

## **Climate Change and Emission Reductions**

Summer-Academy  
“Young Scientists Cooperate for Peace”  
August, 02<sup>nd</sup> - 15<sup>th</sup> 2009 in Hamburg  
Hamburg, August 7<sup>th</sup>

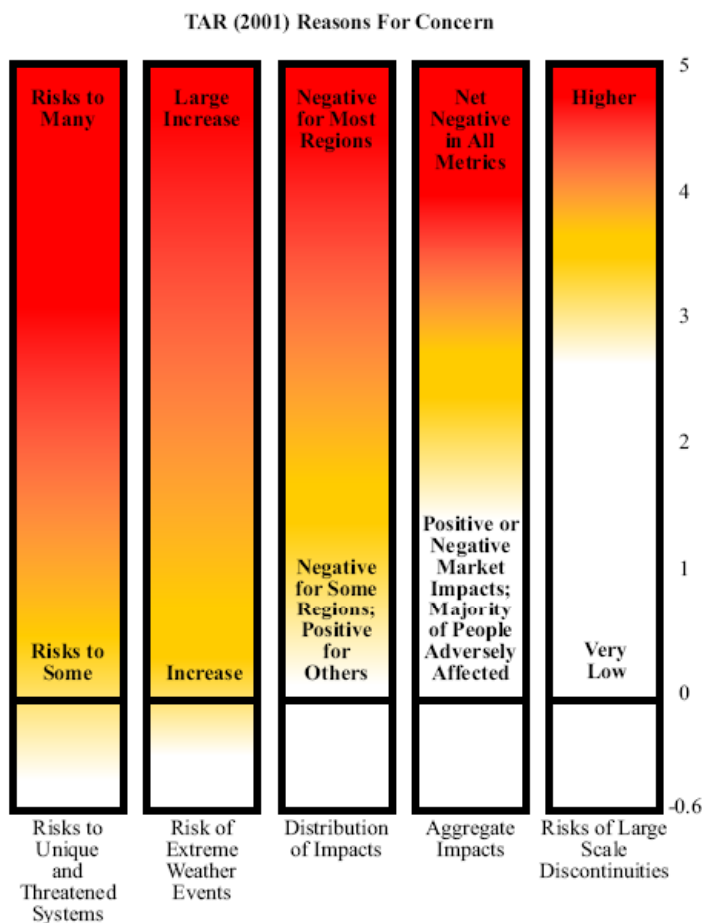
*Sven Bode*



- Hamburg based, private think tank that offers independent expertise for decision makers in politics, administrations and the private sector
  
- Focus
  - Liberalised power markets
  - Emissions trading and trade in green certificates
  - Renewable energies
  - Carbon capture and storage (CCS)
  - Decentralised energy systems
  
- Svante Arrhenius
  - Swedish physicist and chemist (1859 -1927)
  - First to realise the role of carbon dioxide for the climate and to propose anthropogenic climate change already in 1895

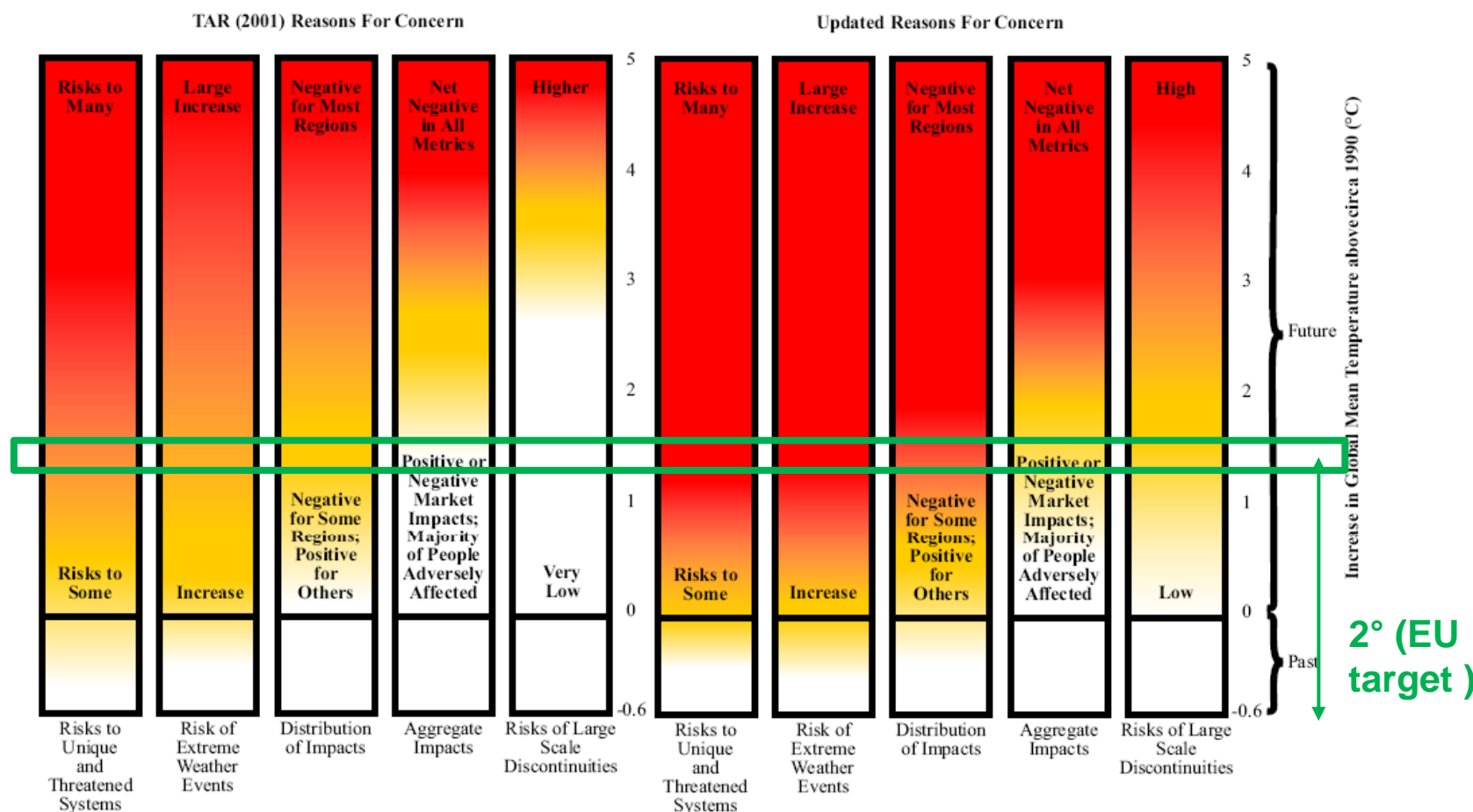


# Key driver: climate change - „reasons for concern“



Source: Smith, J. B.; Schneider, S. H.; Oppenheimer, M. (2009) Assessing dangerous climate change through an update of the Intergovernmental Panel on Climate Change (IPCC) "reasons for concern", Proceedings of the National Academy of Science (PNAS), doi 10.1073/pnas.0812355106

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## Need for massive reductions of GHG emissions



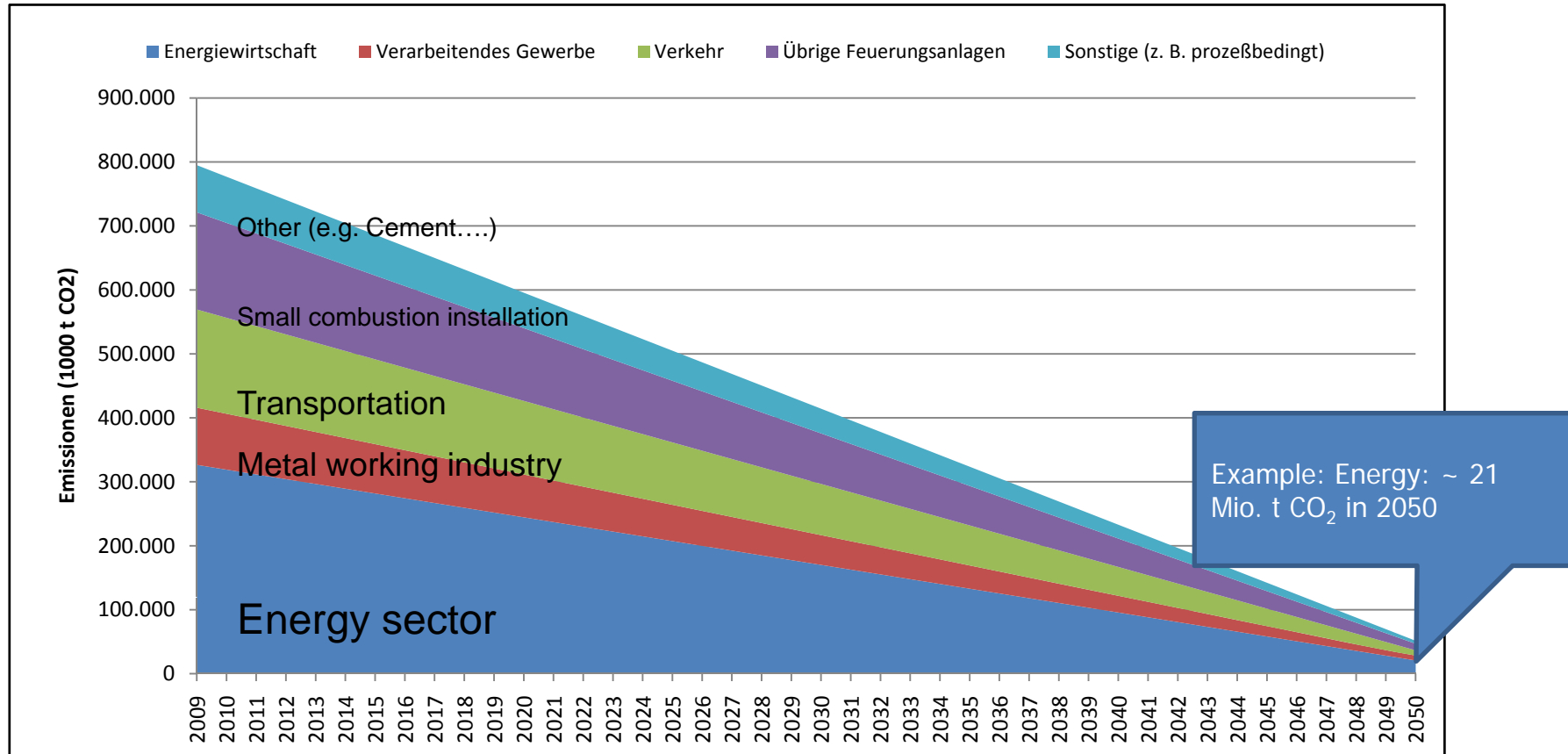
- “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system “ (Art. 2 UNFCCC) requires considerable reductions of GHG emissions

Table 1: Characteristics of greenhouse gas stabilisation scenarios (UNFCCC 2007)

Category	CO <sub>2</sub> equivalent concentration (ppm)	Global mean temperature increase*) (°C)	Change in global CO <sub>2</sub> emissions in 2050 (% of 2000 emissions)	Allowed emissions by Annex I Parties in 2050 (% change from 1990 emissions)
I	445-490	2,0 - 2,4	-85 to -50	<b>-80 bis -95</b>
III	535-590	2,8 - 3,2	-30 to +5	-40 bis -90
IV	590-710	3,2 - 4,0	+10 to +60	-30 bis -80

\*) above pre-industrial at equilibrium using ‘best estimate’ climate sensitivity

# Minus 95 %: What does it mean? The case of Germany



Possible emission trajectory for Germany; emission target – minus 95% comp. 1990

(Source: own calculations, Emissionen 1990: UBA 2006)



## Options for emission reductions

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- Power:
  - Supply:
    - Renewables (RE) Feed-in tariff very effective,
    - CCS: more research needed
    - Fuel switch (e.g. coal to gas)
      - fluctuating RE and “baseload” coal/ lignite not compatible in the long-run
  - Demand: despite all announcement no increase in efficiency
- Heat:
  - Supply: some potential for biomass and geothermal. Full potential needs to be verified, solar thermal
  - Demand: The forgotten variable – although insulation “proven technology” almost no progress in existing building
- Transportation:
  - Supply: continuous increase in efficiency of vehicles
  - Demand:
    - passenger km.: slightly decrease (excl. Flights)
    - goods traffic continuously increasing

## Options for emission reductions

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- Behaviour (Change in)



- It not only about climate change....
  - Resources are becomes scarce (exp. With 9 billion people)



# Changing Markets: the case for power from RE

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- EU Climate & Energy Package (23 January 2008)
  - 20 % renewables in 2020
    - Transportation
    - Heat
    - Power
- “Pilot Study Renewable Energies 2007” (Federal Ministry for the Environment, Germany)
  - Almost 80 % of power production from renewables in 2050
  - About 50 % of installed capacity = wind



How can we meet such targets in liberalised markets?

- Support schemes (for transitional period)?
- Competitiveness in liberalised markets

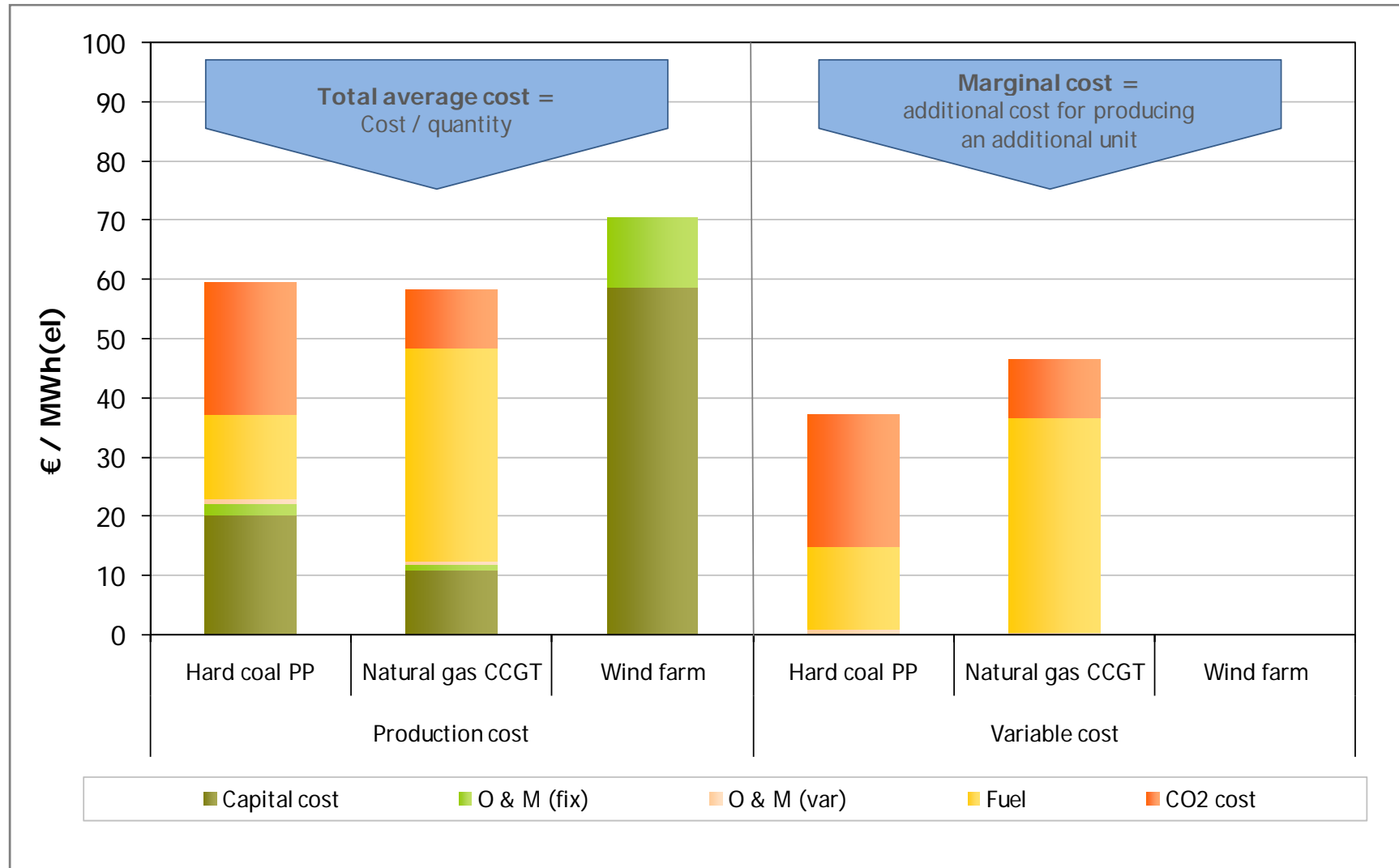
# Investment decision vs. operation decisions

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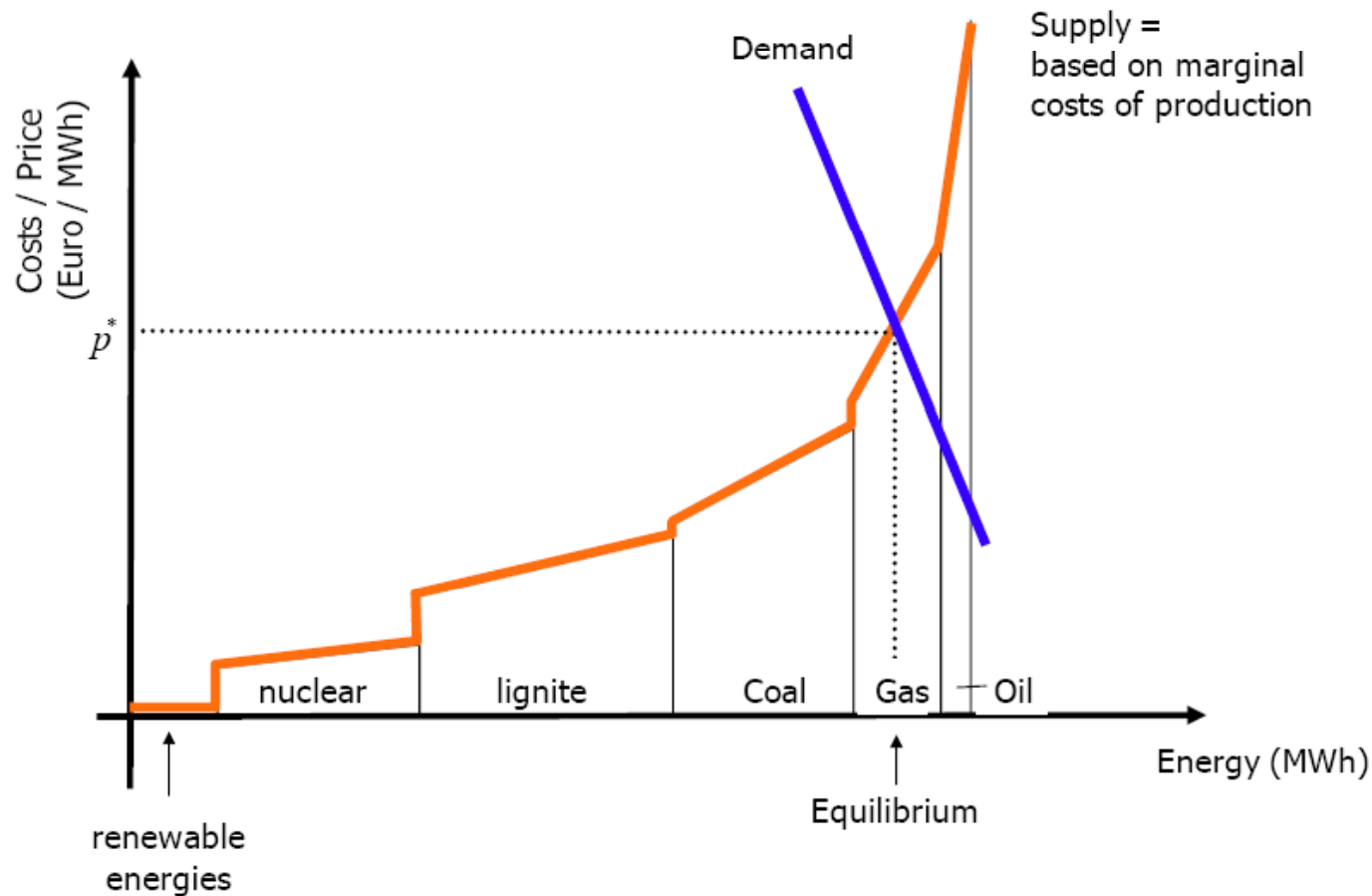


- Investment decision
  - Invest if total average costs (TAC) smaller average revenue (=price)
  - As TAC for renewable greater "price"; little incentive for investments
    - Public support schemes in place
  
- Operation decision (existing plant)
  - Offer at marginal costs
  - Supply if marginal costs are smaller / equal price

# Investment decision vs. operation decisions

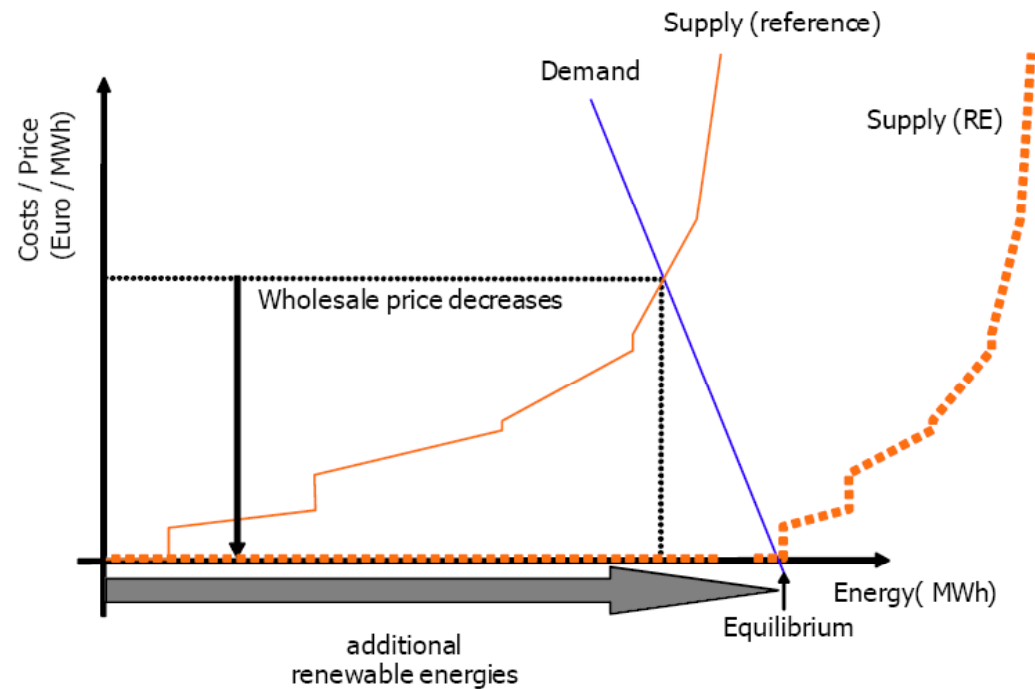
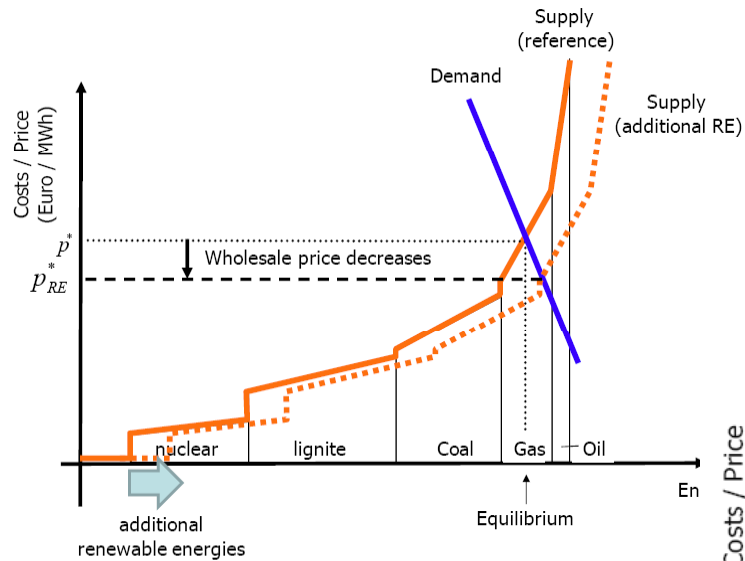


# RE: 2020 and beyond



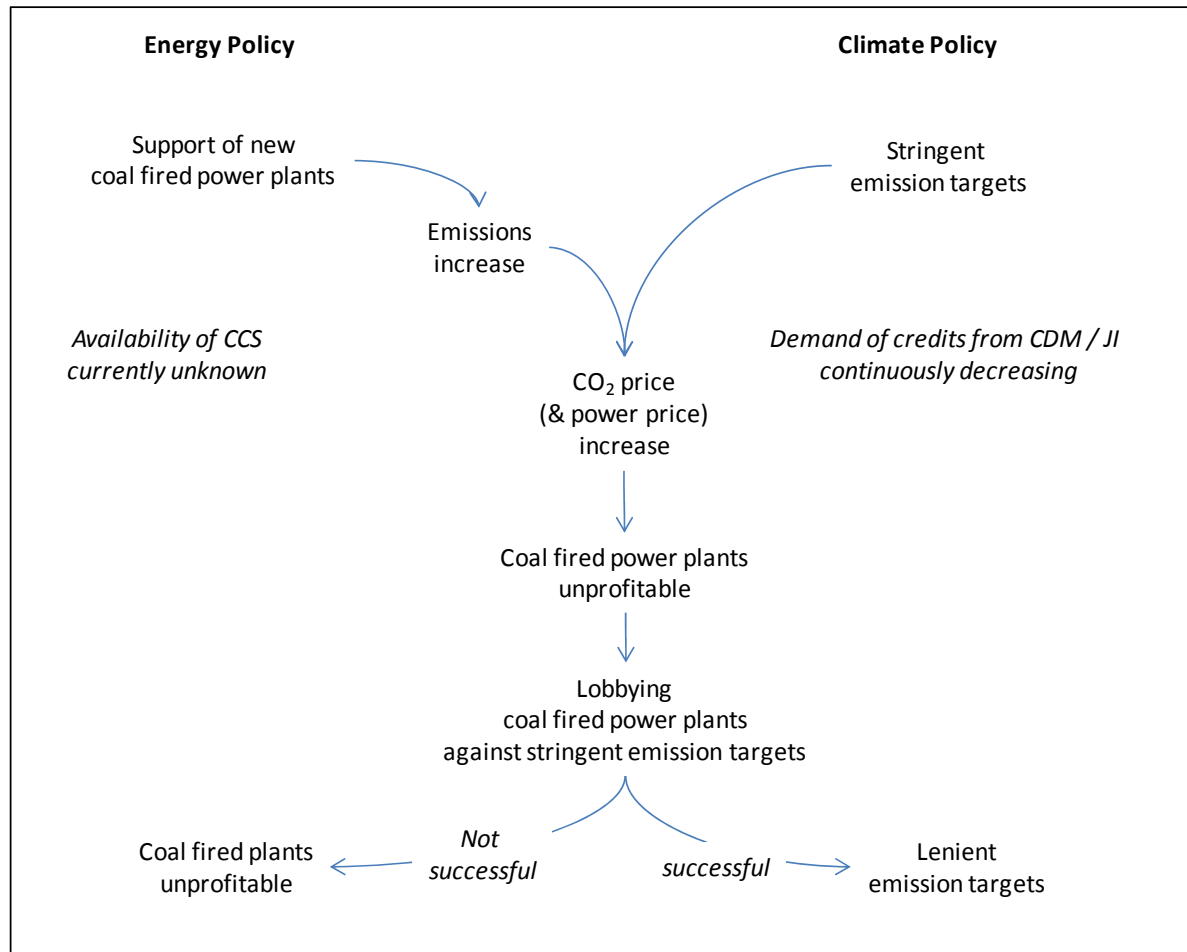
Source: Bode et al (2009) *On the a re-regulation of the liberalised power market in Europe*, in: *Carbon and Climate Law Review*, 2, p. 188 - 197

# RE: 2020 and beyond



→ End of the liberalised power market (in Europe)

# Political economy of investments: coal-fired power plants



Source: Bode et al (2009) *On the a re-regulation of the liberalised power market in Europe*, in: *Carbon and Climate Law Review*, 2, p. 188 - 197



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# Questions?

## Contact

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