PROVISIONAL

Climate policy in UK and Europe

On theories and the law of unintended consequences

Making business sense of climate change

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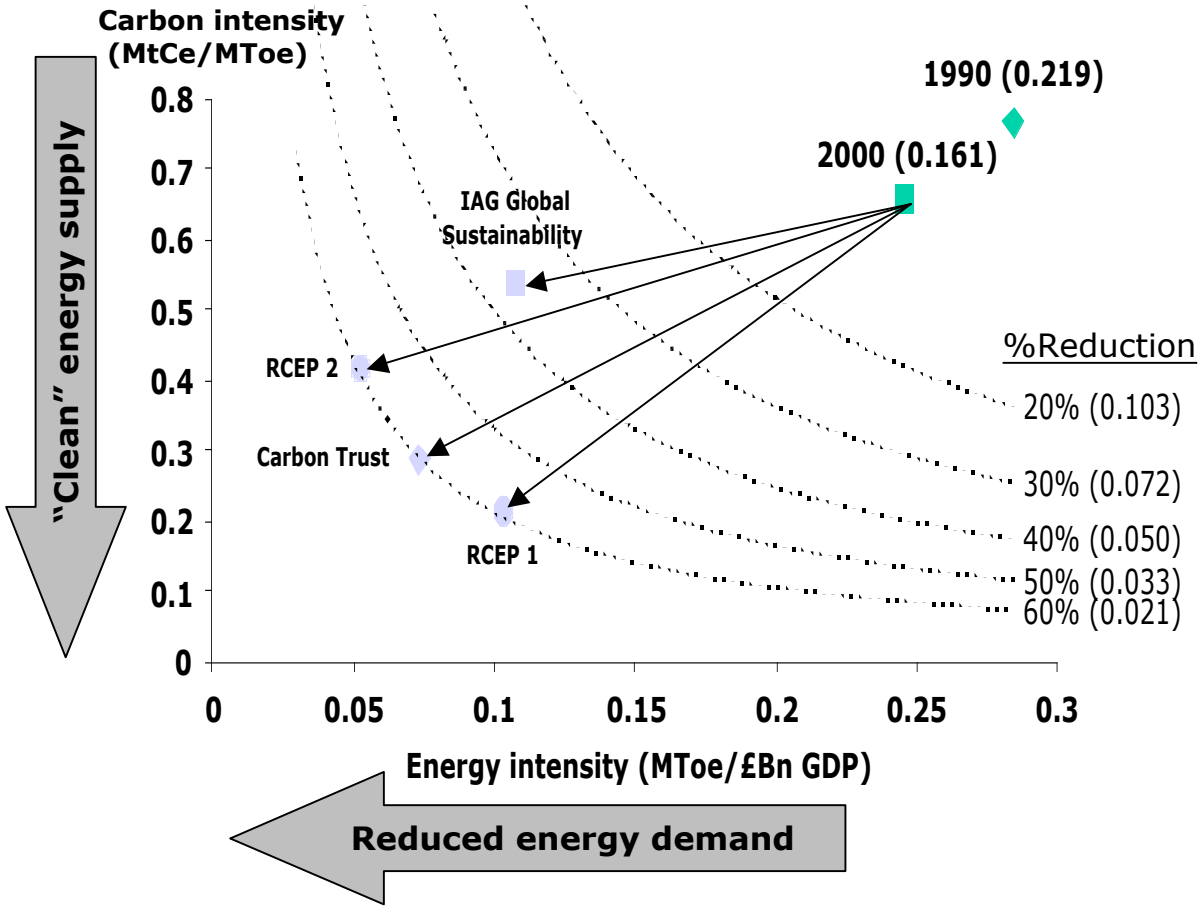
One perspective on the context …

UK policy context (60% target by 2050), implies both much cleaner energy and big improvements in energy efficiency (x10 C.intensity)



The 2003 Energy White Paper set the UK on a path to reduce carbon emissions by 60% by 2050 through a combination of energy efficiency in the short term and renewables in the long term:

"[To achieve the required savings from energy efficiency] *would need roughly a doubling of the rate of energy efficiency improvement seen in the past thirty years"*

"Technology innovation will have a key part to play in underpinning all our goals and delivering a low carbon economy"

"To deliver these outcomes our aim will be to provide industry and investors with a clear and stable policy framework"

Note: Figures in brackets show UK carbon intensity (MtC/£Bn), Scenarios show 2050 projections
Source: RCEP 1998, DTI EP68 GDP growth forecasts, IAG "Long-term Reductions in GHG in the UK", Feb 2002

First part of presentation will sketch foundations of the CT's CCPR study and then focus on the quantitative tools and results

Segment market and identify opportunity → Establish drivers/ barriers to action → Construct and test policy options → Economic & Policy conclusions

- **Emissions by entity type and energy use**
- **Engineering abatement opportunity across segments**

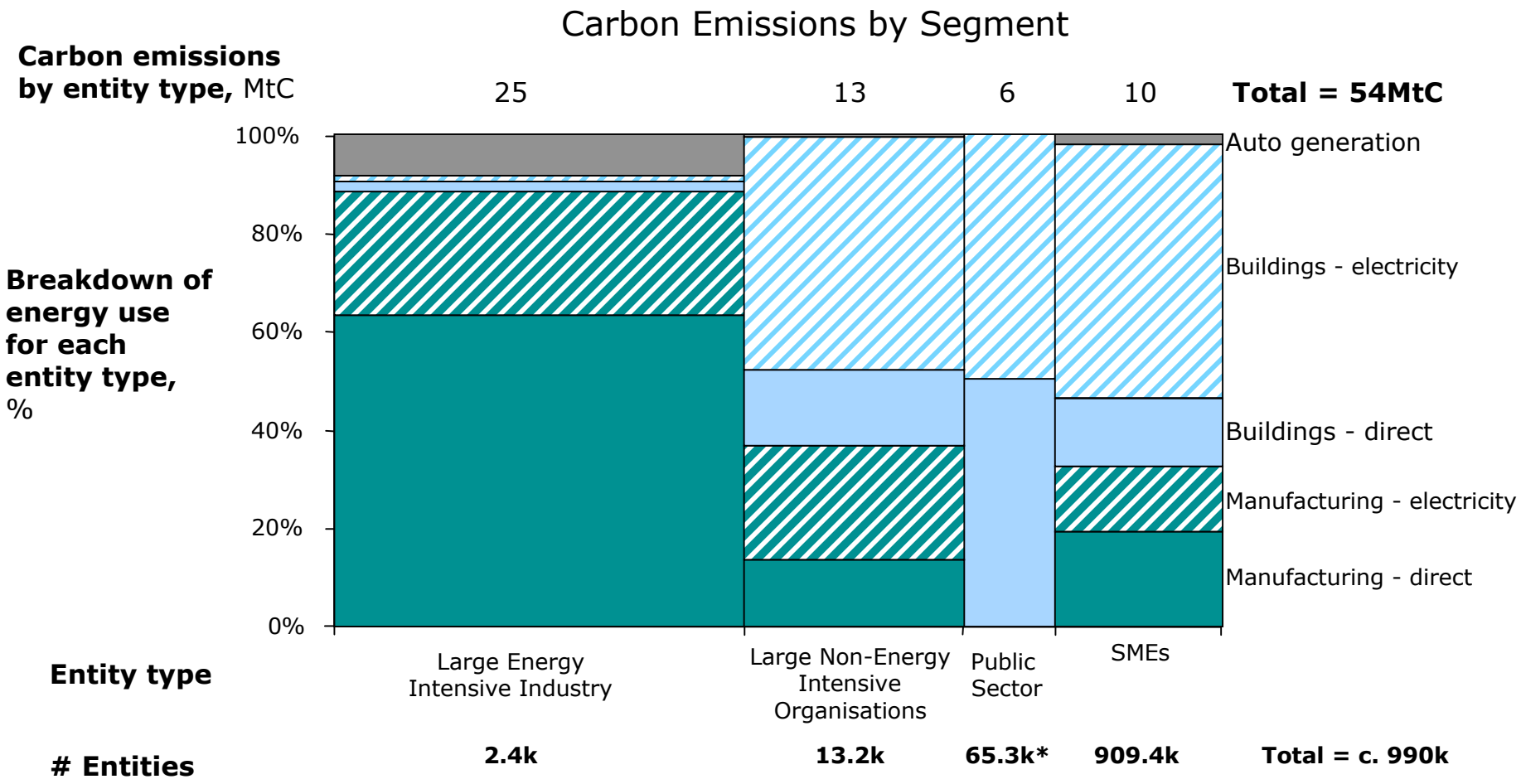
- **Drivers and barriers by segment**

- **Issues with current package - "case for change"**
- **5 options for future policy mix developed**
- **Options tested quantitatively**
- **and with stakeholders**

Modelling work:
- **Carbon delivery, Ecofys**
- **Competitiveness, Oxera**
- **Macroeconomic effects:**
  - **Oxford Economic Forecasting**
  - **Cambridge Econometrics**

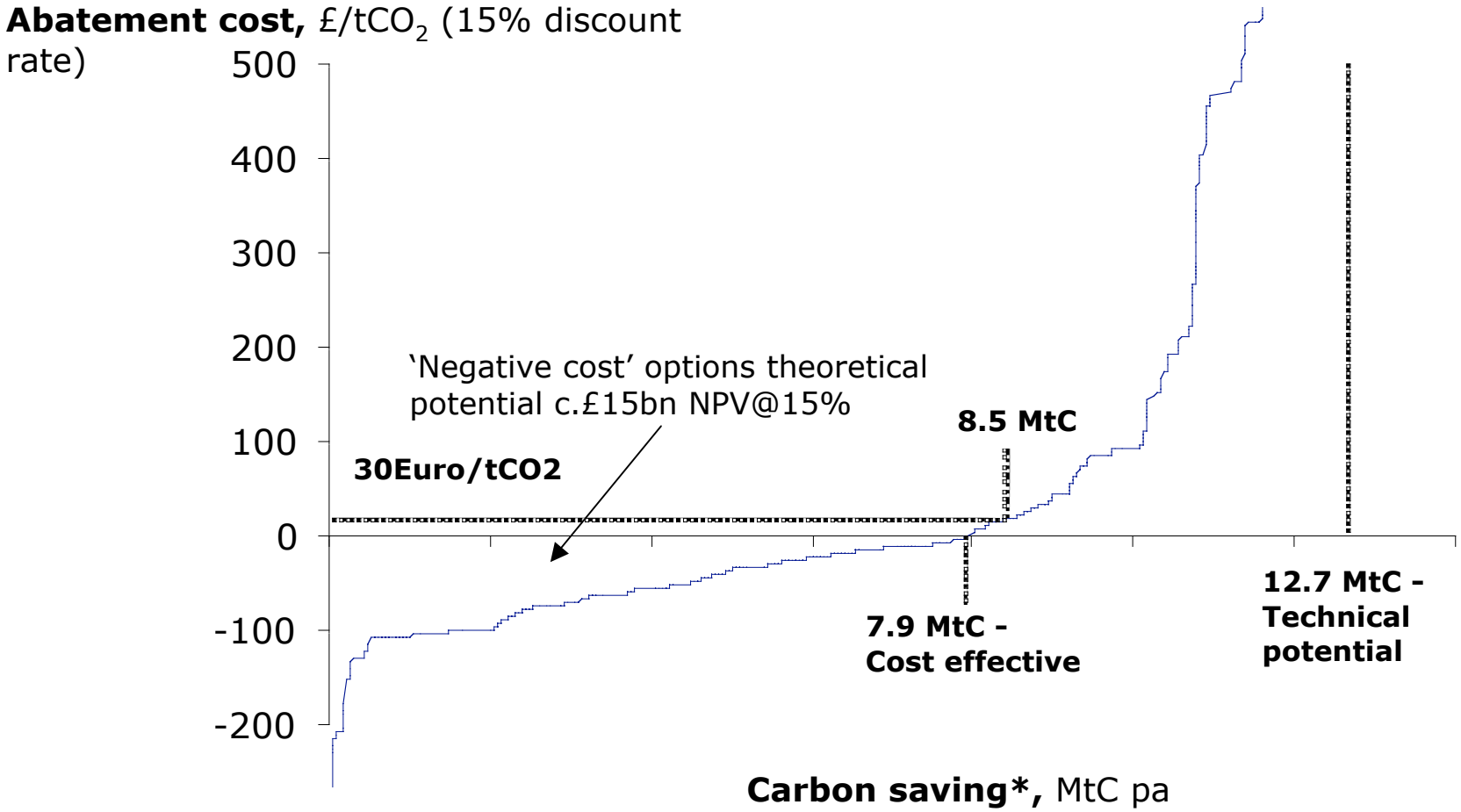
Stakeholder workshops:
- **Energy intensive sectors**
- **Non-energy intensives (hosted by CBI)**
- **Public sector**
- **NGOs**
- **Suppliers of energy efficient equipment**

Segmenting emissions by entity type and use enables opportunity and barriers to change to be mapped by sector



Note: *Includes a bottom-up estimate of numbers of central government organisations; Source: Ecofys

Technology-based 'bottom-up' models generate abatement cost curves that suggest large potential for cost-effective gains



Note: *Carbon saving from existing measures only, **does not include opportunity in new builds and refurbishments accessed through building regulations** (additional 3.7MtC pa – prior to overlaps with other instruments) or innovation.
Source: Ecofys analysis based on BRE and ENUSIM abatement curves

Analysis of barriers and drivers for energy efficiency

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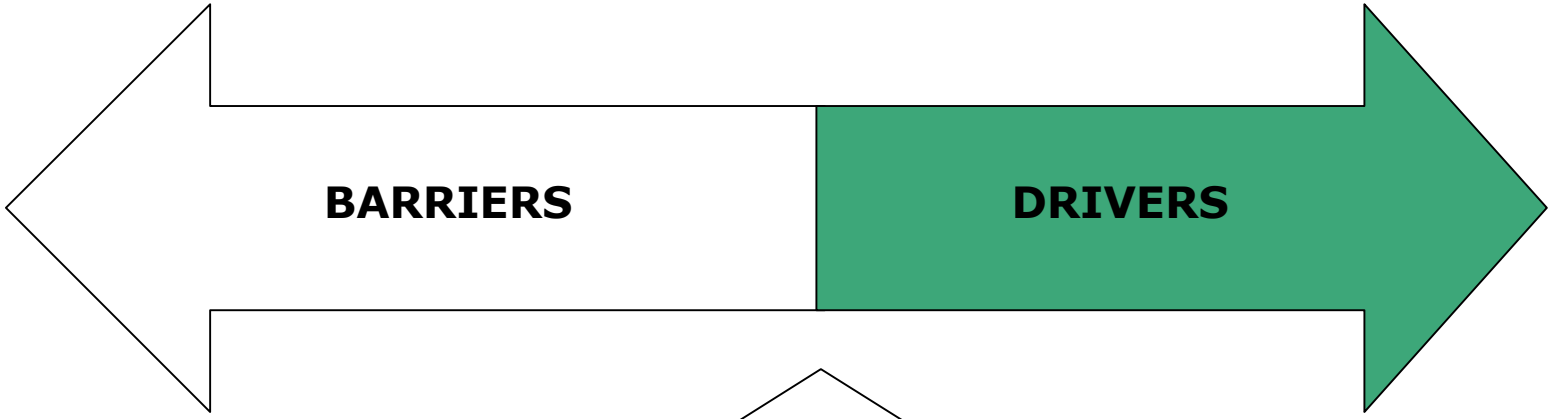
From a business/policy perspective, delivering energy efficiency requires addressing the factors that drive, and impede, changes in organisational decision-making



- **Investment cost**
- **"Hidden" costs**
- **Split incentives & other market failures**
- **Ignorance, inertia and lack of interest**

Classical economic

System & Behavioural

- **Value of energy savings**
- **Co-benefits and intangible benefits e.g. CSR**
- **Systemic efficiency**
- **Awareness and motivation**

Strong evidence base on all elements of driver-barriers but the balance differs between uses and sectors

Cost/benefit depends on time horizons: 'The further down the organisation, the shorter the time horizon'

'Hidden costs' are diverse	Market misalignments dominate 'embedded' performance	Weak drivers for change limit organisational commitment
• Perceived risk of new technologies giving lower quality and performance • High transition costs to operations *"The new energy efficiency motors do not fit in the old imperial frames… transition costs are high."* Transaction costs also important	*"Our worst property is 13 times worse than the best' – major retailer'* *'You should be pleased if have the measurement systems in place to know that' – response from another retailer* *"OEMs control the distribution of motors – most companies do not even know what type of motor they have purchased – hidden in kit."*	▪ Energy is not relevant to "core business" ▪ Lack of senior level commitment ▪ Lack of resources focused on energy management ▪ Engineers do not have a budget for energy efficiency improvements." ▪ *"ECAs target finance departments – engineers never receive the benefits of taking up ECAs."*

Combined effect is to make Awareness and Motivation critical aspects:

"CCLA's were far more likely to have taken action to improve energy efficiency …87% of CCLA firms had taken action or were planning to do so compared with 42% of non-CCLA firms" (Source: CBI/EEF review of CCL, October 2002)

The drivers & barriers fall into four main categories that define the scope and targeting of policy

Issue	Definition	Examples	Policy options
Financial cost/benefit	Ratio of investment cost to value of energy savings	▪ More expensive but more efficient equipment	▪ Economic instruments that reduce equipment cost or finance cost, or increase energy prices ▪ Direct legislative drivers on energy / emissions
Expanded cost/benefit (intangible, transaction and transition costs)	Cost or risk (real or perceived) of moving (or not moving) to more energy-efficient practices including managerial, information, risk and decision-making requirements, not captured above	▪ Costs & risks of change - Incompatibility - Performance risk - Management time - Other transaction costs • Exposure of not changing - Higher emissions risk - Equipment obsolescence - Customer / employee pressure	▪ Services providing information, technical support ▪ Packaged energy service contracts ▪ Standards requiring use of a particular technology/solution, e.g. product standards, etc. to avoid transaction costs
Market Misalignment (split incentives, system failures regulatory failures)	Market structure and constraints that prevent consistent tradeoff between specific energy efficient investment and the societal energy saving benefits	▪ Landlord / tenant split ▪ Regulatory failures e.g. in electricity ▪ First-mover costs and risks ▪ Externally-imposed budget constraints	▪ Contractual or market organisation solutions to split incentives between organisations ▪ Product standards ▪ Capital market solutions (e.g. public sector financing scheme) ▪ Socialisation of first-mover costs
Behaviour & motivation (inertia, awareness, materiality)	Internal issues of firm behaviour linked to awareness, motivation and internal organisation	▪ Organisational failures (e.g.. internal split incentives) ▪ Inertia, rules of thumb ▪ Tendency to ignore small opportunities	▪ Campaigns, sector learning networks ▪ "Attention raising" instruments: e.g. trading; CCAs with sector targets and 'cliff' incentives (tax exemption) ▪ ECA lists and low interest loans available to equipment purchasers in organisations

Issues of 'materiality' underpin several barriers – eg. NPV of significant proportion of abatement measures in average building are not very material

Source: Enviros analysis

Instruments and Applications

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Barrier/driver analysis (four categories): diverse barriers to optimal investment especially in building-related uses

large organisations also demonstrate capital inconsistencies

	Large energy intensive industry*	**Large non-energy intensive organisations**	**Public sector**	**SMEs**
Building energy use	•Financial C/B** •Expanded C/B •Market misalignment •**Behaviour & motivation**	•Financial C/B •Expanded C/B •**Market misalignment** •Behaviour & motivation		•Financial C/B •Expanded C/B •Market misalignment •**Behaviour & motivation**
Manu-facturing energy use	•**Financial C/B** •Expanded C/B •Market misalignment •Behaviour & motivation	•Financial C/B •Expanded C/B •Market misalignment •**Behaviour & motivation**	•**n/a**	•**Financial C/B** •Expanded C/B •Market misalignment •Behaviour & motivation

• In buildings energy use, main driver/barrier differs by market segment but is ***not*** **financial C/B**

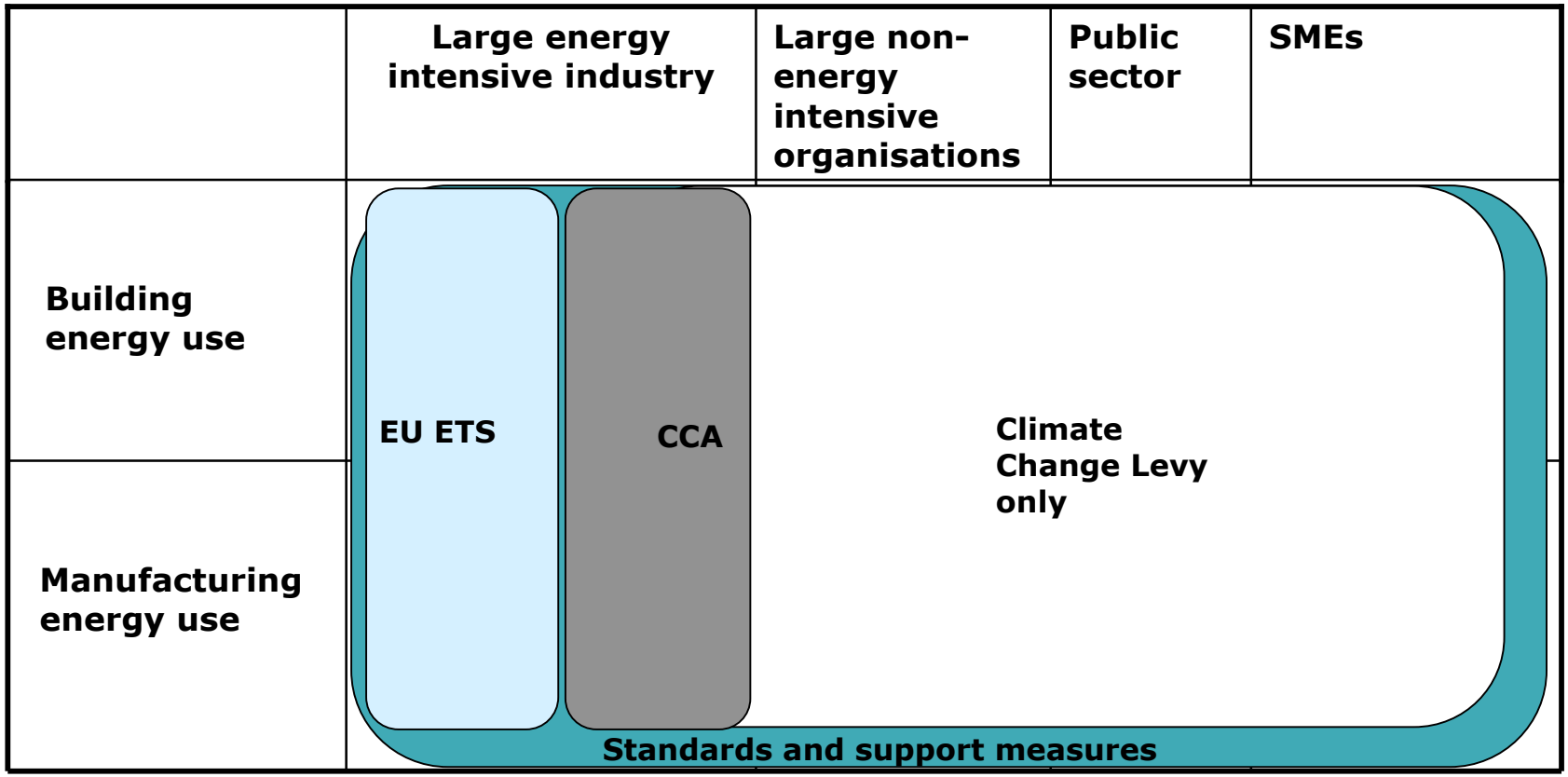
• In manufacturing energy use, **financial C/B is important, other costs and barriers matter too**

• Issues of behaviour and motivation (and how they affect internal organisation) are significant & sometime dominant for all large organisations

• A generic barrier across all SME energy use is non-financial costs, particularly **transaction costs**

* Includes EU ETS and CCA sector companies with >50 employees

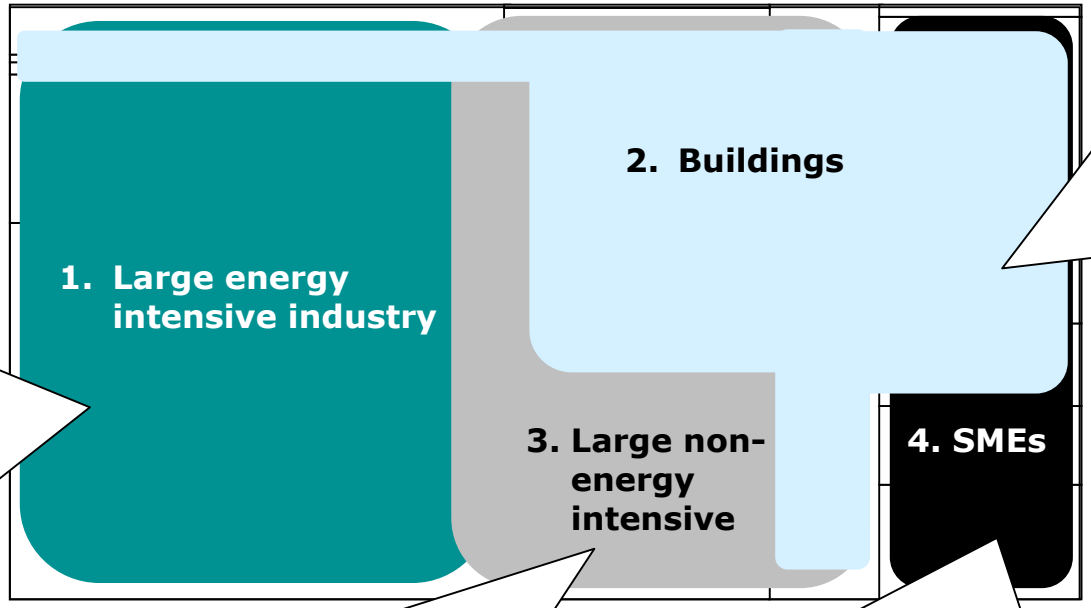
The current Climate Change Programme has instruments appropriate to the large energy intensive operations but does not address main barrier-drivers in other categories



- EU ETS and CCA focused on large-energy intensive industry
- CCL is only economic instrument acting upon remaining sectors
- Standards and support measures used across all segments

Mapping policy instruments to key barriers that need to be overcome

Challenge is to unlock potential in groups 2,3 and 4:



Key Barriers

- Financial C/B
- Behaviour & motivation*

Primary instrument options

Economic instruments creating financial incentive and increasing awareness:

- **CCL**
- **CCA**
- **EU ETS**

Key Barriers

- Behaviour & motivation*
- Market misalignment

Primary instrument options

Force change where issues not material:

- **Building regs**

Separate landlord and tenant action:

- **EPBD**

(Additional) Key Barriers

- Financial C/B - *drivers include CSR and customer pressure*
- Behaviour & motivation*

Primary instrument options

Economic instruments creating financial incentive and increasing awareness:

- **CCL**
- **CCA**
- **Cap and trade (direct/indirect emissions)**
- **Project certificates**

(Additional) Key Barriers

- Financial C/B – *transaction costs*
- Behaviour & motivation*

Primary instrument options**

Economic instruments creating financial incentive, ideally reducing transaction costs:

- **CCL**
- **CCA**
- **Cap and trade (direct/indirect emissions)**
- **EEC for SMEs** – addresses transaction costs

Note: *Carbon Trust can support delivery from all 4 groups

**Size cut-off will apply for some instruments due to transaction costs

Some unintended consequences of the Climate Change Levy

- **The theory**
  - A price instrument (widely criticised for not being in proportion to carbon) intended to drive price-based efficiency and factor substitution
- **The practice**
  - A funding source: not to be underestimated ..
  - An "announcement effect" that grabbed attention
  - Shifts the base of industrial negotiation, thereby driving real change through the Climate Change Agreements, and of everything else that follows …
- **But also**
  - A lock-in to a certain kind of taxation

The impacts of the EU ETS

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EU ETS can substantially increase marginal operating costs, but (eg. cement) can maintain profits with only modest pass-through & price impact (current allocns)

	Increase in marginal production cost, %	Cost pass-through required to maintain sector operating profits: Proportion of increase in marginal cost passed through to prices, %	Cost pass-through required to maintain sector operating profits: Increase in wholesale cement price, %
Scenario 1 €5/tCO_2	27.3%	7.0%	0.6%
Scenario 2 €15/tCO_2	70.5%	7.5%	2.0%
Scenario 3 €25/tCO_2 w/cutback	136.3%	39.7%	16.8%

Phase 1 & 2, direct allocation helps offsets electricity price rise (c.90% cost pass-through in electricity)
Long term scenario, required cement cost pass through increases as its direct allocation is cut back 30%

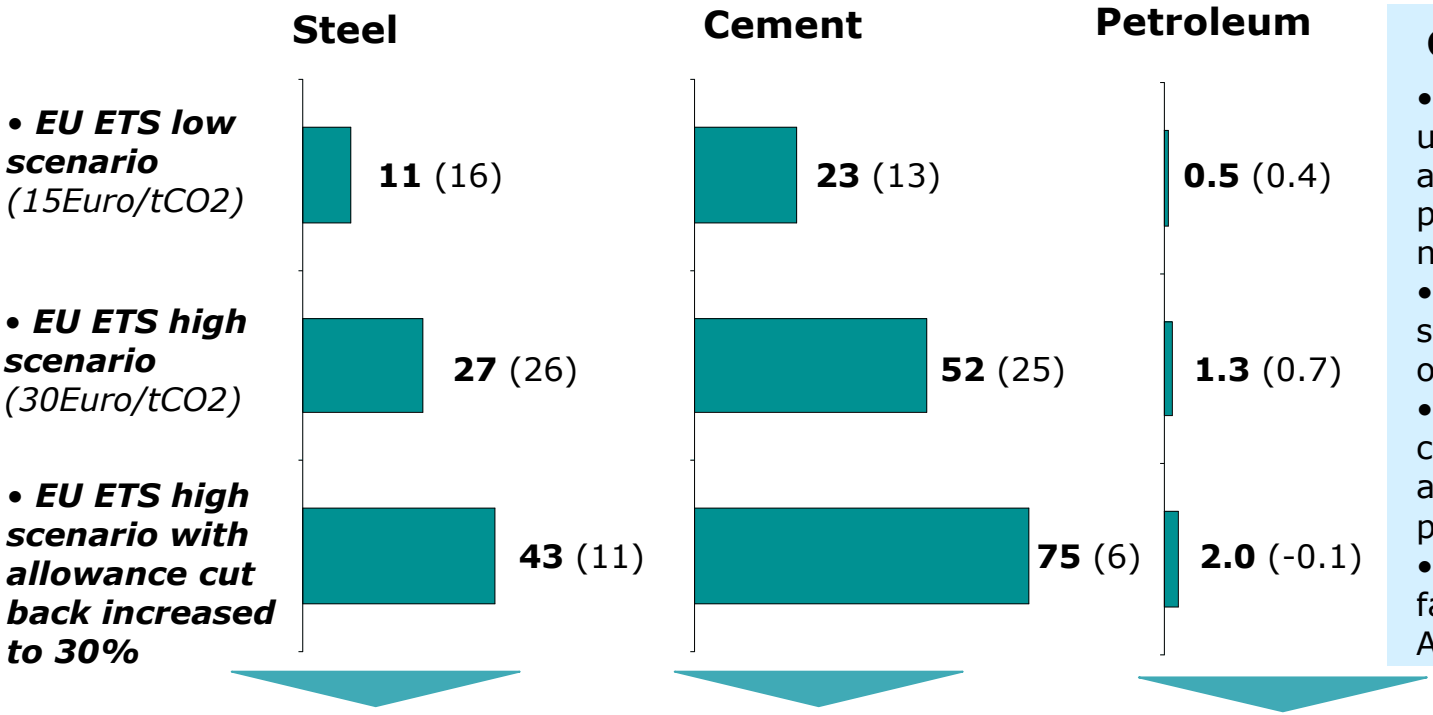
Profit-maximising pass through predicted by market modeling: c.80%

As a result, participating sectors profit …

Non-participants carry the cost, Al. may exit if buys from grid

Policy coverage

Value at stake in 2020, %*
(% change in EBITDA predicted by Cournot model in brackets)



General Insights

- All ETS sectors profit under our standard allocations, as product pricing effects outweigh net input cost increase
- ETS enables these sectors to capture bulk of the 'scarcity rent'
- At €30/tCO2 both cement and steel approaching turning point from imports
- Sectors outside ETS face the higher prices, Al. exits if on grid

- Steel imports impact profit taking at higher prices, still profit from ETS under 30% cutback but only a little
- Cement imports constrain cost pass through, 30% cutback neutralises gains
- Marginal effect as energy is small fraction costs and profits

Note: *Value at stake = (increase in total costs after allowance allocation)/(starting EBITDA); high variant scenarios with CCL doubled; carbon price of 30Euro/tCO2 and cut back of 1% pa versus business as usual projected emissions

Source: Oxera

Some unintended consequences of the European Emissions Trading Scheme

- **The theory & perception**
  - A market-based instrument to add 'carbon costs' as efficiently as possible on the most sensitive, energy-intensive sectors to incentive reductions
- **The practice**
  - A source of big profits
  - .. Making industry rich enough to think long term
  - .. Invest in longer term technology
  - .. and start to lobby for its continuation

- **But also**
  - A tool to subsidise investments, including in carbon intensive investments through perverse allocation mechanisms
  - .. An invitation to gaming, inflating emission projections, making the case for need for higher carbon investments
  - .. That is proving the cause of its own undoing .. Watch the News on 15 May!

Macroeconomic analyses

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The two macro models predict very different impacts on GDP – including generally opposite signs - as well as different sectoral composition effects

Numbers indicate % GDP (at factor cost*) difference from base case (low CCL & ETS)

All scenarios, Double Climate Change Levy	Cambridge Econometrics		Oxford Economic Forecasting	
ETS price scenario	2010 ETS €25/tCO2	2020 ETS €15/tCO2	2010 ETS €15/tCO2	2020 ETS €30/tCO2
Current CCP structure	0.01%	-0.01%	-0.3%	-0.7%
Targets extension	0.25%	0.28%	0.0%	-0.2%
EU ETS extended	0.25%	0.28%	-0.1%	-0.6%
"Focus" package	0.27%	0.30%	-0.3%	-0.9%

*** c.x2 at market prices: government guidelines exclude transfer payments in GDP**

Note: the direction of difference is opposite from that usually found in the literature!

Analysis of models and discussions with consultants suggest two main hypotheses to explain the wide differences in GDP impacts

Whether or not revenues raised by economic instruments can be used productively

- The General Equilibrium formulation has no revenues – it measures impact on input costs as a factor of production with no offsetting gains possible from revenue recycling (the OEF model also has a fixed labour supply).
- Cambridge Econometrics assume revenue recycling via reduction in Employee National Insurance Contributions. With an elastic labour supply, the reduced cost of labour boosts employment (by 5 – 50,000 jobs) which may help boost GDP

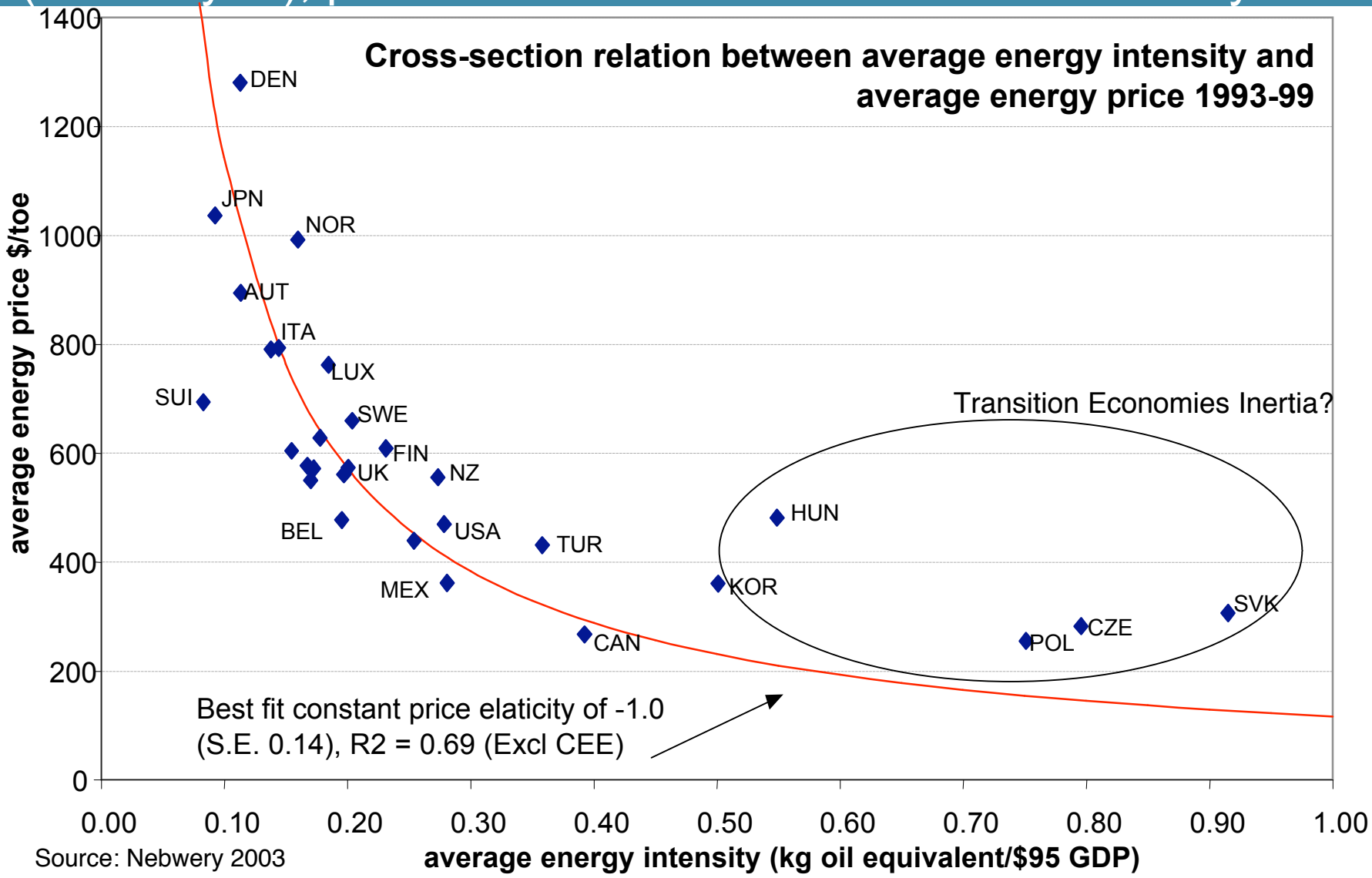
The difference in the Focus package may be biggest because the new instrument analysed for service sector (auctioned allowances) raises money

Whether announcement and awareness effects, in response to introduction of new instruments, can invoke behavioural (managerial, structural) energy-saving responses independent of price and if so at what scale and persistence

OEF incorporate a direct investment response in the case of

But through it all – price *does matter …*

Cross-country comparisons suggest final national energy expenditure per unit GDP is insensitive to price in long term (elasticity -1), price increases match increased efficiency



Source: Nebwery 2003

Conclusions and additional approaches

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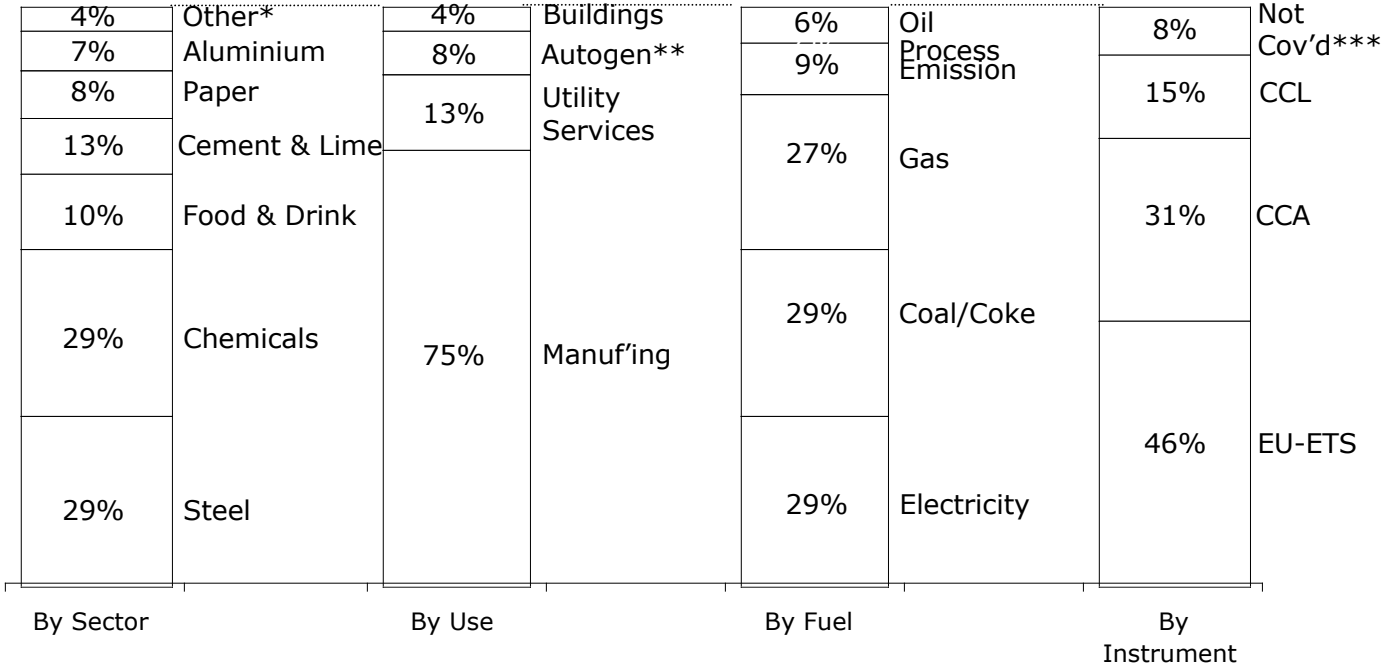
APPENDIX

- Emissions mapping across 4 entity types
- Description of all new and existing policy instruments

Characteristics of large energy intensive industry

Breakdown of Large (>50 employees) Energy Intensive Industry Emissions 2002, %

100% = 25MtC



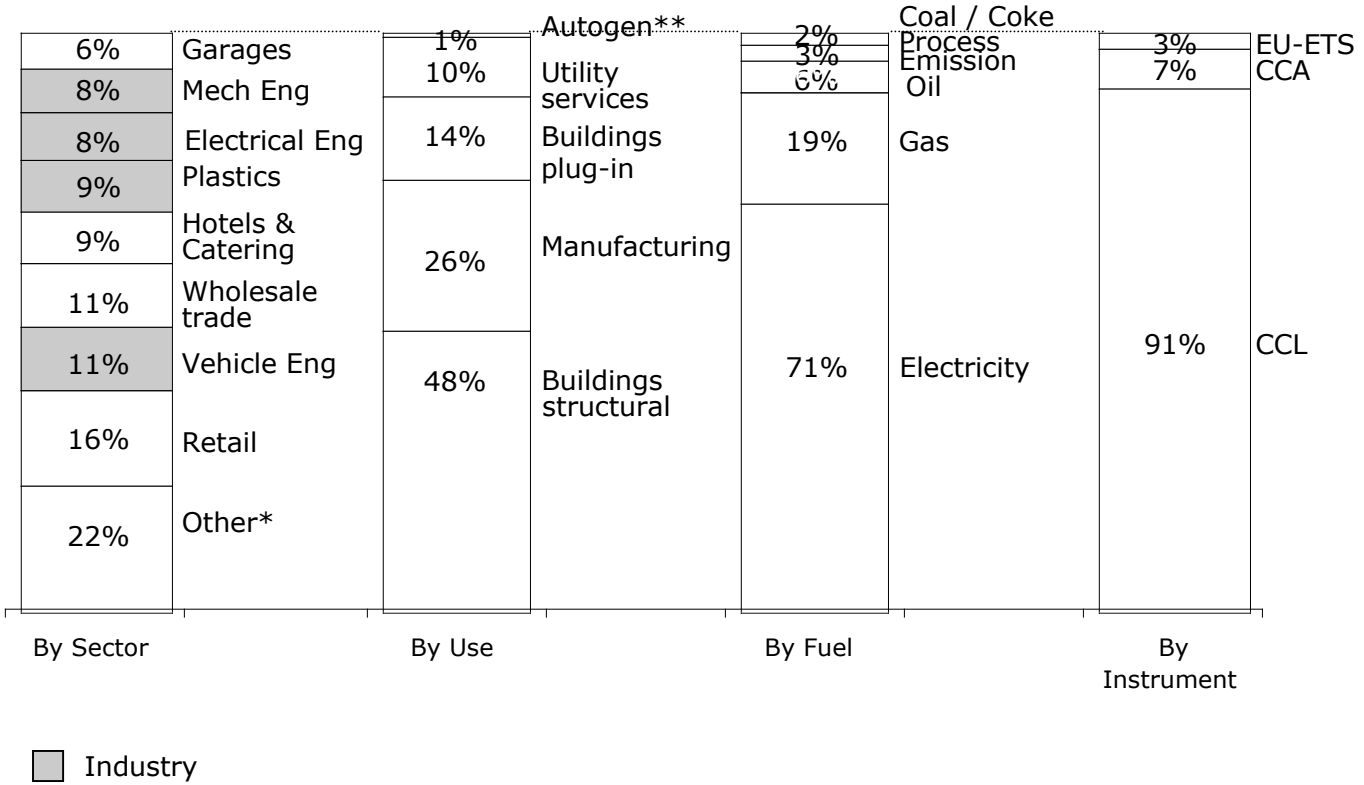
Key Characteristics

- Steel and Chemicals generate >50% of emissions
- Manufacturing dominates energy intensive industrial emissions
- The fuel mix is split quite evenly between electricity, coal/coke and gas
- EU-ETS is the key regulatory instrument for this entity type

Note: *Other includes Bricks, Ceramics, Glass and Other Non-Ferrous Metals; **Autogeneration emissions associated with 'inefficiency' of self-generation (emissions due to electricity created included in total for electricity); *** Not Cov'd - Process emissions not covered by existing instruments

Characteristics of large non-energy intensive companies

Breakdown of Large (>250 employees) Energy Intensive Industry Emissions 2002, %



Key Characteristics

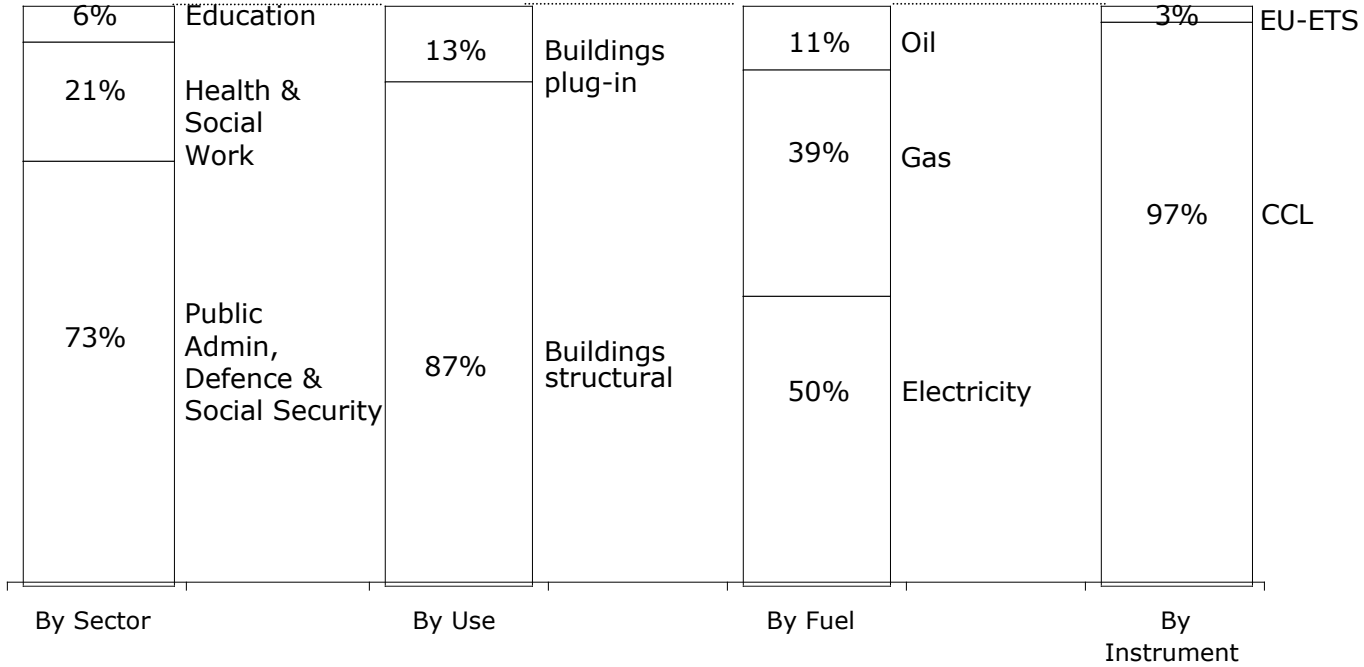
- Emissions are spread relatively evenly across sectors
- Buildings usage accounts for over 60% of emissions
- The fuel mix is dominated by electricity
- CCL is the key regulatory instrument for this entity type

Note: *Other includes Transport & Storage, Real Estate, Construction, Non-Metallic Minerals, Printing, Textiles, Water and Other Industries; **Autogeneration emissions associated with 'inefficiency' of self-generation

Characteristics of public sector organisations

Breakdown of Public Sector Emissions 2002, %

100% = 6MtC

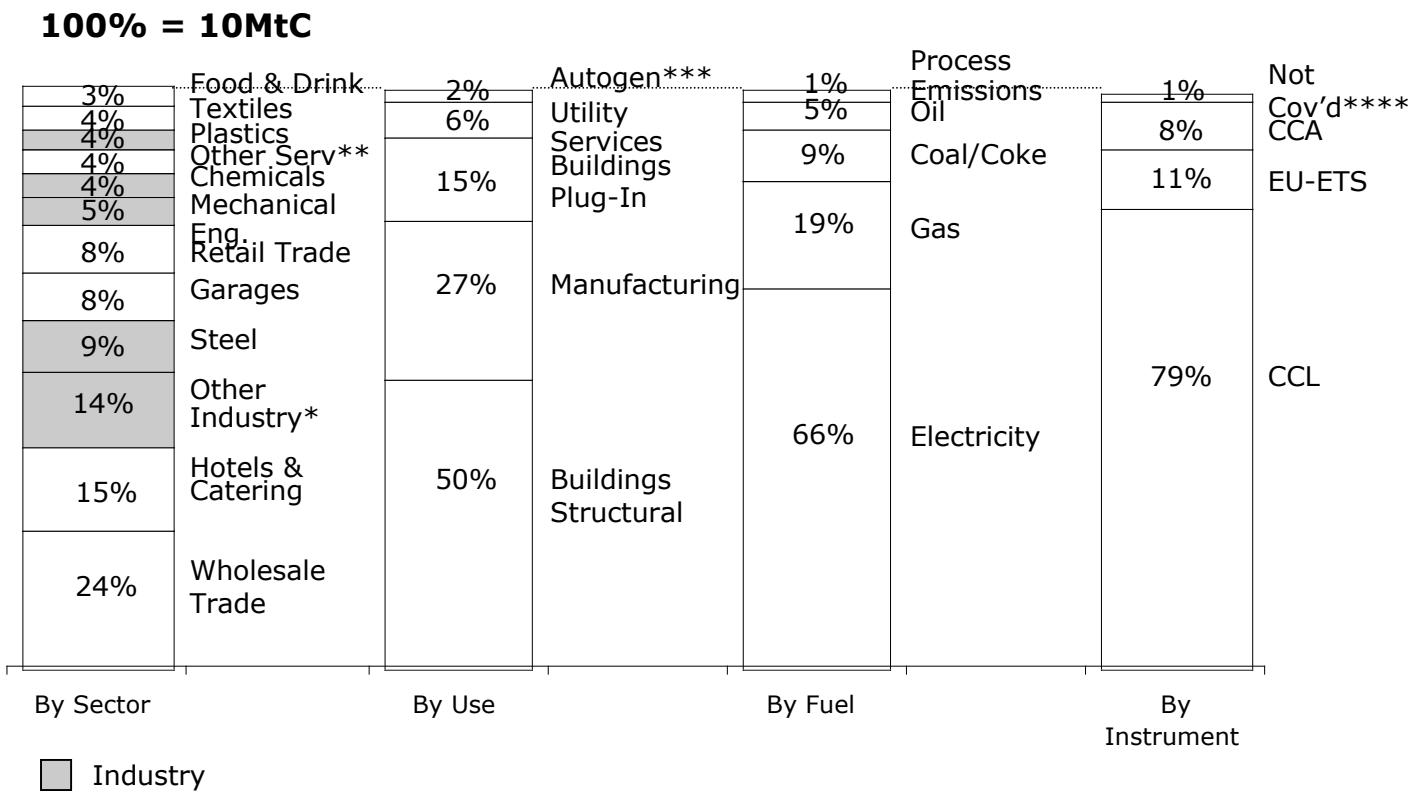


Key Characteristics

- Public sector emissions are exclusively buildings-related
- Electricity and gas make up |90% of the fuel mix
- CCL is the key regulatory instrument for this entity type

Characteristics of SMEs

Breakdown of industrial (>50 emps) and service (>250 emps) SME Emissions 2002, %



Key Characteristics

- SME emissions are highly fragmented by sector
- Buildings make up ~2/3rds of SME emissions
- Electricity makes up 2/3 of the SME fuel mix
- Although CCL is the key regulatory instrument for SMEs, 11% of SMEs are covered by EU-ETS

Note: *Other Industry includes Bricks, Cement, Ceramics, Glass, Aluminium, Other Non-Ferrous Metals, Construction, Vehicle Engineering, Water, Non Metallic Minerals, Printing, Paper, Electrical Engineering and Other Industries; **Other Serv includes Transport & Storage and Real Estate; ***Auto Generation emissions associated with 'inefficiency' of self-generation; ****Not Cov'd - Process emissions not covered by existing instruments