Carbon Pricing and the Restructuring of Electricity Sectors

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Carbon Pricing, Power Markets And The Competitiveness Of Nuclear Power

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http://www.eprg.group.cam.ac.uk
Outline

• The need for carbon pricing
• EU Instruments: ETS and 20-20-20 Directive
  – in conflict, need reform
• Stabilising the carbon price
  – taxes, banks or floors
• Restructuring electricity - the UK EMR
  – CO₂ floor, CfD, capacity payments, EPS, ...
Peak CO$_2$-warming vs cumulative emissions 1750–2500

If we want a 50% chance of less than 2°C rise we can only emit another 500 Gt C ever.

Median prediction

most model predictions in this range

cumulative post-1750 emissions (trillion tonnes carbon)

peak CO$_2$-induced warming relative to 1770

Coal reserves

Unconventional oil and gas

Median prediction

likely

Now

Oil

Gas

Coal

Low

High

Now

Total cumulative emissions determines global warming

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

Source: ENEP Emissions Gap Report 2010
Policies for mitigating climate change

• GHG emissions are a global stock public bad
  – uncertain distant damage with uneven impacts
    => very hard to agree coordinated policies
  – damage regardless of emissions location, persistent
    => damage moderately independent of date of emission
  – much irreversible over historical time scales

• Solution: uniform charge for GHG emissions,
  – charge rises at discount rate
  – reset in light of new information
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 spill-overs and burden sharing

• **EU SET-Plan** to double R&D spend
  – to support less mature low-C options

*But ETS undermined by 20-20-20*
2020 projected CO2 price

Source: Committee on Climate Change, 2008 and 2009
CO₂ prices are volatile and now too low
Weitzman: Taxes superior to permits unless MB of abatement steeper than MC

CO₂ is a global persistent stock pollutant

- CO₂ damage today effectively same as tomorrow
- => marginal benefit of abatement essentially flat
- marginal cost of abatement rises rapidly
- future abatement costs very uncertain

**Carbon tax superior to tradable permits**

*but permits easier to introduce*
Costs of errors setting prices or quantities

With quota would produce up to here at high cost

With tax would produce here at low cost

Efficiency loss from tax

Efficiency loss from quota

Correct MC

MC

Best estimate of Marginal Cost of abatement

MB, Marginal benefit from abatement

Reductions in emissions

£/tC

Q*

Q

$\text{MB, Marginal benefit from abatement}$
Failures of ETS

• Current ETS sets quota of total EU emissions

• Renewables Directive increases RES
  => increased RES does not reduce CO₂
  => reduces price of EUA
  => prejudices other low-C generation like nuclear

• Risks undermining support for RES

*Solved by fixing EUA price instead of quota*
Reforming ETS

- Reform EU ETS to provide rising price floor
  - sufficient for nuclear or on-shore wind if cheaper
- 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
  - offer CfD at €45/EUA for 20y from commissioning?

*makes extra carbon savings additional*
Stabilising CO$_2$ price

- **Floor price** - Member states receive x% of NAP each year, adjusted to support EUA price

- **EU Carbon Bank**
  - buys and sells EUAs to stabilise price
  - **Member States resist transferring any EUAs?**

- **Replace by carbon tax?**
  - Cheaper to implement and **Cash positive**
  - Covers whole economy, simplifies policy
  - underwritten by CfD on path for commitment
  - **Need border tax adjustment for traded sectors?**
Competitiveness impacts

• No difference between permits and taxes
  – both raise opportunity cost of emitting \( \text{CO}_2 \)
  – both raise cost of electricity by same amount
  – if auctioned Govt. gets €€, if granted Co.s get €€

• easier to rebate C tax on exports
  – border taxes on imports, or exempt traded goods?

*ETS lobby-prone, so might be rebated C-taxes*
Need for market reform

- Low-C generation is capital intensive
  - except CCS has low variable cost
  - wind: v low variable cost, intermittent

=> risk of low prices much of year
  - peak and average prices set by gas +C price?

=> how to encourage investment in low-C gen?
  - economics depend on C-price over life: 40+ yrs
  - renewables supported by FITs or ROC

Nuclear power will need assurance on C price
UK Electricity Market Reform

• **C-price floor** to underwrite wholesale price
  – reduces temptation to renege on contracts
  – supports decentralised market-led investment

• **CfD for low-C** to guarantee future revenues
  – negotiated or tender auctions, technology specific

• **Capacity payments** to ensure peaking capacity
  – and reduce risk to capital intensive plant/

• **Emission performance standards**
  – belt and braces to rule out unabated coal
Correlation of coal+EUA on gas+EUA slightly higher at 96%
Why?

• Mutually reinforcing elements to reduce risk
  – fossil generation hedged, low-C risky => CfD
  – cost of risk high for low-C
• Carbon price floor to avoid subsidy claims
  – “no subsidies to nuclear power”
  – reduces risk of renegotiating contracts
  – but risks inefficient trade if not EU wide
• Capacity payments and EPS - for comfort?
Conclusions

• EU ETS CO$_2$ price is too low
  – needs *credible* rising stabilised floor price

• RES Directive undermines ETS
  – and risks bringing ETS into disrepute
  – fixing EUA price avoids this conflict

• Most electricity markets will not deliver low-C
  – without contracts and/or minimum *credible* C price

• UK EMR is (moderately) coherent

  *EU carbon price floor would help*
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