ANU 2008

ALLOCATION CHALLENGES AND THE GREEN PAPER

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29 August 2008

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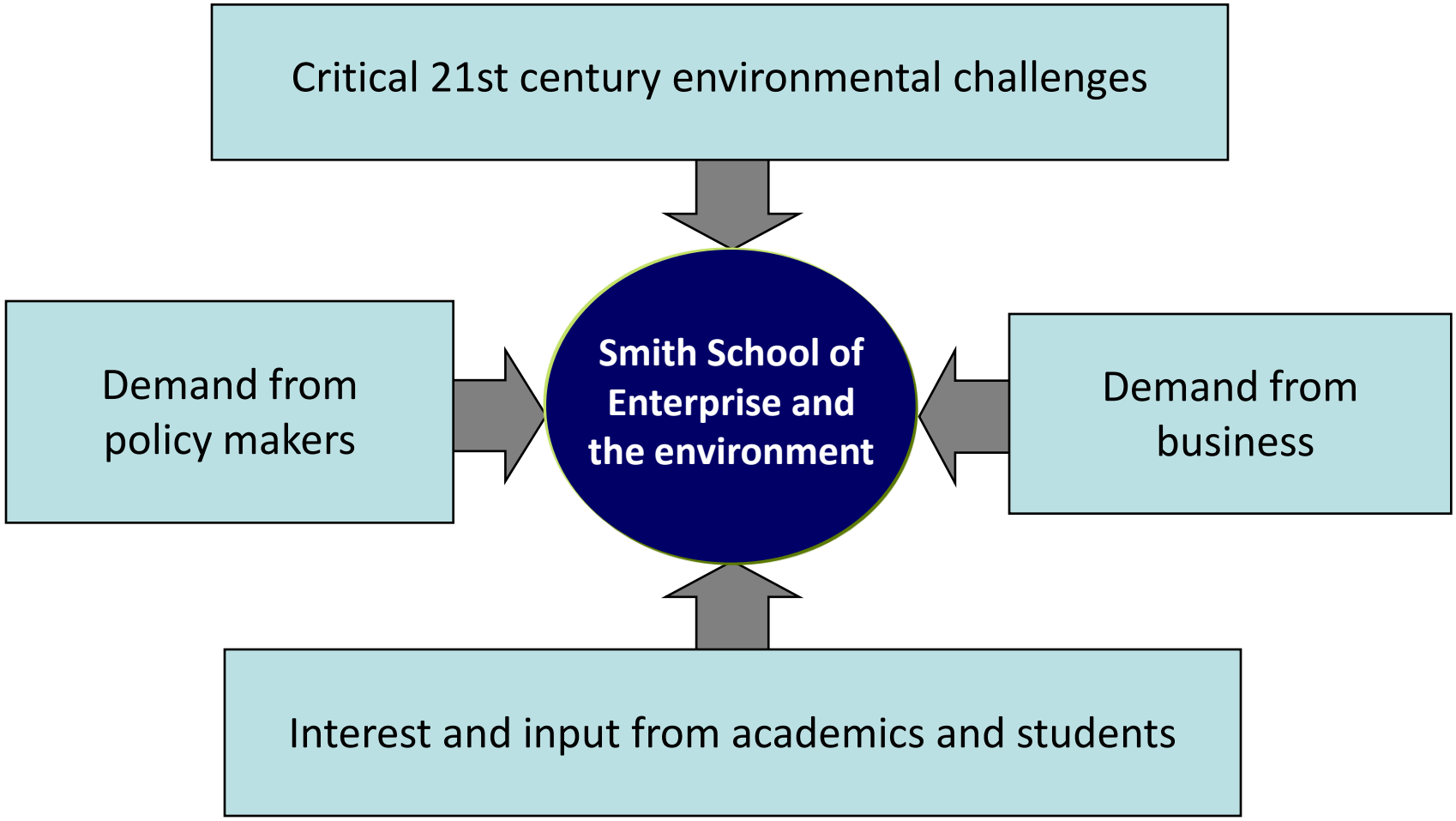
Critical 21st century environmental challenges
Demand from policy makers
Smith School of Enterprise and the environment
Demand from business
Interest and input from academics and students

MY RESEARCH

- Long-range ethics and economics (discounting)
- What is the right low-carbon policies? When are carbon taxes better than emissions trading?
- Emissions trading scheme design
- Policy-relevant science – alternatives to concentration targets?
- What does actual evidence about human behaviour (biases and inconsistencies) imply for environmental policy?

MY OTHER INTERESTS

ClimateBridge

Climate Bridge Sample VER Projects
19 August 2008

Please note: This is only a selection of Climate Bridge portfolio. We are happy to prepare bundles of alternative projects of different sizes, standards, and technologies to optimally meet your needs.

Wind power	
Type of project	Pre-registration
Standard	VCS 2007 (possibly GS VER)
Estimated issuance	November 2008*
Est. Annual ERs	100,927**
Est. Available VERs	50,000
Vintage(s)	2008
Note: This high profile project is supplying renewable power to the Beijing Olympics Games and is the first wind power plant in Beijing. Please inquire for more information.	

Coal Mine Methane Electricity	
Type of project	Pre-registration
Standard	VER+
Estimated issuance	Issued!
Est. Annual ERs	41,348**
Est. Available VERs	81,200
Vintage(s)	

Medium hydropower (<20 MW)	
Type of project	Pre-registration
Standard	VCS 2007
Estimated issuance	Nov 2008*
Est. Annual ERs	68,535**
Est. Available VERs	90,000
Vintage(s)	2007, 2008

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Defra

Peer Review: Reform of the Clean Development Mechanism

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AGENDA

1. Introduction
2. Some theory
3. The Green Paper
4. Key allocation challenges
   - EITE Definition and application
   - Coal-fired power and special treatment
5. Other important issues
6. Summary

BASICS: AUCTION OR FREE ALLOCATION

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Why Auction?

- Avoid distortions and losses from rent-seeking
  - Provided cost of running auction lower than rent-seeking costs
- Dynamic efficiency
  - Freixas, Guesnerie and Tirole (1985) ratchet effects
- Increased management attention
  - Balance sheet and accounting effects
- Progressive wealth effects
  - Shareholders are on average wealthier than average citizens
  - Politics: Shareholders are not necessarily Australian citizens
- Legal “ownership”
  - Atmosphere is a public asset; should be paid for it if it used

MORE ON AUCTIONING

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RESEARCH ARTICLE

www.climatepolicy.com

Auctioning of EU ETS phase II allowances: how and why?

Cameron Hepburn[1]*, Michael Grubb[2], Karsten Neuhoff[2], Felix Matthes[3], Maximilien Tse[4]

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BASICS: AUCTION OR FREE ALLOCATION

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Why free allocation?

- Limit “carbon leakage”
  - Allocation that is output-based provides an incentive for firms to continue domestic production
- Limit “profit leakage”
- Politics: industry support
- Legal “ownership”
  - Firms argue that past emissions create expectation of rights

How to freely allocate?

- Once-off grandfathering using distant historic baseline (e.g. 1990)
- Industry benchmarking
- Updating

FIRST BEST: CLOSE TO 100% AUCTIONS

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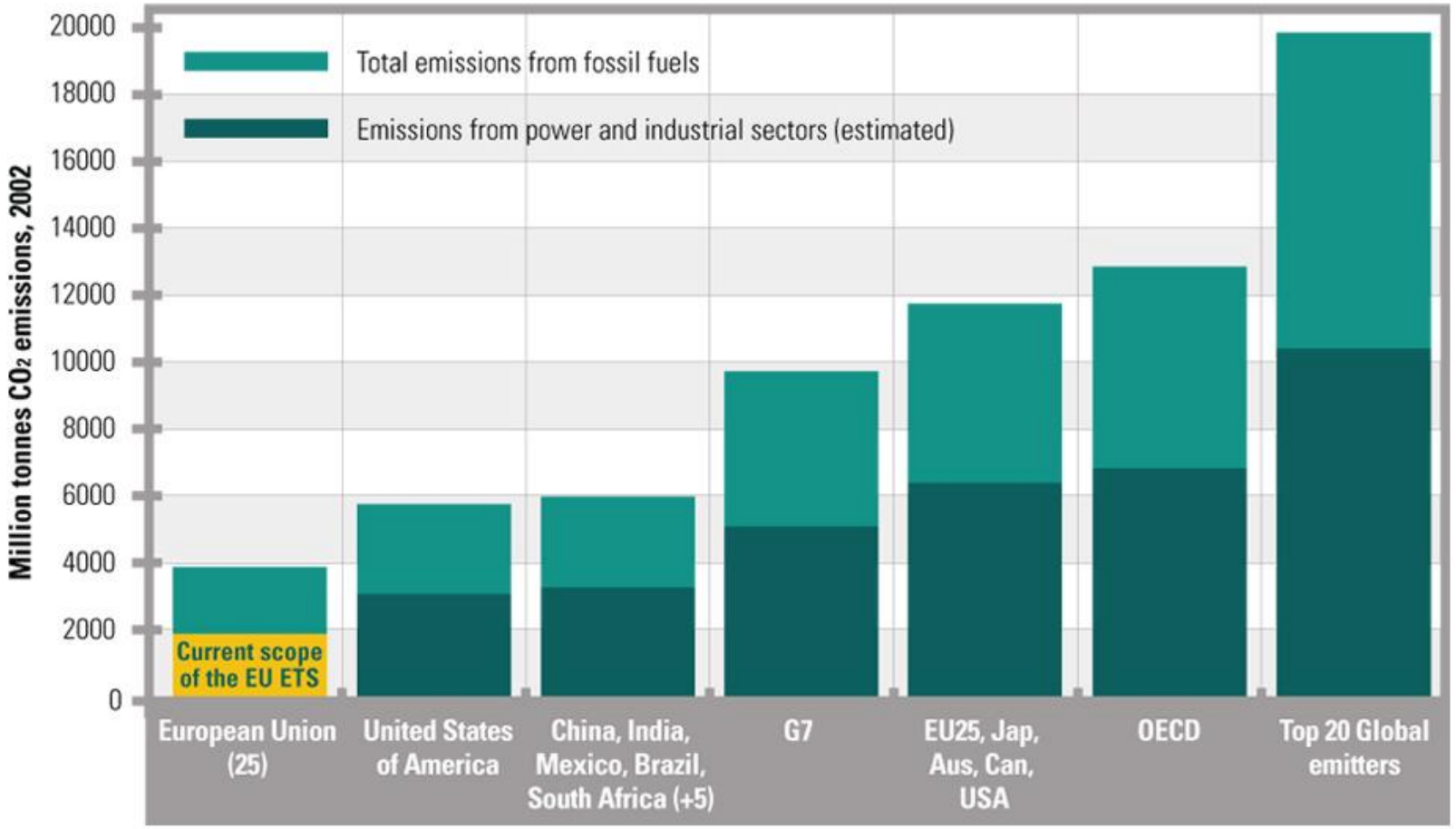
First best: Close to 100% auctioning

- "Carbon leakage" arguments do matter
- "Profit leakage" also legitimate

In reality: Close to profit-neutral allocation

- Best result in EU ETS would have been profit-neutral allocation (PNA)
  - This is the allocation that leaves firms no better or no worse off than before the scheme
- And yet, in the EU ETS:
  - Max of 5% auctions in Phase 1: 2005-2007
  - Max of 10% auctions in Phase 2: 2008-2012
- Green Paper proposals are superior

ALLOCATION CHALLENGES INCREASE



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Source: Stern (2007); adapted by Hepburn and ABN AMRO (2007)

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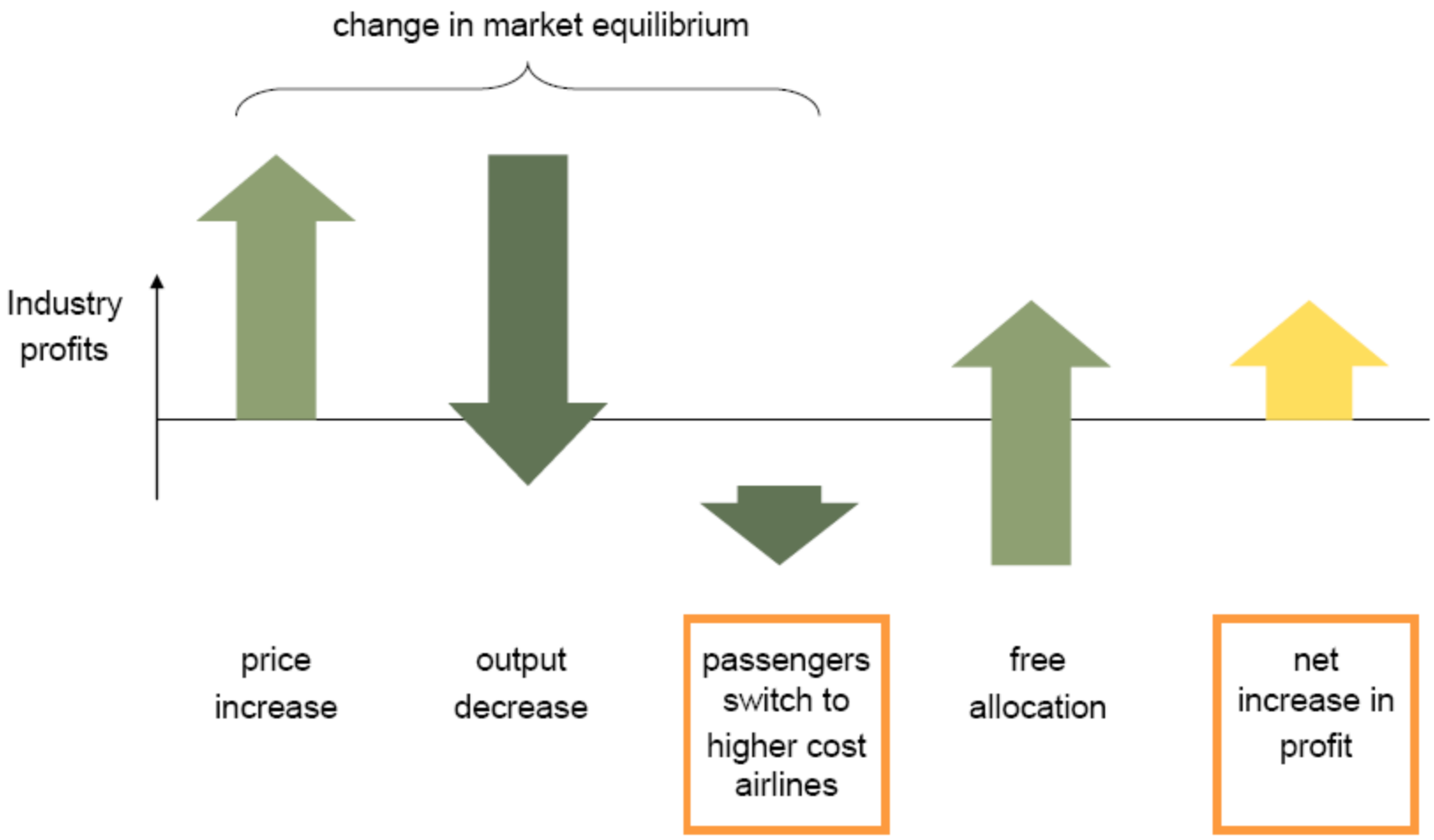
WINDFALL PROFITS

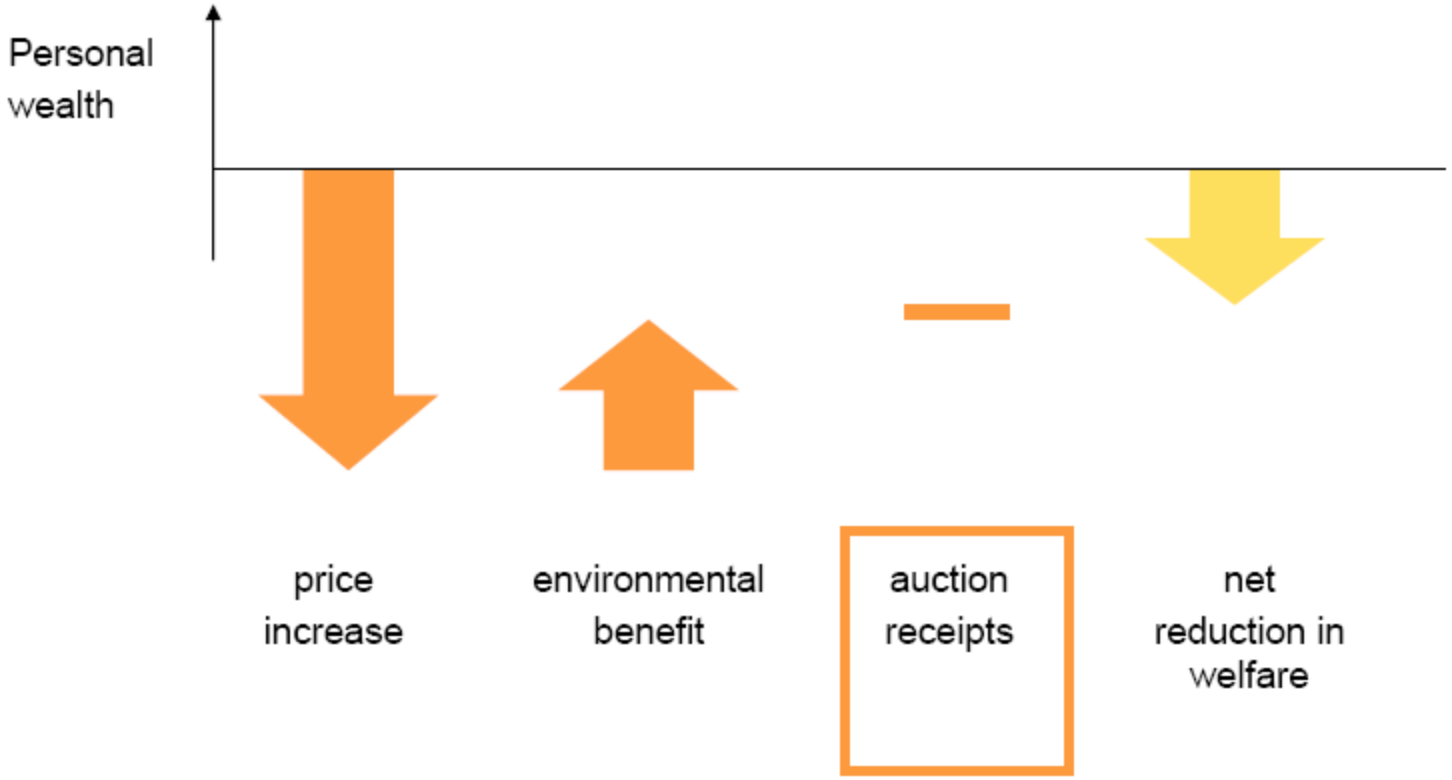
- Emissions trading increases marginal costs of production
  - This is independent of allocation method, due to opportunity cost of *not* selling permits)
- Other things equal, this reduces profits, but firms may:
  - Reduce output and increase price (cost pass through)
  - Substitute towards cleaner production (abatement)
  - Receive free allocations of allowances (lump sum windfall)
- The first two responses are subject to strategic effects which depend upon market structure

→ **Expect windfall profits from 100% free allocation (and very likely with more than 50% free allocation)**

EVEN EU LOW COST AIRLINES PROFIT



BUT CONSUMERS ARE OUT OF POCKET



I.O. THEORY AND MODELLING

- Model (with Quah and Ritz) calculates PNA for different industries
- Key assumptions
  - Firms compete strategically (e.g. oligopoly)
  - No restriction of firm symmetry (i.e. asymmetric Cournot)
  - No restrictions on demand (not necessarily isoelastic or linear)
- Other assumptions
  - No firm has power over the permit price (it is exogenous); but firms do have some power over the goods price
  - No general equilibrium effects
  - Permit costs are “small” relative to total costs of production
- Limits
  - Assumes spot competition (not long-term “take or pay”)
  - Data inputs (elasticities in particular) can be contested

RELEVANT LITERATURE

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- Bovenberg, Goulder, Gurney (2005) *RAND Journal of Economics*
  - Asks an important and broad set of questions
    - What are the efficiency costs of profit-neutral allocations?
  - Addresses general equilibrium interactions (labour markets, taxes)
  - Industry-level analysis with constant returns to scale

- Smale, Hartley, Hepburn and Grubb (2006) *Climate Policy*
  - Impact on profits and competitiveness of EU ETS
  - Cournot competition (but assumes firms are identical)
  - Isoelastic demand

- Demailly, Quirion (2006) *Climate Policy*
  - Cement industry focus
  - Linear demand
  - Numerical model

OUR KEY RESULTS

- Analytical formulae determining the profit-neutral allocation for a firm or an industry in an asymmetric Cournot oligopoly.
  - Result is expressed in terms of the number of firms, the Herfindahl index, emissions intensity, and demand curvature.
- Illustrative calculations on the level of profit-neutral grandfathering for three industries affected by the EU ETS
  - Cement, newsprint, and steel
  - Use info available on firm numbers, demand curves, etc.
- Calculations largely bear out the impression of our theoretical work, namely, only a fraction of emissions permits need to be freely allocated to ensure profit-neutrality.

MONOPOLY CASE

- ETS constitutes a change in the price of an input (CO_2 allowance) from zero to some positive number *t*.
- Monopoly therefore adjusts production decision, substituting away from CO_2 if possible
- Preview of monopoly results, after ETS:
  - Lower emissions
  - Lower operating profit
  - PNA is a fraction of previous emissions
  - But nevertheless the monopolist is a net supplier of permits

PNA FOR MONOPOLY

- Optimal profit at price t is $\Pi^*(t)$, with emissions $\zeta^*(t)$.
- Initial profit and emissions are $\Pi^*(0)$ and $\zeta^*(0)$.
- Define

$$\Pi^*(t) = \underline{\Pi}^*(t) - t\zeta^*(t)$$

- $\underline{\Pi}^*(t)$ is operating profit before subtracting the cost of permits

Profit maximization by the monopolist guarantees that, at any $t > 0$,

$$\underline{\Pi}^*(t) \leq \Pi^*(0) = \underline{\Pi}^*(0) \qquad (1)$$

$$\Pi^*(t) = \underline{\Pi}^*(t) - t\zeta^*(t) \geq \Pi^* - t\zeta^*. \qquad (2)$$

PNA FOR MONOPOLY

Profit maximization by the monopolist guarantees that, at any $t > 0$,

$$\underline{\Pi}^*(t) \leq \Pi^*(0) = \underline{\Pi}^*(0)$$

Operating profit must fall (by revealed preference)

$$\Pi^*(t) = \underline{\Pi}^*(t) - t\zeta^*(t) \geq \Pi^* - t\zeta^*.$$

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True by definition

PNA FOR MONOPOLY

Profit maximization by the monopolist guarantees that, at any $t > 0$,

$$\underline{\Pi}^*(t) \leq \Pi^*(0) = \underline{\Pi}^*(0)$$ ← Operating profit must fall (by revealed preference)

$$\Pi^*(t) = \underline{\Pi}^*(t) - t\zeta^*(t) \geq \Pi^* - t\zeta^*.$$ ← (Args suppressed if zero)

↑ True by definition

↑ True by revealed preference:
after ETS is introduced, and t is payable,
total profits at new optimum choices (arg = t) must exceed
total profits at old optimum choices (arg = 0)

PNA FOR MONOPOLY

- Emissions must be reduced, as the inequalities imply: $\zeta^*(t) \leq \zeta^*$
- And monopolist is worse off, as from (1): $\Pi^*(t) = \underline{\Pi}^*(t) - t\zeta^*(t) \leq \Pi^*$

- What lump sum would compensate the monopolist?
- As $\Pi^*(t) + t\zeta^* \geq \Pi^*, \text{ so there is } 0 \leq \gamma(t) \leq 1$ such that

$$\Pi^*(t) + t\left[\gamma(t)\zeta^*\right] = \Pi^*.$$

- As γ(t) ≤ 1, the PNA (or the *fraction* of pre-ETS emissions that need to be covered by allowances to ensure profit neutrality) is weakly less than 100%.

ANALYTICAL RESULTS IN COURNOT

In a Cournot model, it is possible to derive simple formulae for $\tilde{\gamma} = \lim_{t \to 0} \gamma(t)$ and $\tilde{\gamma}_i = \lim_{t \to 0} \gamma_i(t)$.

By definition, $\gamma_i(t)$ satisfies

$$\Pi_i^*(t) + t\left[\gamma_i(t)\zeta_i^*(0)\right] = \Pi_i^*(0)$$

FOR AN INDIVIDUAL FIRM

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Formula:

$$\tilde{\gamma}_i = 2z_i - \frac{N\left[2 - \sigma_i E\right]}{\left[N + 1 - E\right]}$$

where z_i is firm i's emissions intensity, σ_i its market share, and

$$E = -Q^* P''(Q^*)/P'(Q^*)$$

Elasticity of the slope of inverse demand

is the curvature of demand.

In general $\tilde{\gamma}_i$ is not constant across firms, unless demand is linear and emissions uniform.

If firms are symmetric, $\tilde{\gamma}_i < 1$.

It is possible for $\tilde{\gamma}_i < 0$.

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Formula:

$$\tilde{\gamma} = 2 - \frac{N\,[2 - EH]}{[N + 1 - E]\,[\sum_{i=1}^{N} \sigma_i z_i\,]}$$

where H is the Herfindhal index.

NUMERICAL EXAMPLE

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- Assume the UK landlocked Cement industry has 4 main players with a combined 90% market share
- Assume emissions intensity is uniform
- Assume that international competition is weak (e.g. due to transport costs)

→ **PNA is between 20-50% for a very wide range of demand curves**

Industry	Demand	Industry-level $\tilde{\gamma}$	Max. firm-level $\tilde{\gamma}_i$
Cement (UK)	Quadratic	0.176	0.375
	Linear	0.222	0.222
	Log-linear	0.280	0.400

Industry	Elasticity	Industry-level $\tilde{\gamma}$	Max. firm-level $\tilde{\gamma}_i$
Cement (UK)	0.40 (low)	0.516	1.127
	0.80 (best)	0.376	0.696
	3.00 (high)	0.303	0.470

NUMERICAL EXAMPLE

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- Similar results derived from cost-pass through assumptions

Cement (UK)		
dP^*/dt	Industry-level $\tilde{\gamma}$	Max. firm-level $\tilde{\gamma}_i$
1%	-0.235	1.782
20%	-0.136	1.445
40%	-0.032	1.090
60%	0.072	0.735
80%	0.176	0.380
100%	0.280	0.400
120%	0.384	0.720
140%	0.488	1.040
160%	0.592	1.360
180%	0.696	1.680
200%	0.800	N/A

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DON'T JUDGE THE BOOK BY ITS COVER...

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PREFERRED POSITIONS ON ALLOCATION

- Initially, free allocation is 20% (or 30% if agriculture is included) free allocation, targeted to EITE sectors
- Compare to:
  - EU ETS Phase 1: min 95% free allocation
  - EU ETS Phase 2: min 90% free allocation
  - RGGI: 0% free allocation

- Allocations would, over the longer term, **progressively move towards 100 per cent auctioning** as the scheme matures, subject to the provision of transitional assistance for emissions-intensive trade-exposed industries and strongly affected industries.

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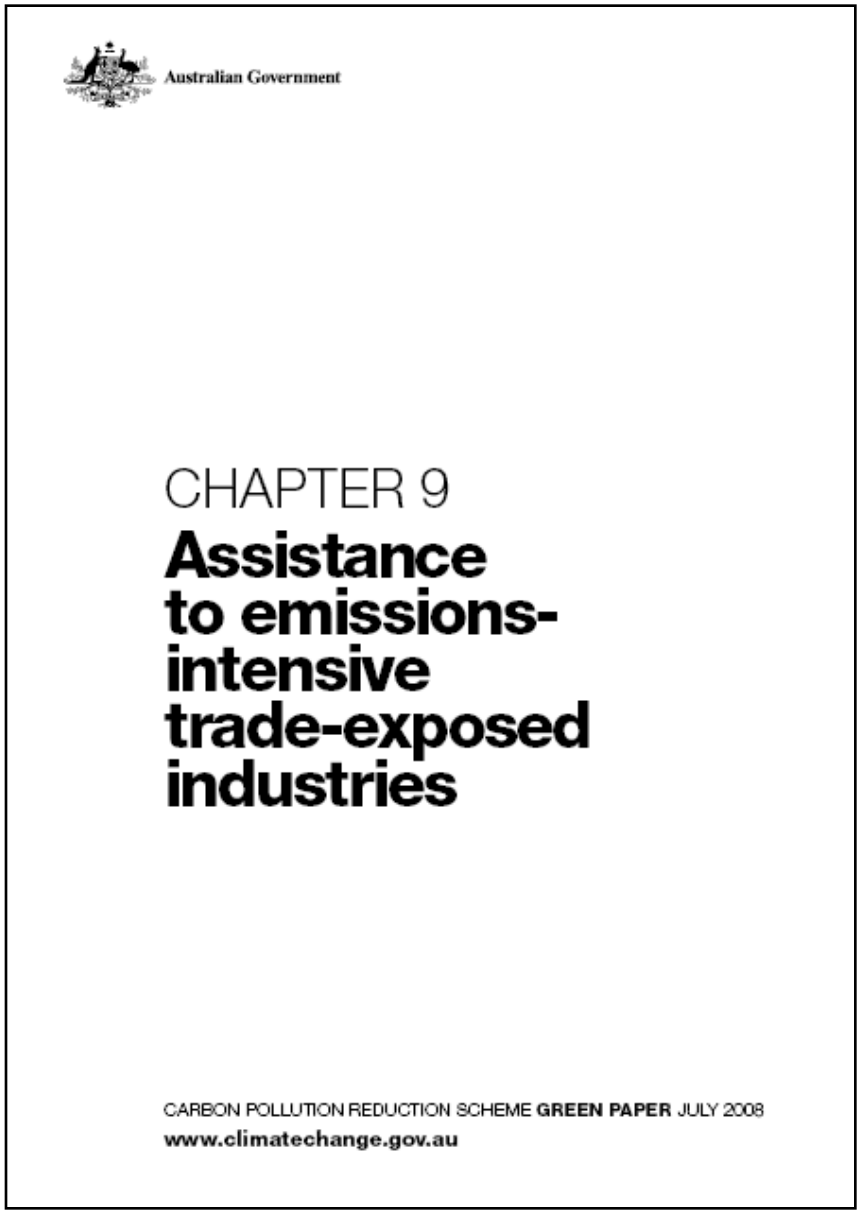
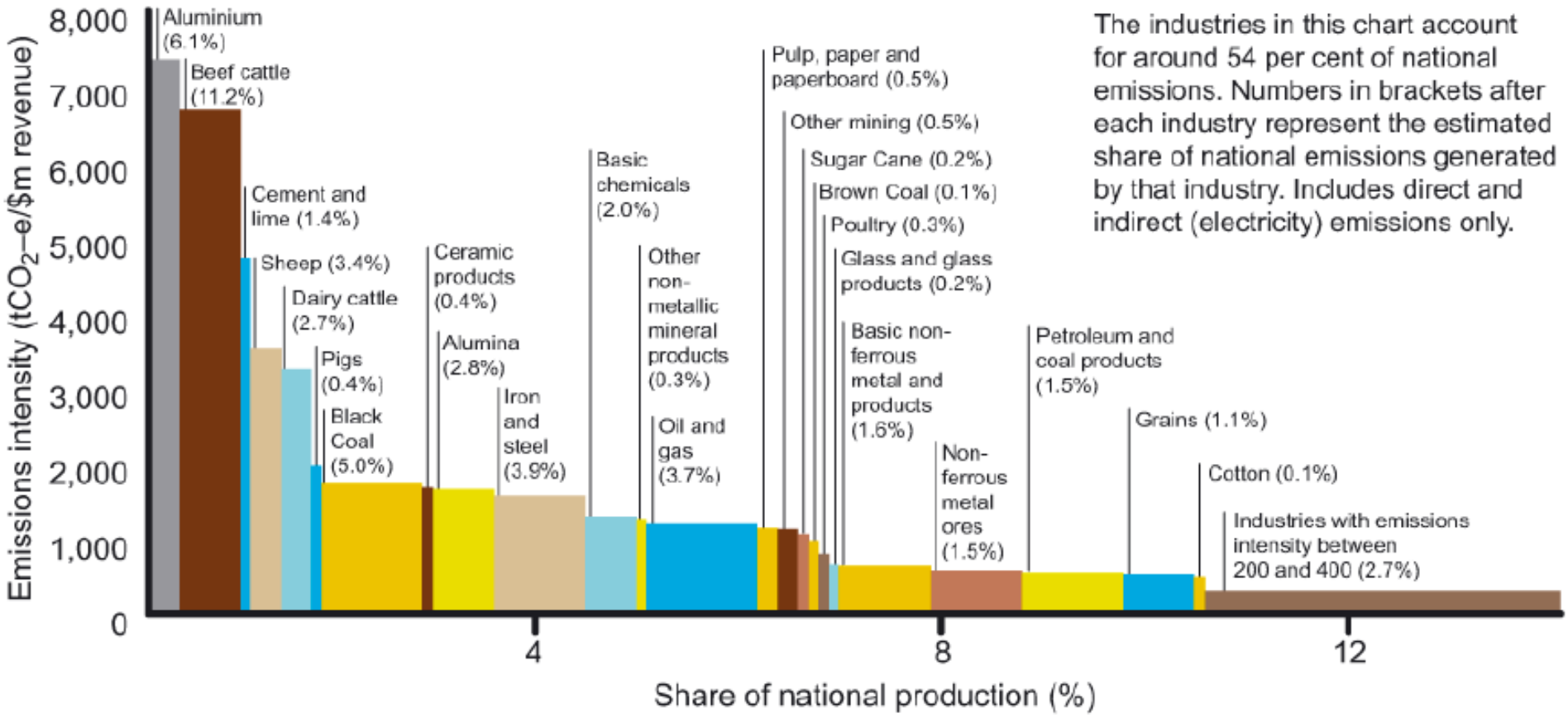
EITE SUPPORT

- Up to around 30% of total allowances freely allocated to EITE
  - 20% if agriculture excluded.
- Eligible if industry-wide emission intensity is above 1,500 tCO2e per million dollars of revenue.
- Cover 90% of emissions for EITE activities with intensities above 2,000 tCO2e per $million
- Cover 60% of emissions for EITE with intensities from 1,500 to 2,000 tCO2e per $million
- May reconsider **but** the total quantum of EITE assistance must be limited to around 30% (with ag).



WHO ARE EITE?



Source: Centre for Integrated Sustainability Analysis (CISA), University of Sydney, 2008[9]

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HOW DOES IT WORK?

$$A_{ia} = \underbrace{k_a\left(EI^d_{ia} \times O_{ia}\right)}_{\text{Allocations with respect to direct emissions}} + \underbrace{k_a\left(EI^e_{ia} \times EF \times O_{ia}\right)}_{\text{Allocations with respect to indirect electricity emissions}}$$

where:

- A_{ia} = allocation of permits to entity i for emissions associated with activity a
- k_a = assistance rate for activity a, representing the degree of assistance provided to entities for this activity both initially and over time
- EI^d_{ia} = direct emissions-intensity baseline for entity i conducting activity a (that is, baseline level of direct emissions per unit of output for the activity)
- EI^e_{ia} = electricity-intensity baseline for indirect electricity emissions for entity i conducting activity a (that is, baseline level of electricity per unit of output for the activity)
- EF = electricity factor, which reflects the impact of the carbon price on the price of electricity
- O_{ia} = output of activity a by entity i

CARBON LEAKAGE AND OTHER PROBLEMS

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- Carbon leakage happens in three ways:
  1. Existing industry moves offshore (very unlikely)
  2. Output from existing plant is generated offshore (more likely)
  3. New facilities are built offshore (also more likely)
- Assistance for leakage should therefore focus on new facilities
- (Assistance for transition on old facilities)

- Discontinuities in EITE support potentially creates incentive problems and gaming
  - As based *recent* past emissions (2006-2008)
- However, discontinuity allows easier categorisation of firms; reduced importance of the precise emissions intensity estimate should reduce arguments

COAL-FIRED POWER

Strongly affected industries are:

- non-trade-exposed
- emissions-intensive
- include some entities that are emissions-intensive compared to their competitors, such that they cannot pass on carbon costs and could experience significant losses in asset value
- have significant sunk capital costs
- not have significant economically viable abatement opportunities available to them

→ **In other words, coal-fired power**

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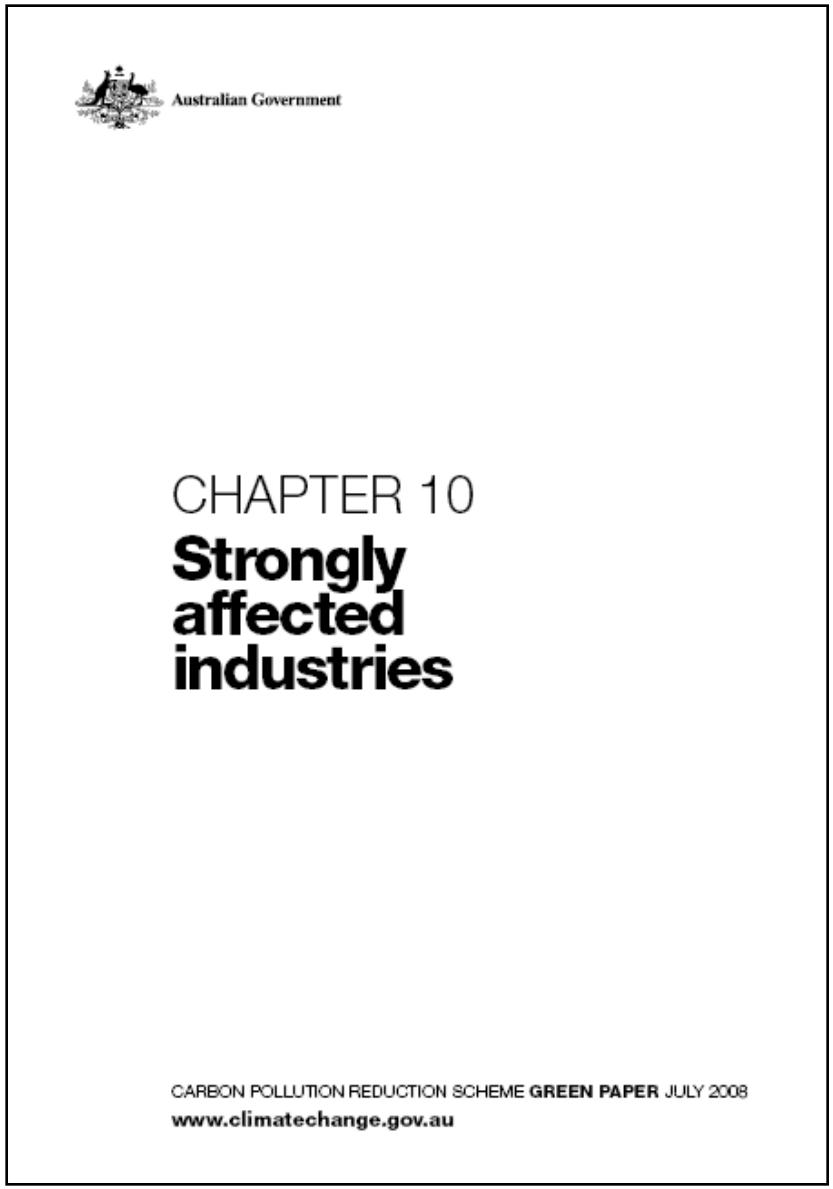
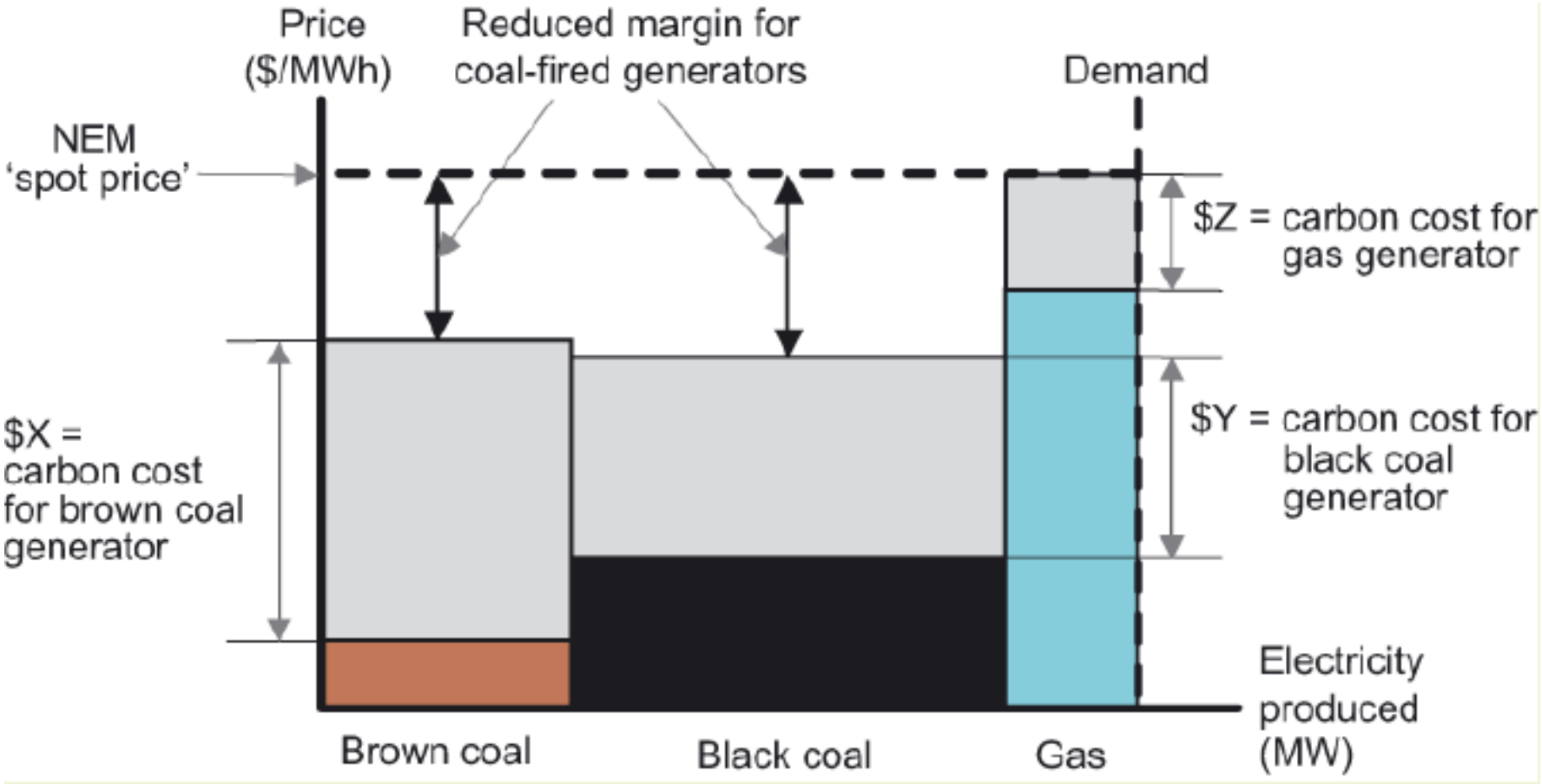


REGULATORY CAPTURE?



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QUESTIONS FROM A BYSTANDER

- How fat are coal-fired margins?
  - e.g.What are current returns to shareholders?
- Is marginal price always set by gas, or is it sometimes (if not often) true that coal-fired generation is on the margin?
  - If so, the full carbon cost is incorporated
- What are the market structure impacts?
- What if the dispatch order changes after the carbon price is incorporated?
- If coal is genuinely badly hurt to point of closure, as the models suggest, what support is justified?

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OTHER KEY ISSUES

Price cap

- How high is the cap?
- A low cap would cause linking problems in the longer term

Offsets

- Avoiding AAUs, limiting to CERs is reasonable: question is over the limits

Stimulating low-carbon investment and RD&D

- CCS investment in particular is critical; paper is a little light on how this will be achieved

New low-carbon business opportunities

- Discourse focuses on “costs”, rather than productivity improvements, new wealth generating industries for Australia etc

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SUMMARY

- Most economists start from the view that allowances should be entirely (or almost entirely) auctioned in a first-best world
  - In a second-best real world, outcomes between 100% auctioning and the PNA is likely
  - The PNA for many industries is less than 50%
- The Aussie Green Paper is second-best, but is substantially better than the third best EU ETS
- Some EITE support is not unreasonable, but:
  - Discontinuities are second-best
  - For focus on trade exposure (and less on emissions intensity) may be warranted
- On coal, Green Paper sends very generous signals

THANK YOU

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Thank you

Comments and questions welcome

FREE ALLOCATION DISTORTIONS

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Allowance allocation method	*Impacts*	More expenditure on extending plant life relative to new build		Increase plant operation		Less energy efficiency investment
	Distortions	Discourage plant closure	Distortion biased towards higher emitting plants	Shields output (and consumption) from average carbon cost	Distortion biased towards higher emitting plants	Reduce incentives for energy efficiency investments
Auction						
Bench-marking	**capacity only**	X				
	capacity by fuel/ plant type*	X	X			
Updating from previous periods'	**output only**	Y		X		
	output by fuel/ plant type*	X	X	X	X	
	emissions	X	X	X	X	X

Note: X indicates a direct distortion arising from the allocation rule. Y indicates indirect distortions if allocation is not purely proportional to output/emissions.
* Differentiating by plant type adds additional distortions compared to purely fuel-based.

Source: *Neuhoff et al. (2006b).*