# Features of Low Carbon Economies

## Policies, Practices and Economic Implications in Germany

International Research and Forum on
Economics of Climate Change
Toward a Low Carbon Economy in China

Inception Meeting
Stockholm, 14th February 2008

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Potsdam Institut für Klimafolgenforschung
Forschungsbereich Nachhaltige Lösungen

# Content

1. The EU Energy Package
2. Experience and Practices
3. Energy Mix in the Next Few Decades
4. Economic Implications and Outlook

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# Energy Package of EU

**Climate Protection**
**2° C - 450ppm**

**Security of Supply**

**Competitiveness**

**Diversify and Stabilise Energy Imports**

- Energy Charter EU-Russia
- Launch North-Africa-EU energy partnership
- Establish EU strategic gas reserve

**Curb Emissions**

- 20% reduction EU emissions by 2020
- 30% reduction industrialised nations and EU 2020, if negotiatable
- 60-80% reduction target for industrialised nations by 2050
- 20% share renewables in EU primary energy by 2020, tradable quota system
- 20% improvement in energy efficiency 2020
- 10% share biofuels 2020
- 12 large CCS plants in EU 2015
- Reform and extend EU ETS

**Liberalize EU Energy Markets**

- Ownership unbundling energy transmission
- Stronger regulation energy markets
- Expand trans-european energy grids

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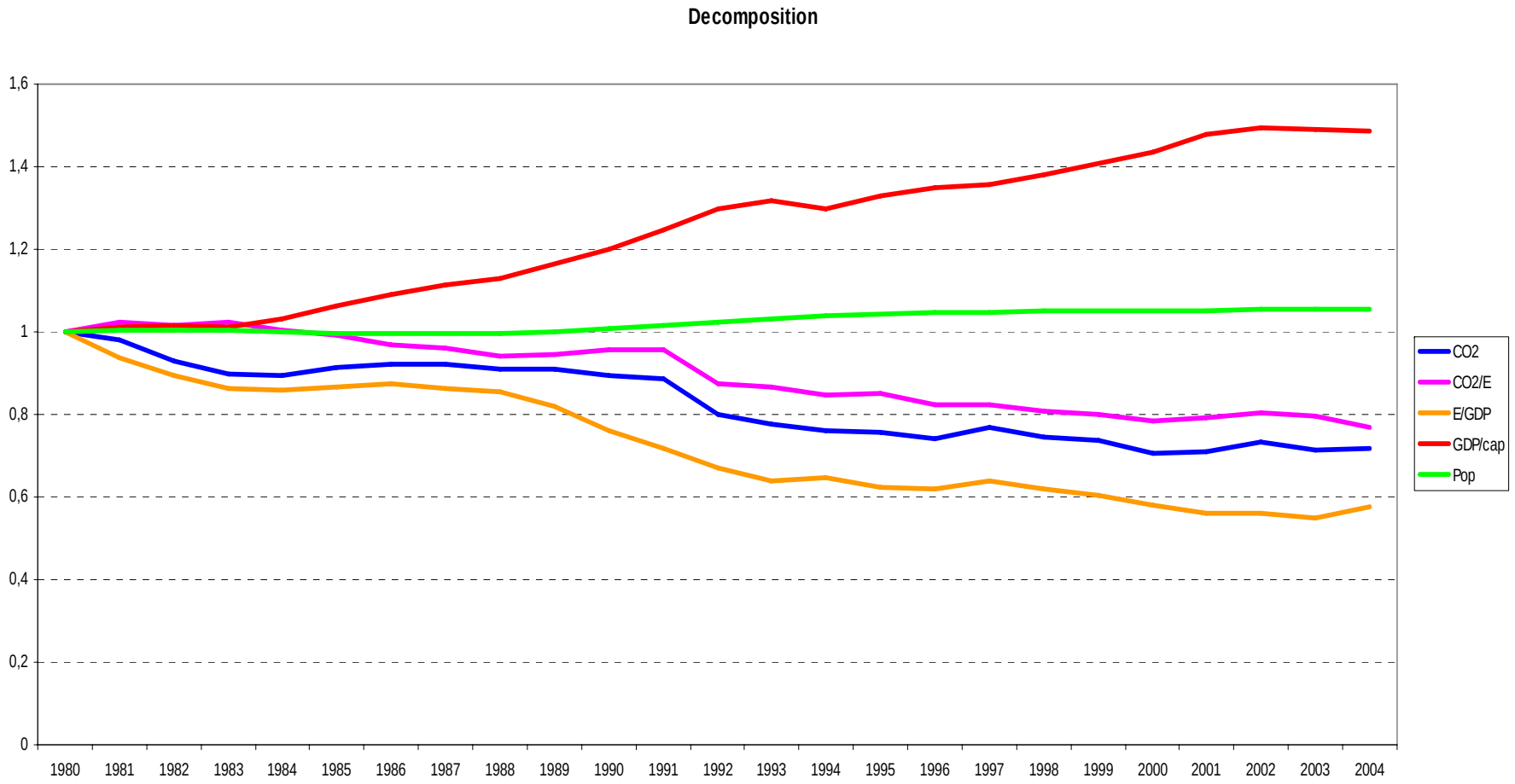
# Historical Emissions and Energy Trends in Germany: Kaya decomposition




Source: PIK/World Bank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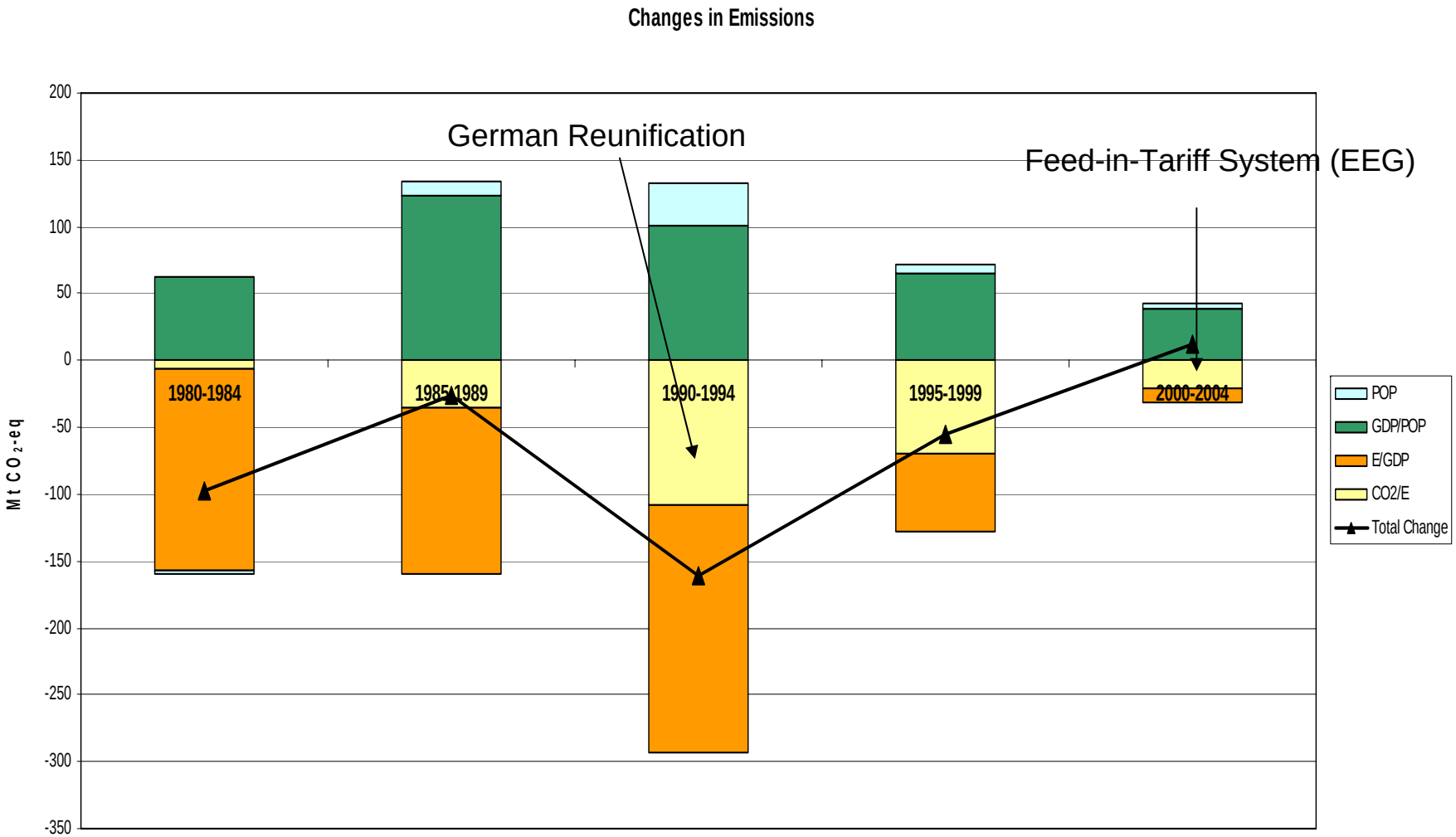
# Historical Emissions and Energy Trends in Germany
# Kaya decomposition





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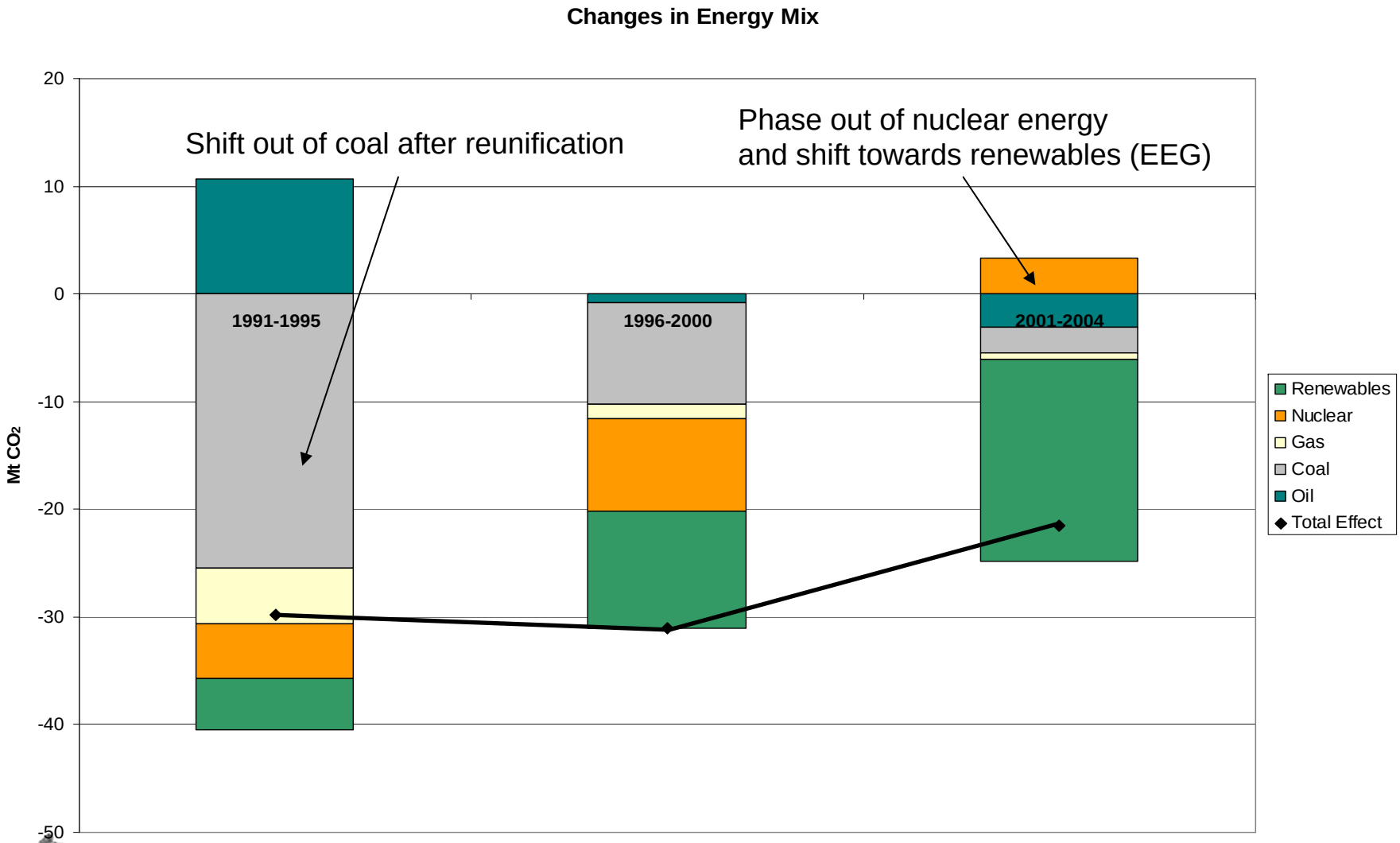
Source: PIK/World Bank

# Energy Mix

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Source: PIK/World Bank/BMWi

# The EEG: Annual production of electricity from renewable sources

Tariff ranges from the EEG 2000: (c/kWh)

Hydro: 6.65 - 7.67

Biomass: 8.70 – 10.23

Wind: 6.19 – 9.10

Solar: 45.7 - 57.4

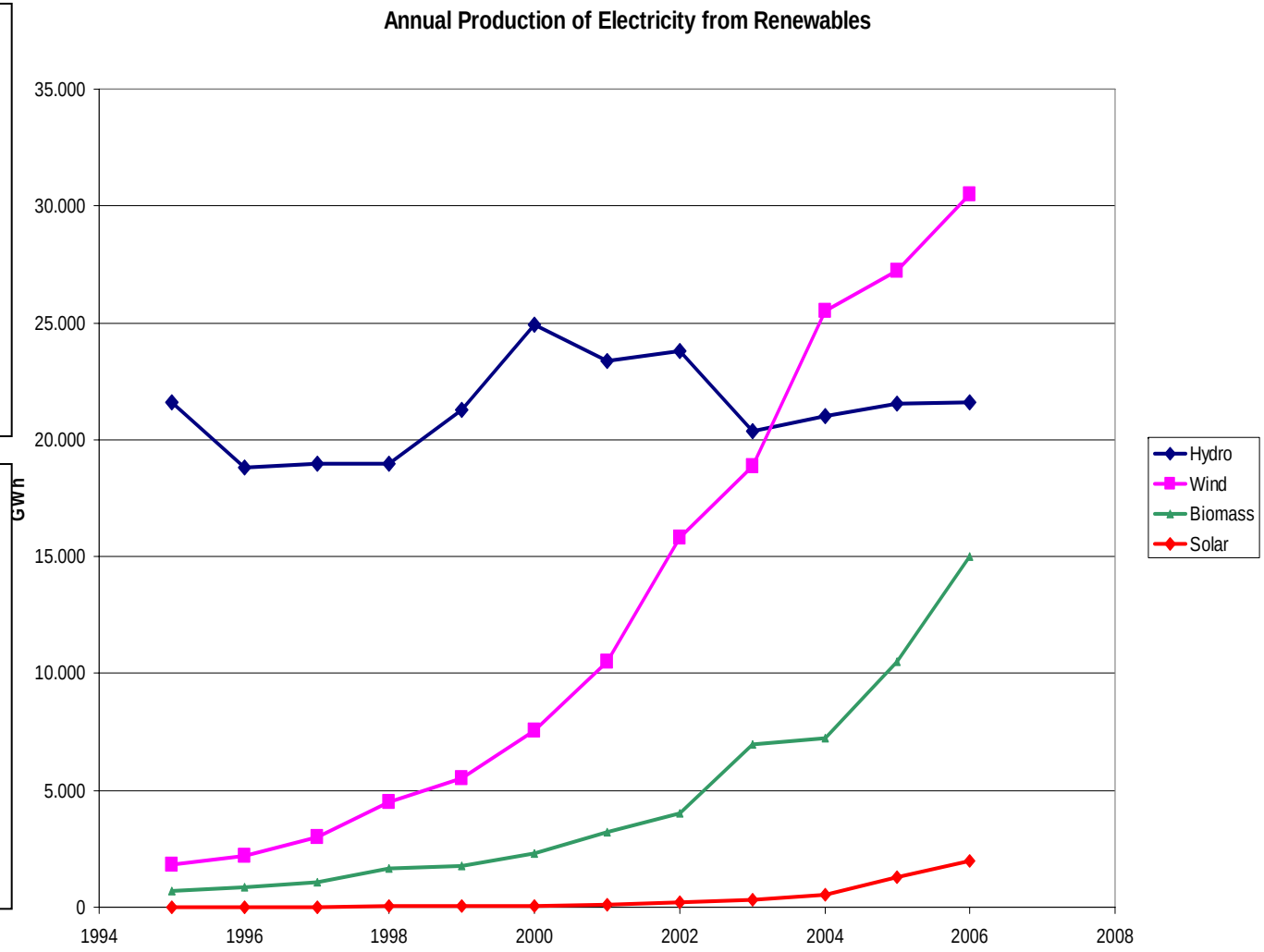
2004: changed feed-in tariffs:

Hydro: increase for plants < 5 MW

Wind: unchanged

Biomass: increase for plants < 5 MW, decrease for rest

Solar: unchanged

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Source: BMWi

# The EEG: Installed capacity of renewable energies in electricity generation

Tariff ranges from the EEG 2000: (c/kWh)

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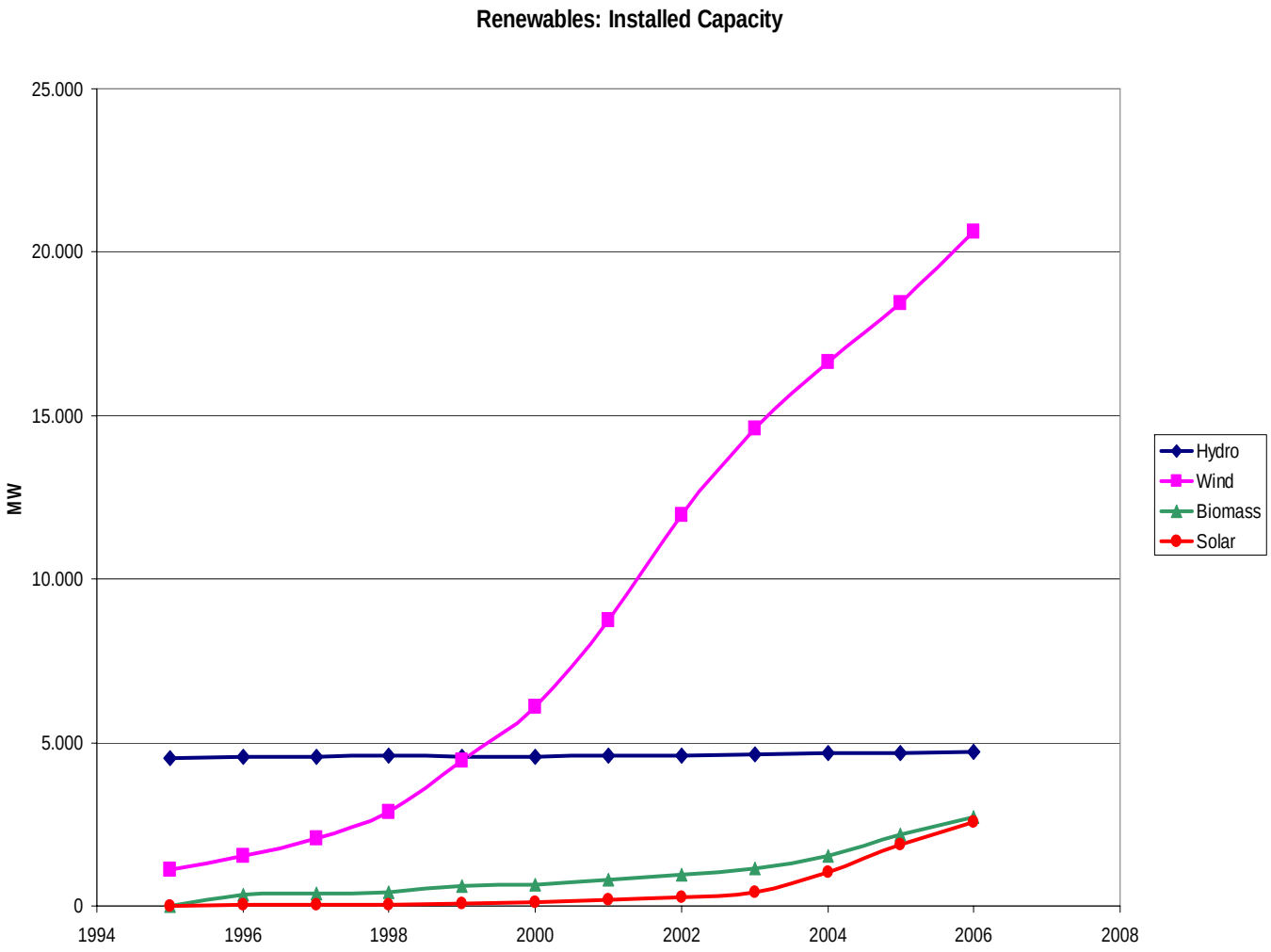


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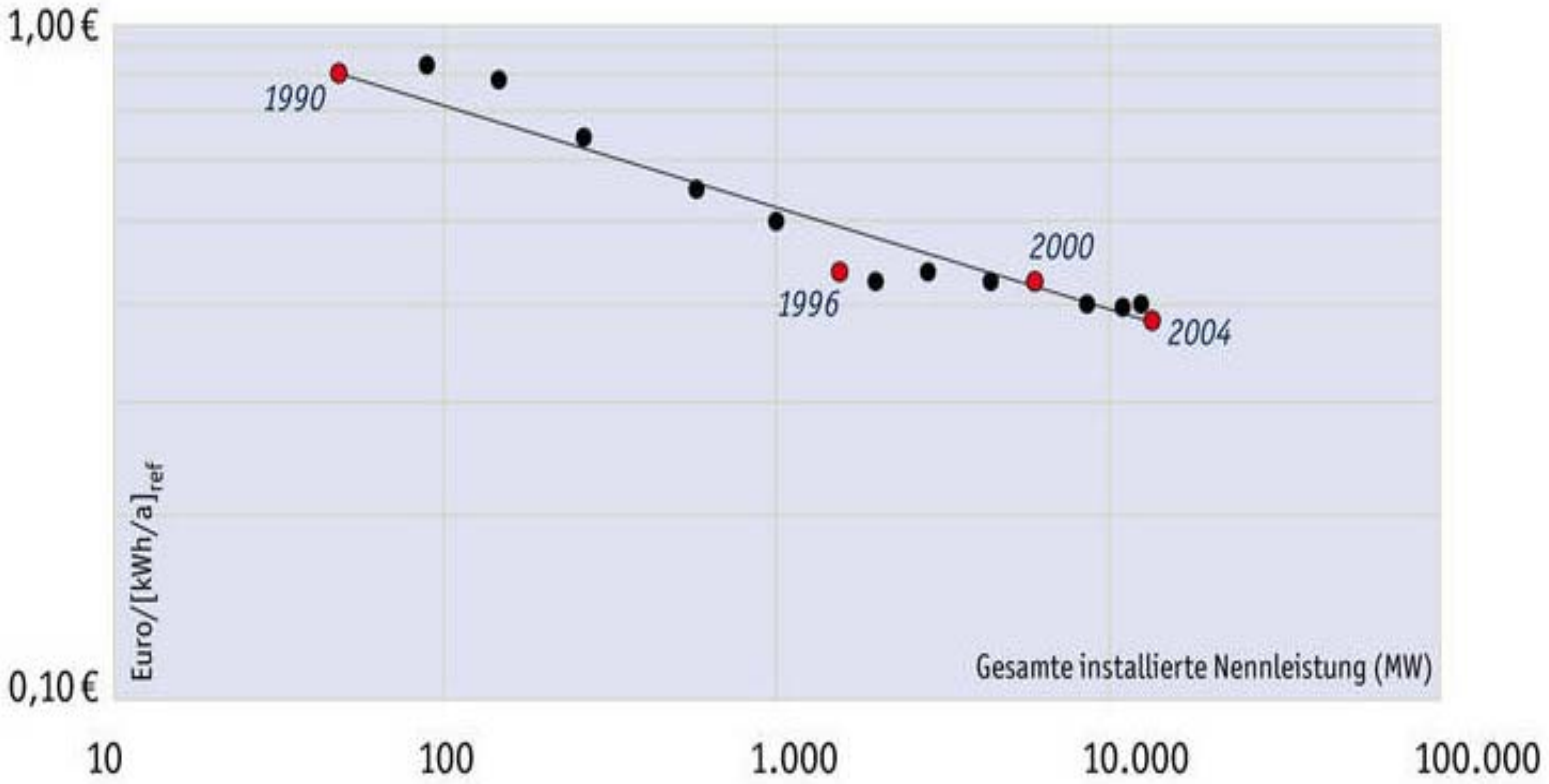
Source: BMWi

# Learning by Doing




Source: Bundesverband Windenergie e.V.

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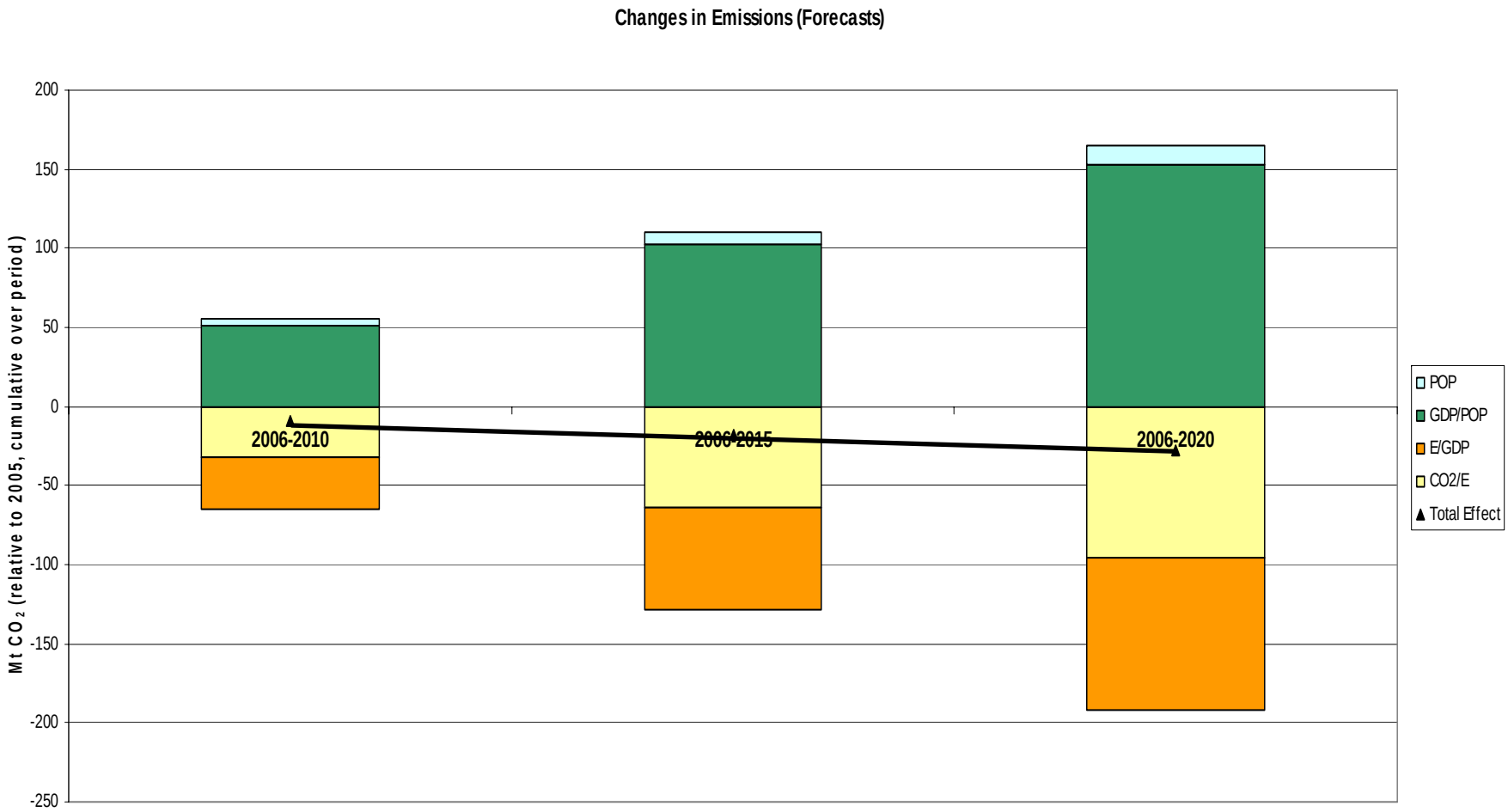
# Emissions in Germany: BAU Forecast




Source: PIK 2008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# The IEKP: what needs to be achieved?

- Annual growth rates of fundamental determinats during the 1995-2004 period:
  - GDP per capita: +1.3%
  - Population growth: +0.1%
  - E/GDP: -0.8%
  - $CO_2$/E: -0.8%

- Therefore, with the measures already implemented, one can expect an annual decrease of $CO_2$ emissions of roughly 0.2%, resulting in emissions in 2020 that are 21.3% below their 1990 value

- The measures proposed by the IEKP and the EU Energy package therefore have to achieve an additional abatement of roughly 189 Mt $CO_2$ per year (i.e. 15.7% of year 1990 emissions)
  - Promoting Renewables
  - Enhancing Energy Efficiency

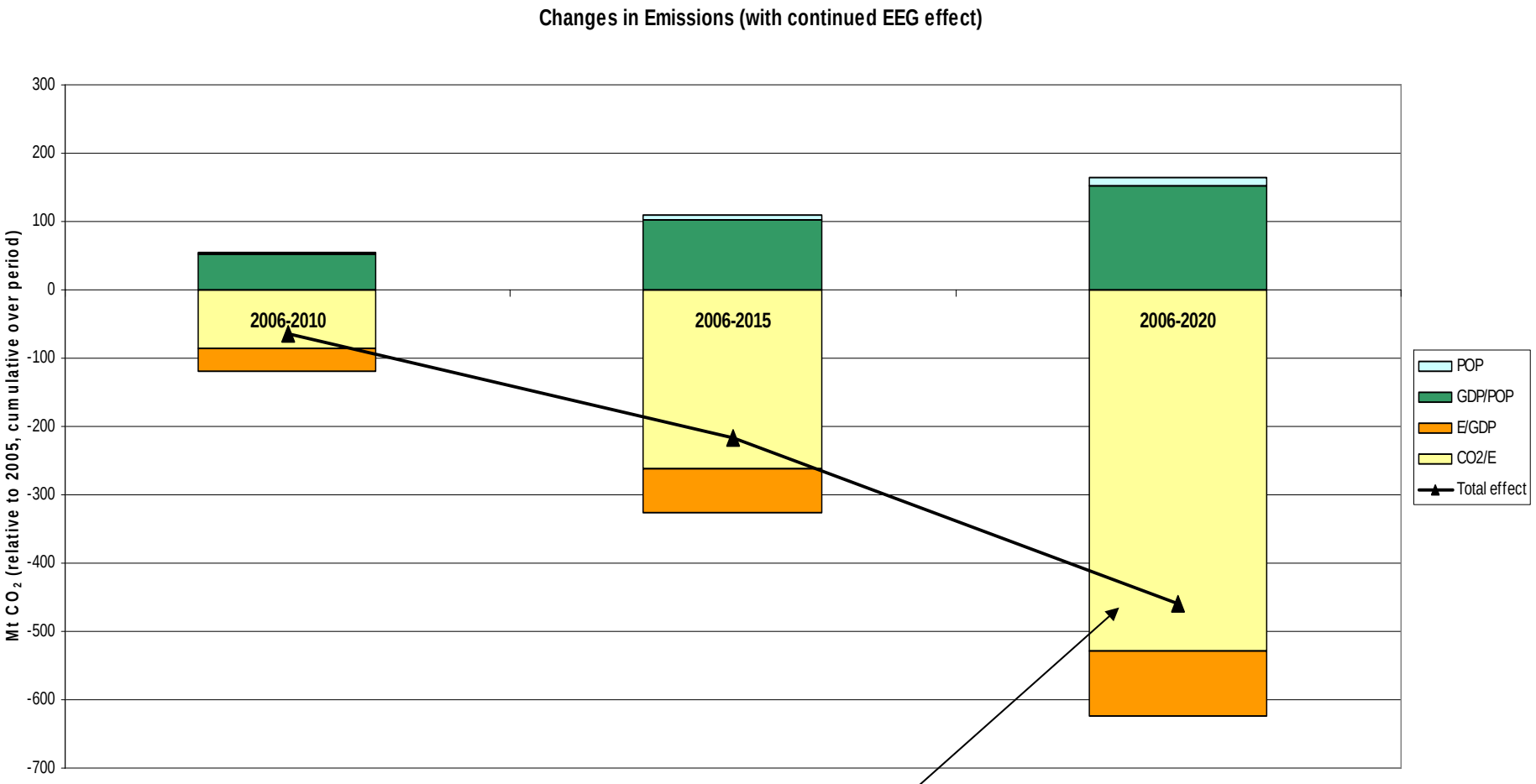
# The IEKP: UBA estimates of potential impacts

| Sector | Potential Reductions (Mt CO2 per year) | Policy Instrument | Effectiveness |
|---|---|---|---|
| Transportation | 33 Mt | Technology Standard (Biofuel and Fuel Efficiency Standards) | Low |
| Energy Efficiency | 25 Mt | Demand Management Technology Standards | Unknown |
| Renewables in electricity generation | 55 Mt | Feed-in-Tariff System (EEG) | High |
| Renewables for heating | 9 Mt | Technology Standard (EEWärmeG) | Low |
| Combined heat and power | 14 Mt | Feed-in-Tariff, Benchmark within ETS | Probably High |
| Residential sector | 31 Mt | Subsidized Credits for Insulation | High |
| Reduction of CFC emissions | 8 Mt (CO2-eq.) | Technology Standard Subsidies | Unknown |
| Overall abatement: | 175 Mt (185 Mt required) | | Unknown |



Source: PIK 2008

# Emissions in Germany: Forecast with continued EEG effects




2020: renewable share of 26% in electricity
Annual emissions are 54 Mt $CO_2$ (=4.5% of 1990 value) below BAU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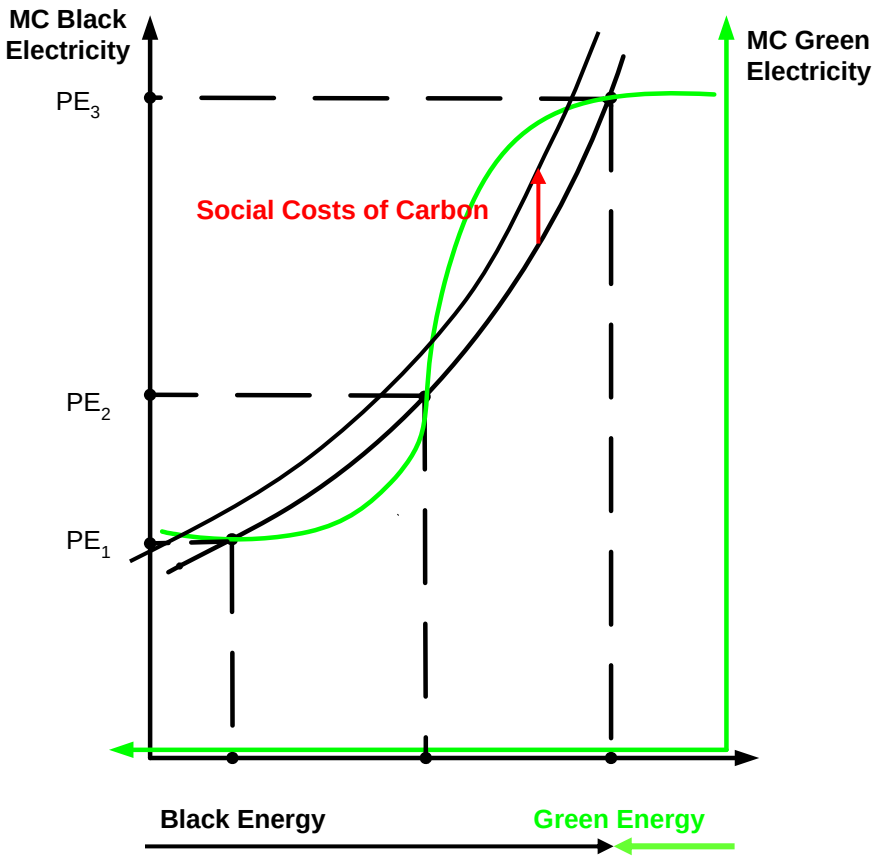
Source: PIK 2008

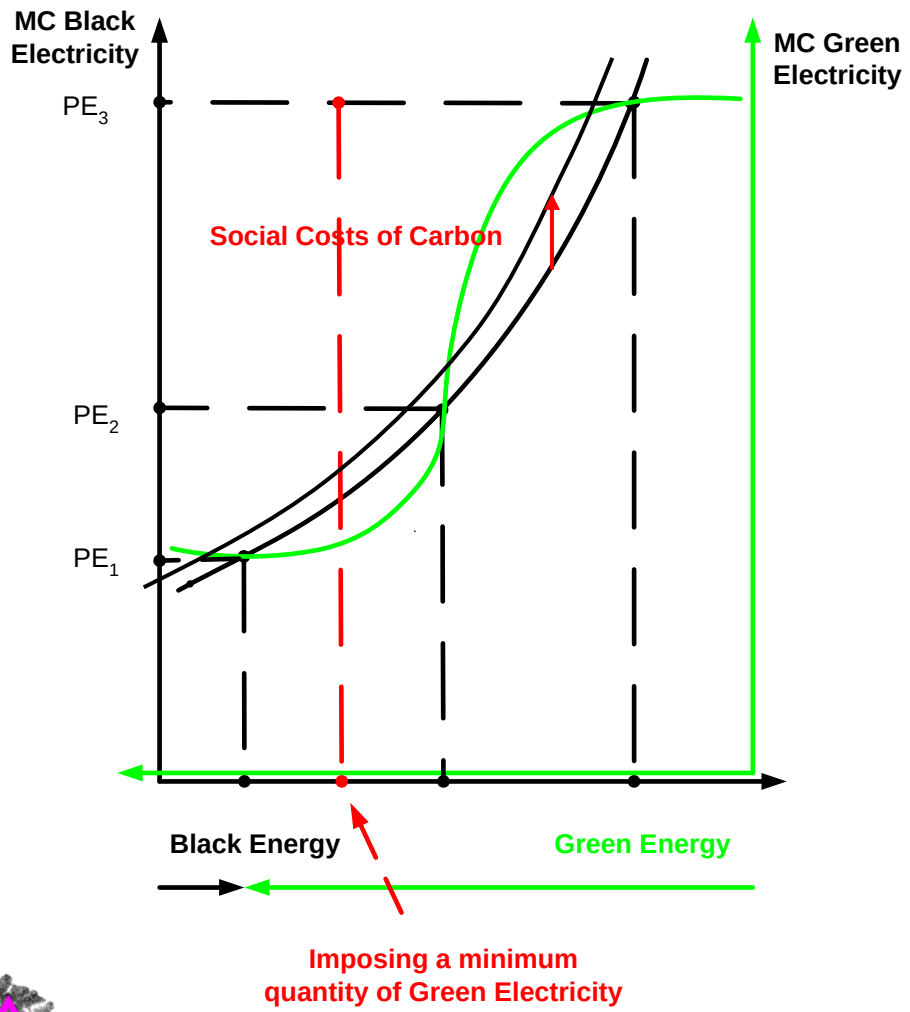
# Why promoting Renewables when an ETS is in place?






Quelle: O. Edenhofer

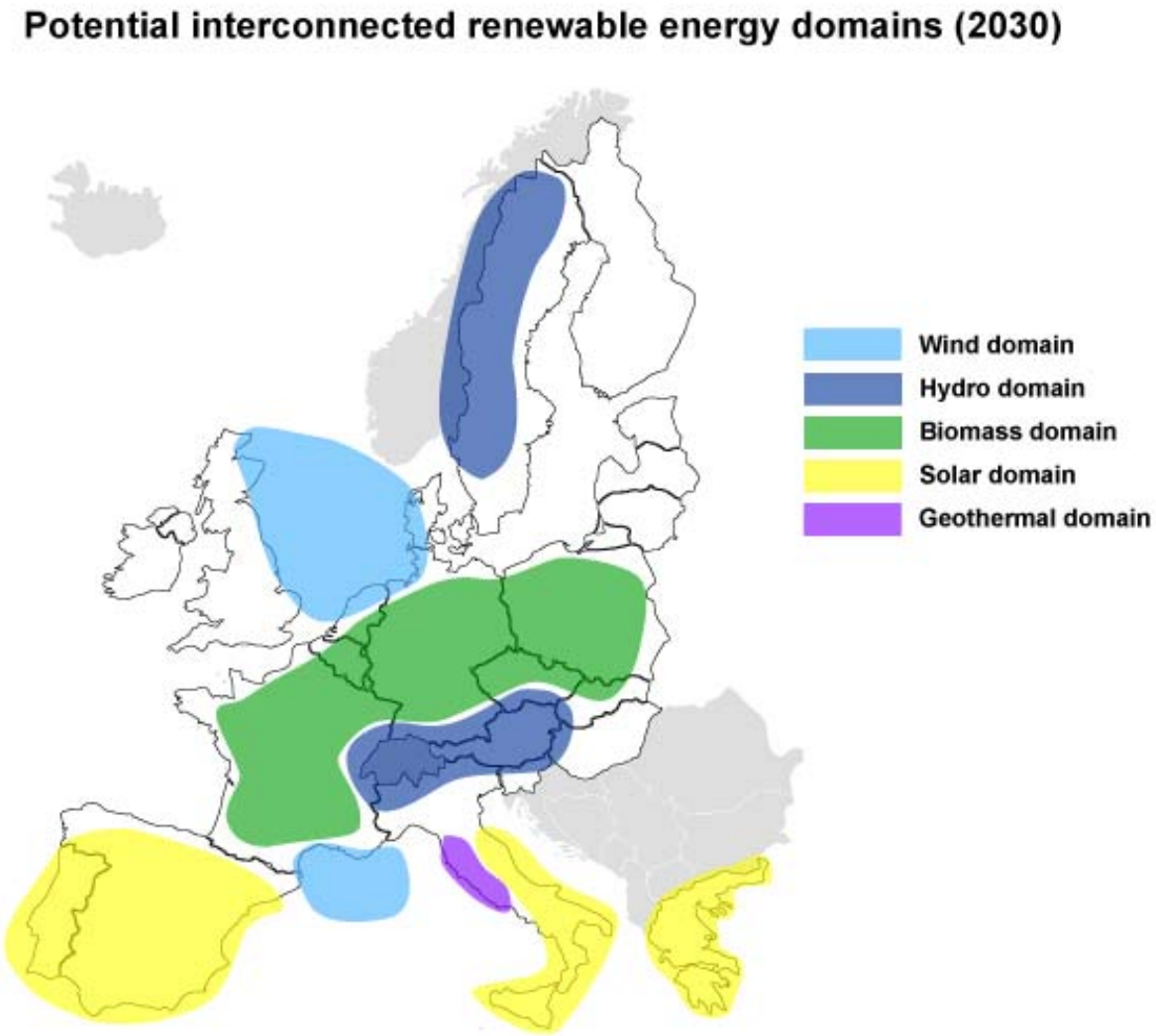
# Multiple Equilibria





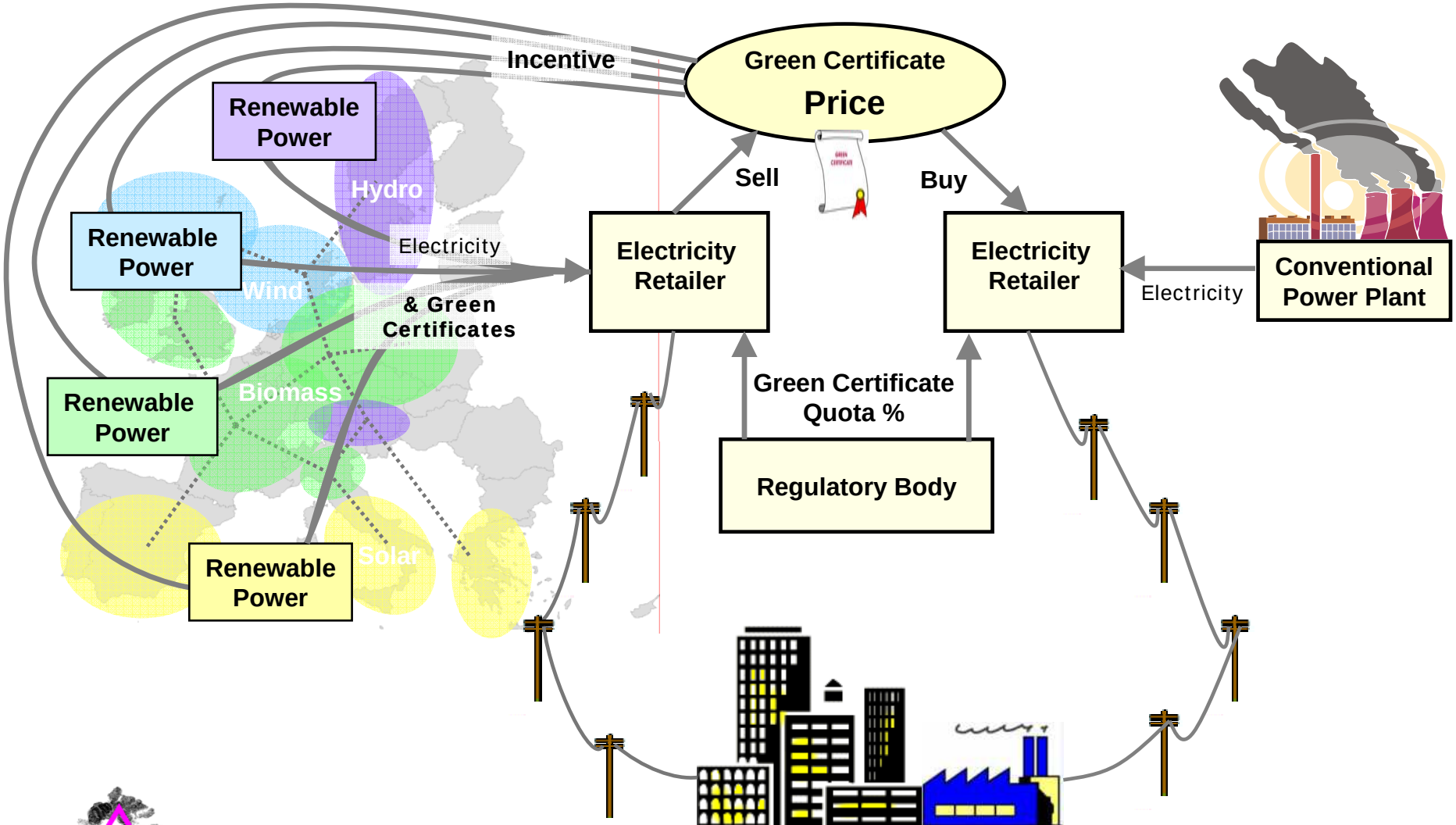

Quelle: O. Edenhofer

# Comparative Advantages for Renewables




PIK 2007

# Impact of Tradable Quote on Renewables



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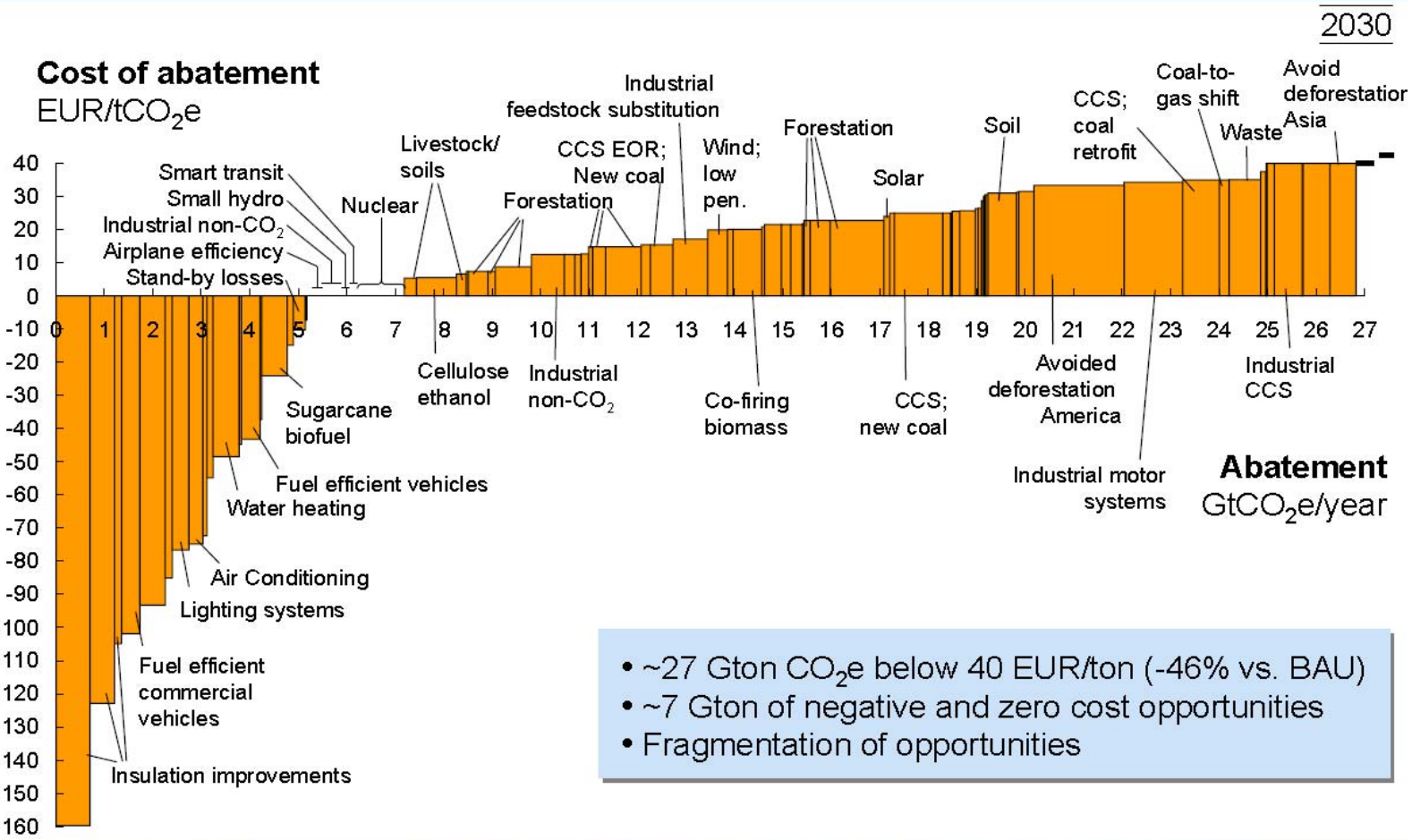
# Why marginal abatement cost curves are not always helpful for assessing climate policy

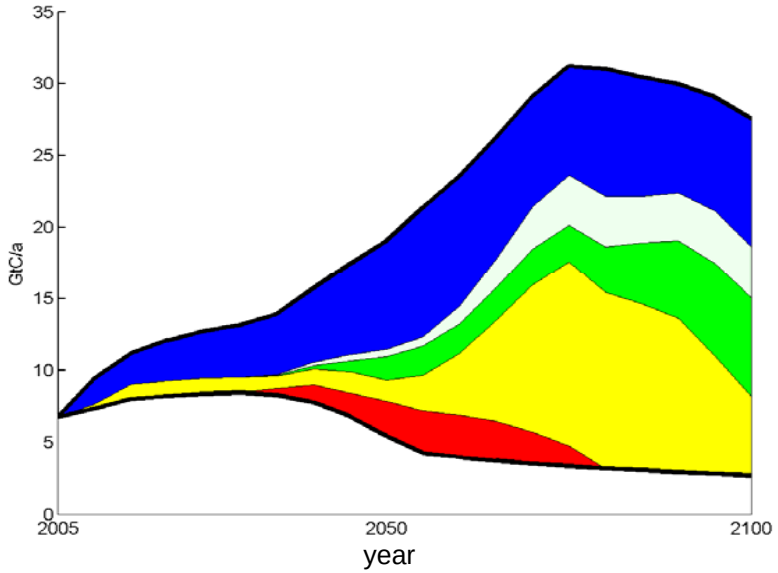
## Global cost curve of GHG abatement opportunities beyond business as usual



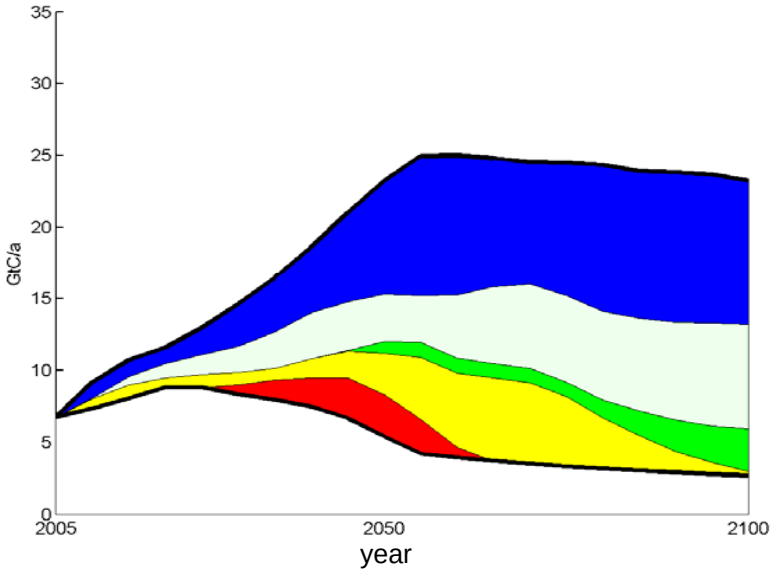

- ~27 Gton $CO_2$e below 40 EUR/ton (-46% vs. BAU)
- ~7 Gton of negative and zero cost opportunities
- Fragmentation of opportunities

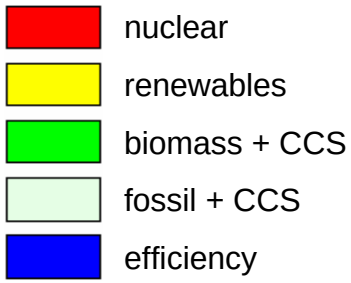
# Impact of High Oil and Gas Prices on the Portfolio of Mitigation Options

**coal/oil/gas cheap**



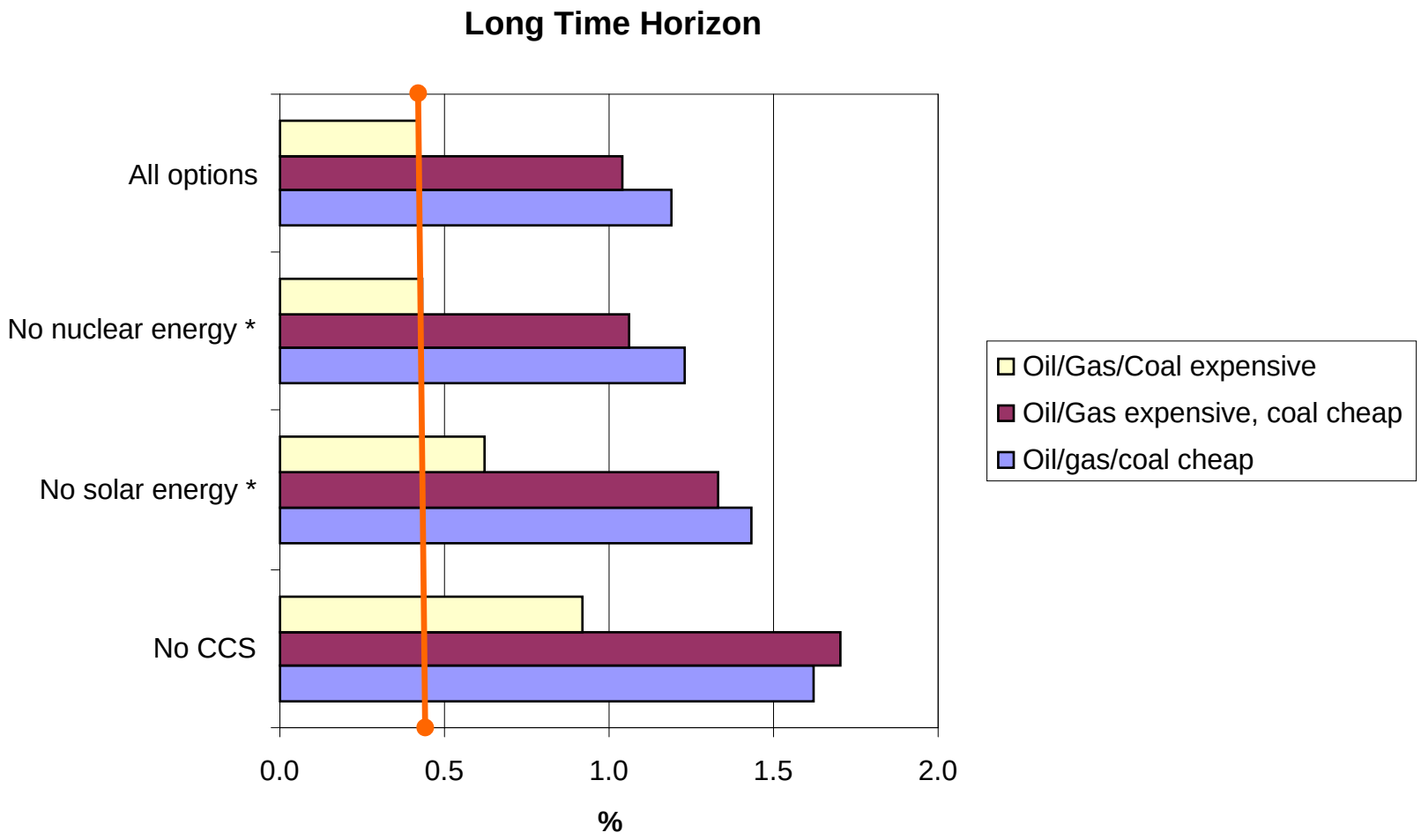

**coal cheap, oil/gas expensive**




PIK 2008

# Option Values of different Mitigation Options

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* : no *mitigation-induced* extension of nuclear and solar energy, respectively

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