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

The logic or otherwise of the EU renewables target

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Smith Institute

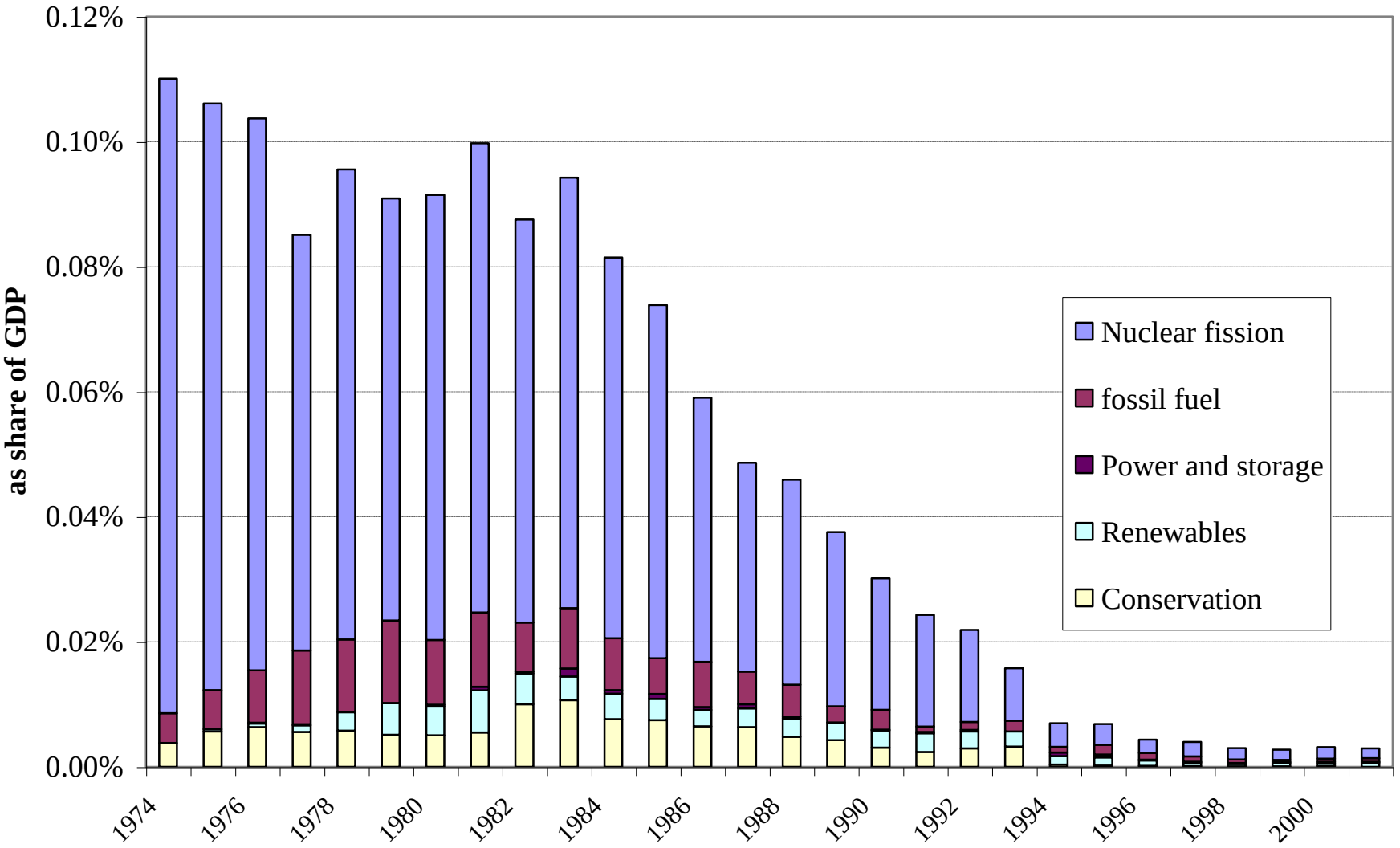
Oxford, 14 October 2008

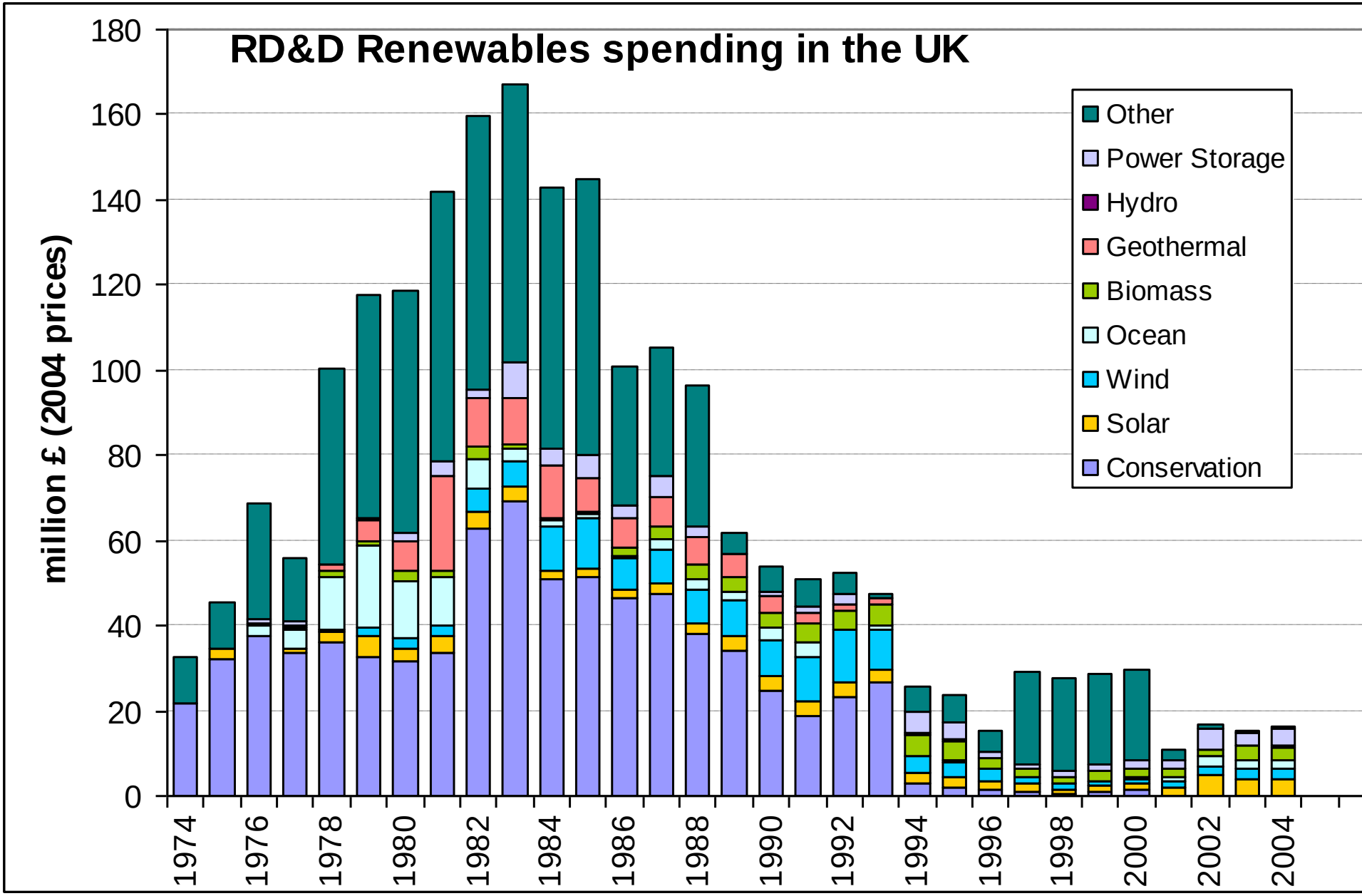
http://www.electricitypolicy.org.uk

Economics of climate change

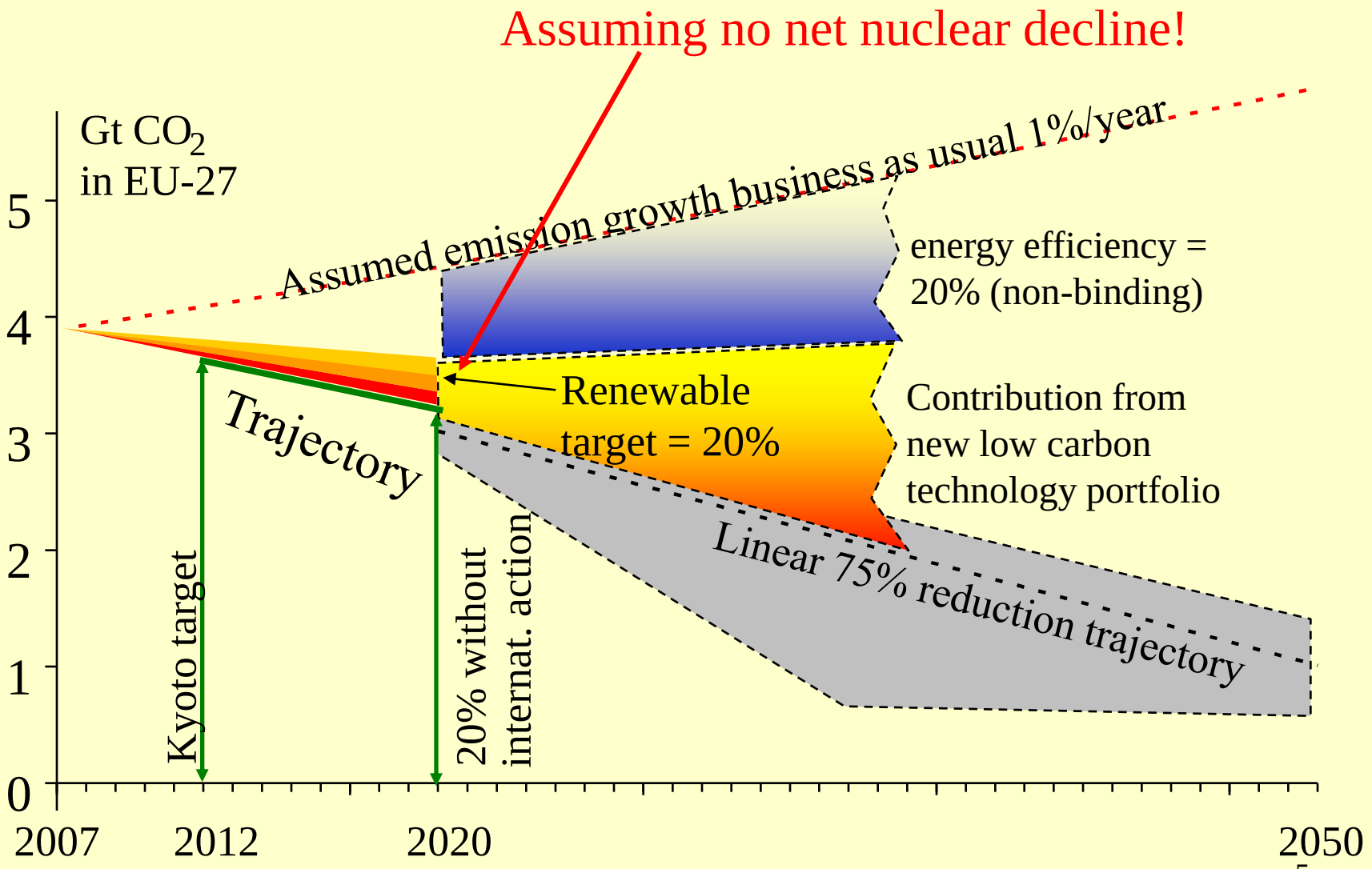
- Climate change : "greatest example of ***market failure*** we have ever seen" (Stern)
  - need to charge for CO_2 (via ETS and/or carbon taxes)
  - problem with competitiveness: border taxes
- RD&D for low-C technologies: ***public good***:
  - correct by patents, subsidies, ROCs, targets
  - such as the ***20-20-20 EU Renewables target***

UK energy R&D as a percent of GDP




RD&D Renewables spending in the UK
million £ (2004 prices)
180
160
140
120
100
80
60
40
20
0
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
Other
Power Storage
Hydro
Geothermal
Biomass
Ocean
Wind
Solar
Conservation

The challenge

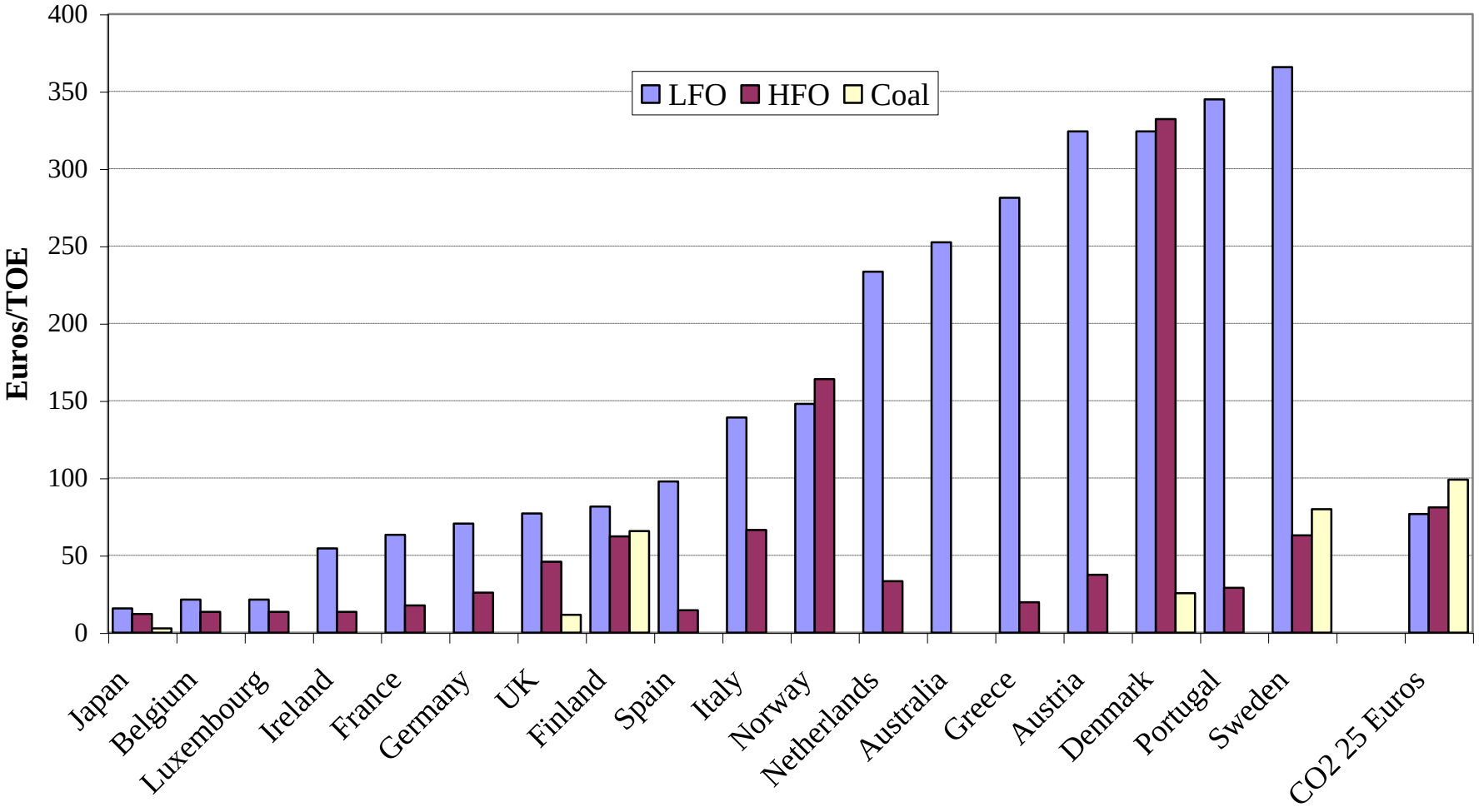


Sustainability

- Correct market failures: CO_2 and RD&D
- Choose right instruments
  - Stable, credible, minimise excess rents
  - ETS can be improved: bands, auctions
- Include all agents or deal with free-loaders
  - Carbon taxes for non-ETS sectors?

  => Sort out rationale of fuel taxes?
  - Border taxes on imputed carbon?

Industrial fuel excises 2003



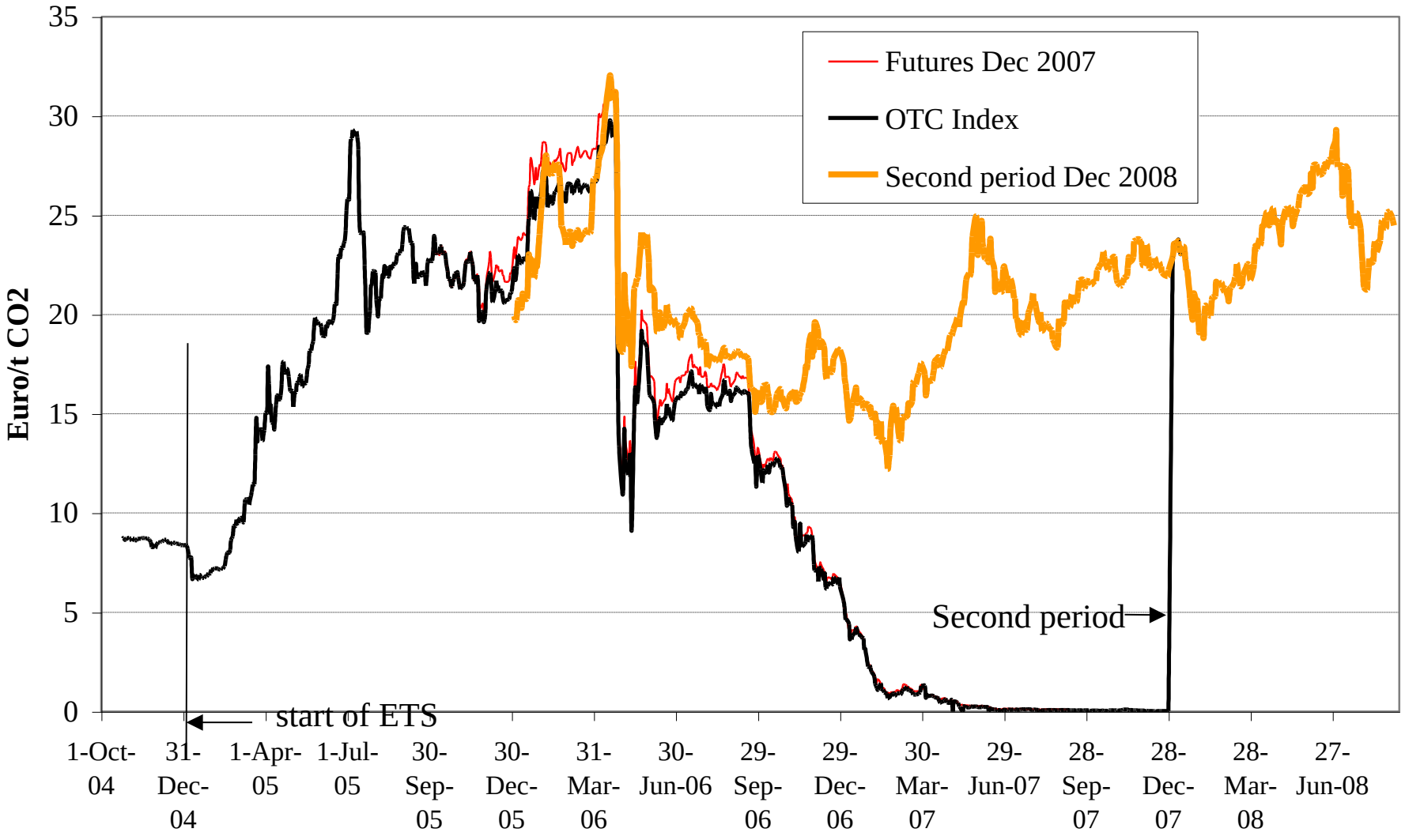
Carbon pricing

- "action to put a value on carbon" (EWP p35)
  - "establishing a price for carbon" incentivises efficient energy use and investment
- Policy is quantity, not price, driven
- Quotas facilitate wider agreements
  - tighten caps for 20% (or 30%) reduction by 2020

  => predictable trajectory for emissions

not the same as predictable future price

EUA price 25 October 2004-3 Sep 2008

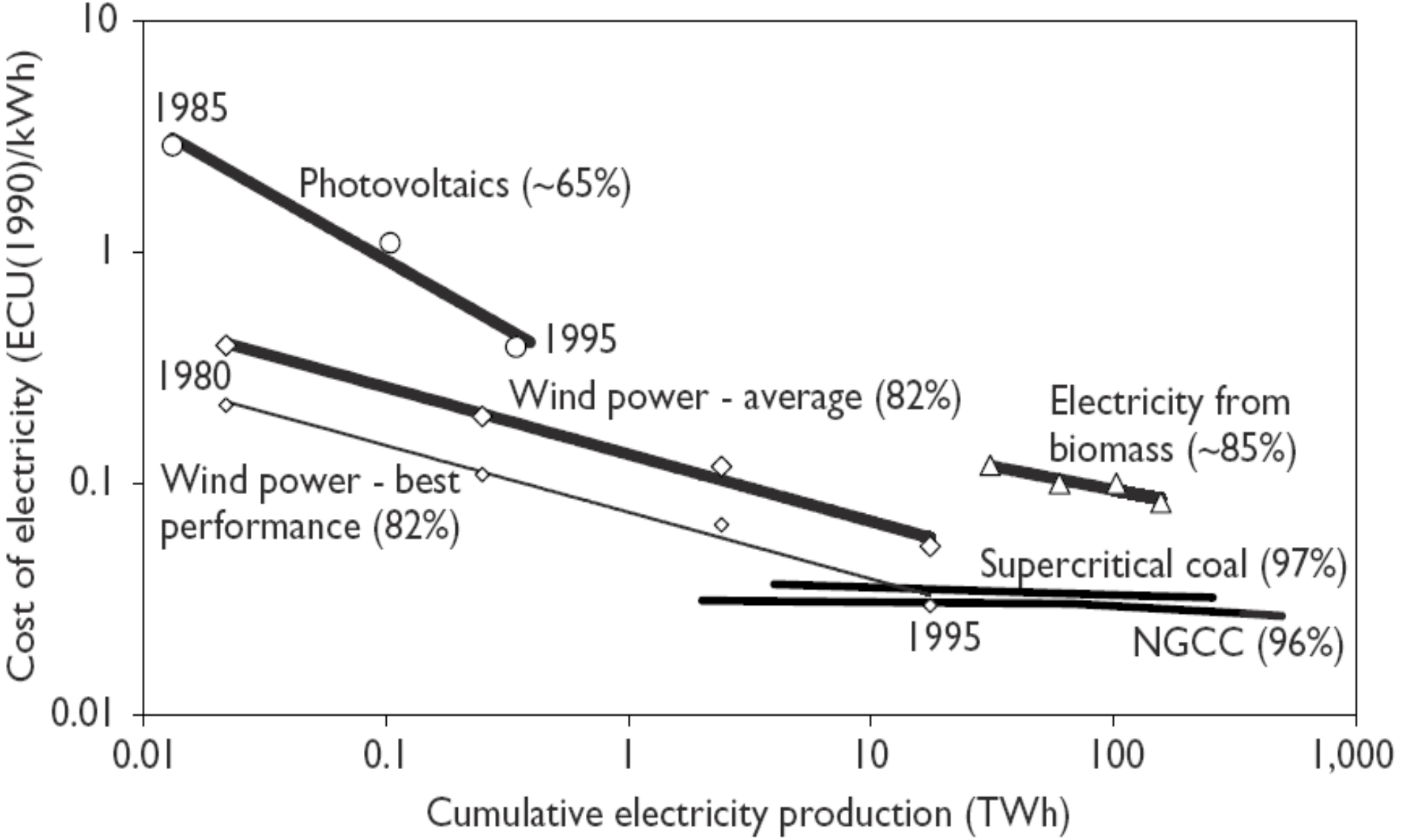


The case for renewables

- Not currently commercial
- RD&D+ learning-by-doing to lower costs
  - aim to make commercial for rest of world
  - assuming sensible carbon price
- need burden sharing for collective action
- country targets do this

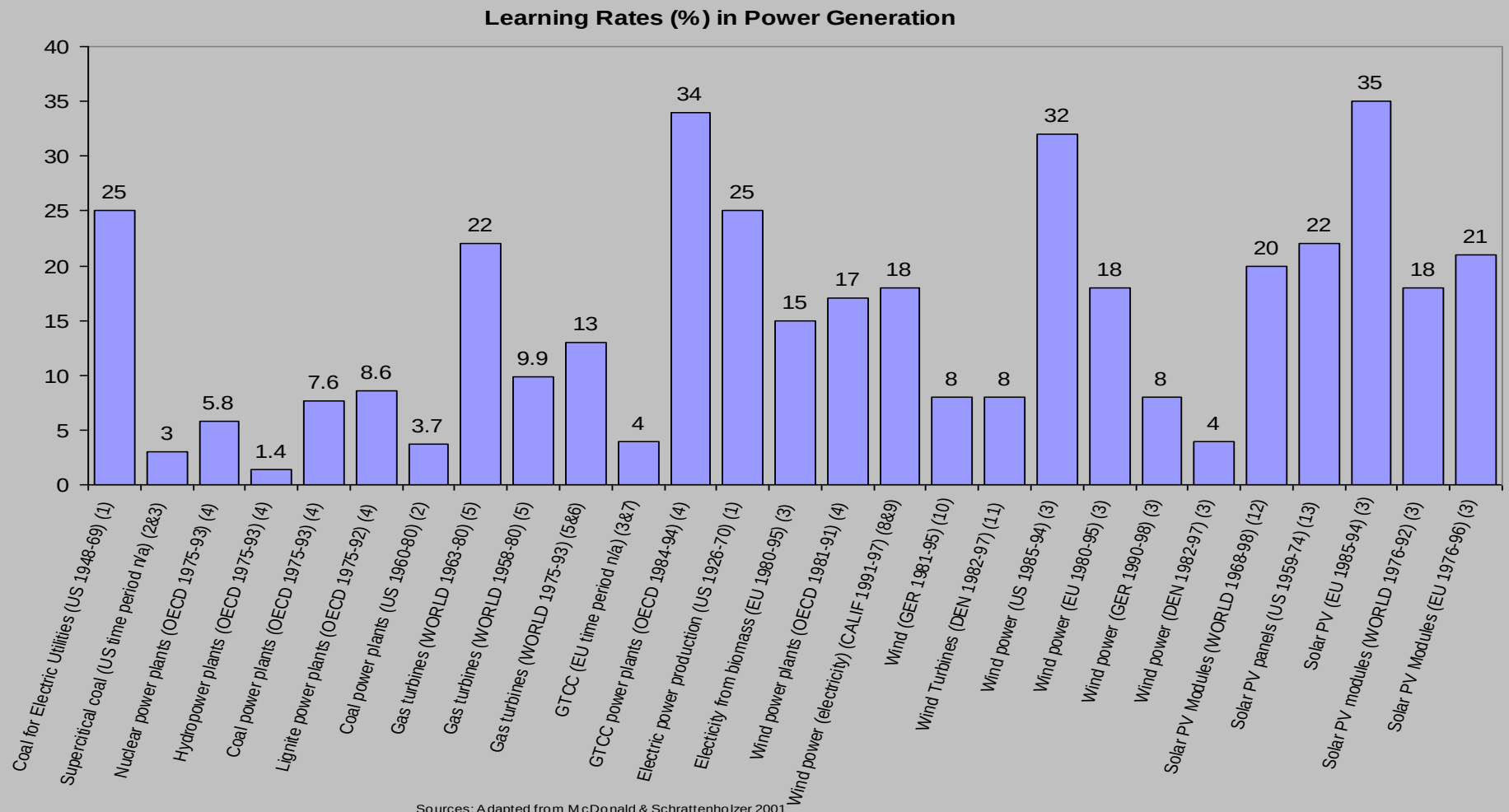
fail to deliver socially optimal technologies?

Experience curves



‘Experience curves’ offer *one* body of evidence

Whatever the ‘learning rate’ is, it is not zero



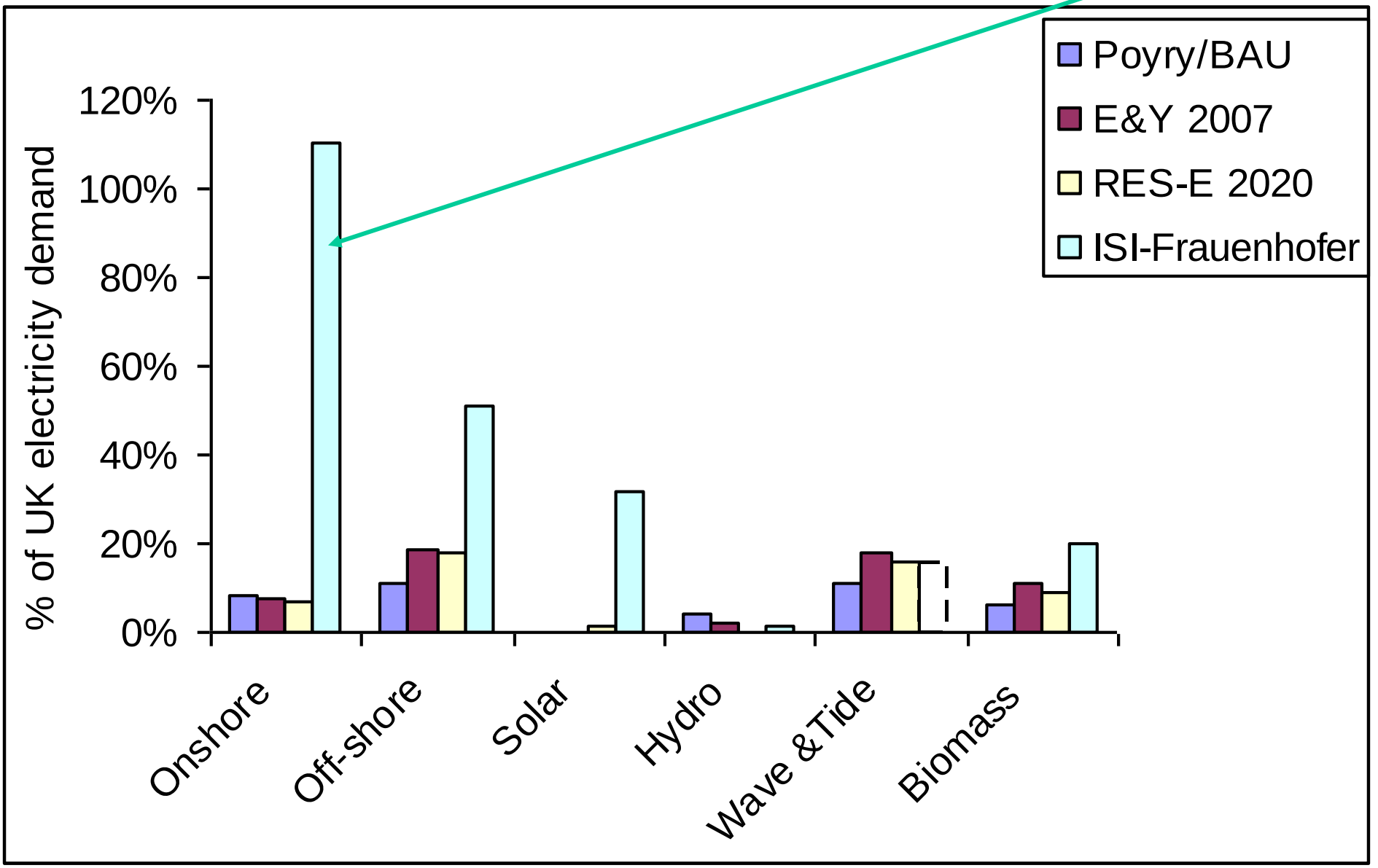
Sources: Adapted from McDonald & Schrattenholzer 2001
(1) Fisher (1974); (2) Joskcow & Rose (1985); (3) IEA (2000); (4) Kouvaritakis et al. (2000);
(5) MacGregor et al. (1991); (6) Nakicenovic et al. (1998); (7) Claeson (1999); (8) CEC (1997); (9) Loiter

Notes: World GTCC data from Claeson (1999) excluded due to outlayers (negative learning rates);
possibly explained by to oligoplistic pricing behavior.

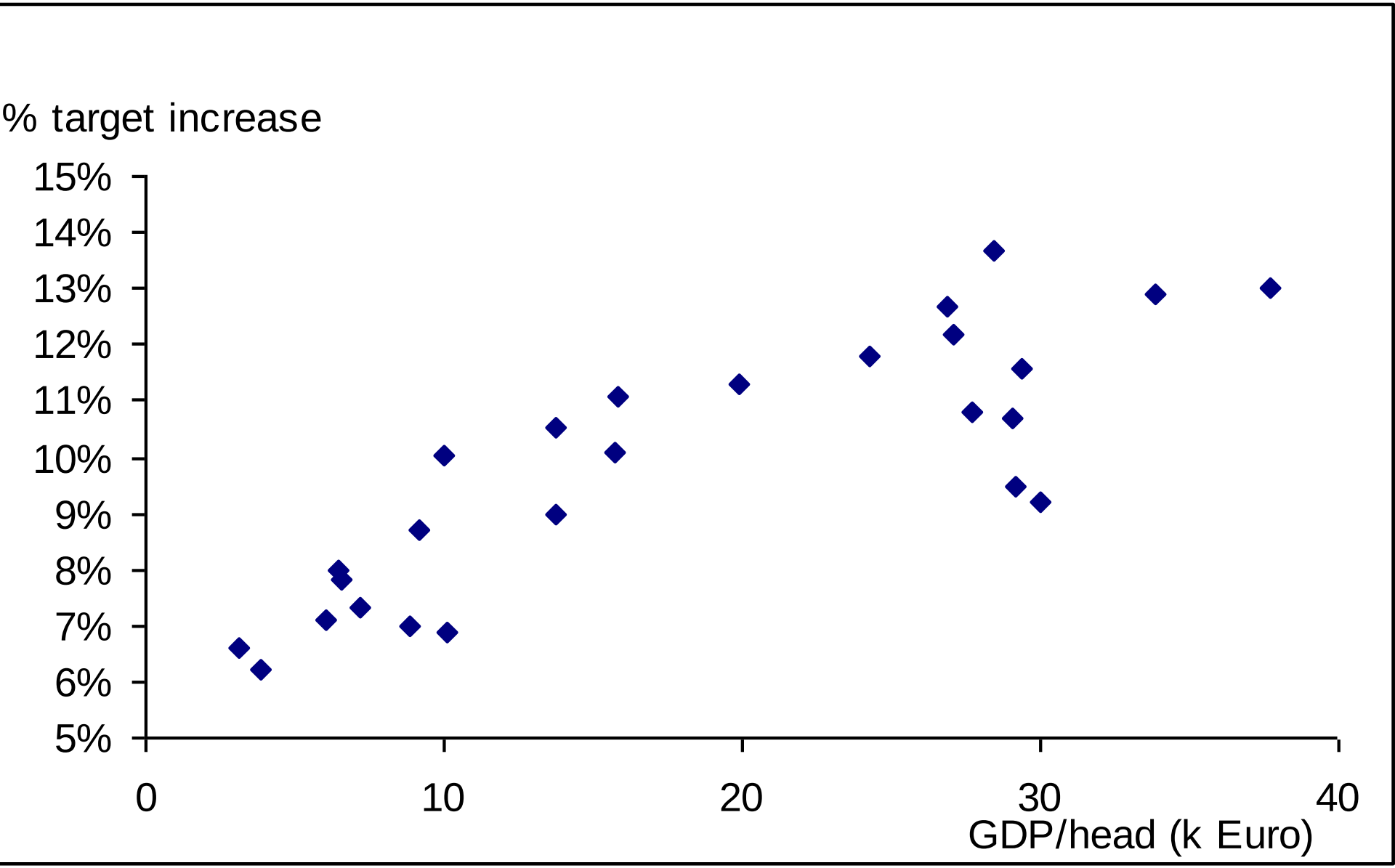
EU 2020 targets – from heads of state

- Increase renewable share in final ***energy*** consumption from 7% to 20%
- Corresponds to about 60% of potential that can be realised by 2020 across Europe
  = considerably less than *ultimate* potential
- How to share this across countries
  - According to RE potential?
  - According to economic strength?

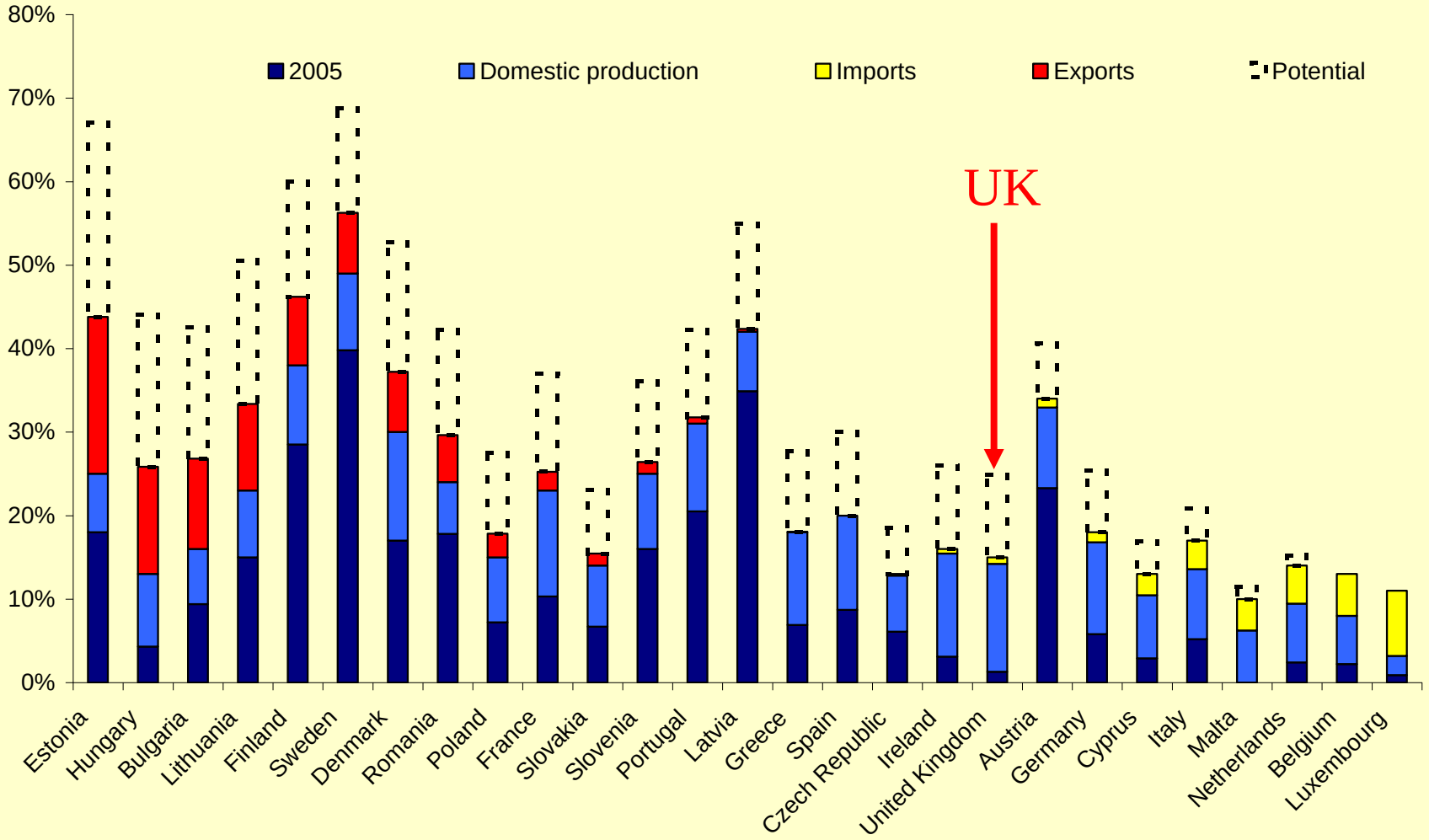
UK 2020 - potential by 2020 and ultimate



Target sharing in Europe – relative to economic strength



What fraction of 2020 potential would have to be captured in different member states?



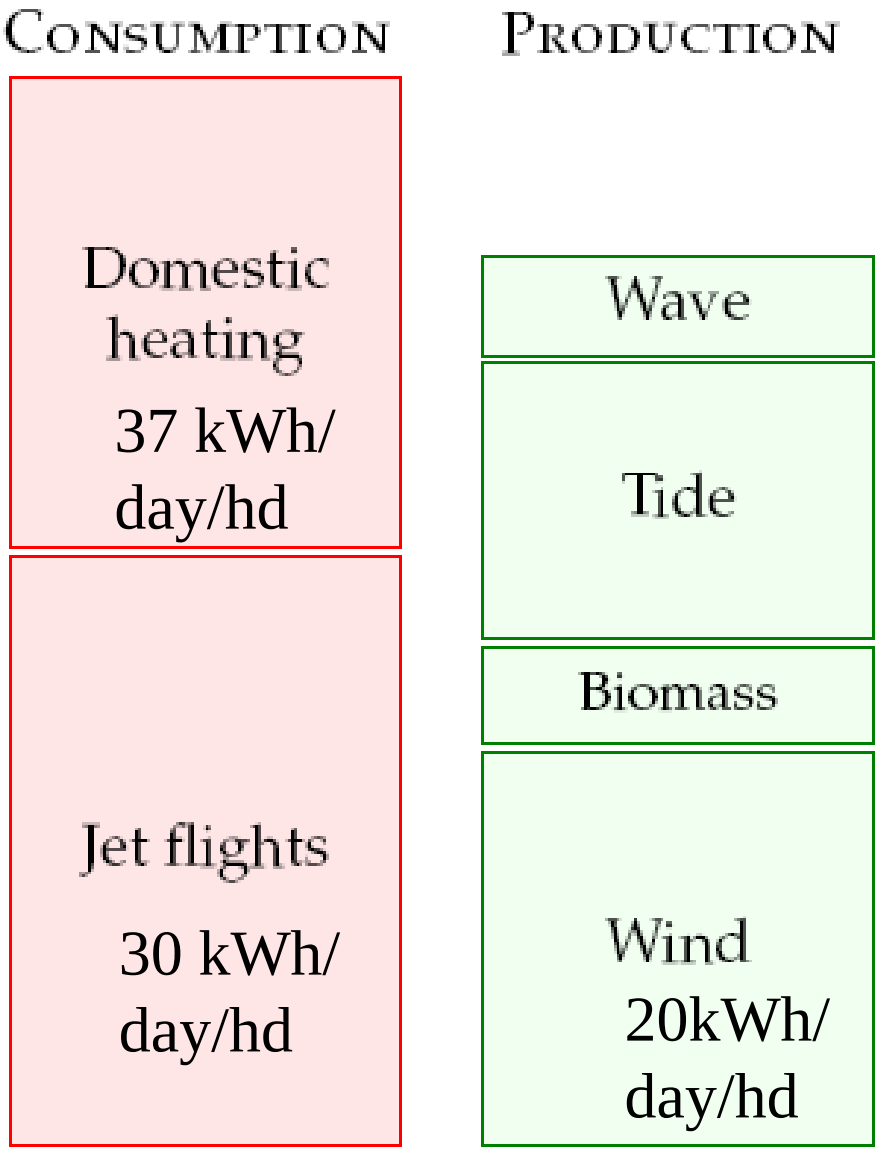
MacKay's rough and ready estimate

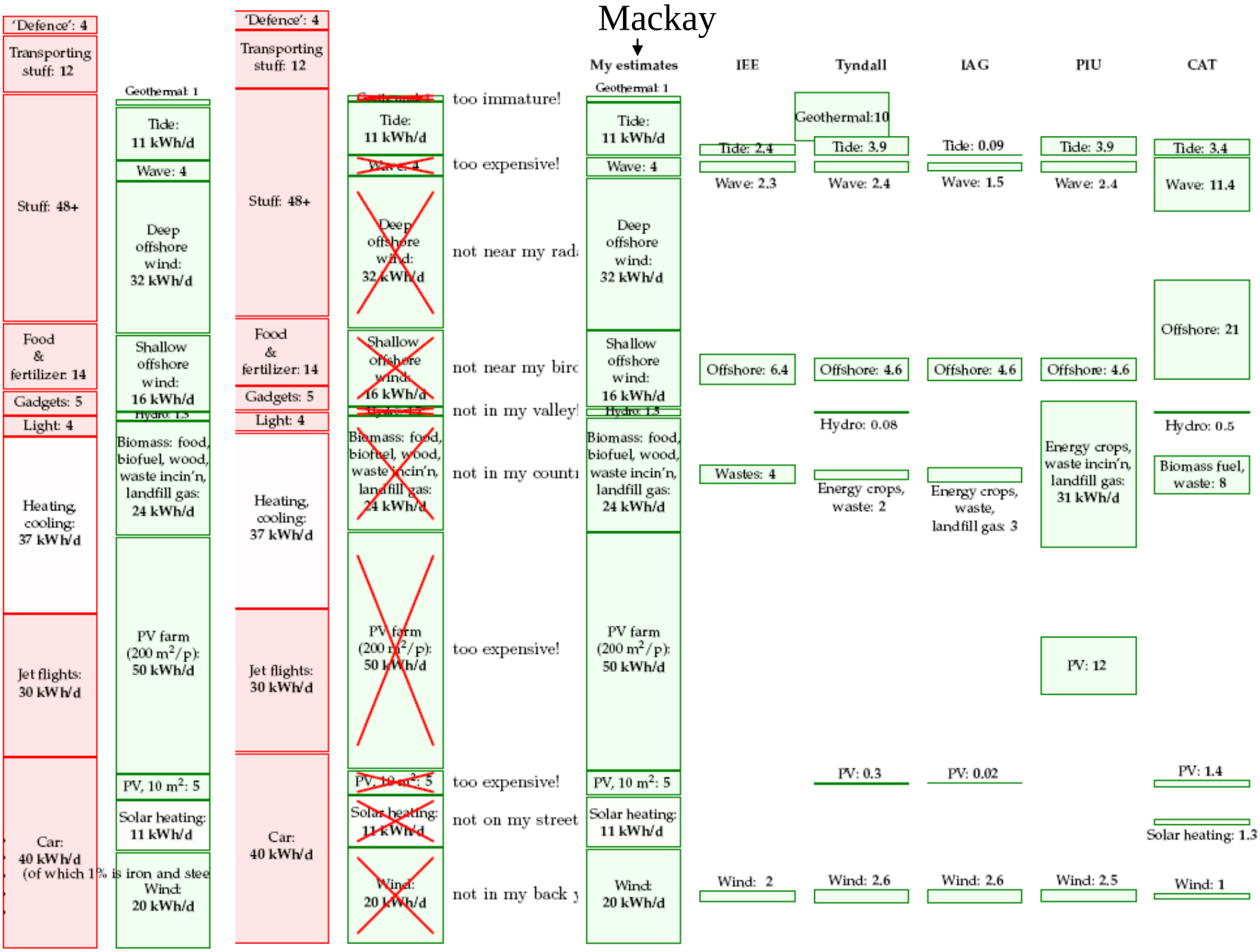
- potential 2W/m^2; pop. density 4000 m^2 /person
- =8kW/person if ALL land area used
- if we covered the windiest 10% of the country with windmills, we might be able to generate *half* of the energy used by driving a car 50 km per day each = 150GW = 430 TWh/yr = 20kWh/day/person

http://www.inference.phy.cam.ac.uk/mackay/

Mackay's ready reckoner

- Two demands for UK energy and four forms of renewables
- cars ***add*** 40kWh/day/hd
- etc




Mackay
'Defence': 4
Transporting stuff: 12
Stuff: 48+
Food & fertilizer: 14
Gadgets: 5
Light: 4
Heating, cooling: 37 kWh/d
Jet flights: 30 kWh/d
Car: 40 kWh/d
(of which 1% is iron and stee
Geothermal: 1
Tide: 11 kWh/d
Wave: 4
Deep offshore wind: 32 kWh/d
Shallow offshore wind: 16 kWh/d
Hydro: 1.5
Biomass: food, biofuel, wood, waste incin'n, landfill gas: 24 kWh/d
PV farm (200 m²/p): 50 kWh/d
PV, 10 m²: 5
Solar heating: 11 kWh/d
Wind: 20 kWh/d
too immature!
too expensive!
not near my rad
not near my birc
not in my valley!
not in my countr
too expensive!
too expensive!
not on my street
not in my back y
My estimates
IEE
Tyndall
IAG
PIU
CAT
Geothermal:10
Tide: 2.4
Tide: 3.9
Tide: 0.09
Tide: 3.9
Tide: 3.4
Wave: 2.3
Wave: 2.4
Wave: 1.5
Wave: 2.4
Wave: 11.4
Offshore: 21
Offshore: 6.4
Offshore: 4.6
Offshore: 4.6
Offshore: 4.6
Hydro: 0.08
Hydro: 0.5
Energy crops, waste incin'n, landfill gas: 31 kWh/d
Biomass fuel, waste: 8
Wastes: 4
Energy crops, waste: 2
Energy crops, waste, landfill gas 3
PV: 12
PV: 0.3
PV: 0.02
PV: 1.4
Solar heating: 1.3
Wind: 2
Wind: 2.6
Wind: 2.6
Wind: 2.5
Wind: 1

UK's 2020 renewables target

= 30-40% renewable **ELECTRICITY** for UK

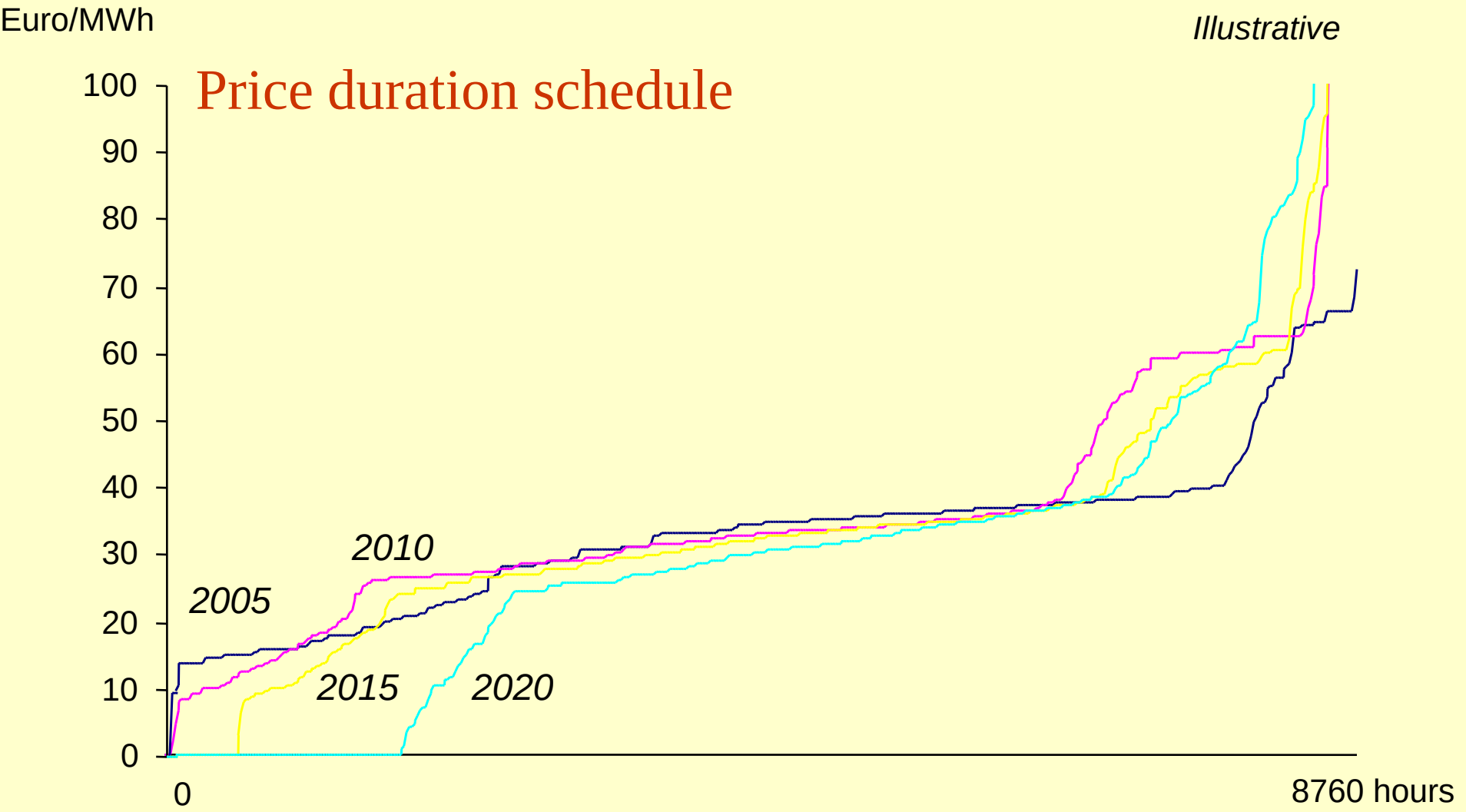
= 120 TWh; wind = 35GW = 90 TWh ≅ 12 GW base-load conventional generation?

- 35 GW> demand for many hours

=> volatile supplies, prices, congestion, ….

- Supporting renewables costs £32-56/yr per domestic consumer for 37% RE (BERR)
  - FIT cheaper than HMG's banded ROCs (Redpoint)

Simulation – more volatility, harms baseload (nuclear)

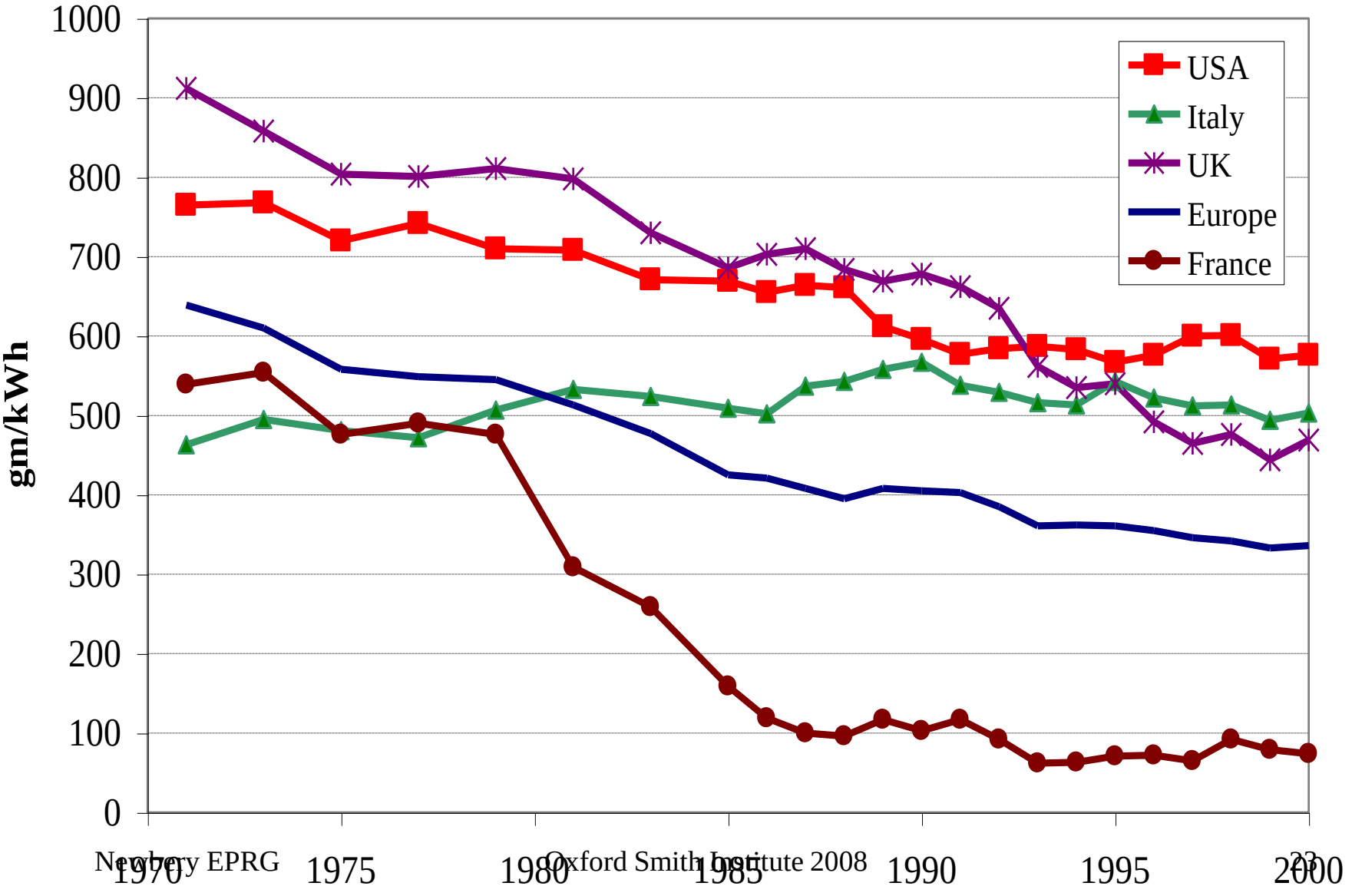


Electricity investment

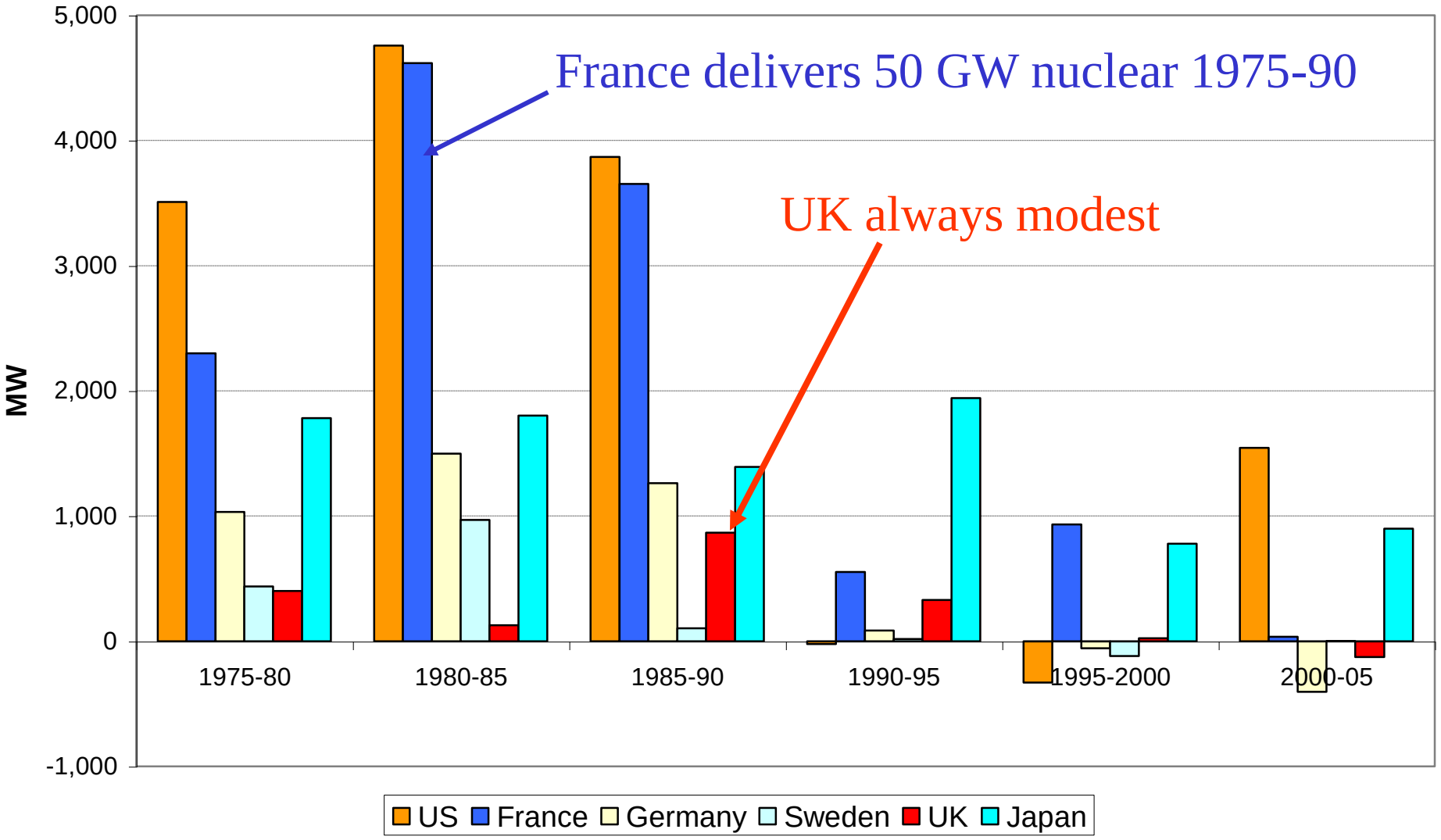
- New capacity needed by 2025
  - all but Sizewell nuclear closed
  - opted out coal closed ??
    - But need to keep coal for low wind hours?
- capacity will last beyond 2050 horizon
  - will lock in carbon intensity for long period
  - France managed to cut C-intensity 80% in 15 yrs by state-funded nuclear investment

Need credible future C price for markets

CO2 emissions per kWh 1971-2000

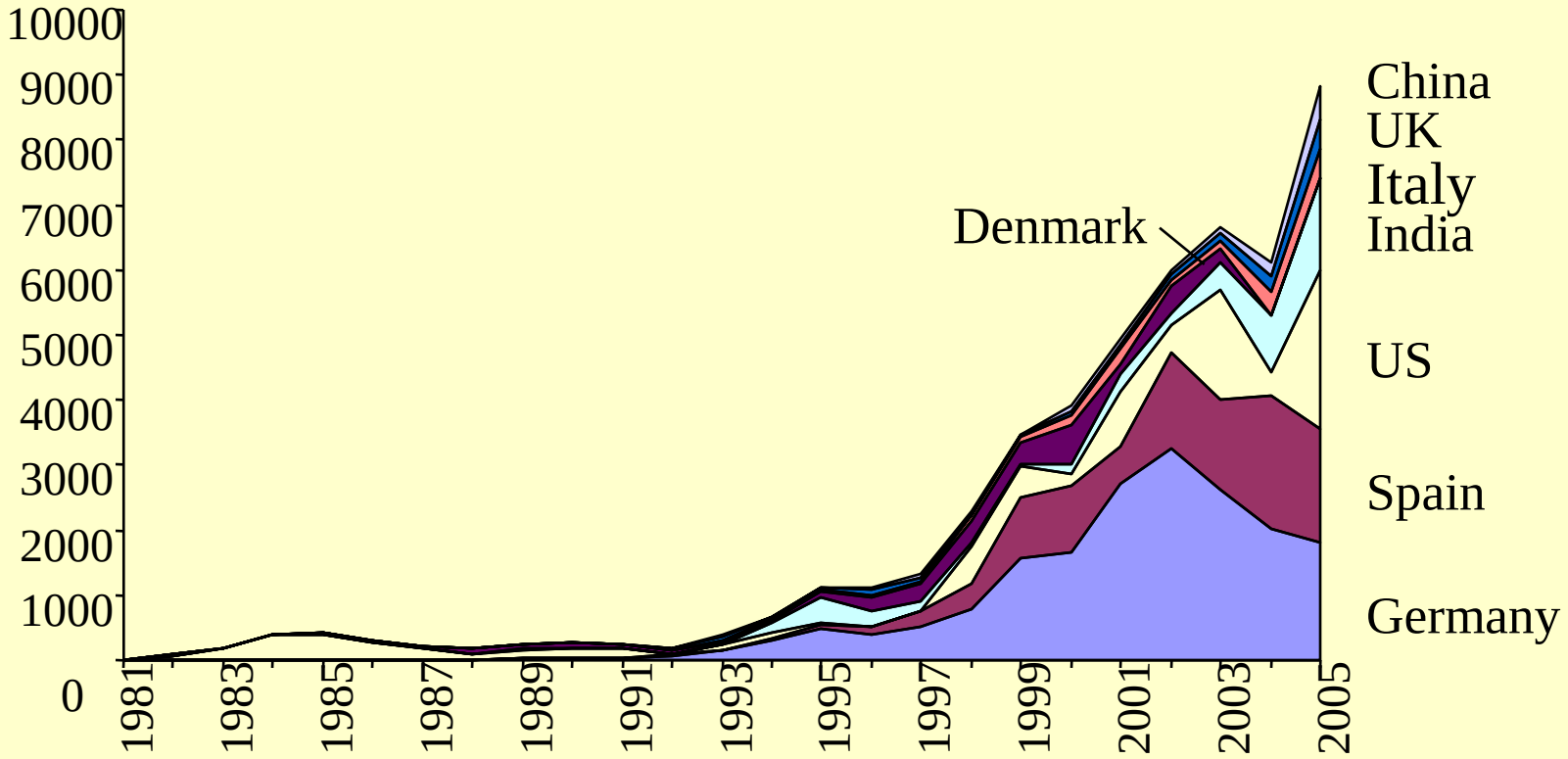


Average annual increment to nuclear capacity



Future demand for wind turbines difficult to predict

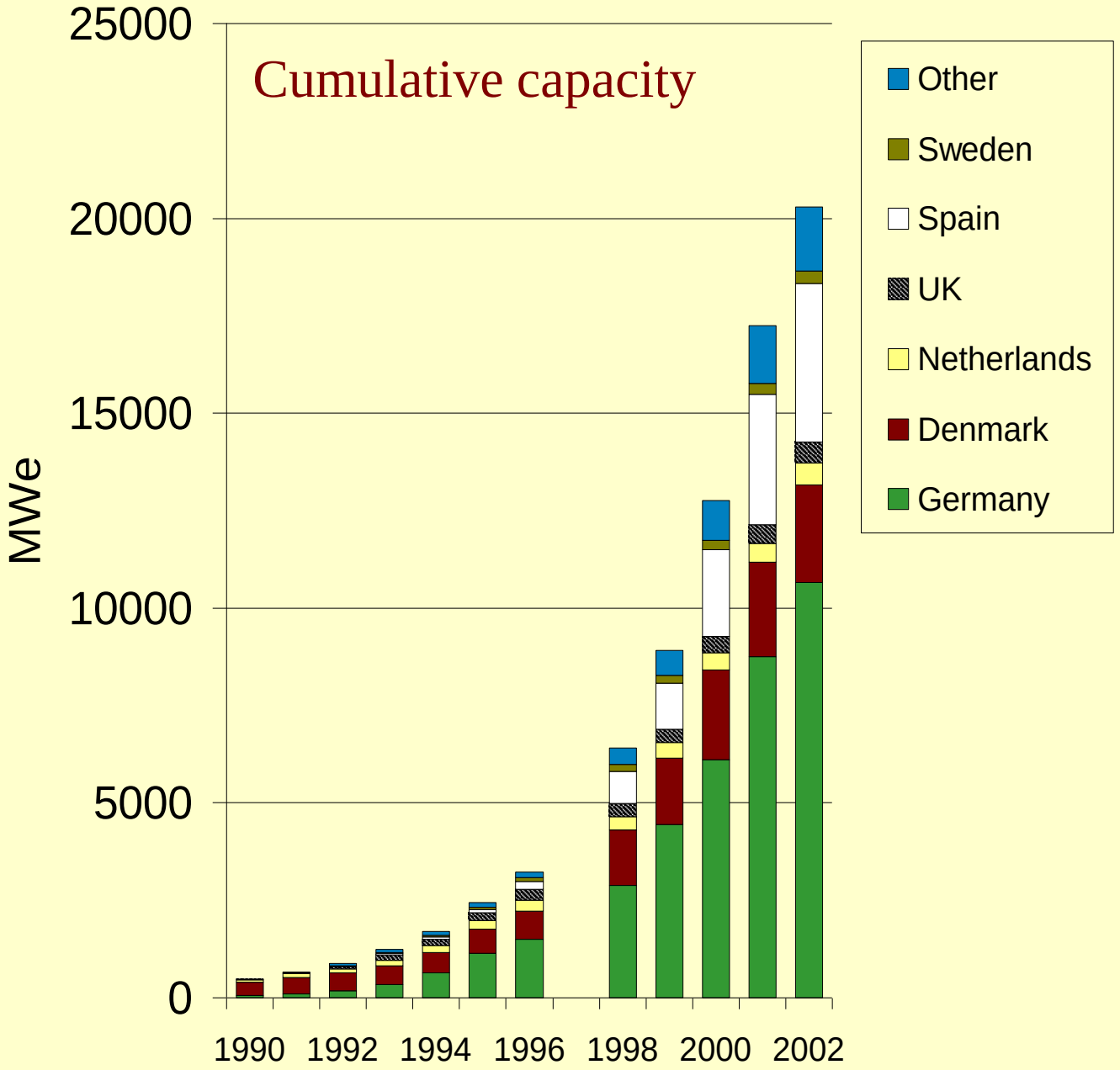
Additions to installed wind power per year (MW)



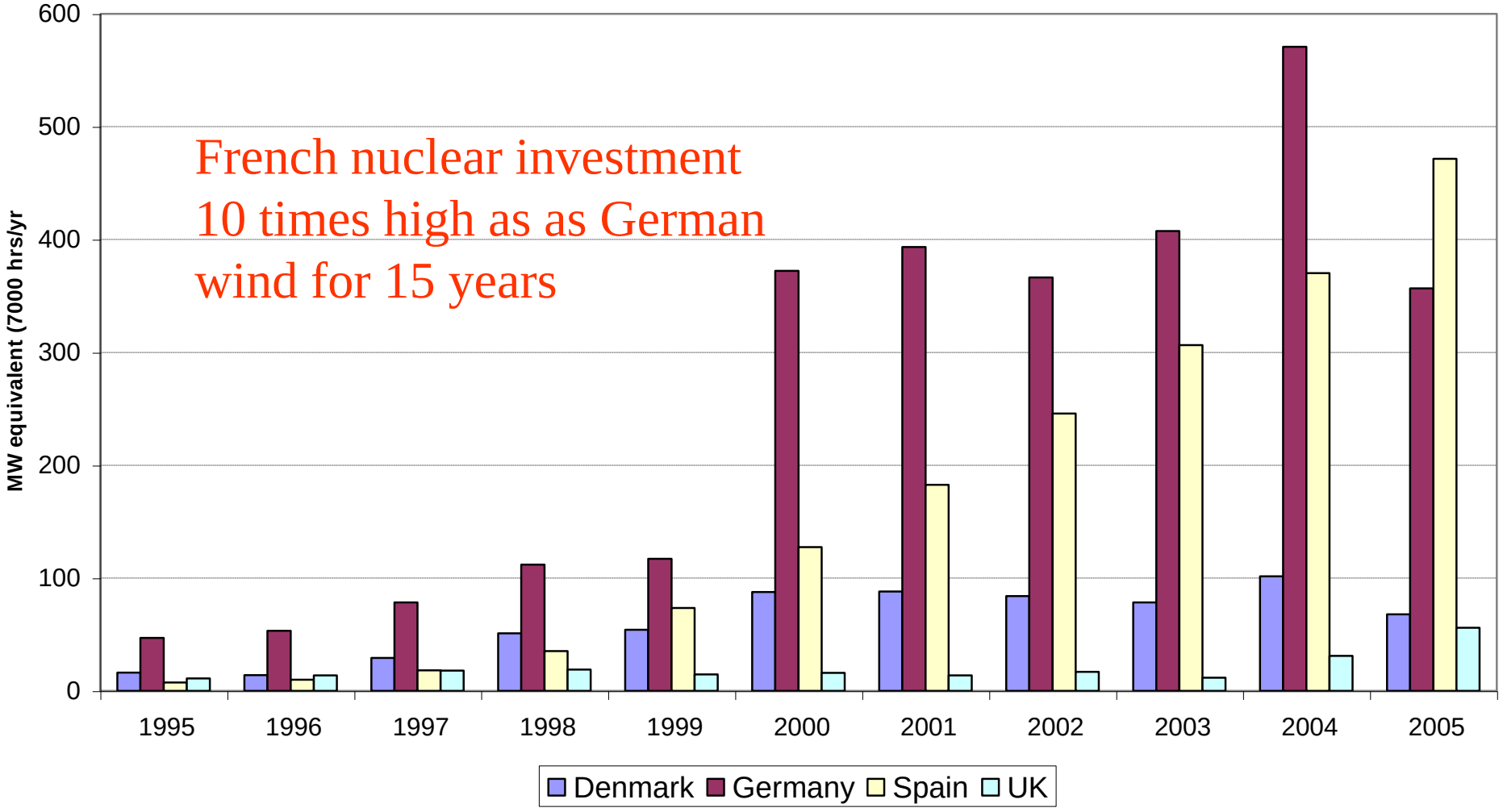
… international markets reduce some of the national volatility

Source BTM consult, GWEC

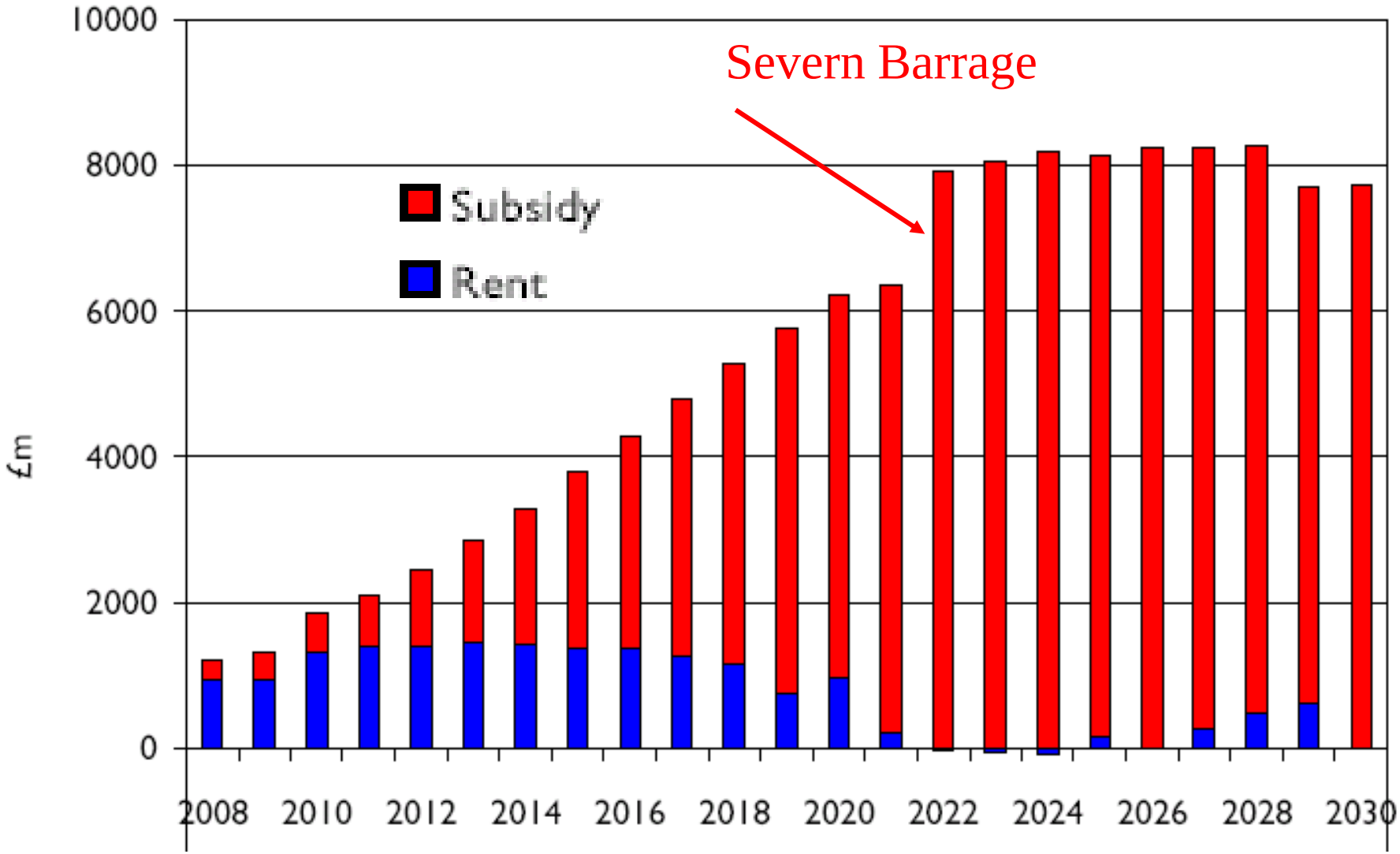
Wind energy is a leading technological success: European capacity has grown 25-30%/yr since 1990 but the UK still lags far behind



Equivalent increment in effective wind capacity previous five years



Total net subsidy for Renewable electricity: **banded ROC**



Source: Redpoint

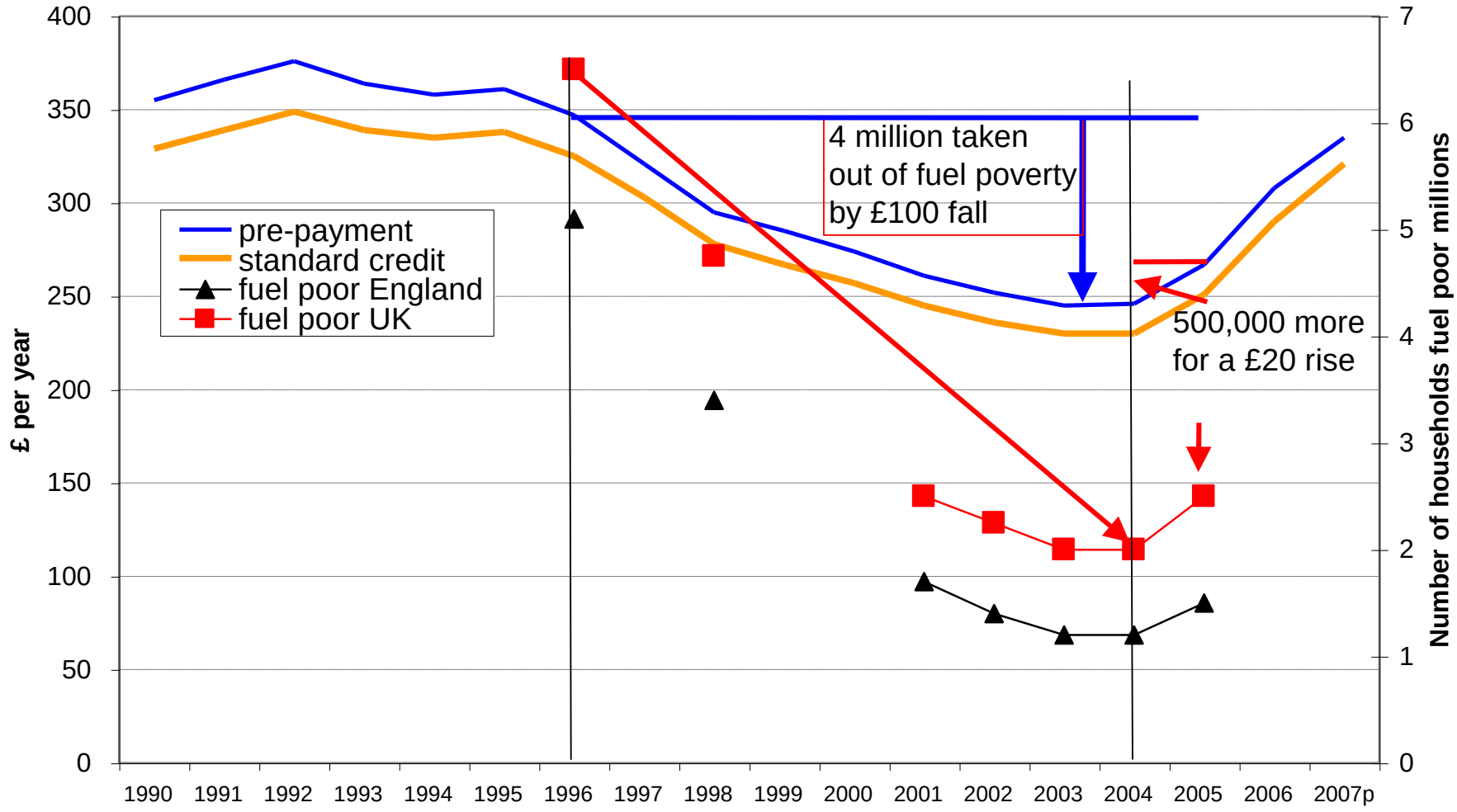
Costs of renewables (Ofgem)

- 120 TWh renewables by 2020
- 2006/7 14.6 TWh cost each customer £10/yr
  - households 29% total =£250 m; total £870m
- BERR predicts £32-53/HH/yr
  - HH = £0.8-1.32 b/yr; total = £2.8-4.6b/yr
- but 120/14.6 = £82/HH = £7bn total

unless costs of renewables/fossil fall by >50%

Fuel poverty

Annual average domestic standard electricity bill



Who should pay for RD&D

- Include it in cost of electricity?
  => Poor consumers subsidise R&D
- Public funds (as with most nuclear R&D)?
- Revenues from auctioning EUAs?
  – No point in allocating any to ESI

Present policy is highly regressive

The case for support

- RD&D => public good => public subsidy
- LbD => lowers cost of successor plants
  - externality, compensate via higher price?
  - Or tenders for capital subsidy?
- Investment in RE => increases capacity
  - in production and supply chains
  - does this relax future constraints and justify further support?

Conclusions

- More thought needed on:
  - ***What*** to support and ***when*** to stop
    - level playing field bad idea
  - ***How*** best to support renewables
    - ROCs worse than FITs
  - ***Who*** should do what and ***who*** should pay
    - how to decentralise over EU: targets for what?
    - Finance from auctioning EUAs!

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EDF