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E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

European electricity and climate change policy

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MSc in Environmental Policy

Cranfield University 15 December 2010

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Outline

- 3 pillars of EU Electricity policy
  - reliability, efficiency and sustainability
- 3 pillars of EU Climate change policy
  - price CO_2, demand-pull innovation, support R&D
- How can they be reconciled and delivered?
  - given the sovereignty of Member States
  - and the challenge of the financial crunch

Reliability: EU reserves adequate to 2020?

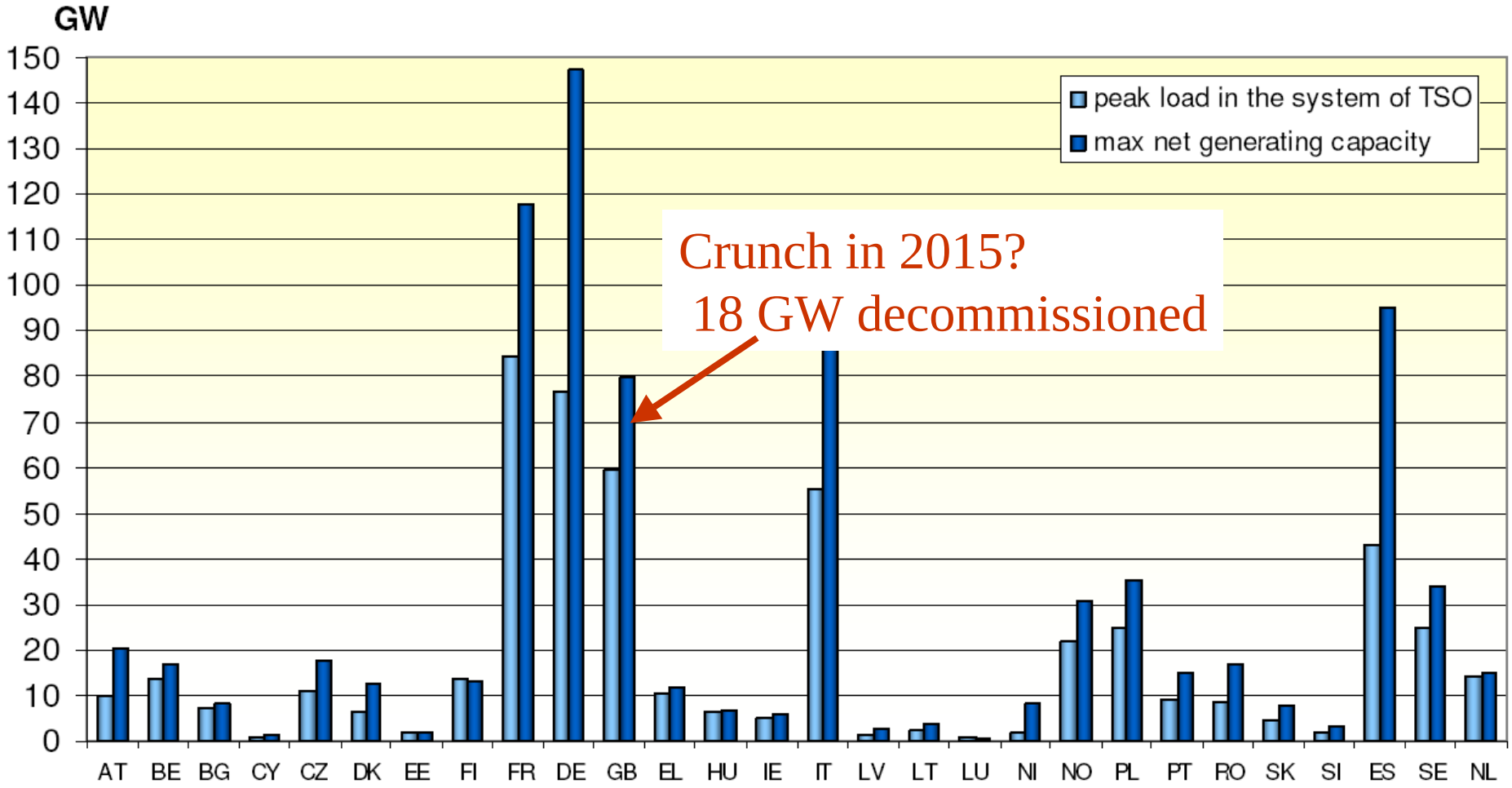
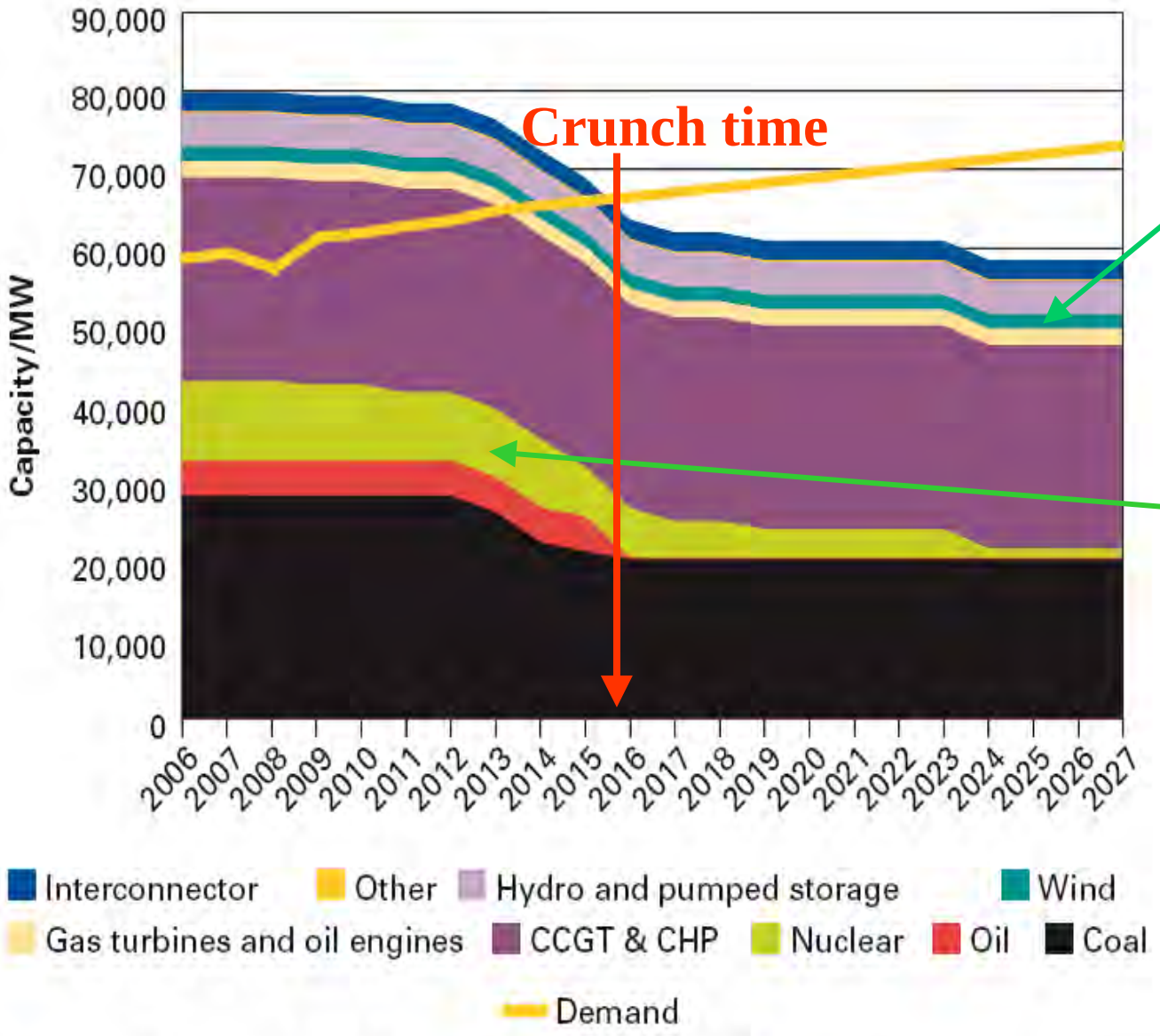
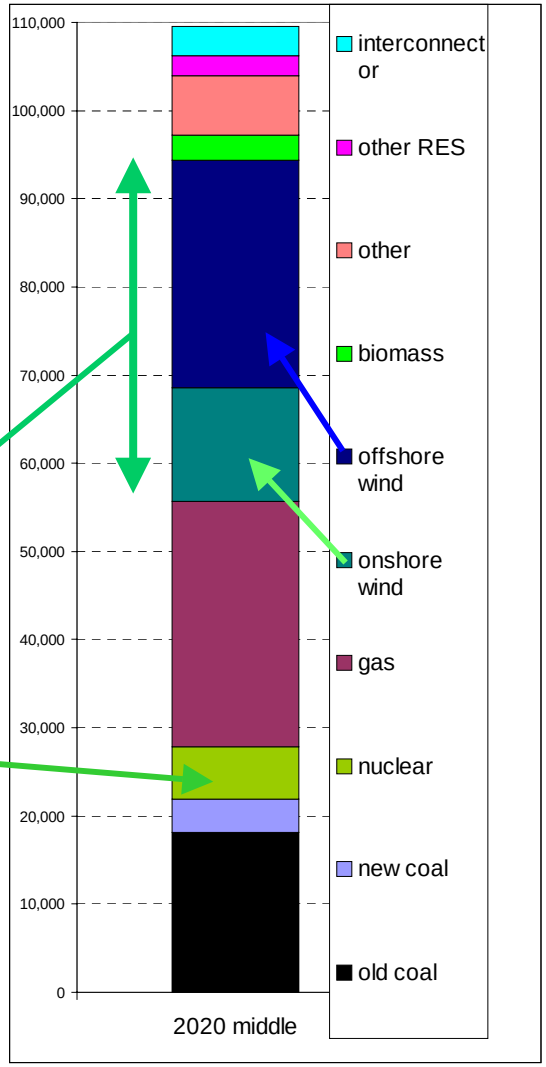


Figure 21: Peak load in the system of TSO vs. max net generating capacity in 2008
(Source: ERGEG national reports database)

Source: ERGEG (2009) Status Review, but see ENTSO E SAF reports

Development of GB generating capacity





SKM (2008) mid-scenario 2020 projection

Source: Digest of UK Energy Statistics/DECC

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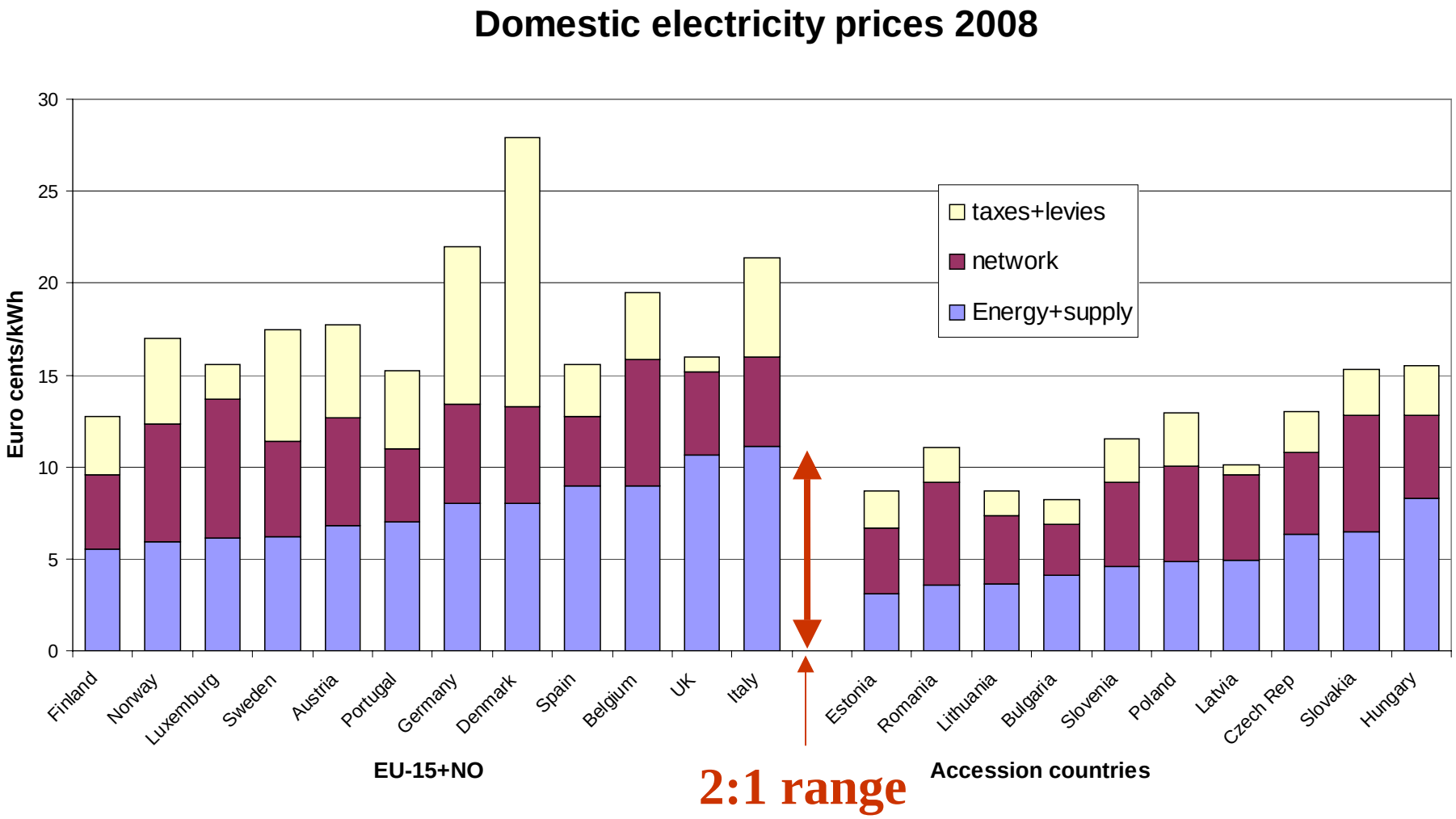
Efficiency

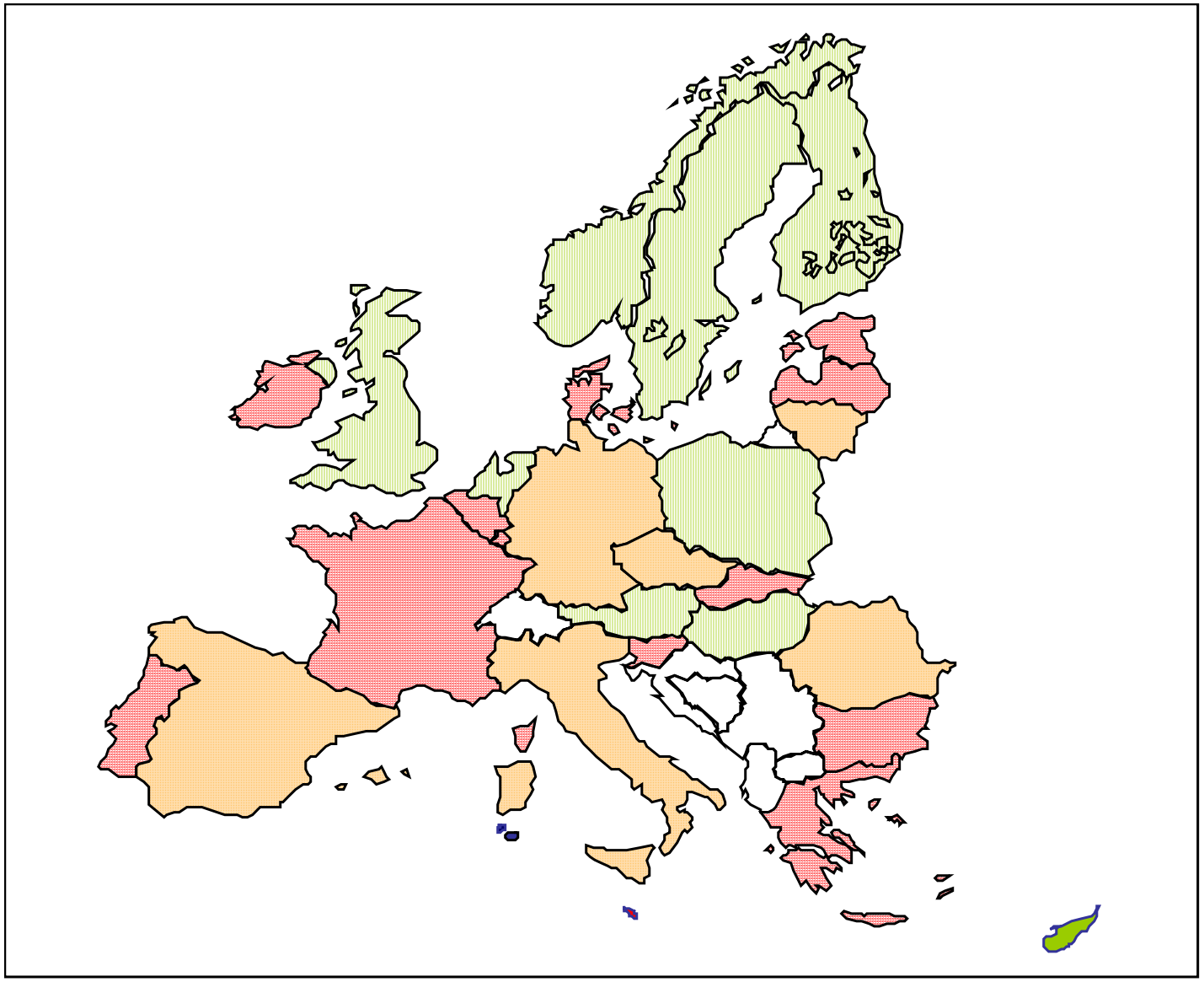
- Competition to deliver efficiency
  - requires competitive markets for gas and electricity
  - and ownership unbundling
  - more firms and/or better interconnection
  - then market coupling and nodal pricing?
- EU Sector Inquiry raises doubts on competition
  - interconnector investment is lagging
  - market coupling slowly progressing
  - but prices still very different across EU

No single energy price in the SEM



Source: ERGEG (2009) Status Review

Many markets still concentrated: 10 countries showed an increase in 2008

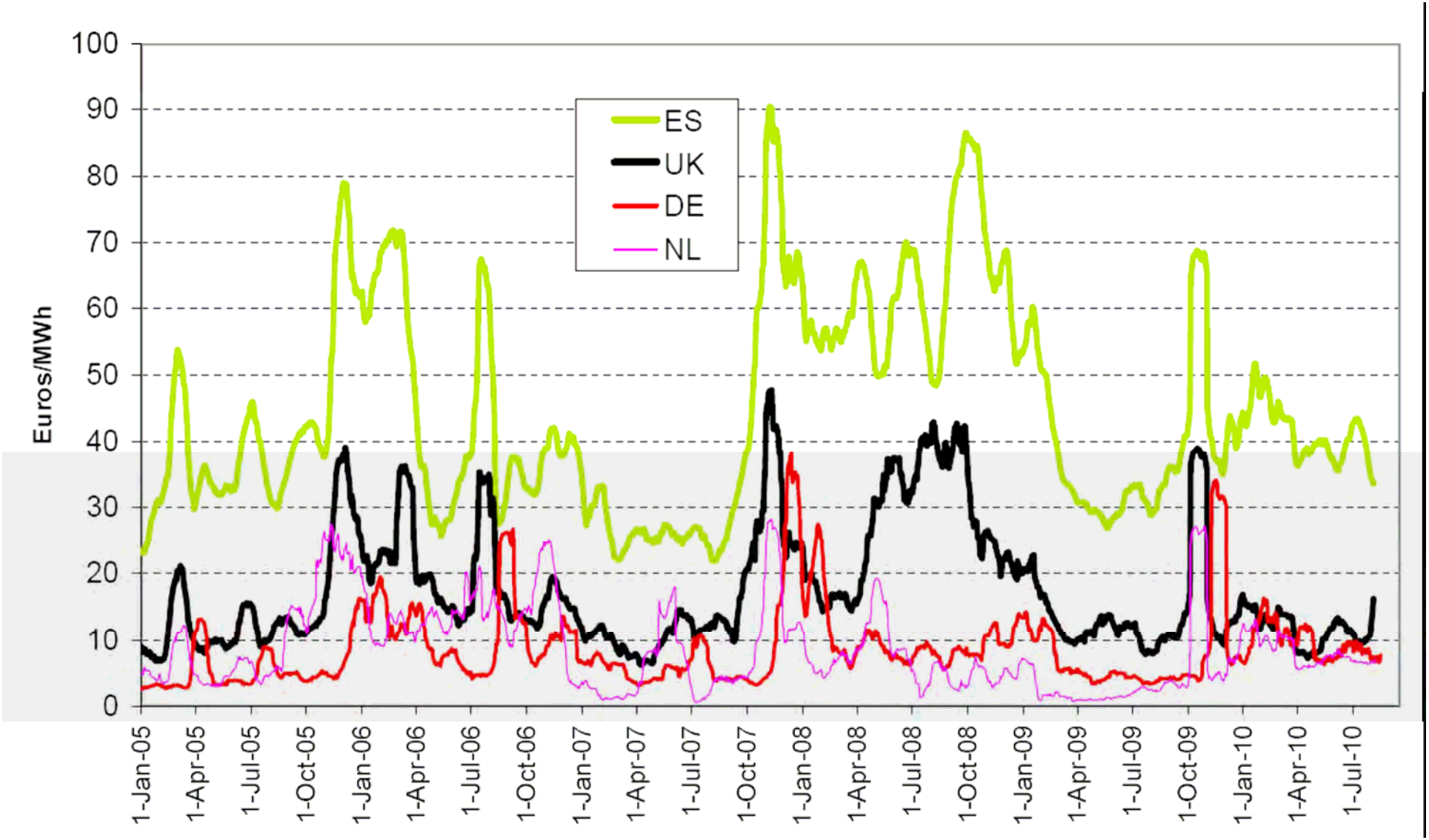


very highly concentrated – HHI above 5000

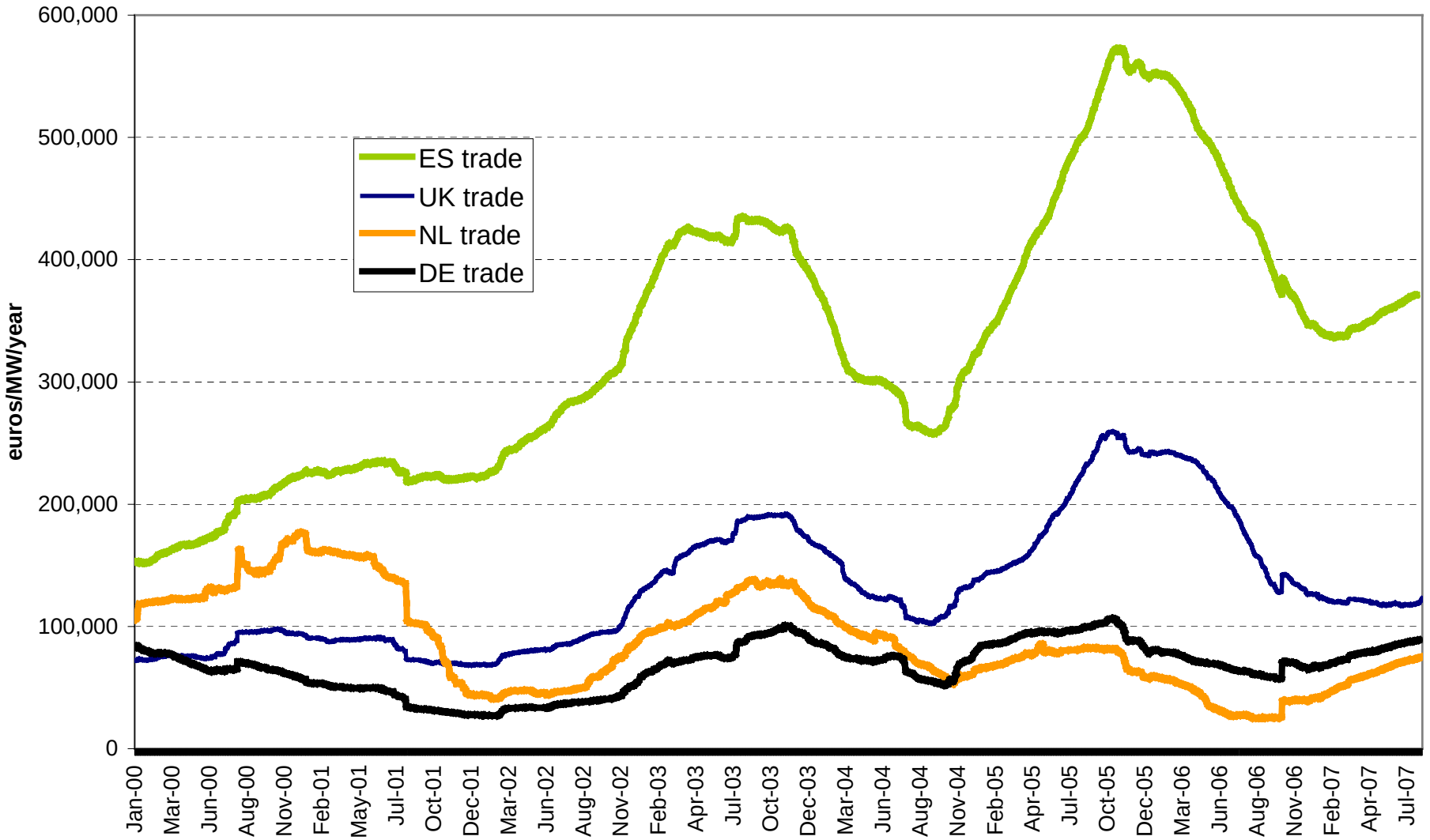
highly concentrated – HHI 1800-5000

moderately concentrated – HHI 750-1800

Absolute hourly difference relative to France 2005-10



Annual value of trade between France and other countries



Source: EEX, Powernext, OMEL, APX

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Cross-border investment

- ENTSO-E publishes 10-year Network Plan
  - 3rd package => 42,000 km new+upgraded lines (14% of total length)
  - 44% in next 5 years at cost of €23-28 billion

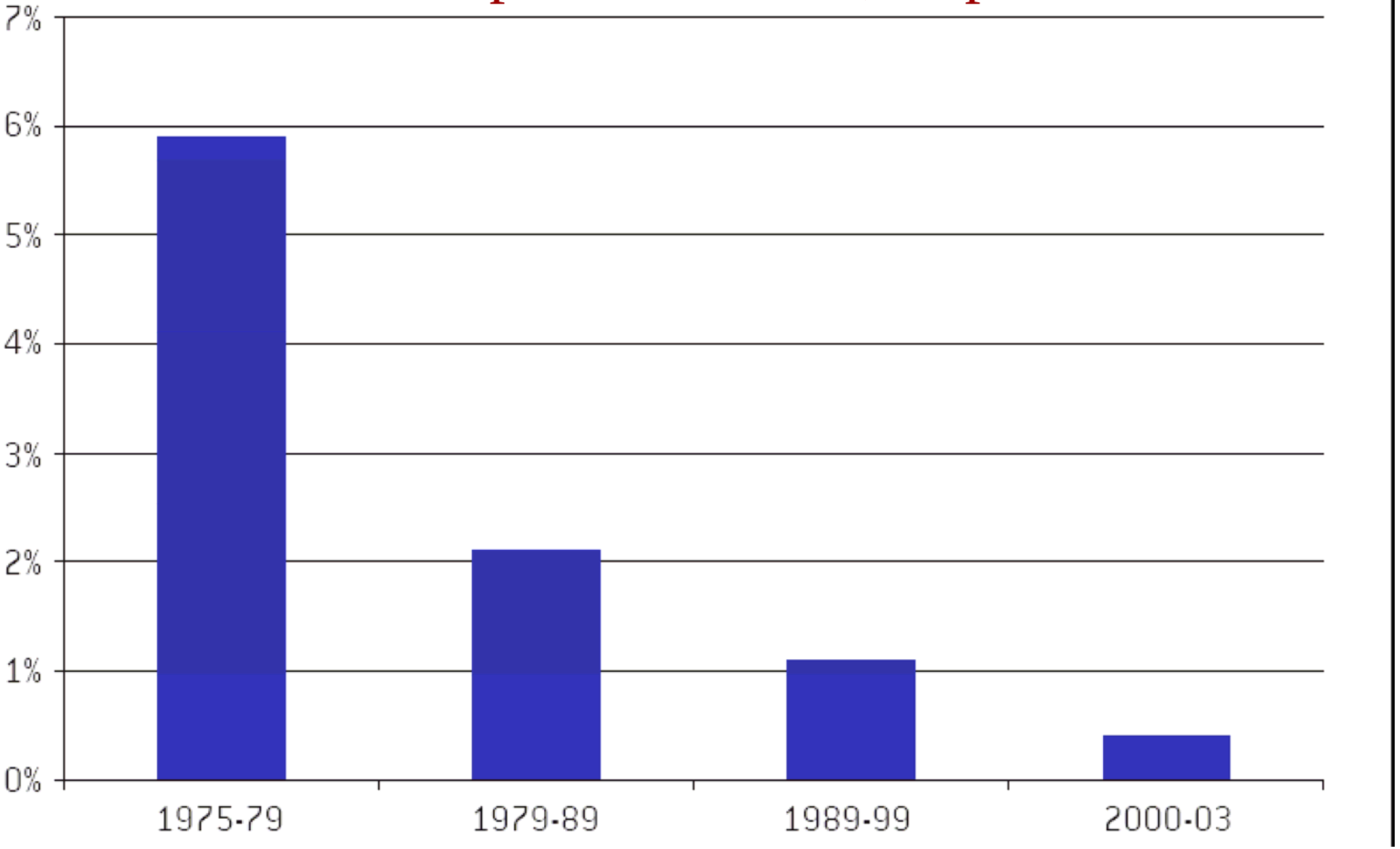
  =1.2% of total p.a. (4 x 2000-3 rate)
  - was 6% p.a. in 1975-79, 2% p.a. 1979-89

Wind makes interconnection more urgent

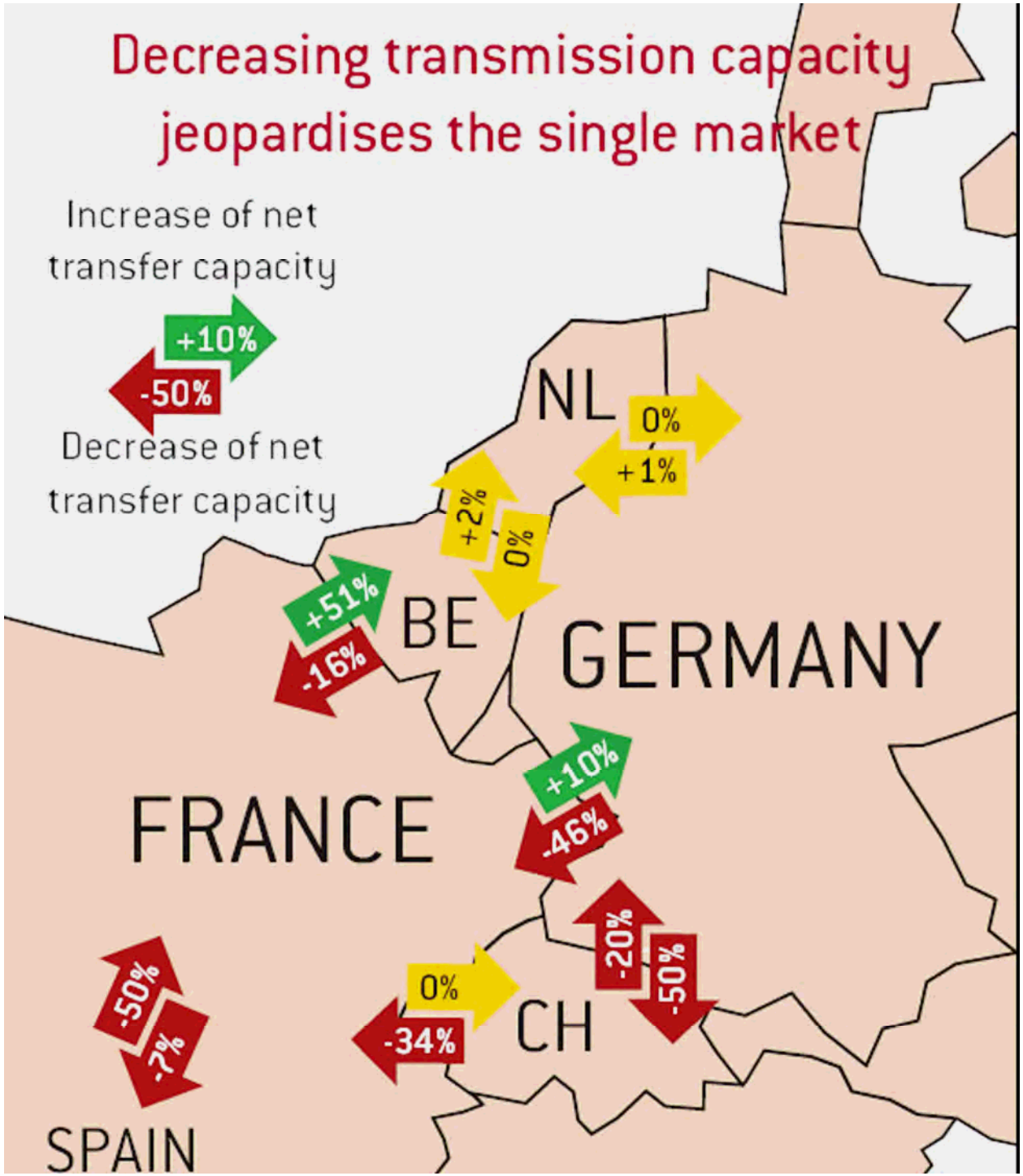
but local opposition is growing

Increase in 220-400kV transmission

16 European countries, % p.a.



Source: Zachman (2010) from IEA (2005)



Change in net transfer capacities between winter 2004/05 and winter 2009/10

- mostly decreases

Source: Zachman (2010) from ENTSO-E. Figure shows change in net transfer capacities between winter 2004/05 and winter 2009/10 in direction of arrow

Sustainability

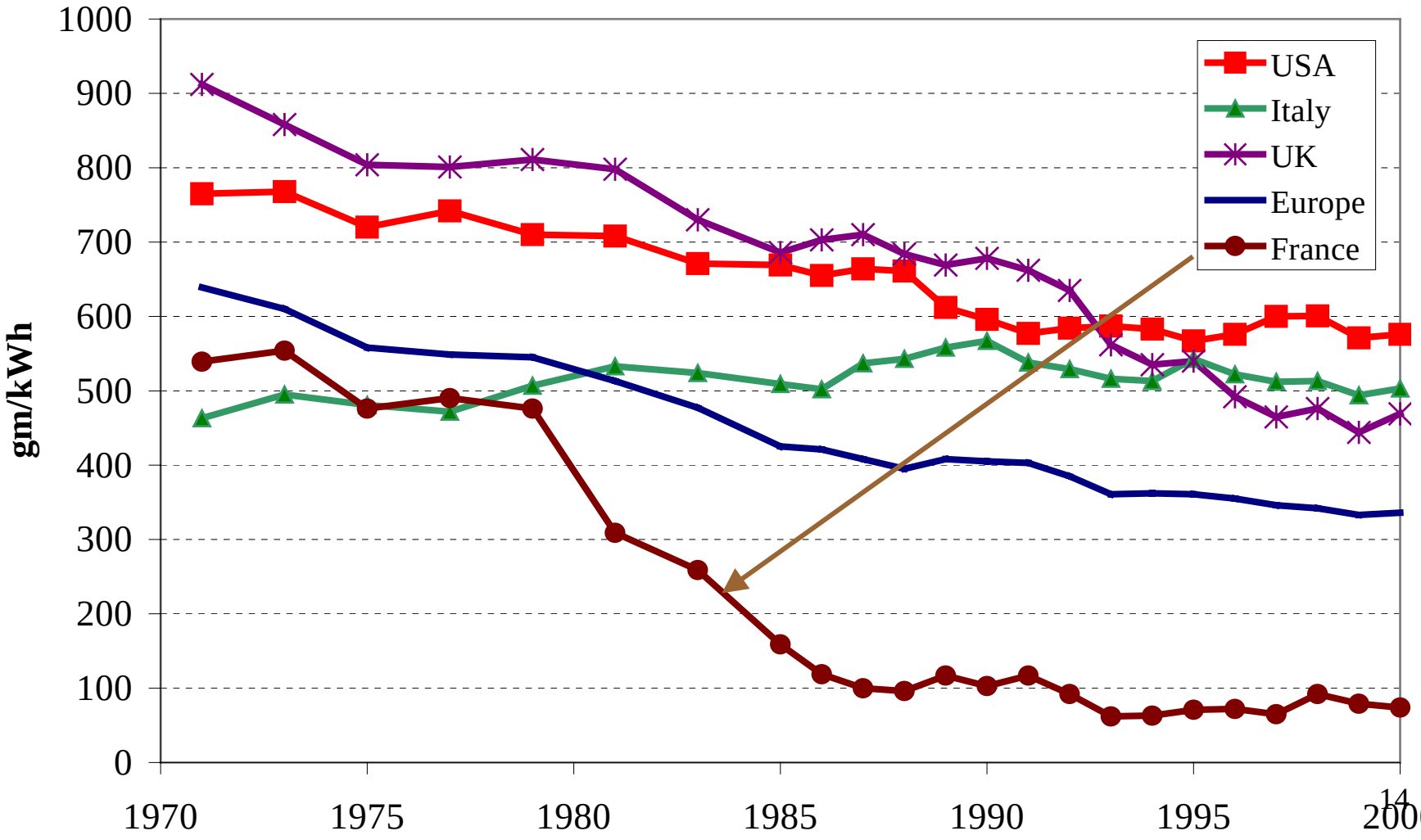
- 80% GHG reduction required by 2050
  - Easier to decarbonise electricity than fuel
- Wide range of low-C electricity
  - nuclear needs an adequate CO_2 price
  - renewables not commercial even with CO_2 price

=> need for RD&D to lower cost

EU Climate change policy to address these

Rapid decarbonisation of electricity is possible - **with nuclear power**

CO2 emissions per kWh 1971-2000



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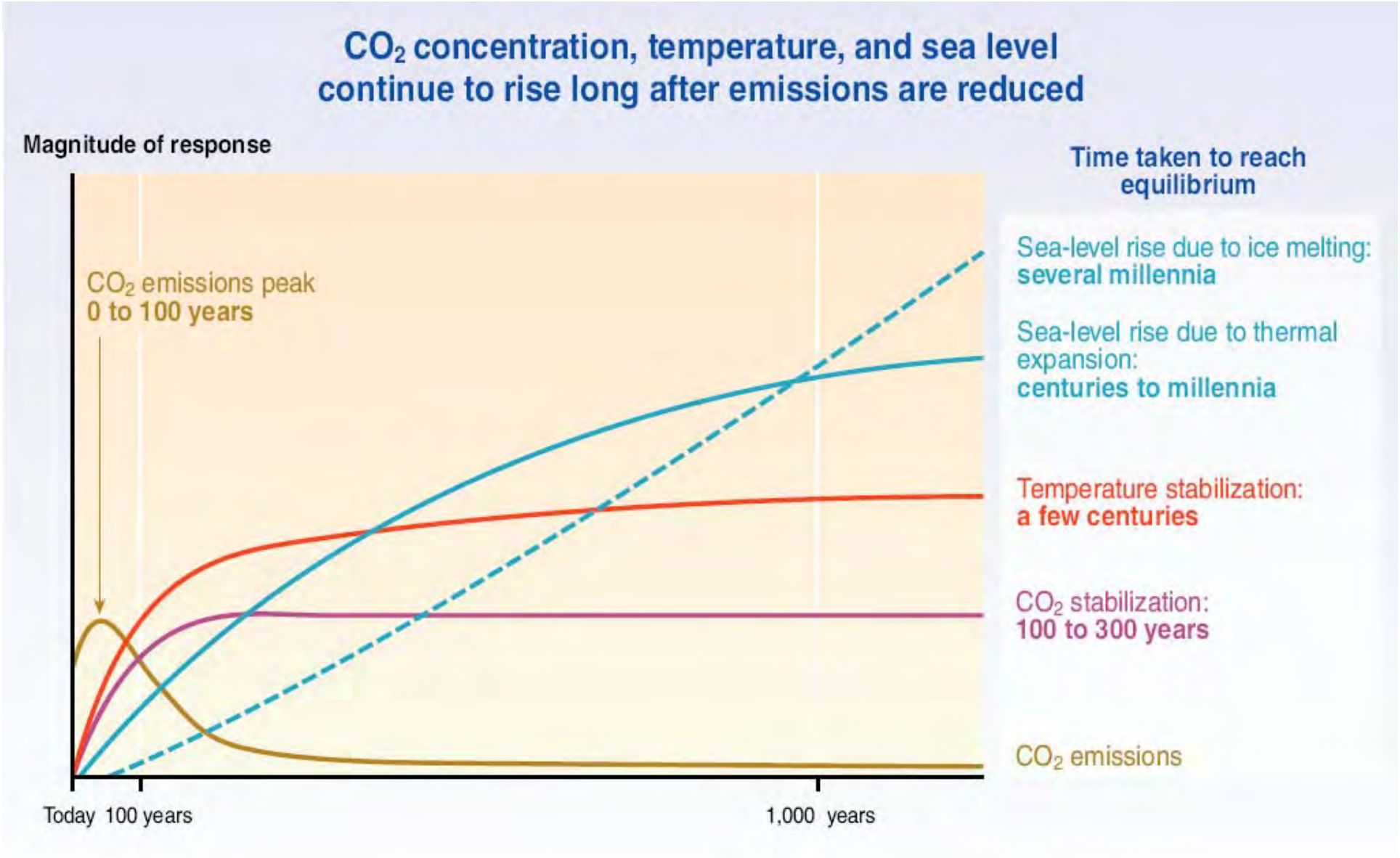
Climate change challenges

- World should not release all C from fossil fuels
- How best to limit cumulative GHG release?
  - Limits on annual emissions or scarcity GHG price related to remaining absorptive capacity?
- Renewables Directive undermines CO_2 price
  - and leads to no reduction in CO_2 emissions!
- EU CO_2 pricing depresses fossil fuel prices
  - rebound elsewhere?

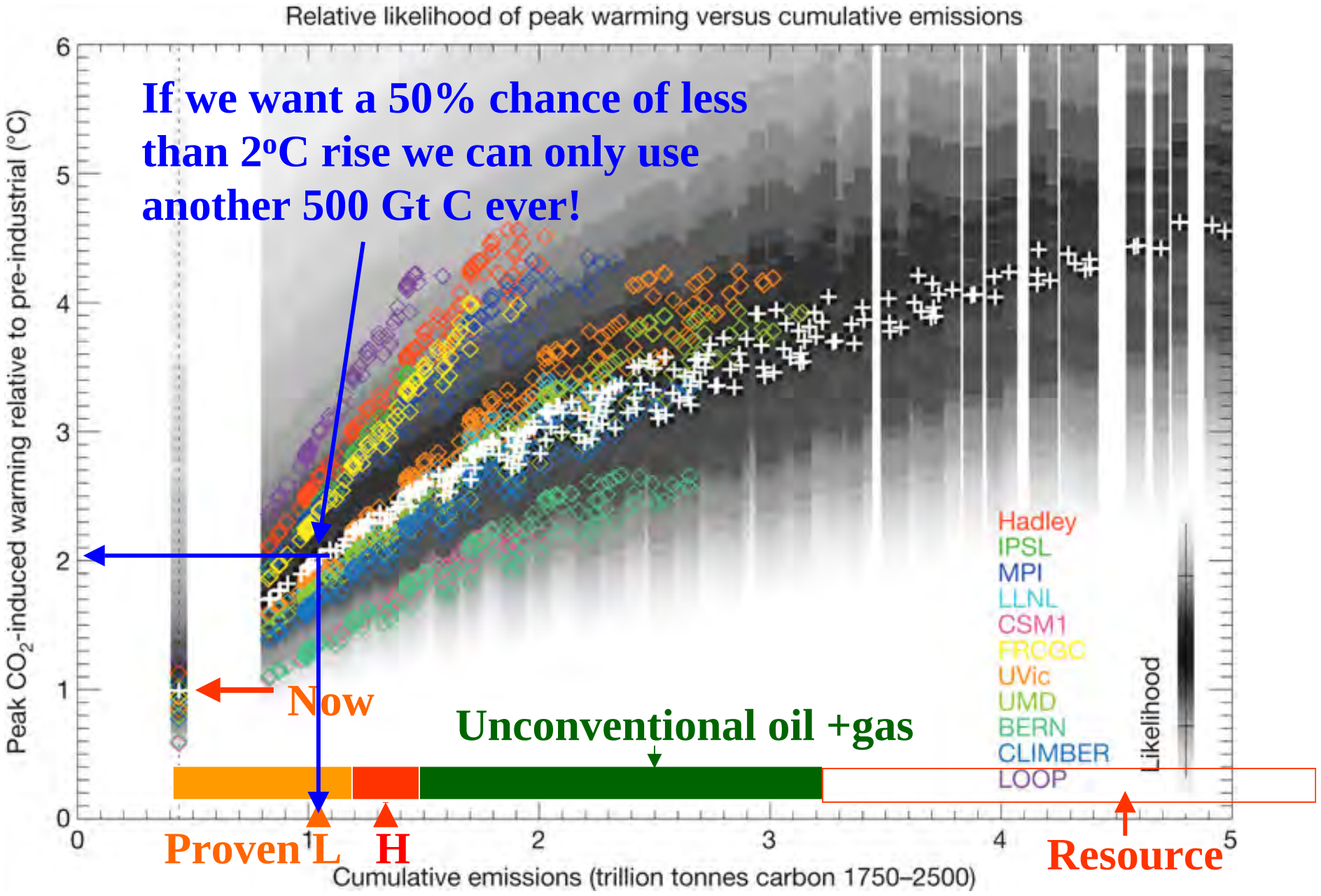
Need for consistency across instruments

CO_2 emissions have long time lags



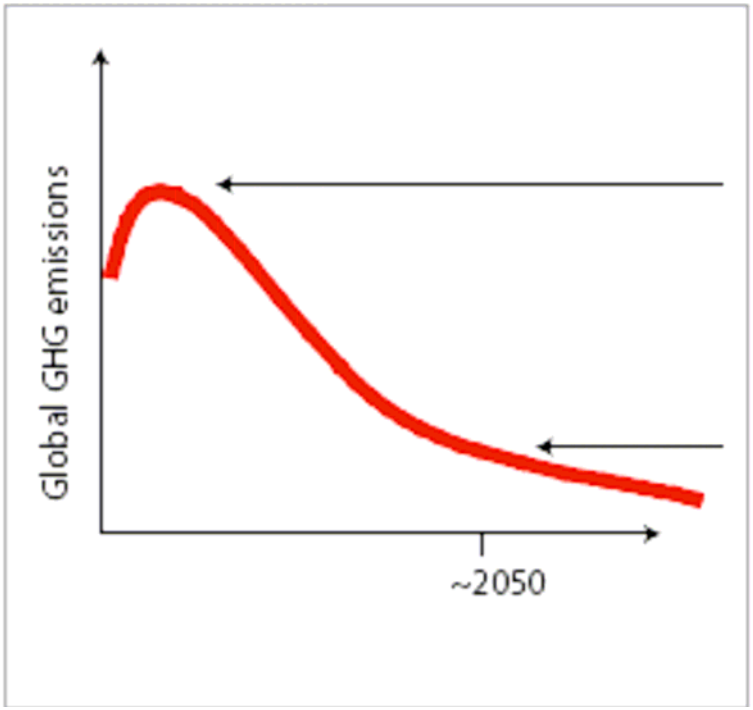
Source: IPCC, TAR, Synthesis Report, SPM, Figure SPM-5

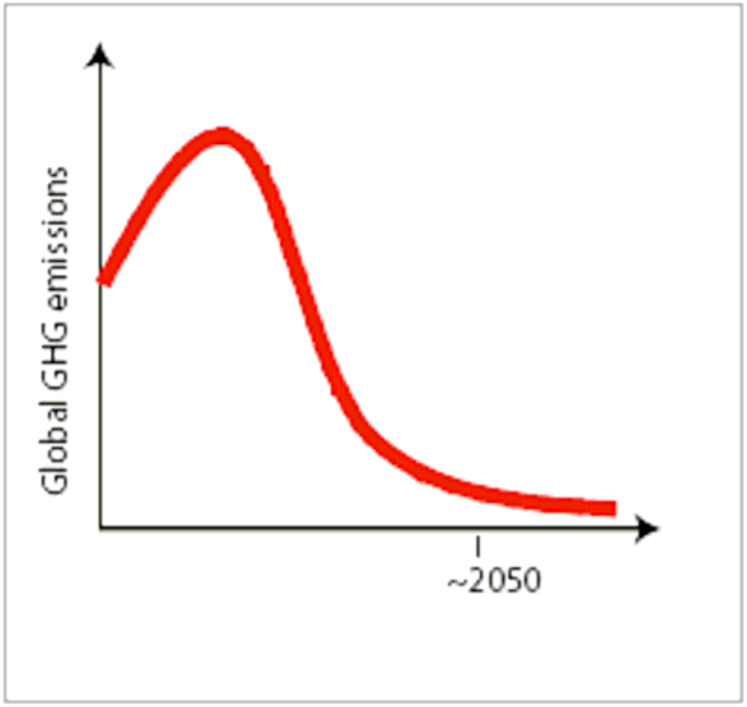
Peak CO_2-warming vs cumulative emissions 1750–2500



MR Allen *et al. Nature* **458**, 1163-1166 (2009) doi:10.1038/nature08019

nature





Total cumulative emissions determines global warming

- Delaying peak requires a faster subsequent decline
- peak should be before 2020

Source: ENEP Emissions Gap Report 2010

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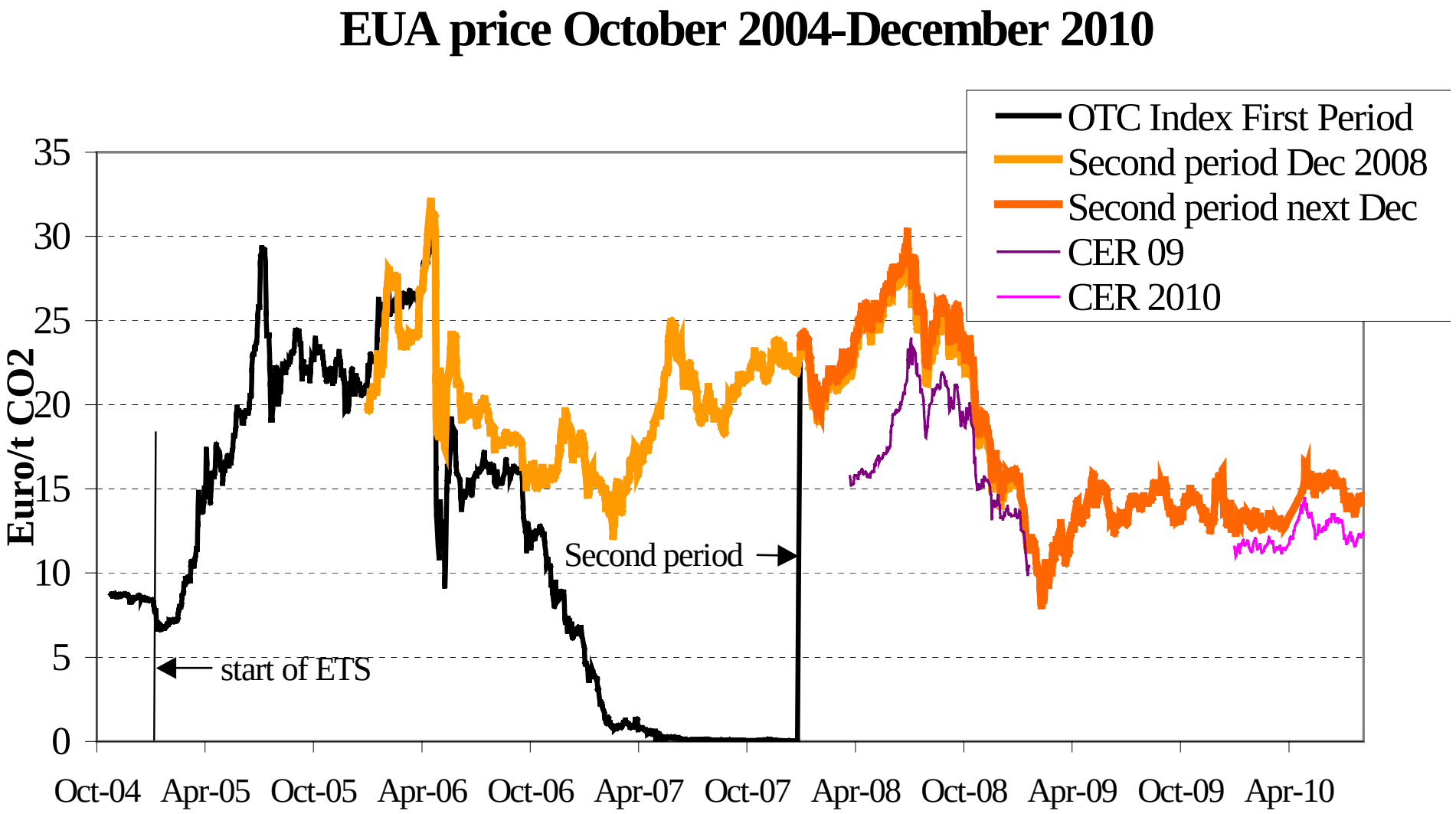
EU climate change policy

- ETS to price CO_2
  - fixes quantity not price => poor guide for low-C
- 20-20-20 Directive: demand pull for renewables
  - justified by learning spillovers and burden sharing
  - over-emphasises current least cost options?
- EU SET-Plan to treble R&D spend
  - to support less mature low-C options

CO_2 prices are volatile and now too low



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Permits vs Taxes

Weitzman: Taxes superior to permits unless MB of abatement steeper than MC

CO_2 is a ***global persistent stock pollutant***

- CO_2 damage today effectively same as tomorrow

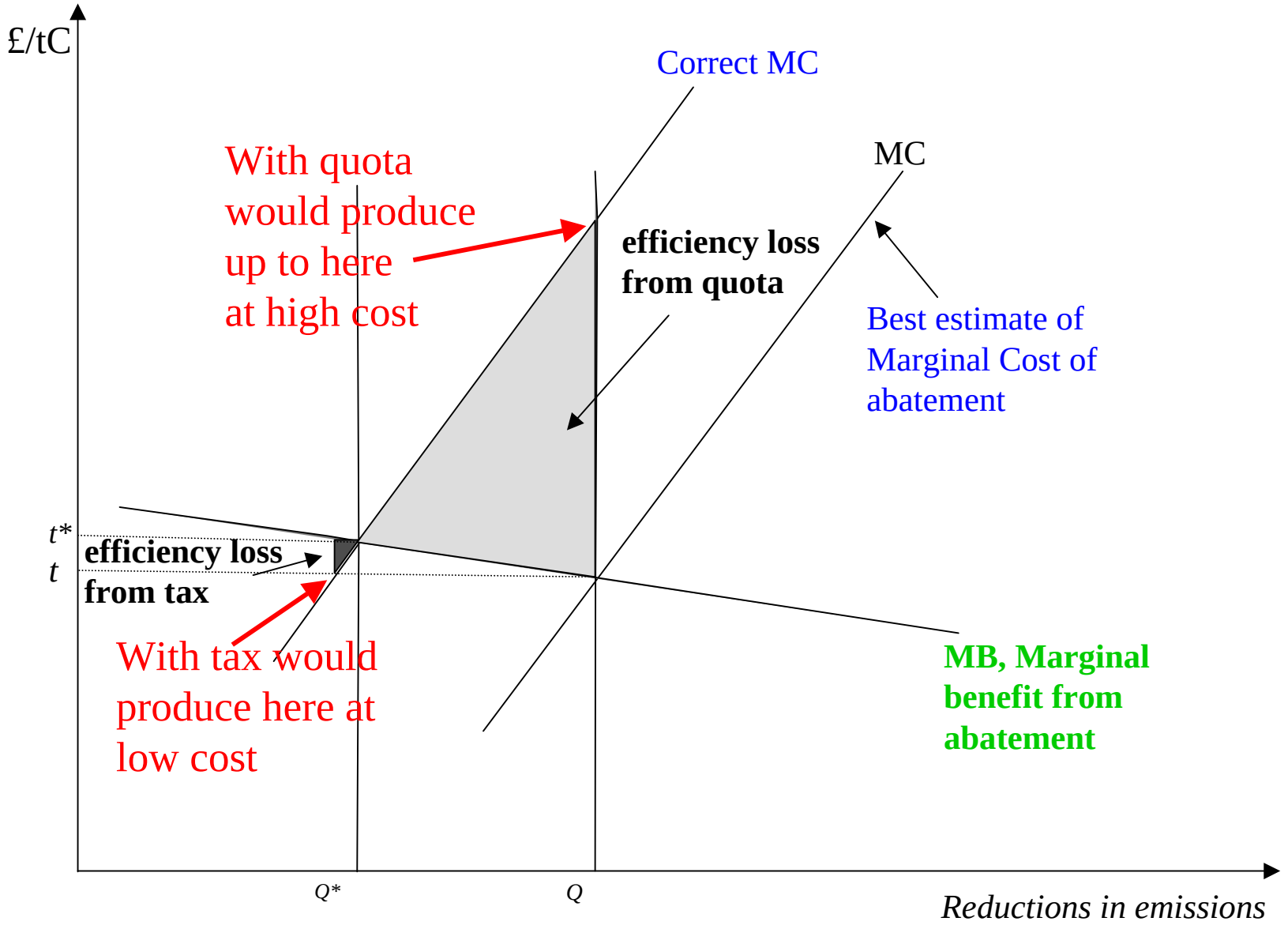
=> marginal benefit of abatement essentially flat

- marginal cost of abatement rises rapidly

Carbon tax superior to tradable permits

but permits easier to introduce

Costs of errors setting prices or quantities



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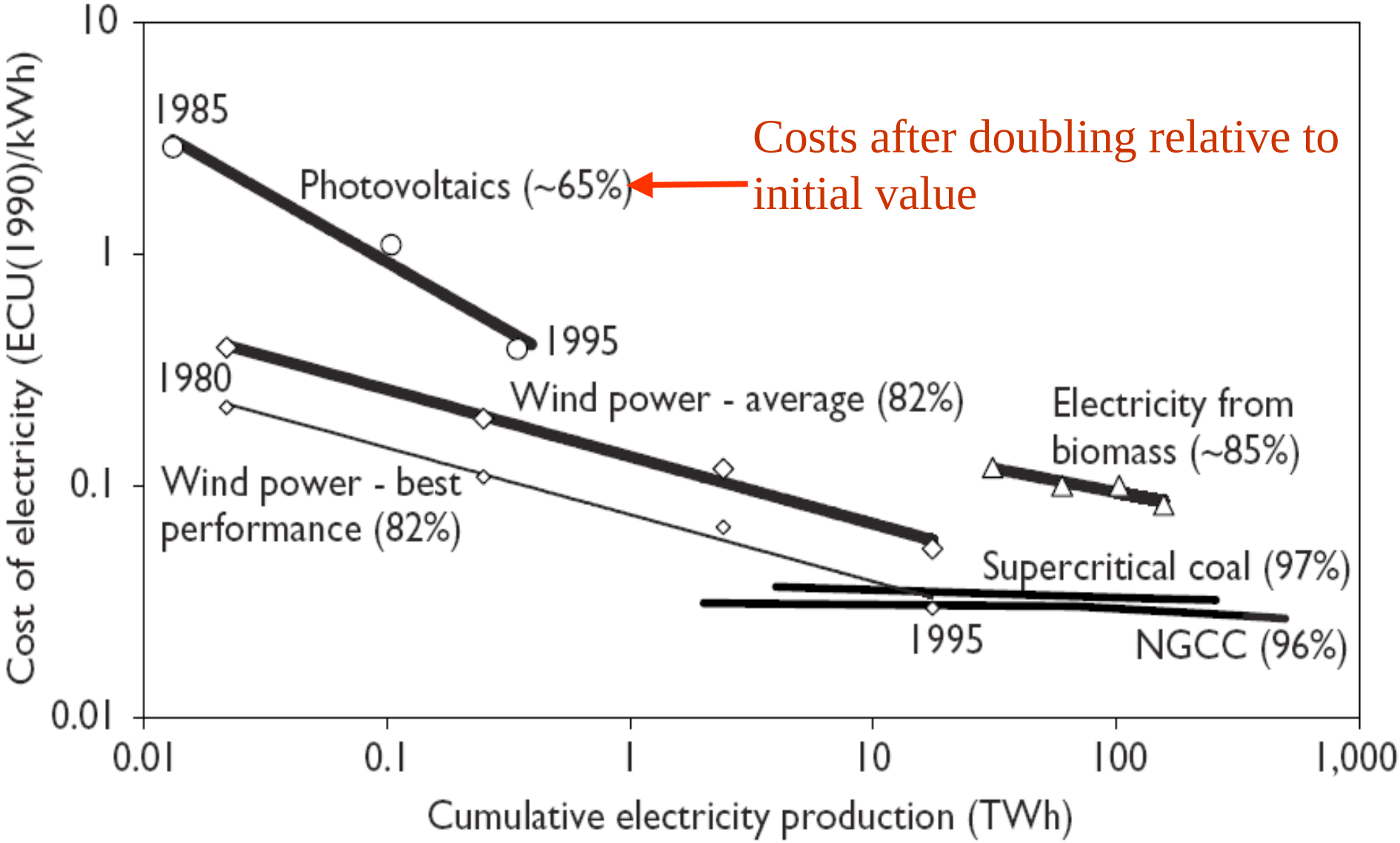
Logic of 20-20-20 Directive

- Supports RES deployment to drive down costs
  - induces investment => learning-by-doing
- Solution to equitable EU burden sharing

  => all countries contribute to public good of learning
- Learning comes from:
  - design (cost, reliability, controllability, etc)
  - production, installation, siting/planning, grid integration

but not from operation (provided reliable)

Experience curves



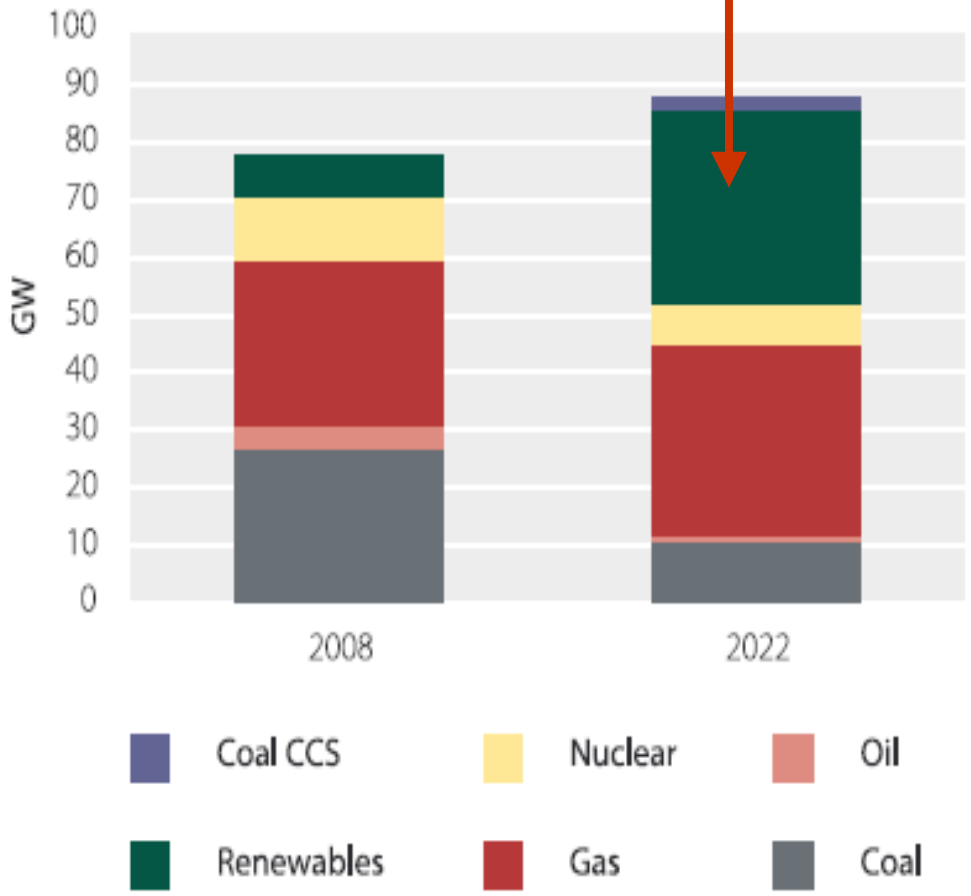
Source: IEA

CCC 2020 scenarios: lots of wind and demand reduction

Capacity

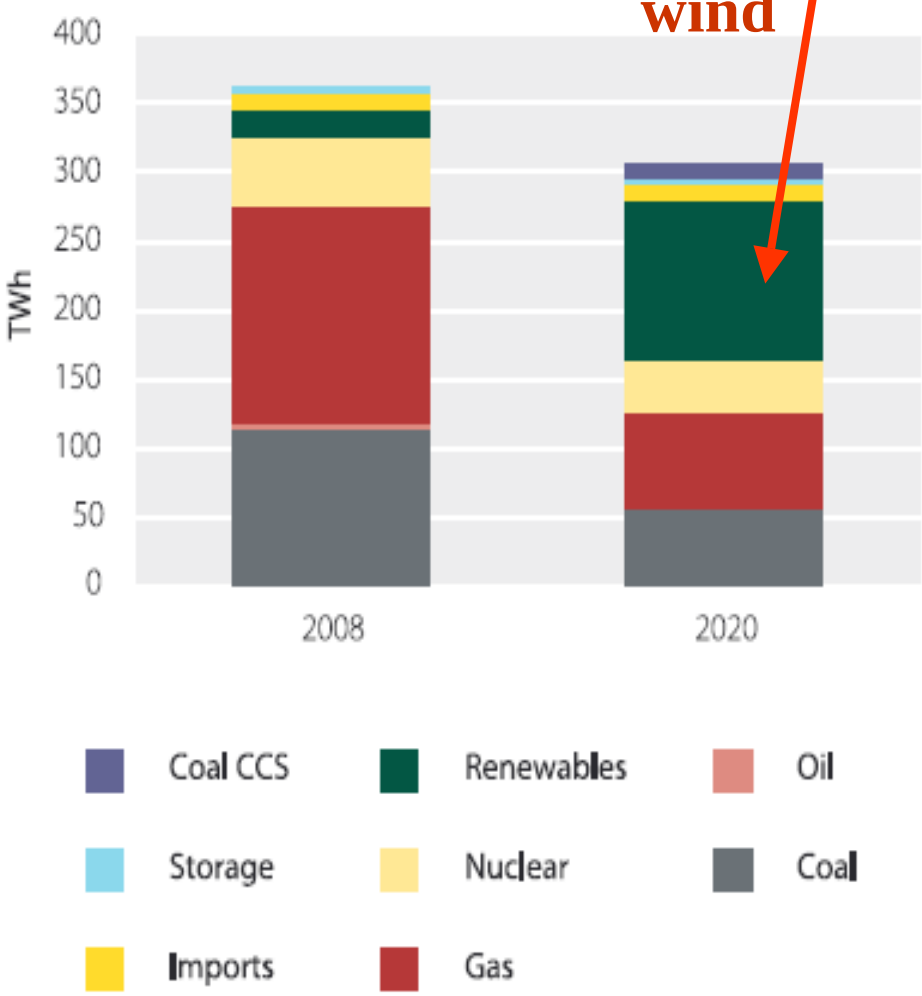
27 GW wind

7 GW other RES



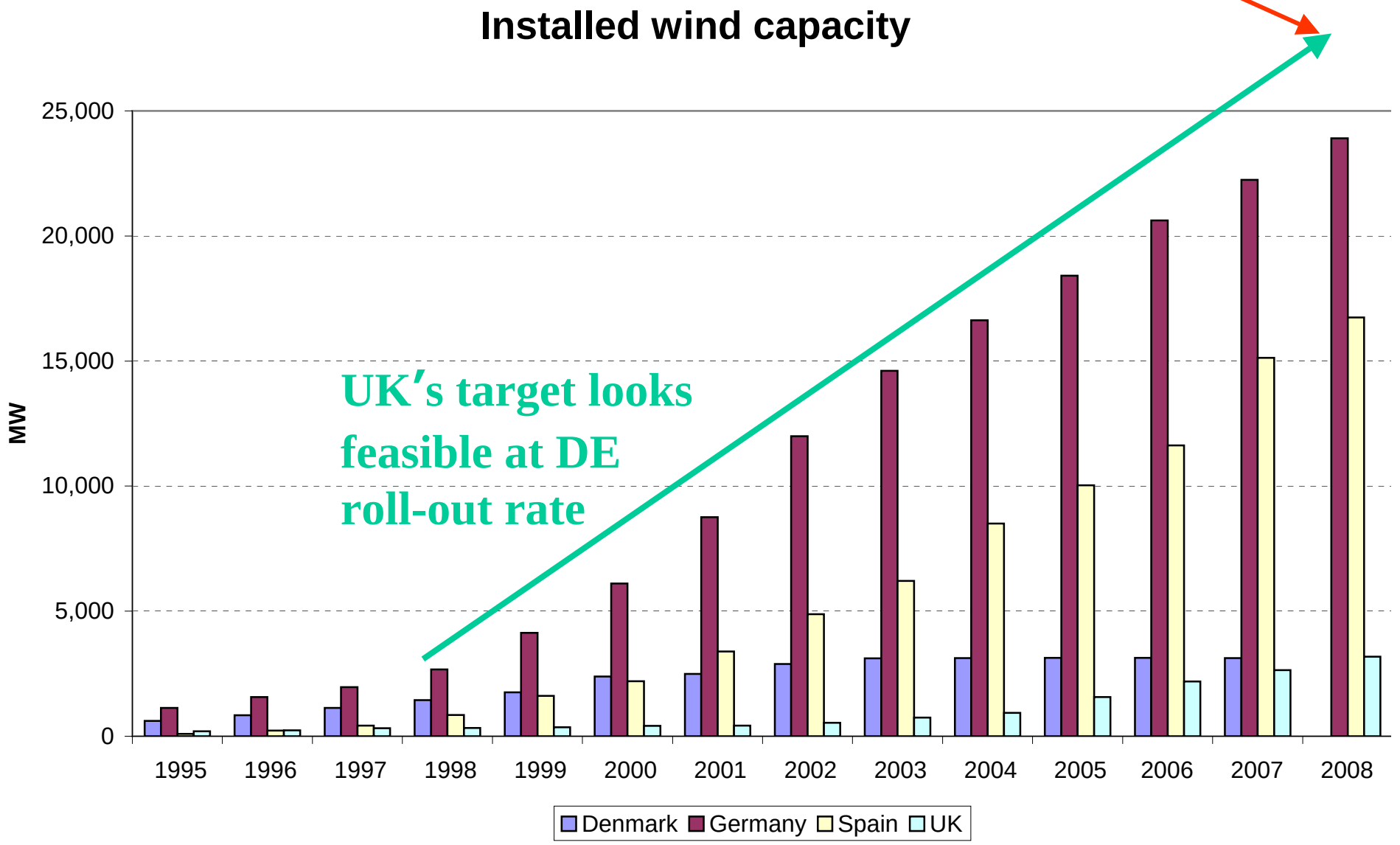
Generation

76 TWh wind

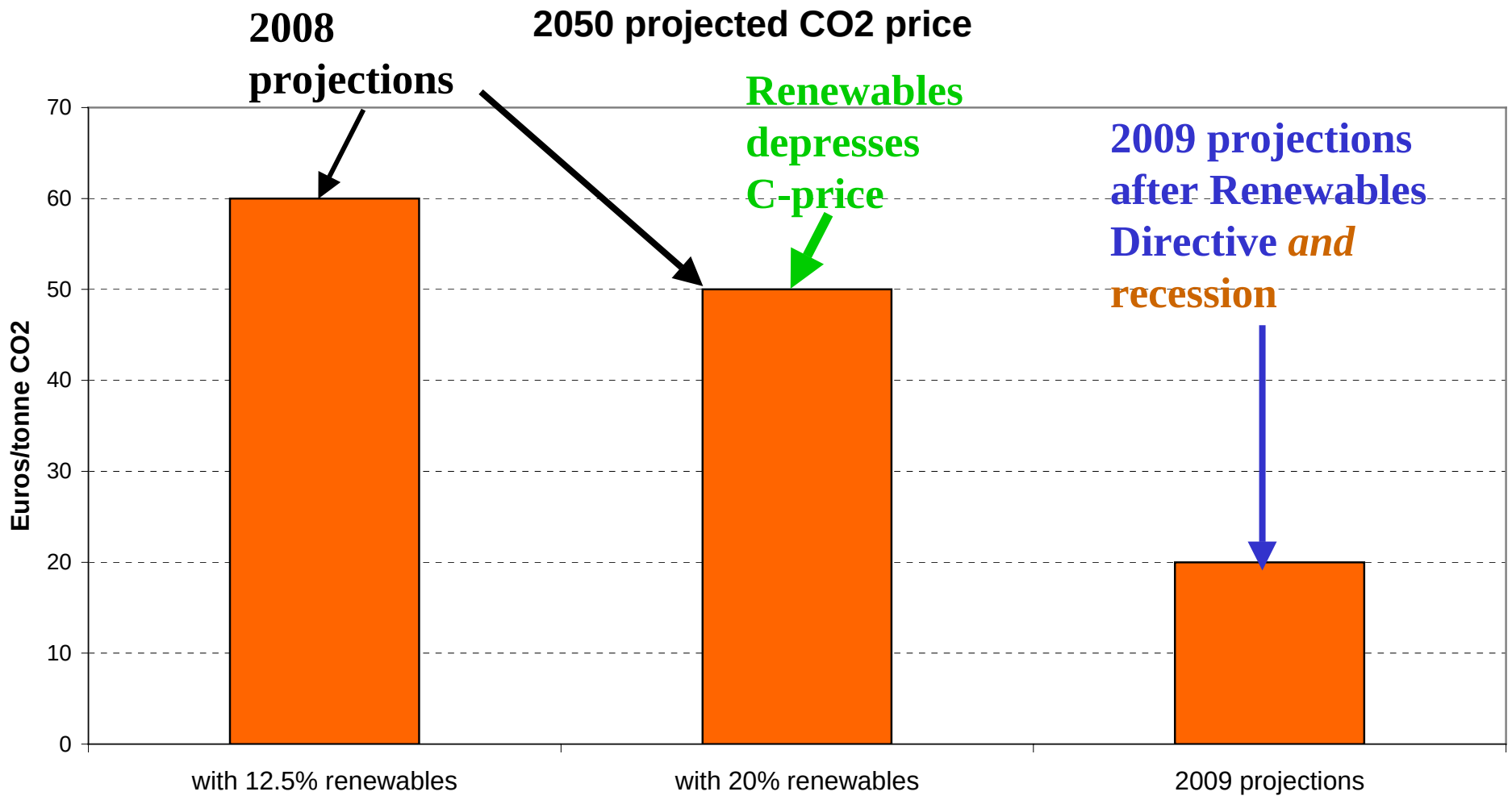


Committee on Climate Change 2009

CCC′09 UK 2020 target is 27,000 MW



20-20-20 Directive undermines ETS



Source: Committee on Climate Change, 2008 and 2009

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Failures of ETS

- Current ETS sets quota of total EU emissions
- Renewables Directive increases RES

  => increased RES does not reduce CO_2

  => reduces price of EUA

  => prejudices other low-C generation like nuclear
- Risks undermining support for RES

  Solved by fixing EUA price instead of quota

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Reforming ETS

- Reform EU ETS to provide rising price floor
  - sufficient for nuclear *or on-shore wind if cheaper*

  => Carbon Bank trades EUAs to stabilise price
- Commitment to raise CO_2 price at 3% p.a. over life of plant may suffice
  - €25/EUA 2010 => €34 in 2020, €61 in 2040 ...
- Making it credible: write CfD on this path
  - remove uncertainty for low-C generation investment

makes extra carbon savings additional

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Carbon tax alternative

- Each Member State imposes a Carbon tax
  - tax bads not goods as part of fiscal adjustment
  - rebated by EUA price for covered sector
  - can start low: €20/t CO_2 and escalate at 5% p.a. above RPI = €34/t by 2020
- Tax or full EUA auctioning to finance SET-Plan and RES, avoid taxing electricity

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Supporting research

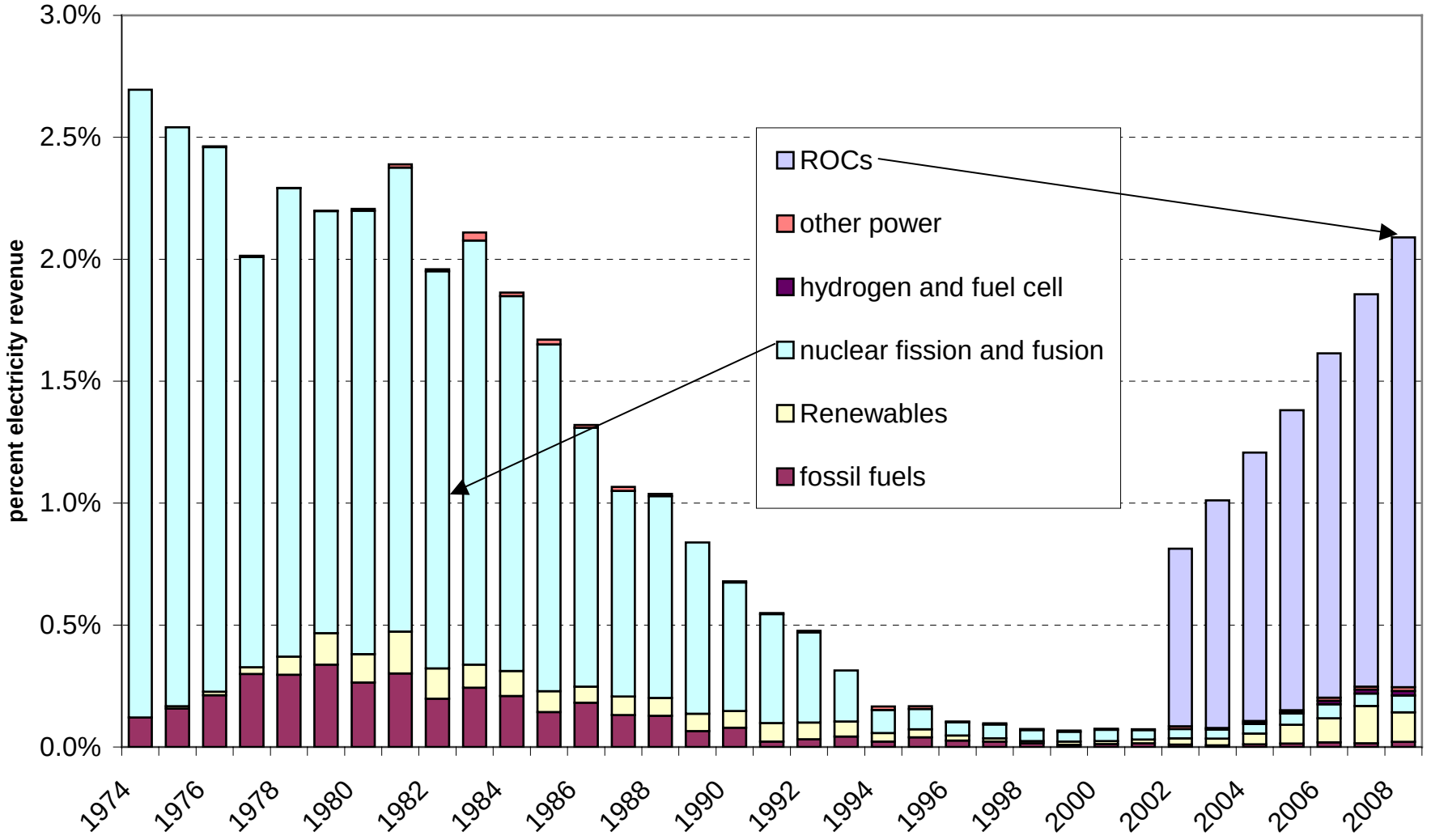
- Strategic Energy Technology (SET) Plan
- Not all RES is ready for major deployment
  - obstacles require R&D and perhaps pilots

  ⇒ need collective action to increase low-C R&D

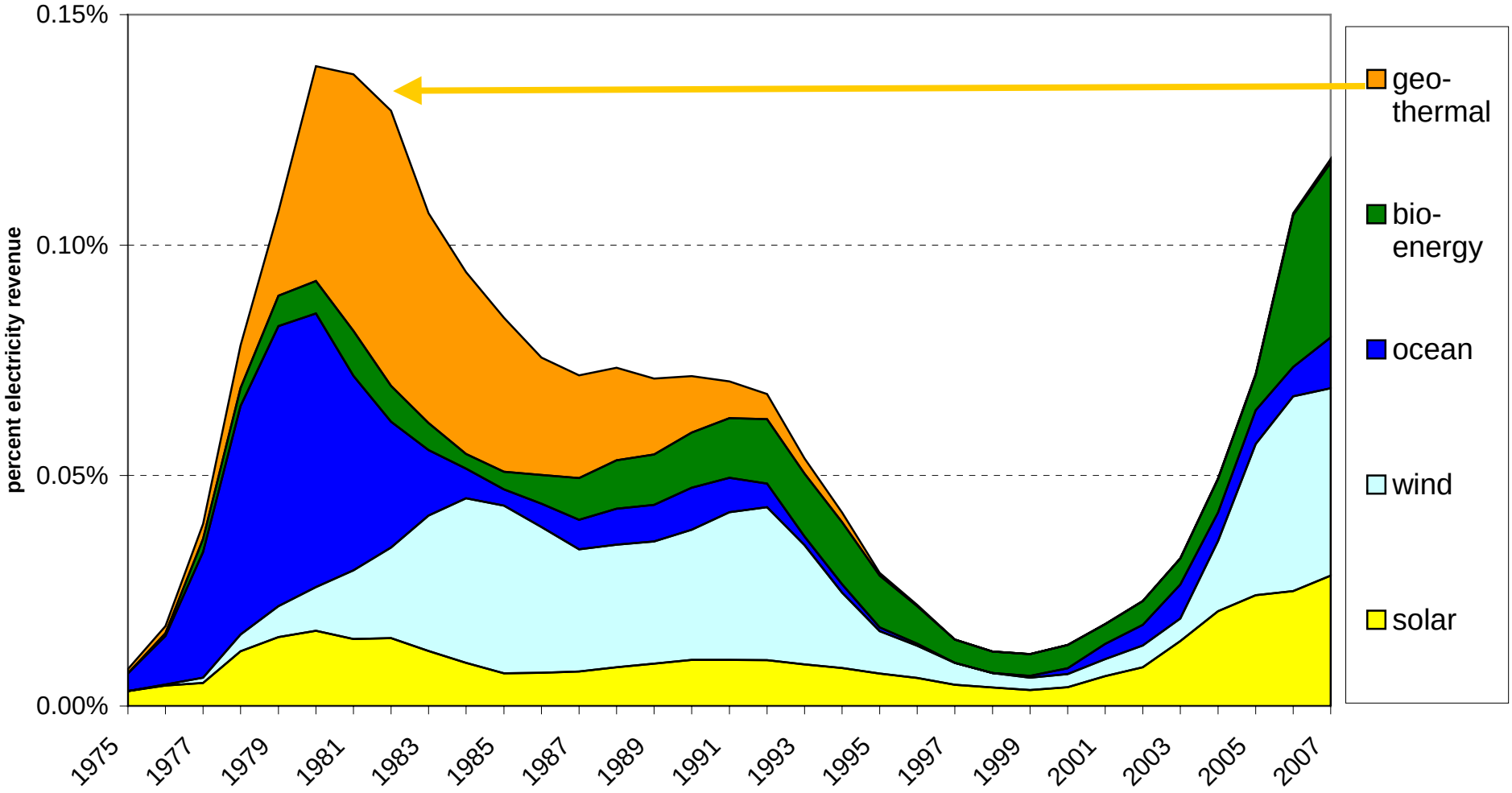
  ⇒IPR benefits made widely available, contrary to MS interests
- But R&D collapsed at end of 1980s
  - liberalisation and resulting pessimism over nuclear future?
- SET plan to leverage MS's R&D, steer choices

Ensure adequate size and diversity of portfolio

UK Electricity R&D intensity



UK Renewables R&D intensity (3-yr moving average)



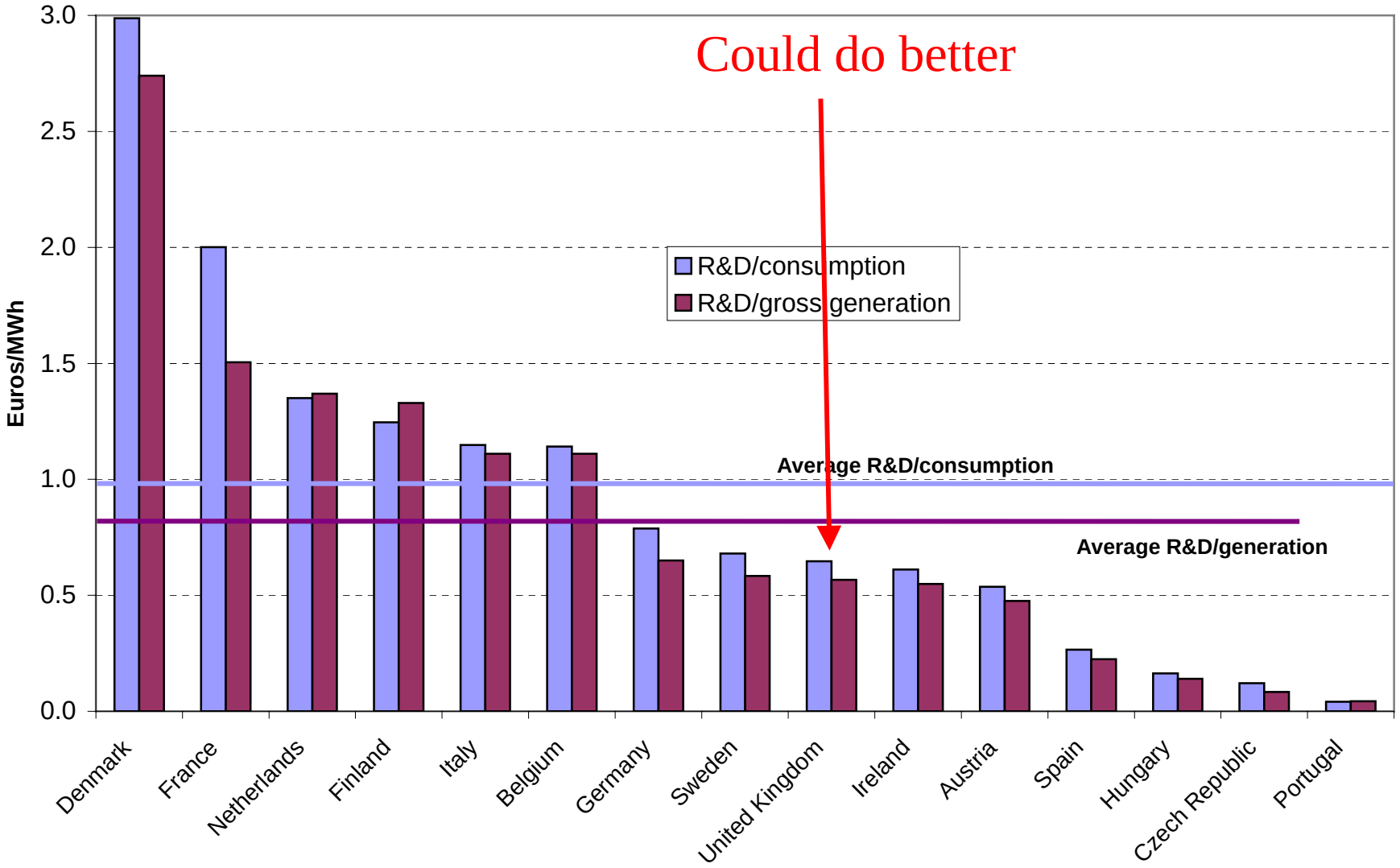
SET support schemes

- 2007 SET R&D non-nuclear ~ €2.4bn (Nuclear €0.94)
  - 70:30 private:public; 80:20 MS:EC
- SET plan to 2020 total €70 bn or double current rate
  - Grid: €2bn; fuel cells + H_2: €5bn; Wind: €6bn;
  - nuclear fission €7bn; bio-energy € 9bn;
  - smart cities €11 bn; CCS €13 bn; Solar: €16bn;
- Joint programming to amplify MS R&D
  - CCS as an example

Needed: club solution for public good problem

Who should finance SET-Plan?

R&D intensity 2008



Sources: COM(2009) 519, Eurostat

Role of EU funding

- Encourage R&D in under-researched areas
- rebalance EU R&D portfolio
- support high-risk high-cost long-term R&D
  - particularly where too costly/risky for one country
- cross-border collaboration to disseminate skills
- encourage open access/reduce restrictive IPR
- create credible commitments by joint agreement

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Conclusions

- Security is primarily a political problem
- Efficiency: more interconnection for wind and competition
- Sustainability and climate change
  - ETS: unstable, low CO_2 price
  - RES Directive undermines ETS
    - and risks bringing ETS into disrepute
  - SET-Plan requires funding
- Reform ETS => rising floor price (or C tax)
  - auction or tax to fund SET-Plan and RES

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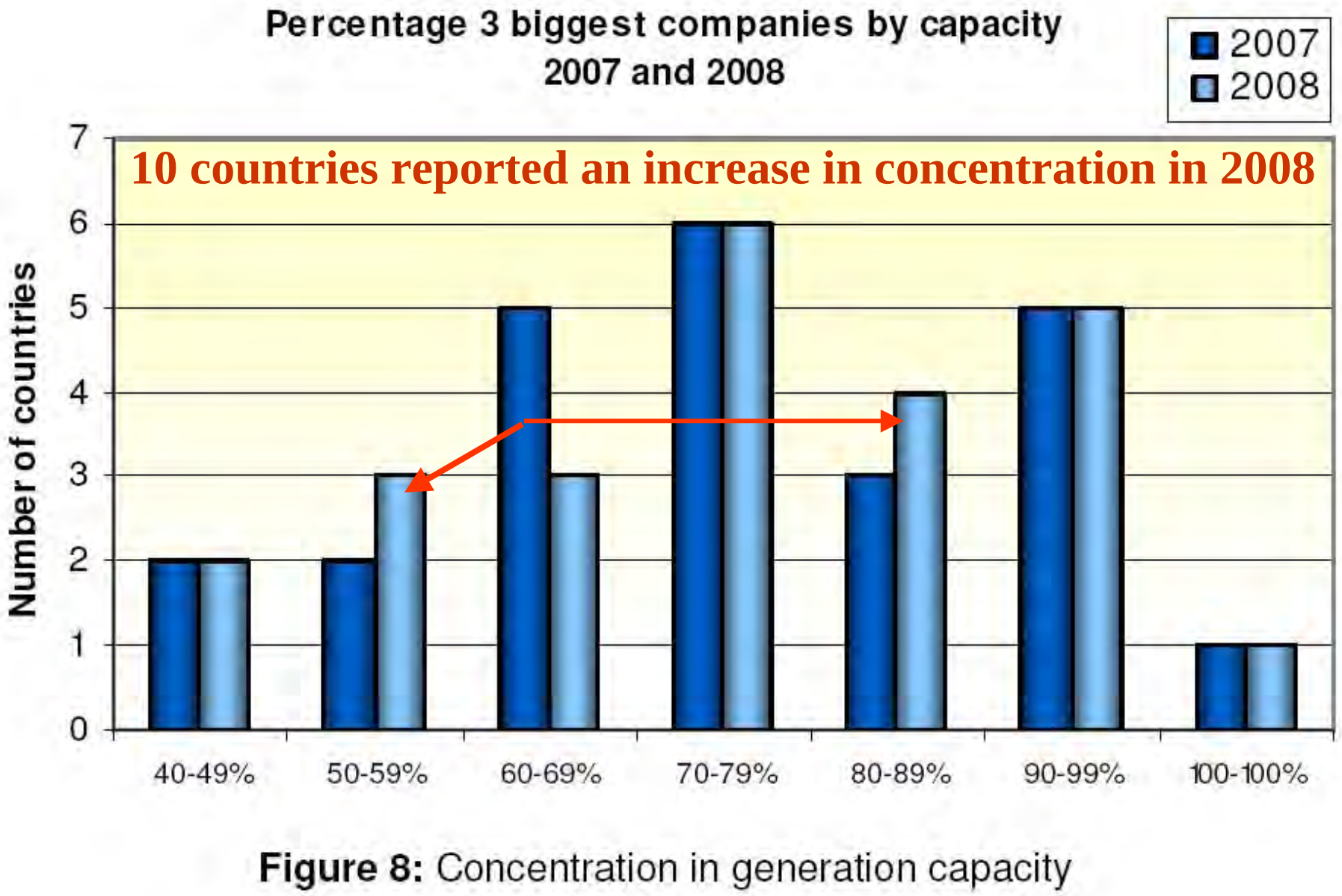

Figure 8: Concentration in generation capacity

Source: ERGEG (2009) Status Review

Acronyms

CfD Contract for Difference

EC European Community

ETS Emission Trading System

EUA European Union Allowance = 1 tonne CO_2

GHG Greenhouse gas like CO_2 - carbon dioxide

HHI Hirschamn Herfindahl Index (sum of squared % market shares, 10,000=monopoly)

MC Marginal cost

RES Renewable Electricity/energy Supply

SET Strategic Energy Technology