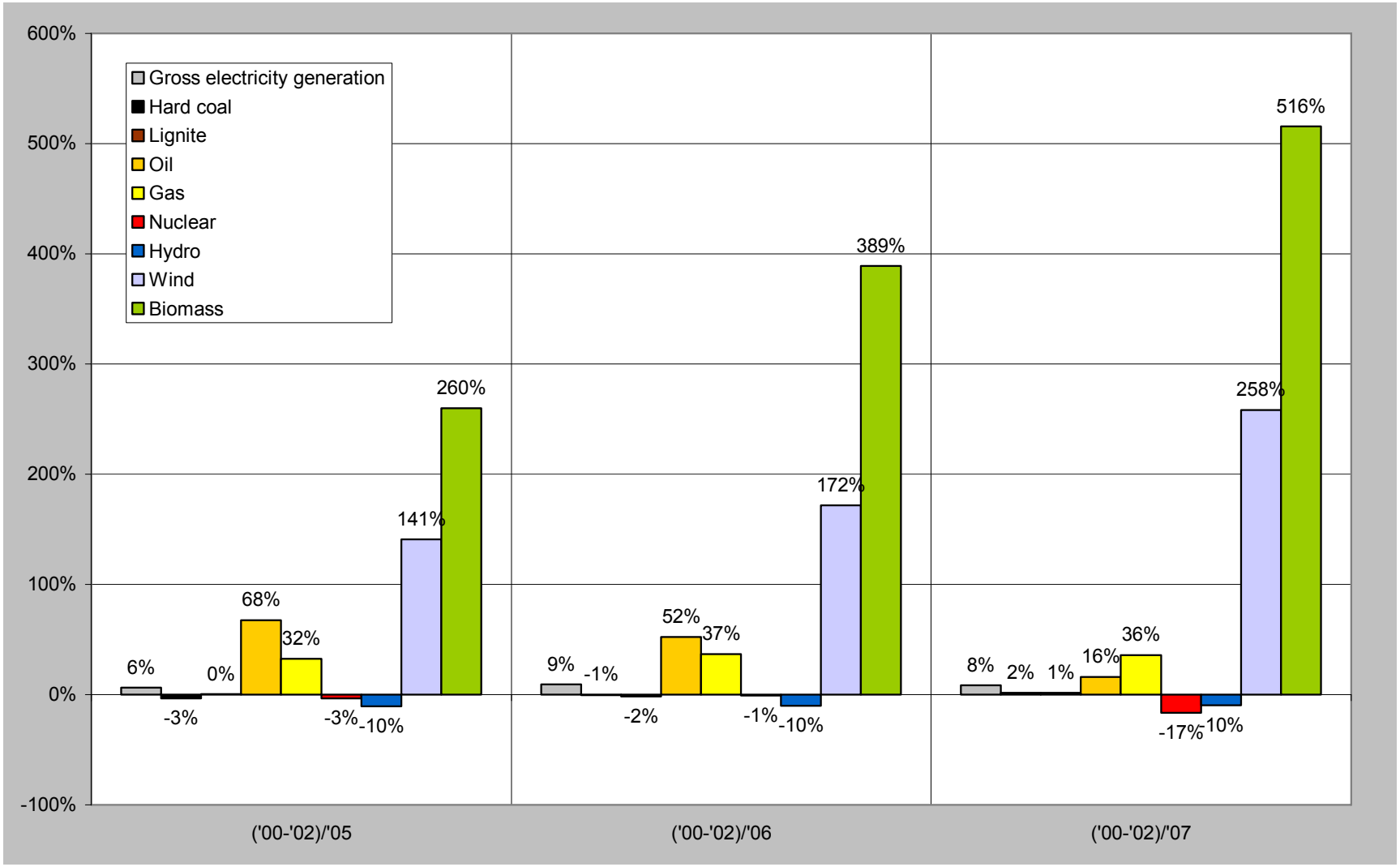

Sources: BMWi 2007, BMWi 2008, own estimates

Change in fuel consumption compared to previous year

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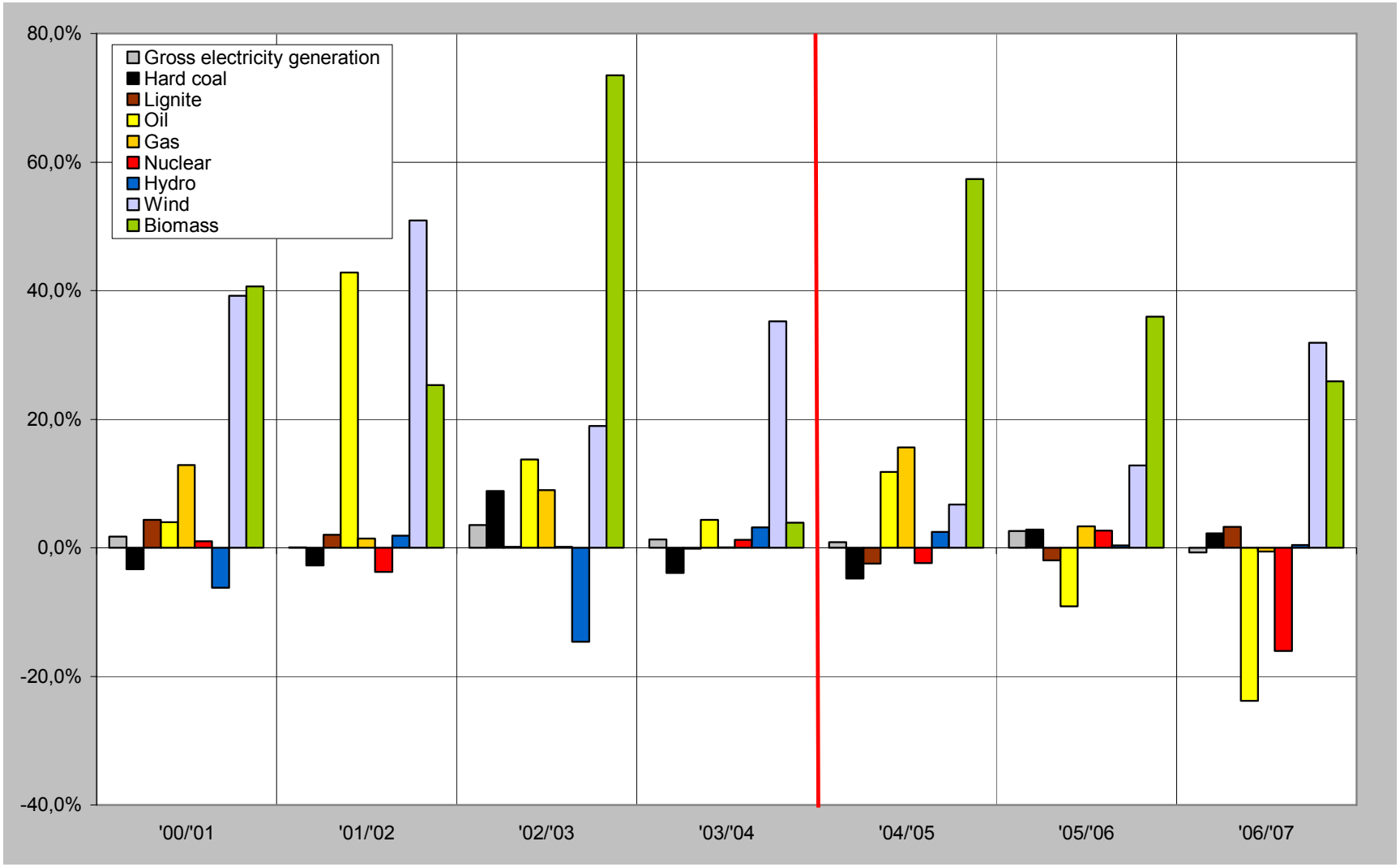

Sources: BMWi 2007, BMWi 2008, own estimates

Development of energy and carbon prices

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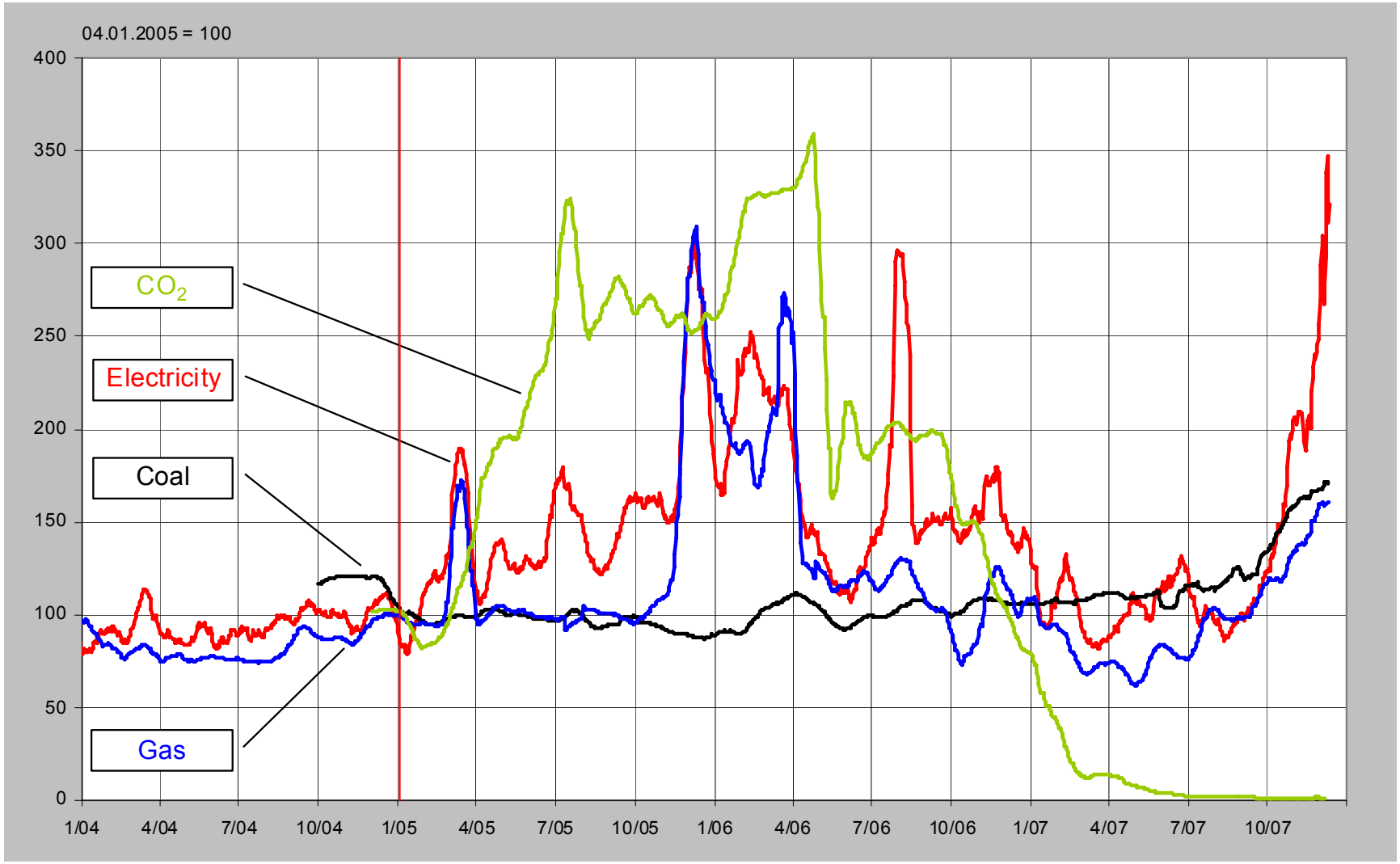
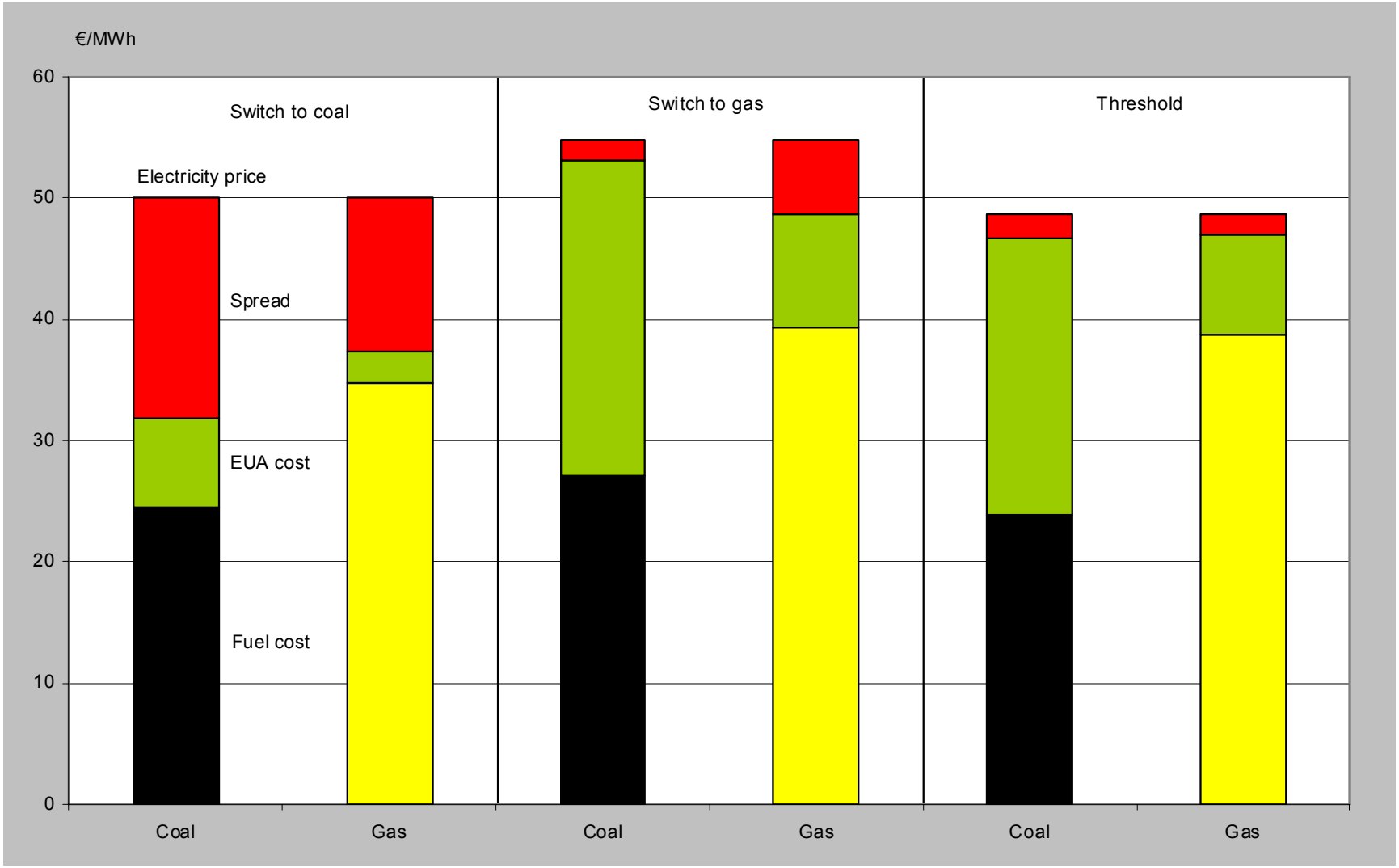


Sources: Point Carbon, EEX, Energate/Spectron Deloitte & Touche, own calculations

Incentives for fuel switch from coal to gas



Sources: own illustration

Coal to gas switch band

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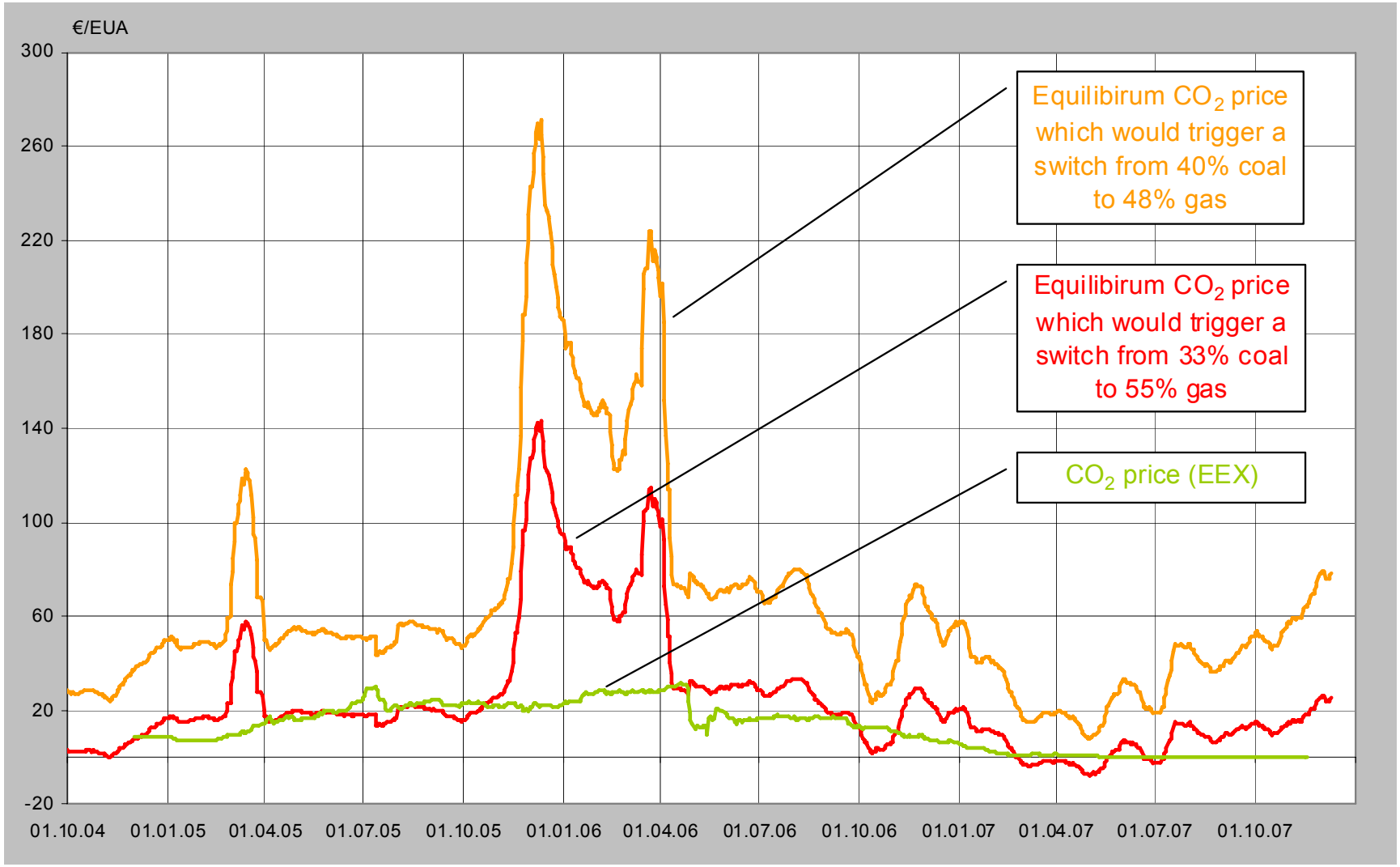
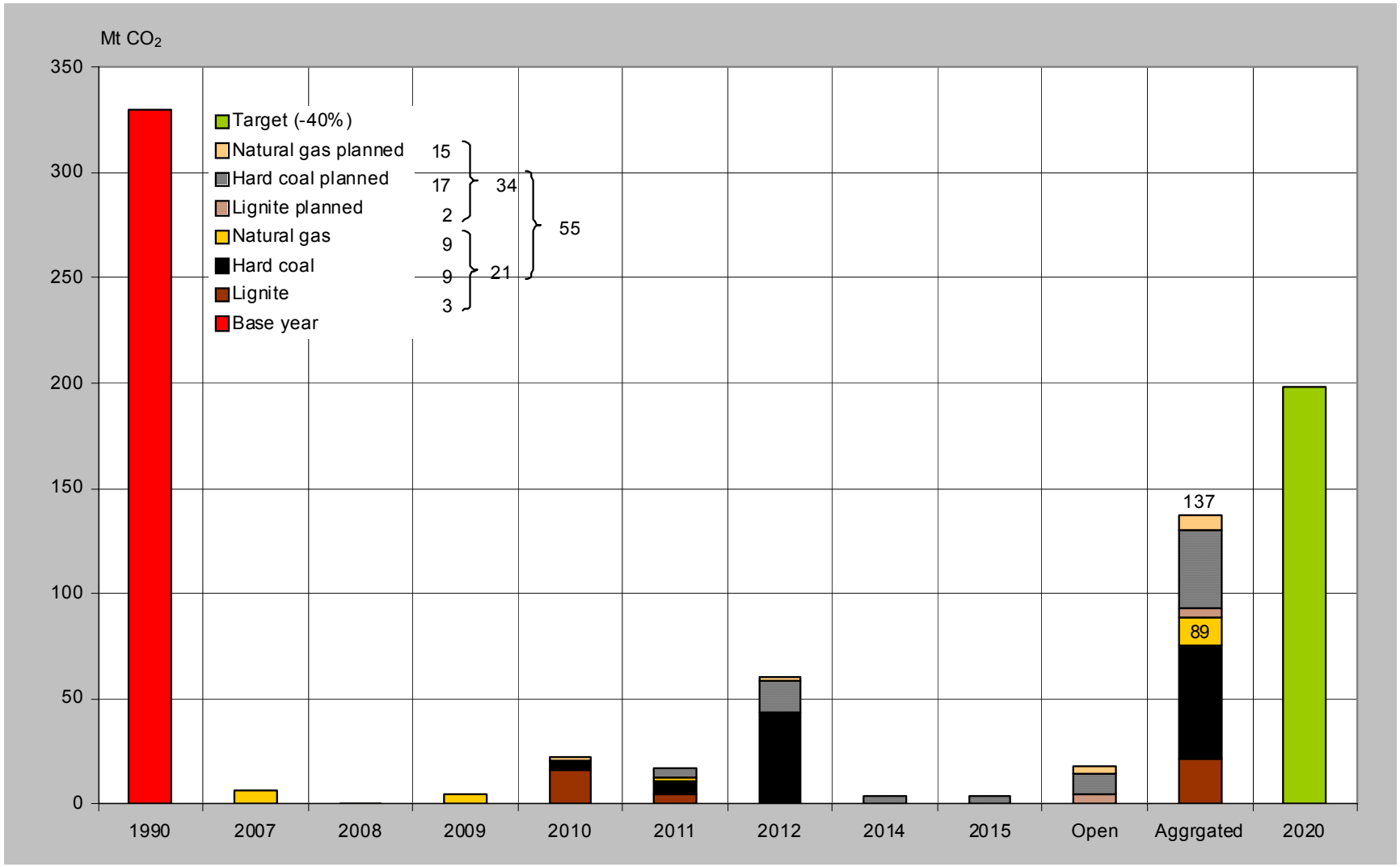


Sources: Point Carbon, EEX, Energate/Spectron Deloitte & Touche, own calculations

Planned emissions by planned capacities



Sources: bdew, BNA, BUND, PLATTS, personal communications, compilation by Öko-Institut

Emissions in large coal power plants

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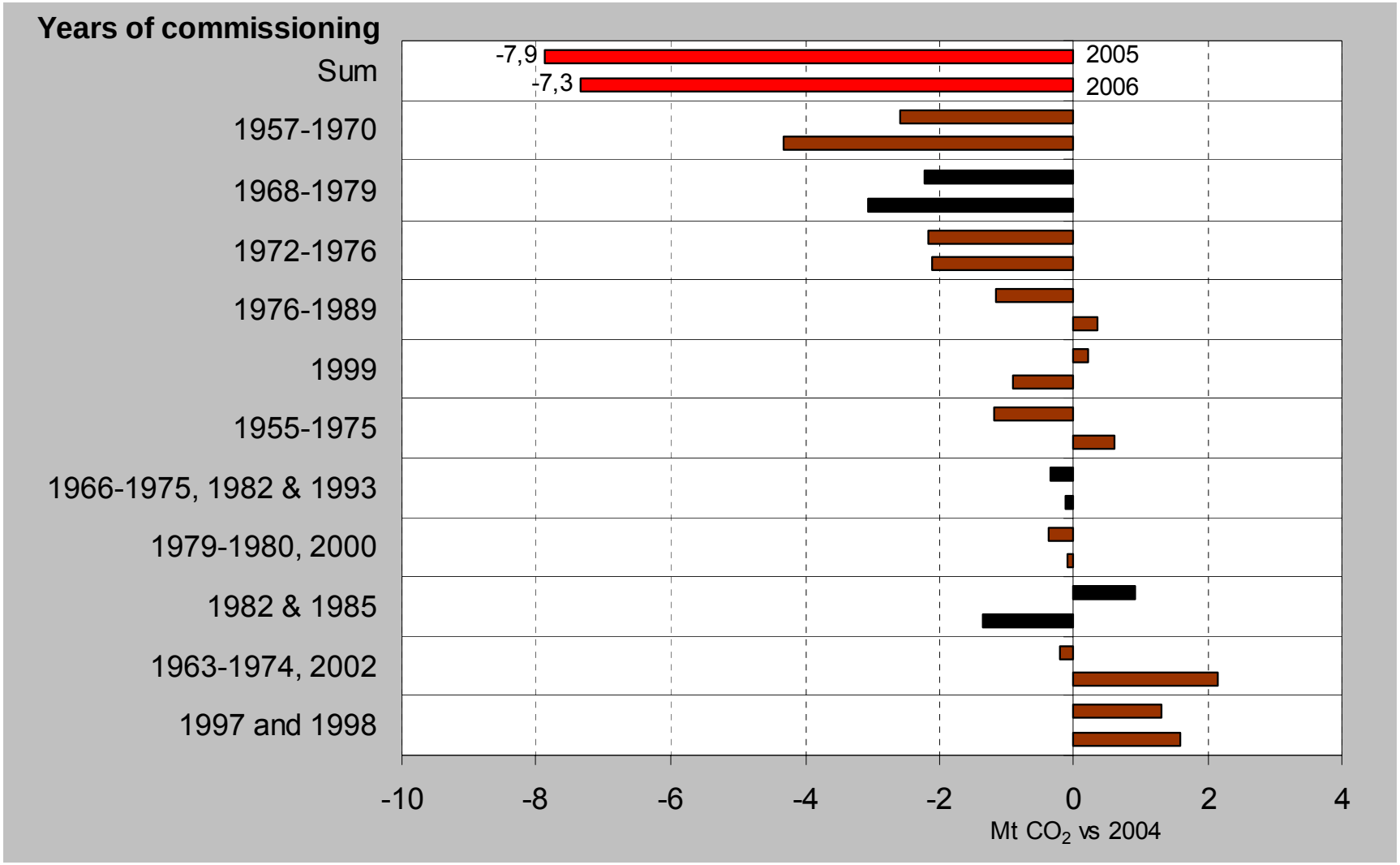

Sources: EPER, CITL, own calculations

Modeled impact of emissions trading 2006

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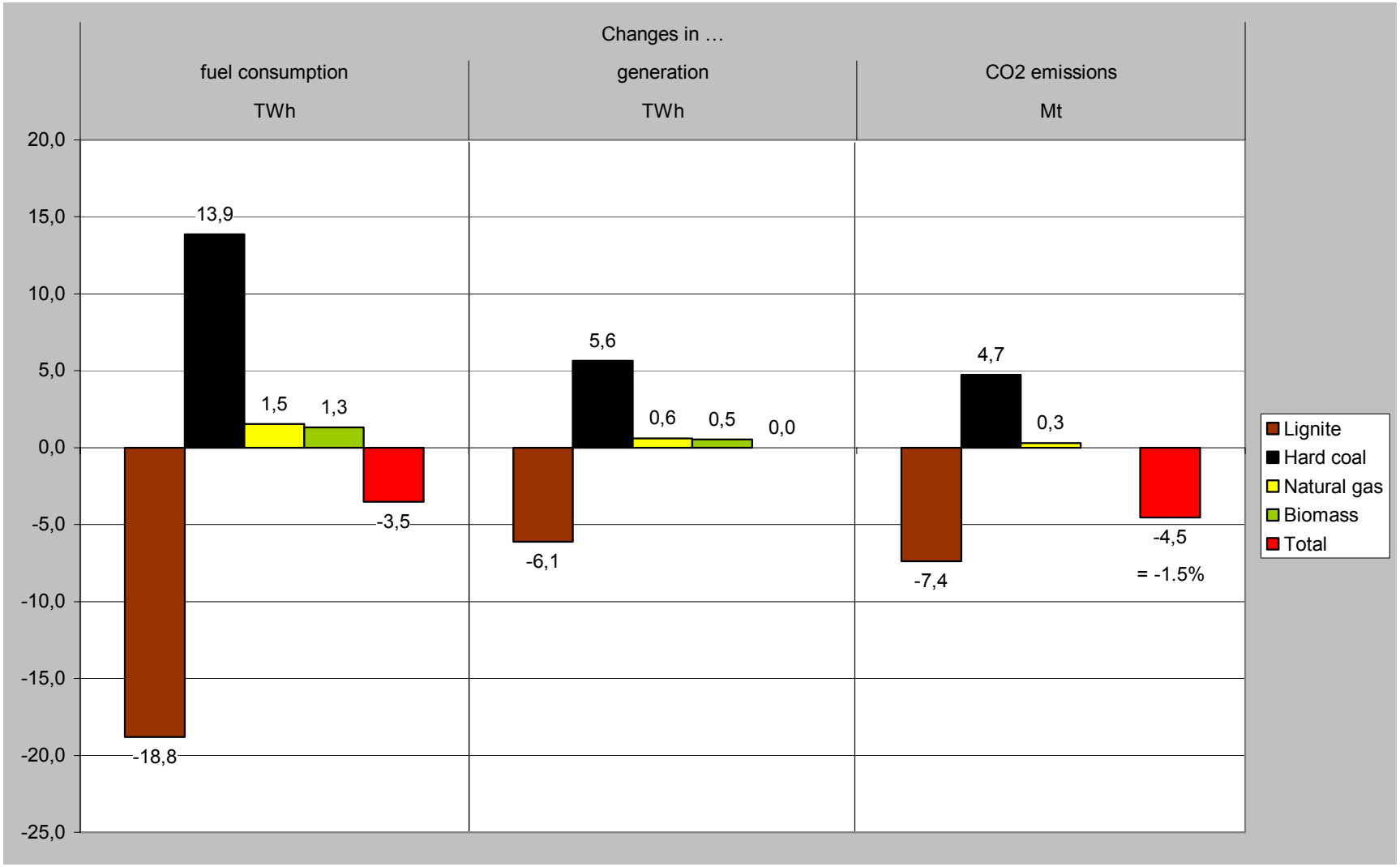

Sources: arrhenius Institut, own calculations

Conclusions (1)

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- Dimensions of emissions trading's impacts on innovation
  - Before the start mainly soft institutional innovations which did not require large investments
  - Hard innovations which involved larger investments were postponed (2 to 4 years)
- Introduction of emissions trading: fostered soft institutional innovations but rather contributed to a delay of hard technical innovation
- CO_2 market works as intended but does – thanks to over-allocation – not yet generate the incentives to trigger substantial investments/innovation
- 14 year rule has contributed to a spike in the investment cycle
- Emissions trading has already induced efficiency improvements, particularly the malus rule
- Germany is considered as a coal friendly country by some internationally operating utilities

Conclusions (2)

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- CCS would not yet have received this attention without emissions trading
- Renewables gained in competitiveness
- Efforts for project based mechanisms were increased only recently, mainly by large utilities
- Design options most sensitive for innovation
  - Overall cap
  - allocation to new entrants
  - long-term international climate regime
- Importance of transfer rule was overestimated

- Emissions trading started already to induced innovation but design could be adapted to increase innovation incentives

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Thanks for your attention!



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