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The NAP and electricity markets: perverse incentives or sound judgment?

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Cambridge, 6 November 2004

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Agenda

- Optimising electricity production when emitting CO2 implies a cost
- How allowance allocation can affect pricing and investment behaviour
- Indicative modelling results
- Conclusion

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- Optimising electricity production when emitting CO2 implies a cost
  - Marginal cost
  - Total cost
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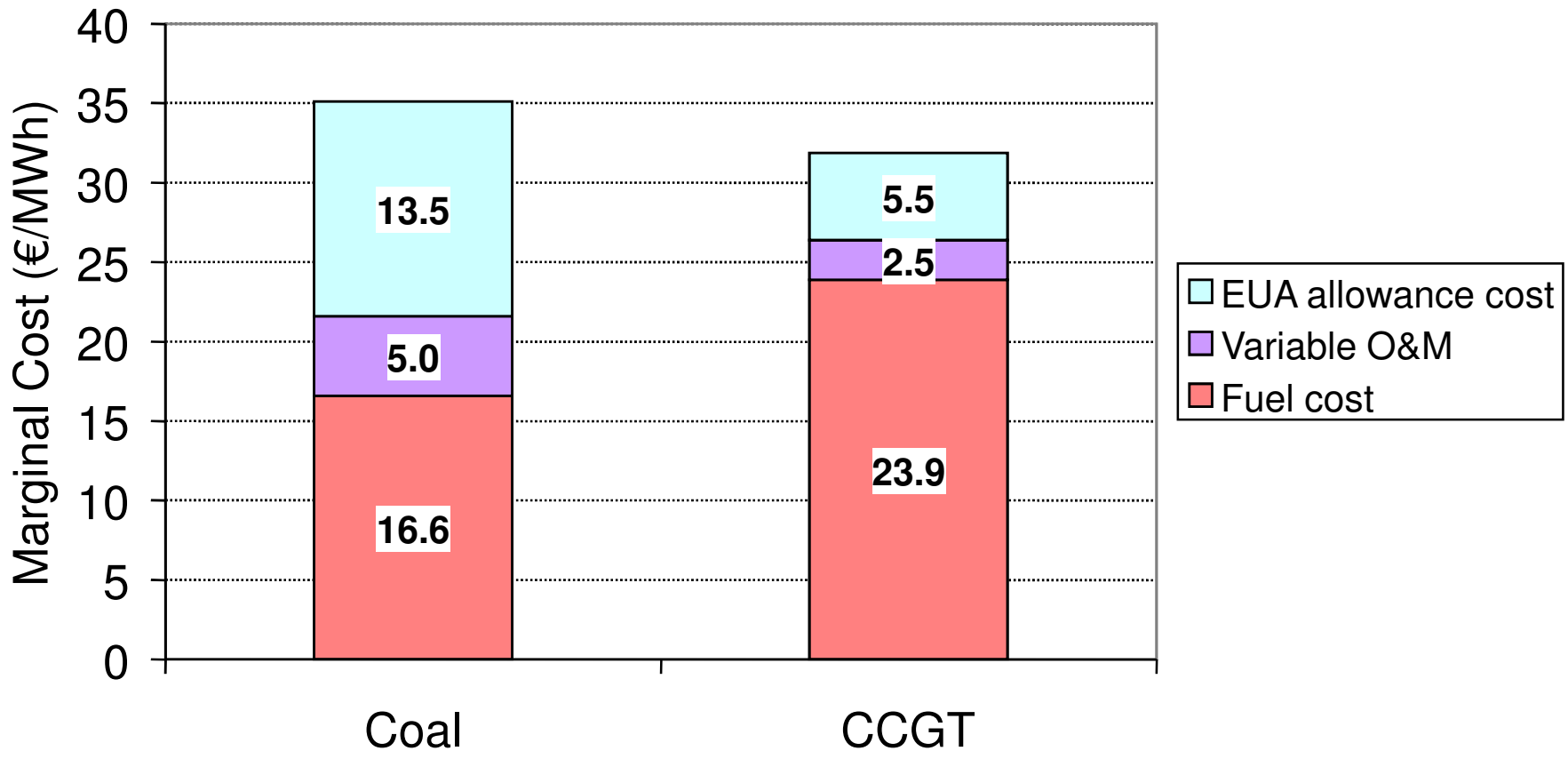
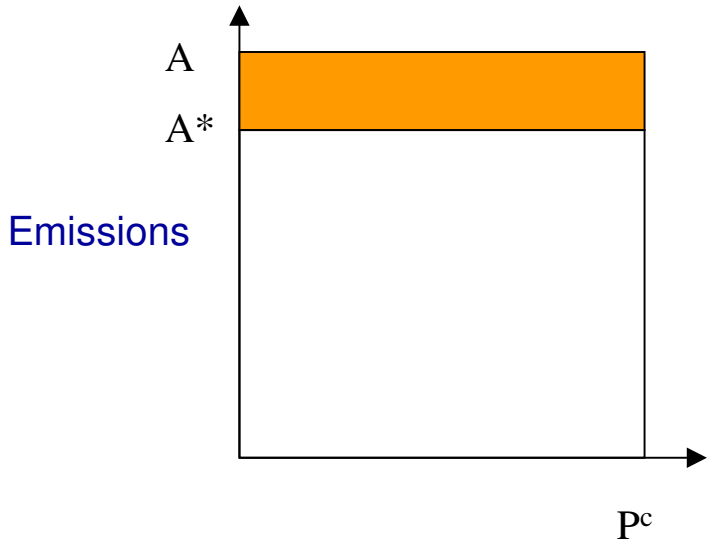
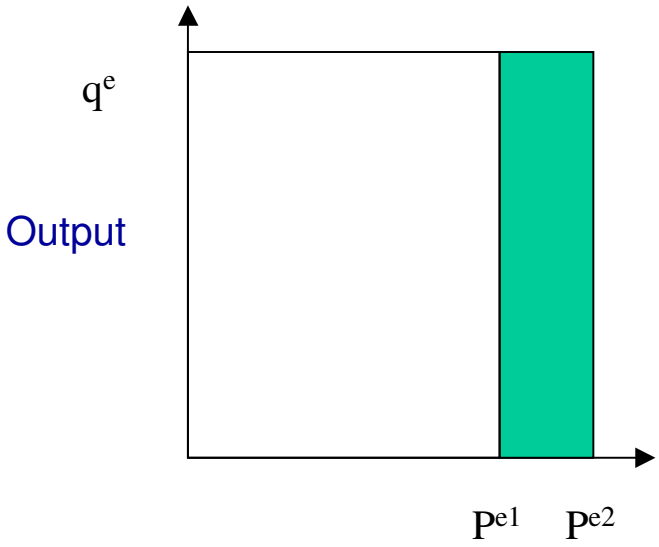
CO2 should increase the marginal cost of production



Note: Based on efficiency ratings of 36% and 50% net HHV efficiency respectively. €15/tCO2.
Price of gas at 3.50€/MMBTu (35€c/therm) and coal at 1.75 €/MMBTu (42€/tonne at 6,000kcal/kg).

But total costs may not go up by that much



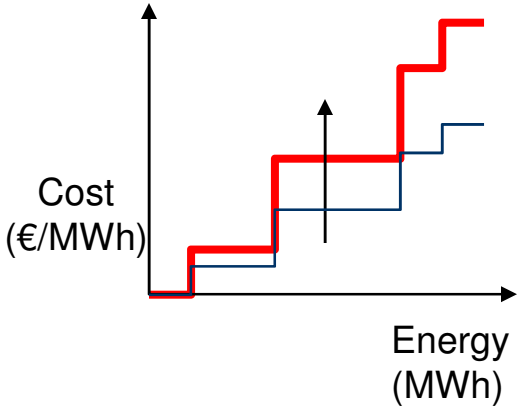


UK example

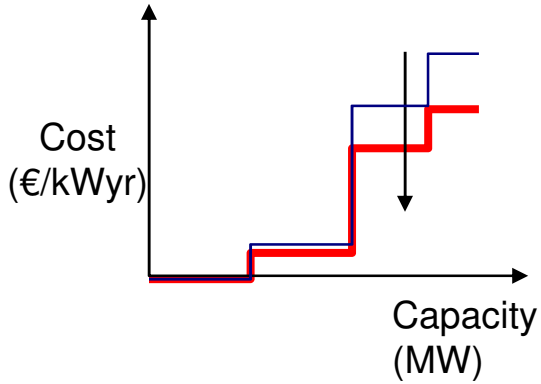
- Orange box:
  - P^c x {A - A*} = €10/tCO2 x 37.9 million tCO2 = €379 million
- Blue box:
  - ΔP^e x q^e = ΔP^e x 385 TWh
- Set them equal => ΔP^e = €379 million / 385 TWh
- Electricity generating sector looking for compensation? ~1€/MWh

Modelling needs to consider both energy and reserve elements

- CO2 will increase the marginal price of electricity
- But the allocation of free allowances to power sector works in the opposite direction by reducing the costs of keeping existing plant or bringing new plant online



Merit order for electricity production based on marginal costs



Costs for maintaining or increasing generating capacity (even if idle)

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  - Updating (rolling baseline)
  - New entrant reserve
  - Contingent allocation
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Updating in a two-period model

$$c_t = p_t - u\beta p_{t+1}.$$

p_t allowance price in period t

c_t opportunity cost of emissions

u updating fraction

β discount factor

- Today's emission cost ct is reduced by the PV of the allowances to be allocated in future
- Easily extended to deal with >2 periods, the impact of banking and borrowing, and/or probabilistic assessment of changes in baseline

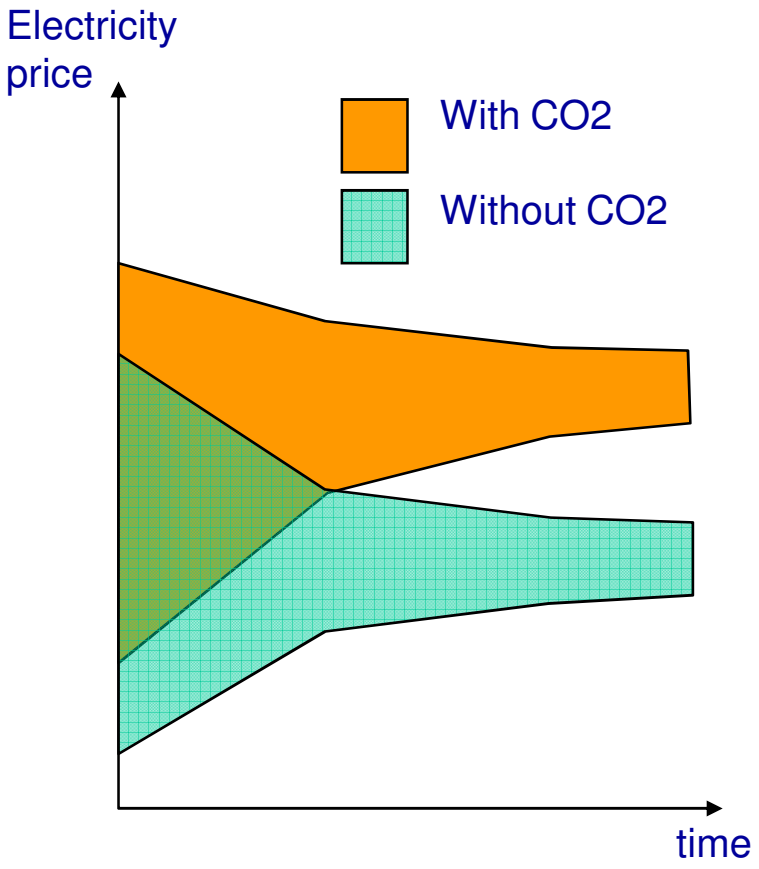
See: Keats and Neuhoff (2004), CMI Working Paper 49, http://www.econ.cam.ac.uk/electricity/publications/wp/index.htm

Why bother? Consider two identical countries, A and B

- Initially, A decides to allocate allowances for forthcoming period t and the following period t+1 on the basis of historical emissions in the t-1 baseline
- But B chooses to allocate allowances in period t+1 based on emissions in period t
- With no cross-border trading, then equal amounts of abatement in each country =>
  $P_A < P_B = P_A/(1- ß \cdot u)$
- With cross-border trading, B will purchase emissions allowances from A, increasing prices and abatement in A and reducing efforts in B

New entrant reserve

- Prices tend towards LRMC
- If new entrants are to receive a free allocation, then this can be offset against their CO2 costs resulting in a lower cap on electricity prices than otherwise
- NB, *ex-post* adjustment to new entrant allocation cam mean NO CO2 cost



Contingent allocation

- When the allocation is contingent on the operational status of existing power stations then allowance can be thought of as an annual (capacity) subsidy
- If annual net operating costs are lower, this reduces the additional compensation to gencos required to maintain an adequate reserve margin
- For any given number of allowances on offer in each year, the higher the price of CO2, the greater the incentive to maintain older, less carbon-efficient plant online

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  - CO2 emissions
  - CCGT capacity expansion

  } UK
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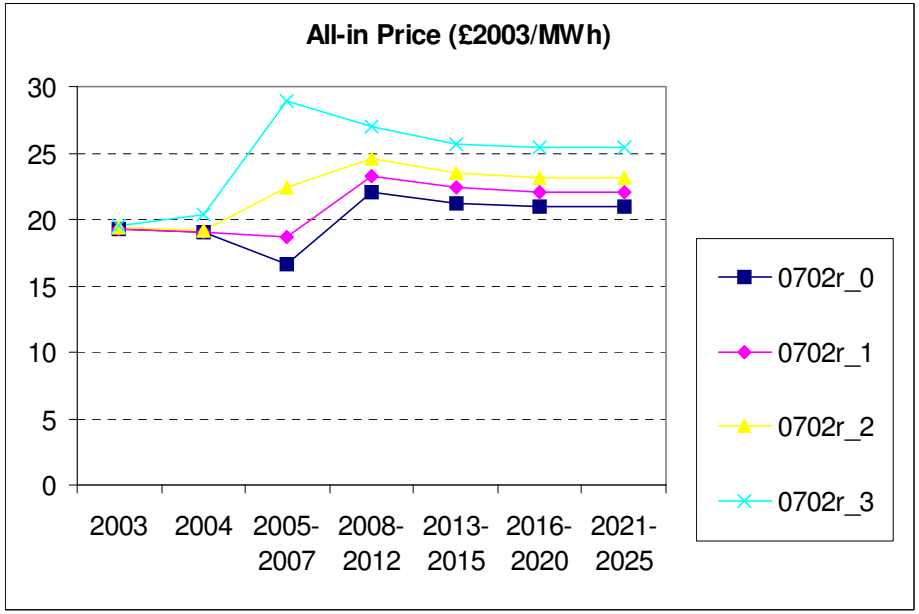
Scenario summary

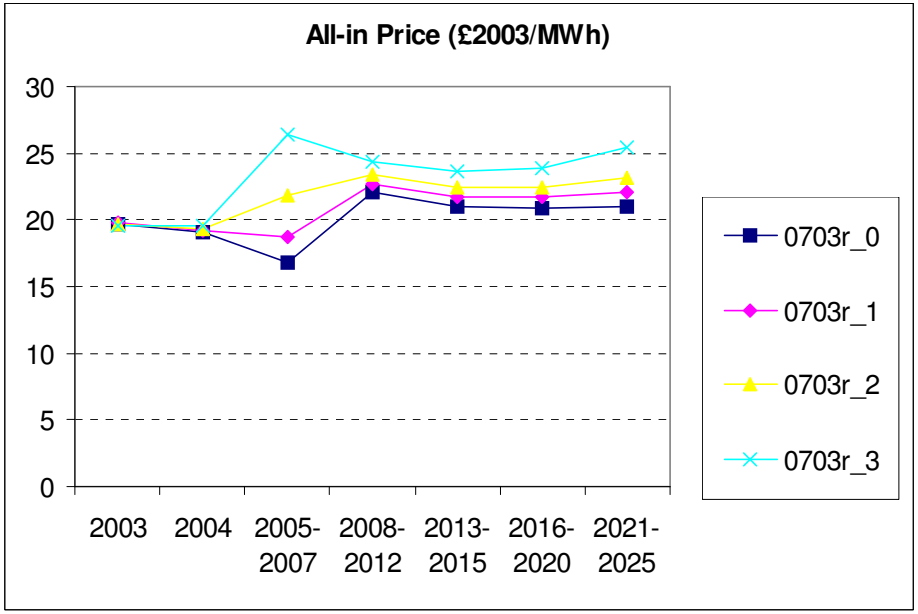
Run Code	CO2 price (Euros)	EUAs to "existing"	EUAs to "new entrants"	
0703r_0	0	na	na	BAU
0703r_1	5	Based on availability	Yes	Contingent allocation (CA)
0703r_2	10	Based on availability	Yes	
0703r_3	20	Based on availability	Yes	
0702r_1	5	Perfect grandfathering	No	Perfect Grandfathering or Auction (PG)
0702r_2	10	Perfect grandfathering	No	
0702r_3	20	Perfect grandfathering	No	

Modelling contingent allocation

- Existing plants allocation based on UK draft NAP, e.g. Drax Power Station's annual allowance
  - 2005-2007: 15,424 MtCO2
  - 2008-2012: 11,567 MtCO2 (75% of 2005-2007)
  - 2013-2017: 8,676 MtCO2 (75% of 2008-2012)
  - 2018-2021: 6,507 MtCO2 (75% of 2005-2007)
  - 2018-2021: no allocation
- New CCGT allocation based on 80% load factor (~2.5tCO2/MW) and falling in the same way as existing plants (x 0.75 per compliance period)
- Allocation defined in terms of tCO2/MW so that any closure leads to a reduction in allowances ("closure" test)

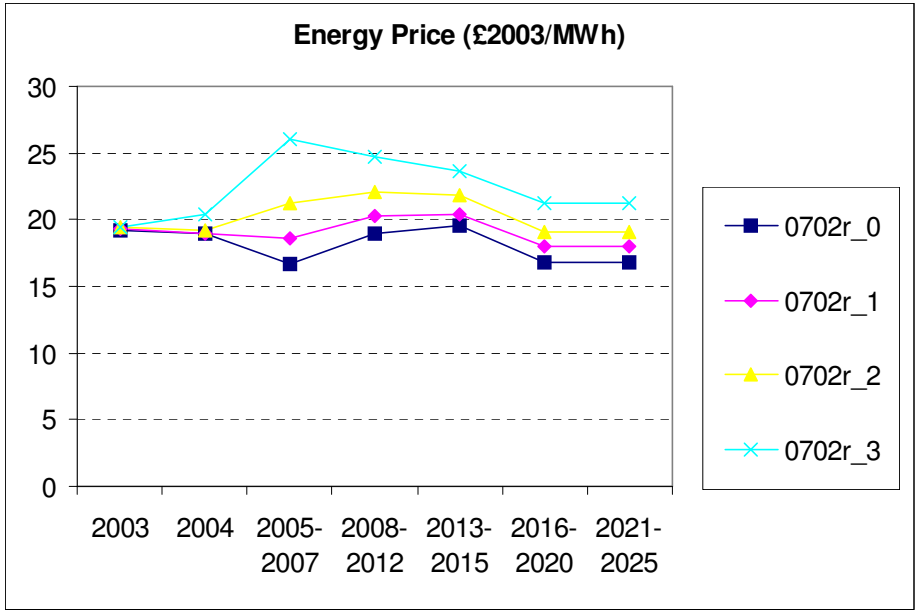
Electricity prices

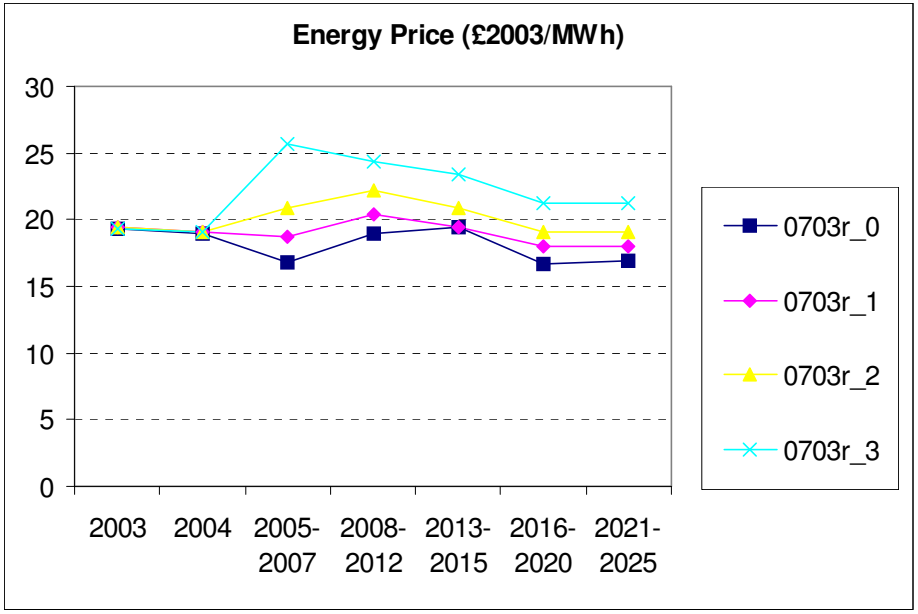




- All-in prices in CA remain below PG levels
- As allowance allocation falls over time to zero, the two scenarios converge

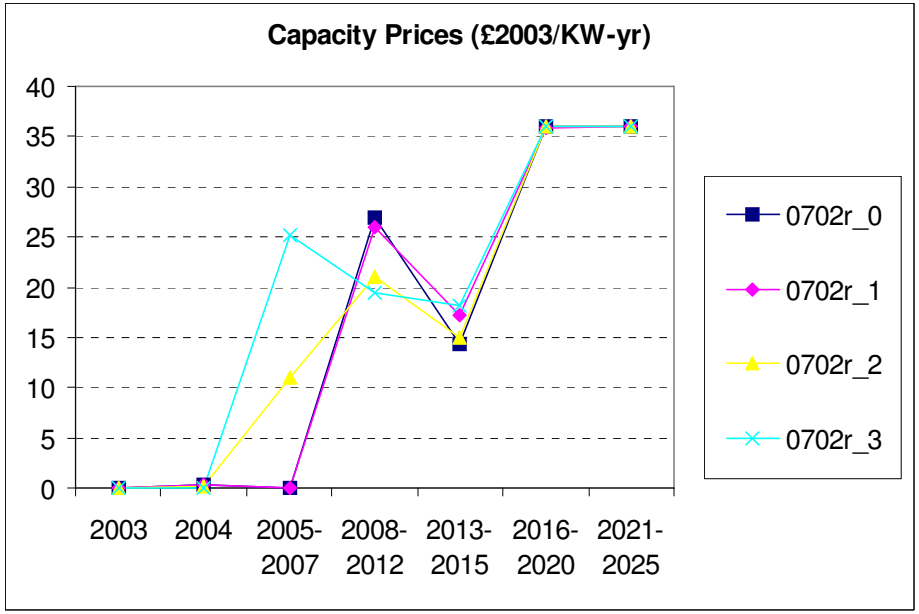
Marginal electricity price

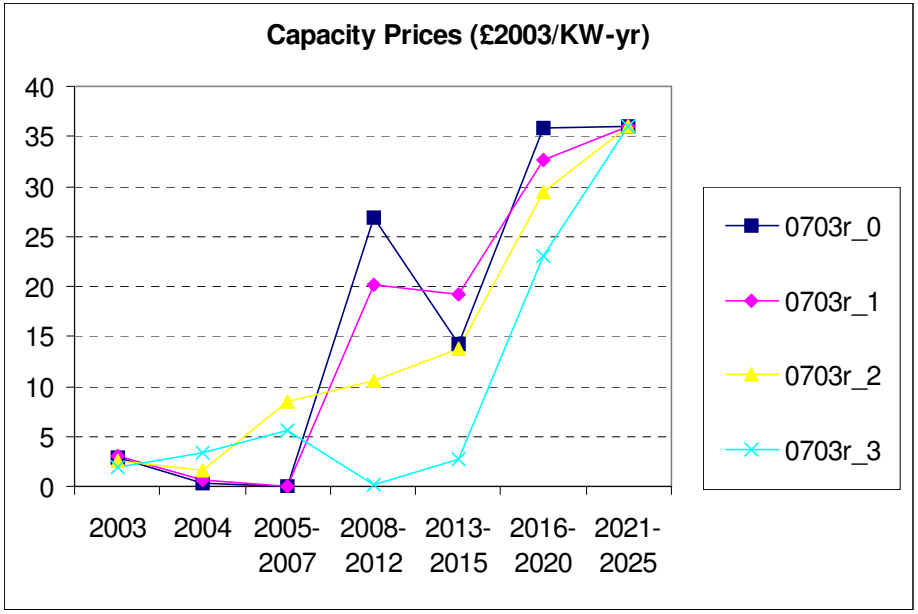




- Changes to marginal electricity prices are the same in both CA and PG cases
- Whether allowances are bought or provided for free, the result is the same – at the margin, gencos will want to pass though the cost of CO2

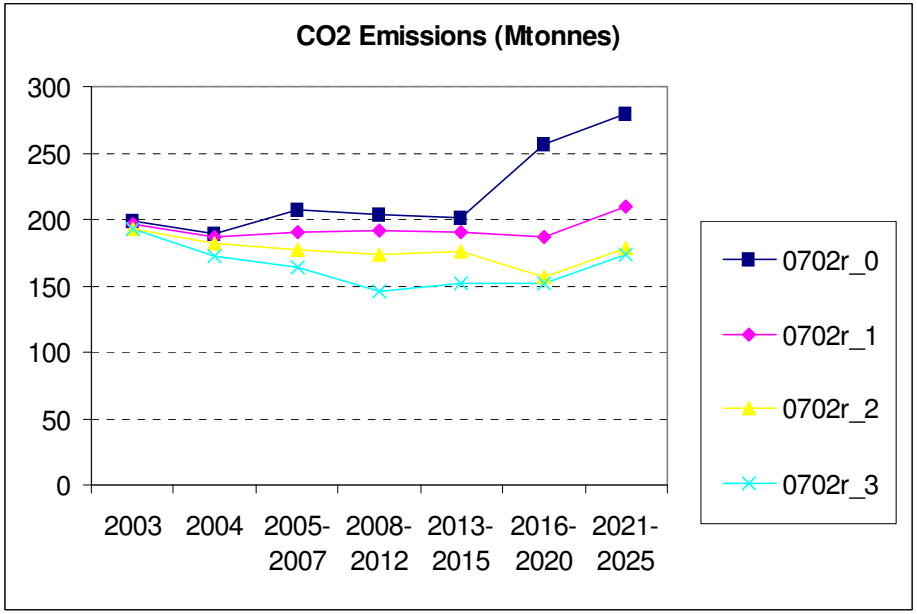
Capacity prices

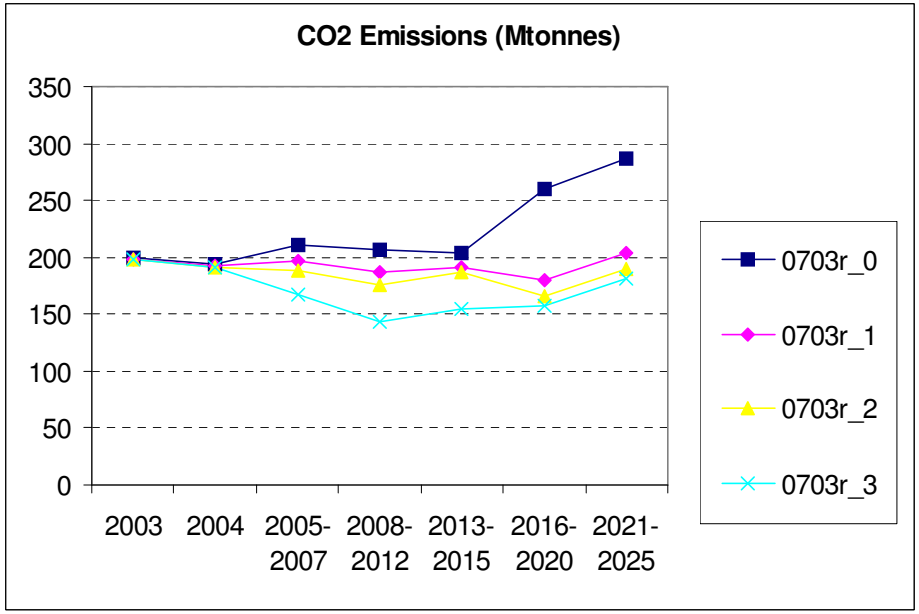




- This is not true in case of the capacity premium. Capacity prices are lower in CA than in PG
- The CA case makes gencos internalise the value of the allocation that under the PG case be a profit windfall
- But is there a downside in terms of emissions abatement and/or dynamic efficiency?

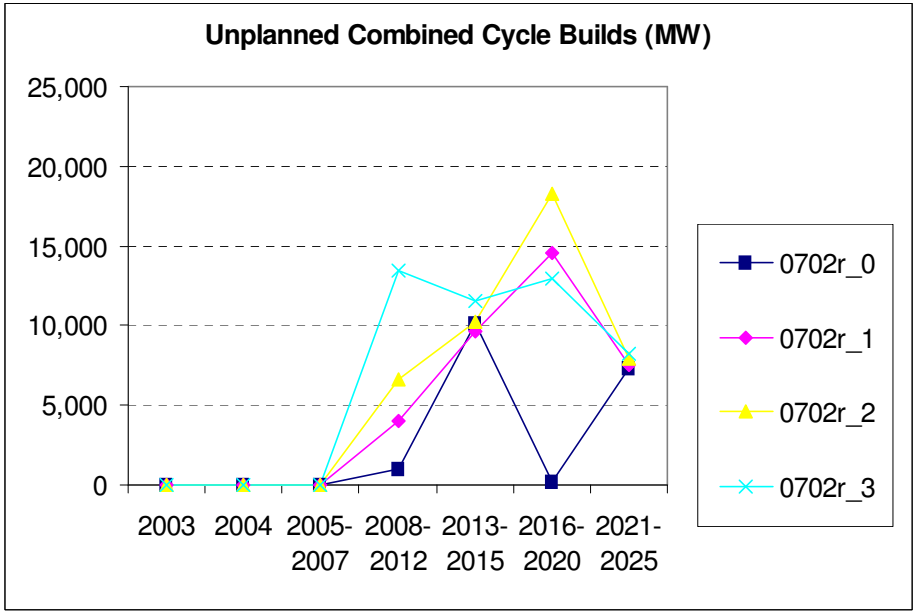
CO2 emissions

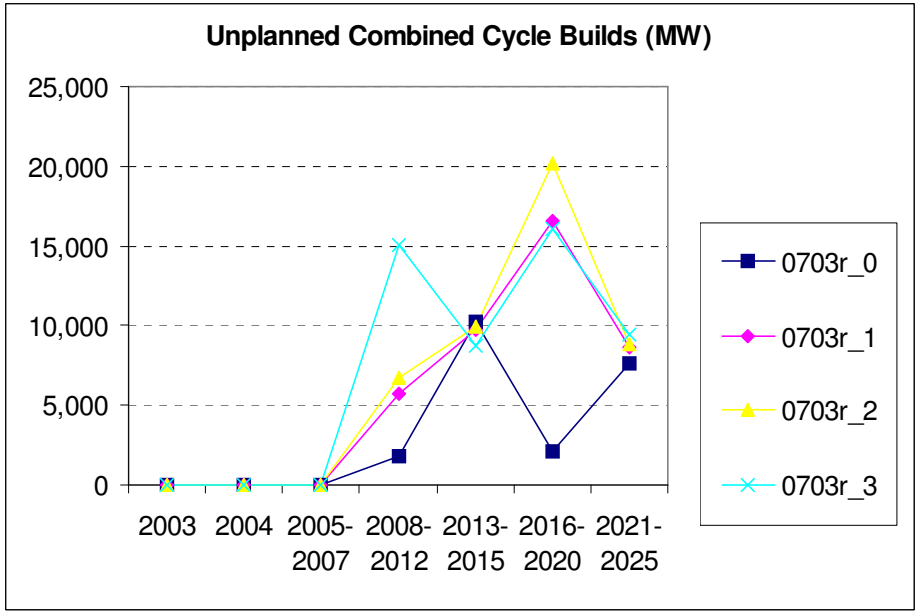




- The emissions of CO2 are not that different between the CA and PG suggesting that the dynamic efficiency has not been compromised

CCGT build





- And this is supported by scale of new build of CCGT – similar in both cases

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Conclusion

- Modelling suggests that policy-makers have managed to pull off the ability to reduce CO2 emissions whilst minimising secondary competitive impact arising from increases in electricity prices
- But issues regarding allocation in future compliance periods remain unclear
- Suggests:

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