

Bottom-up MACCs for ALULUCF in the UK

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Full report at: <http://www.theccc.org.uk/reports/supporting-research/>

The challenge



- Greenhouse gas emissions from agriculture, land use, land use change and forestry (ALFM) represent approximately 8% of UK anthropogenic emissions, mainly as nitrous oxide and methane.
- Climate Change Act of 2008, UK Government committed to ambitious targets of 80% of 1990 levels by 2050
- Budgeting handed to Committee on Climate Change
- How to reduce efficiently? How to derive a budget for the sector?
- Bottom-up Marginal Abatement Cost Curves (MACCs)

Welcome to the Committee on Climate Change (CCC)

The Committee on Climate Change (CCC) is an independent body established under the Climate Change Act to advise the UK Government on setting carbon budgets, and to report to Parliament on the progress made in reducing greenhouse gas emissions.



Carbon Budgets

The CCC (Committee on Climate Change) has proposed levels for the first three carbon budgets from 2008-2022...



Topics

Includes information about climate science and the environment, economic and social impacts, global and UK targets...



Sectors

There is potential for emissions to be reduced across all sectors of the economy. To find out about some of the opportunities and technologies required read on...

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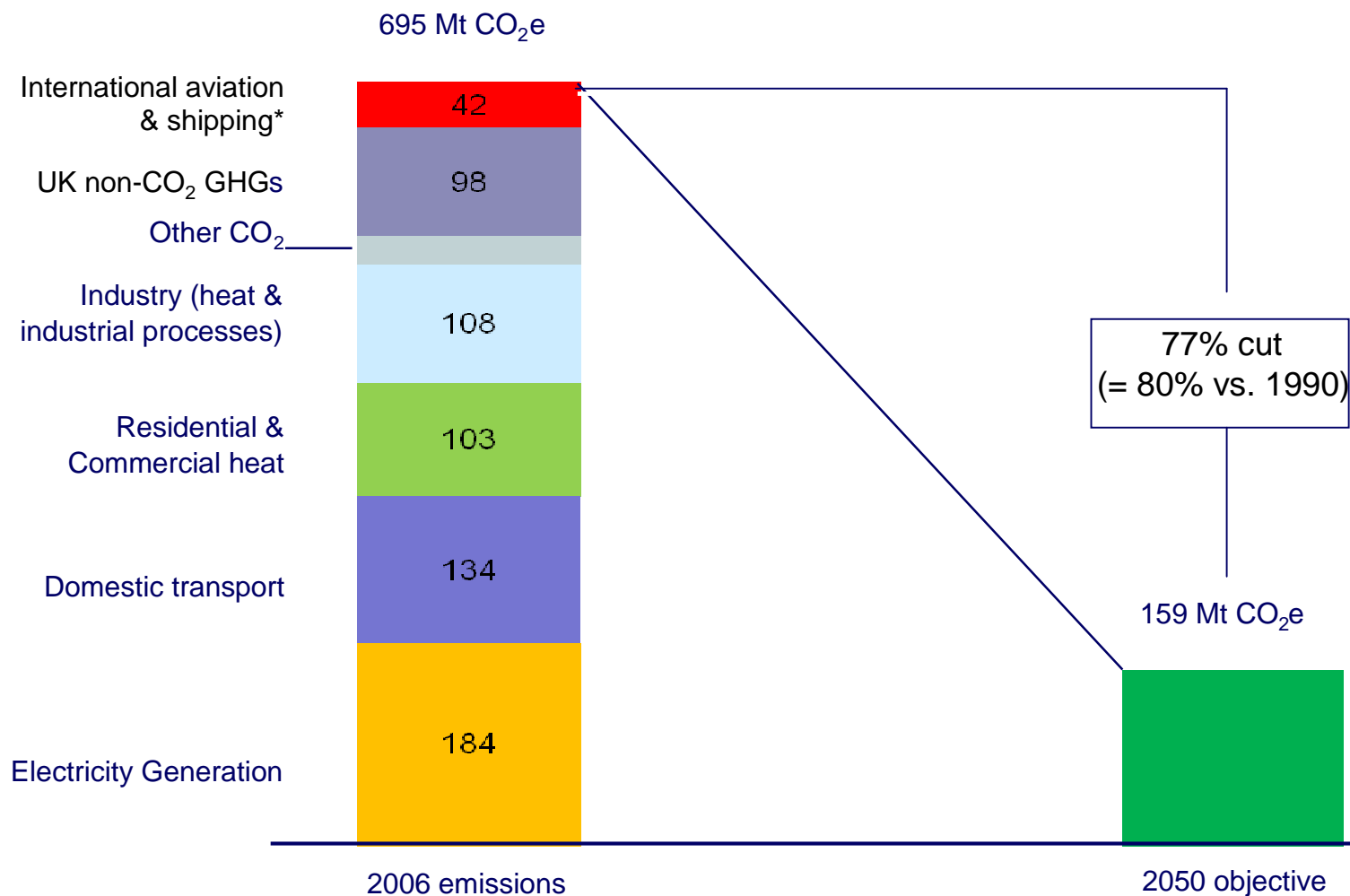
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Climate Change Glossary



Not sure what some of these terms mean, use our glossary to find out more >

Mitigation: the challenge

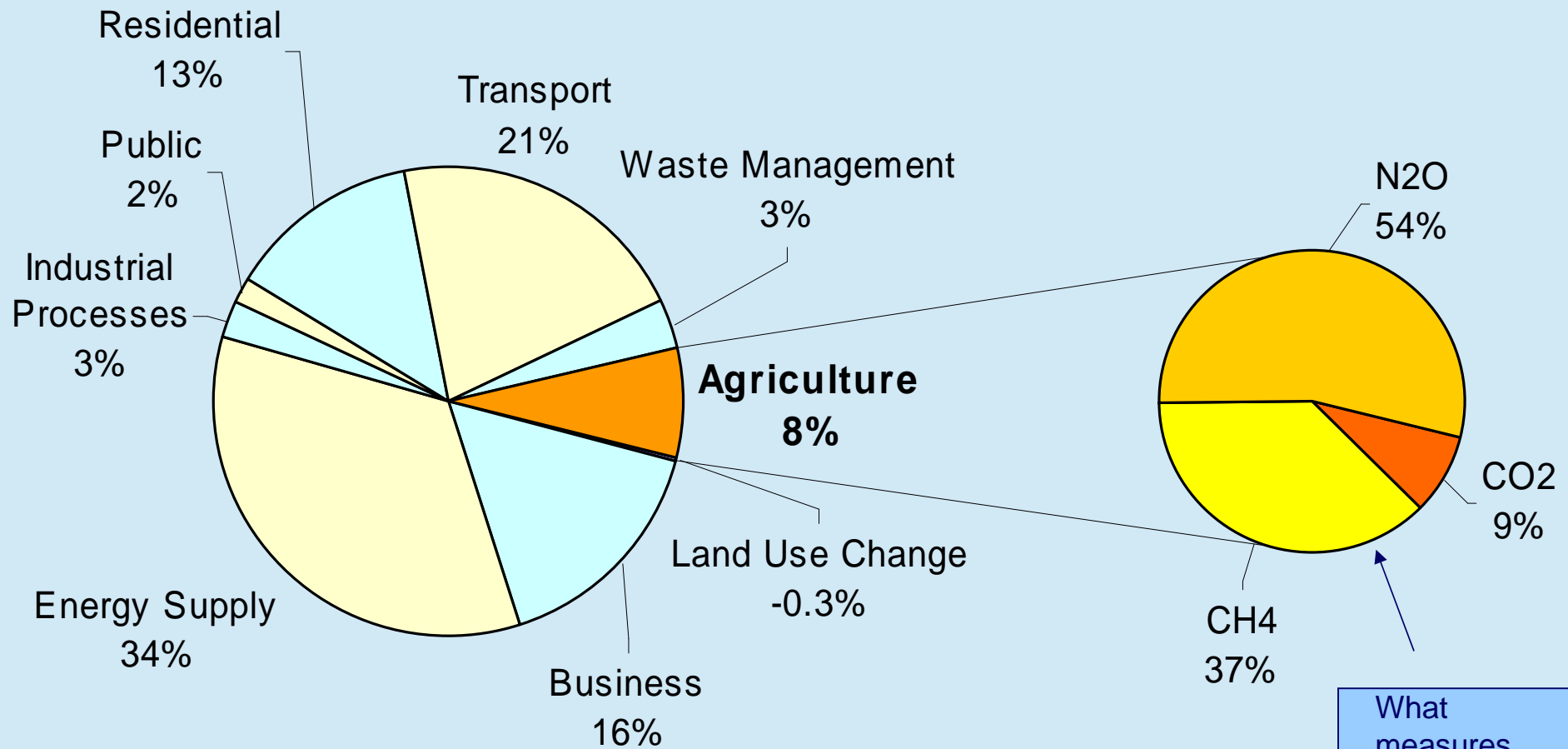


* bunker fuels basis

UK agricultural emissions

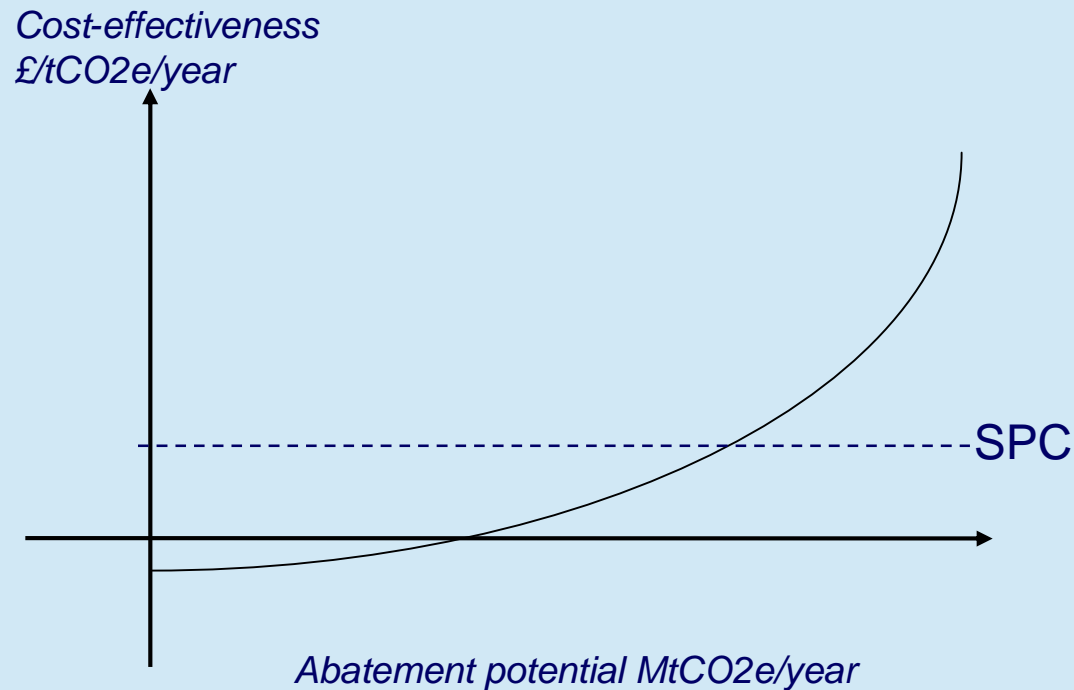


Total GHG emissions, UK, 2005 (695 Mt CO₂e)



What measures to reduce?

What are MACCs, and why do we need them?



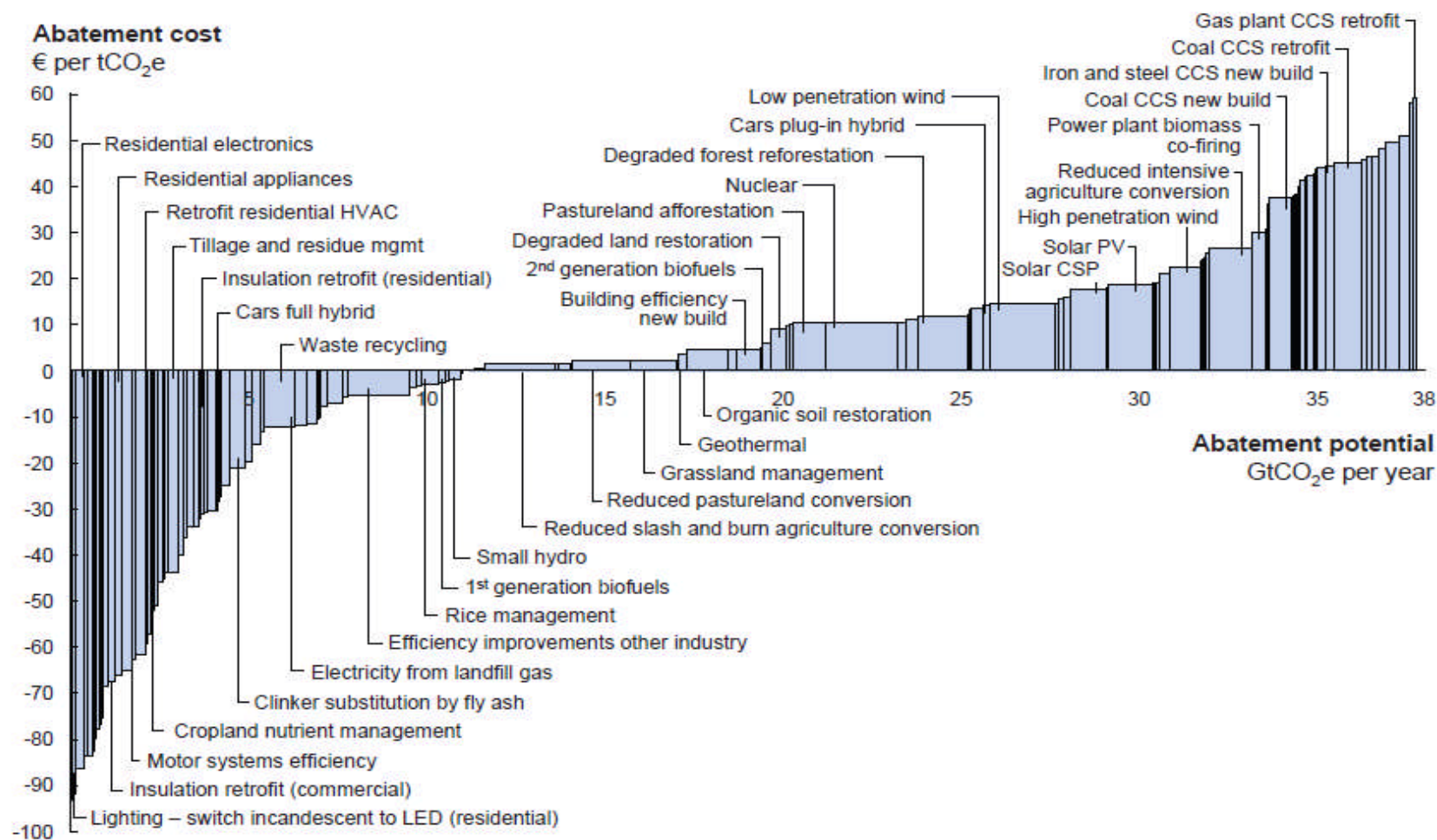
- Need them to identify the efficient level of pollution and hence regulation – required to set targets for GHG mitigation.
- Identify the most cost-effective ways of meeting the targets – within and between sectors.
- Identify options that cost less than the Shadow Price of Carbon (SPC).

McKinsey & Co global MACCs



Exhibit 1

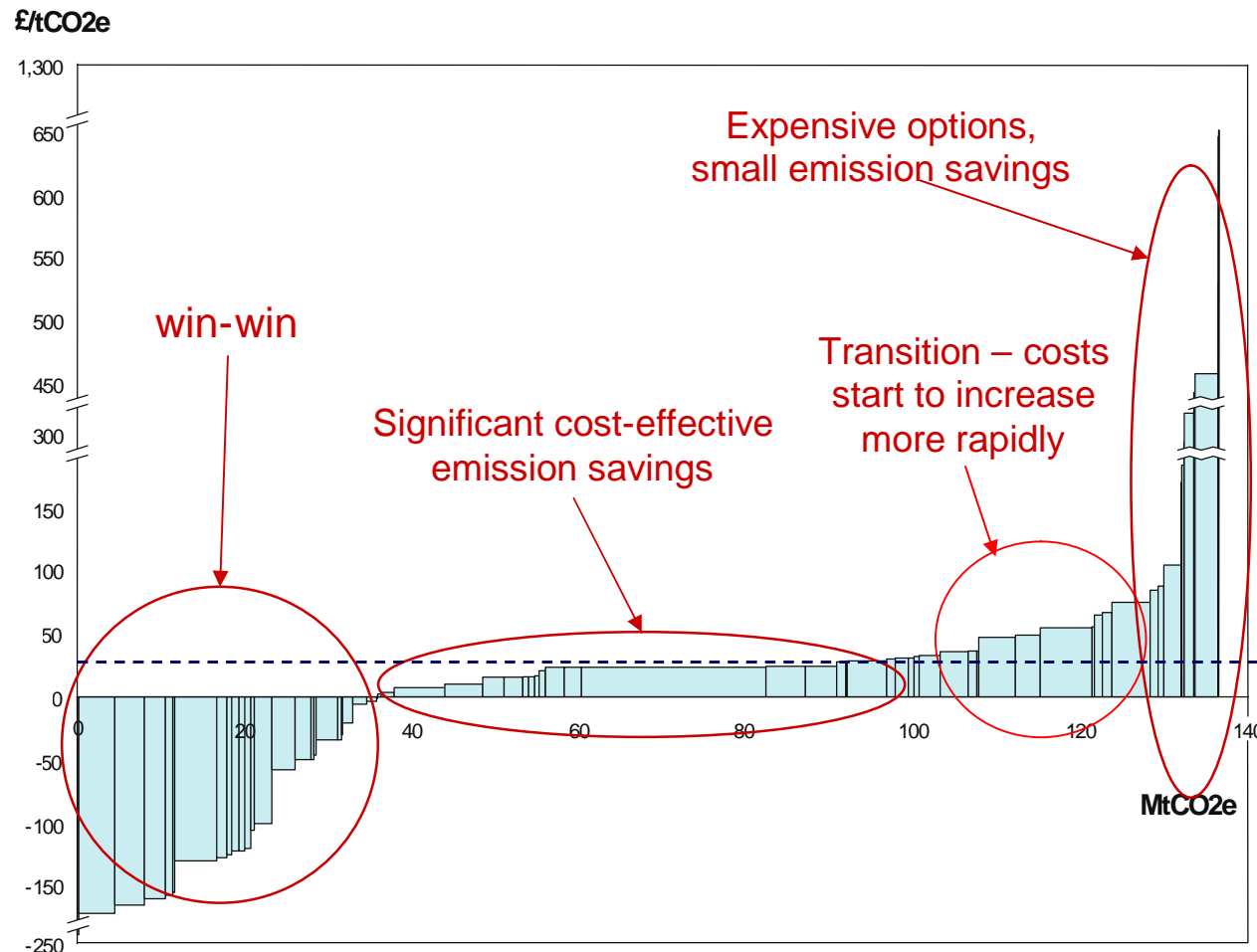
Global GHG abatement cost curve beyond business-as-usual – 2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO₂e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

Source: Global GHG Abatement Cost Curve v2.0

Methods – Marginal abatement cost curves



- Options ranked in decreasing order of cost-effectiveness from L to R
- Width of each bar: abatement potential
- Height of each bar: cost-effectiveness

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What did we do, and why?

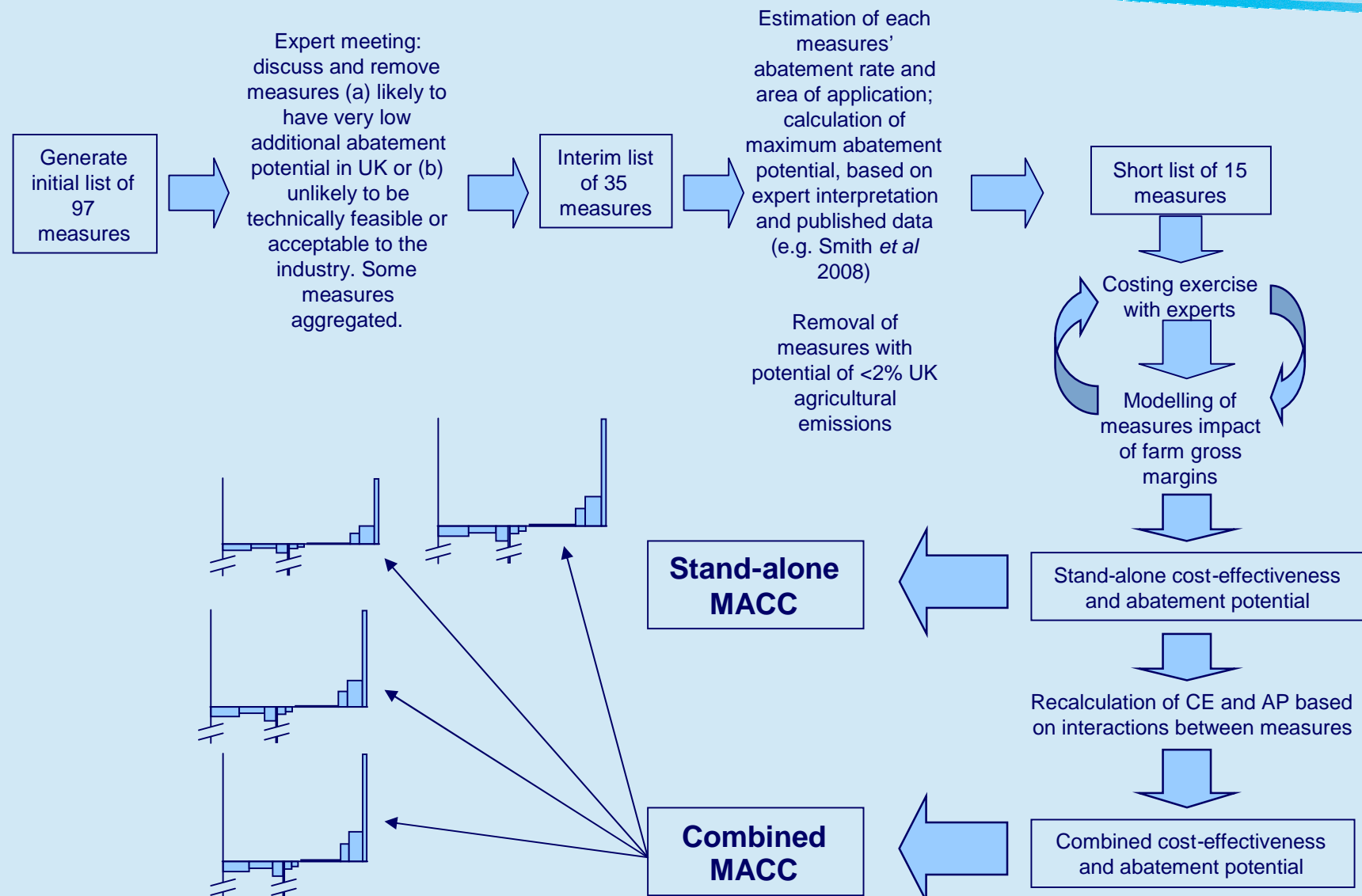


Developed MACCs for the ALULUCF (for a range of time periods, potentials, discount rates etc.).

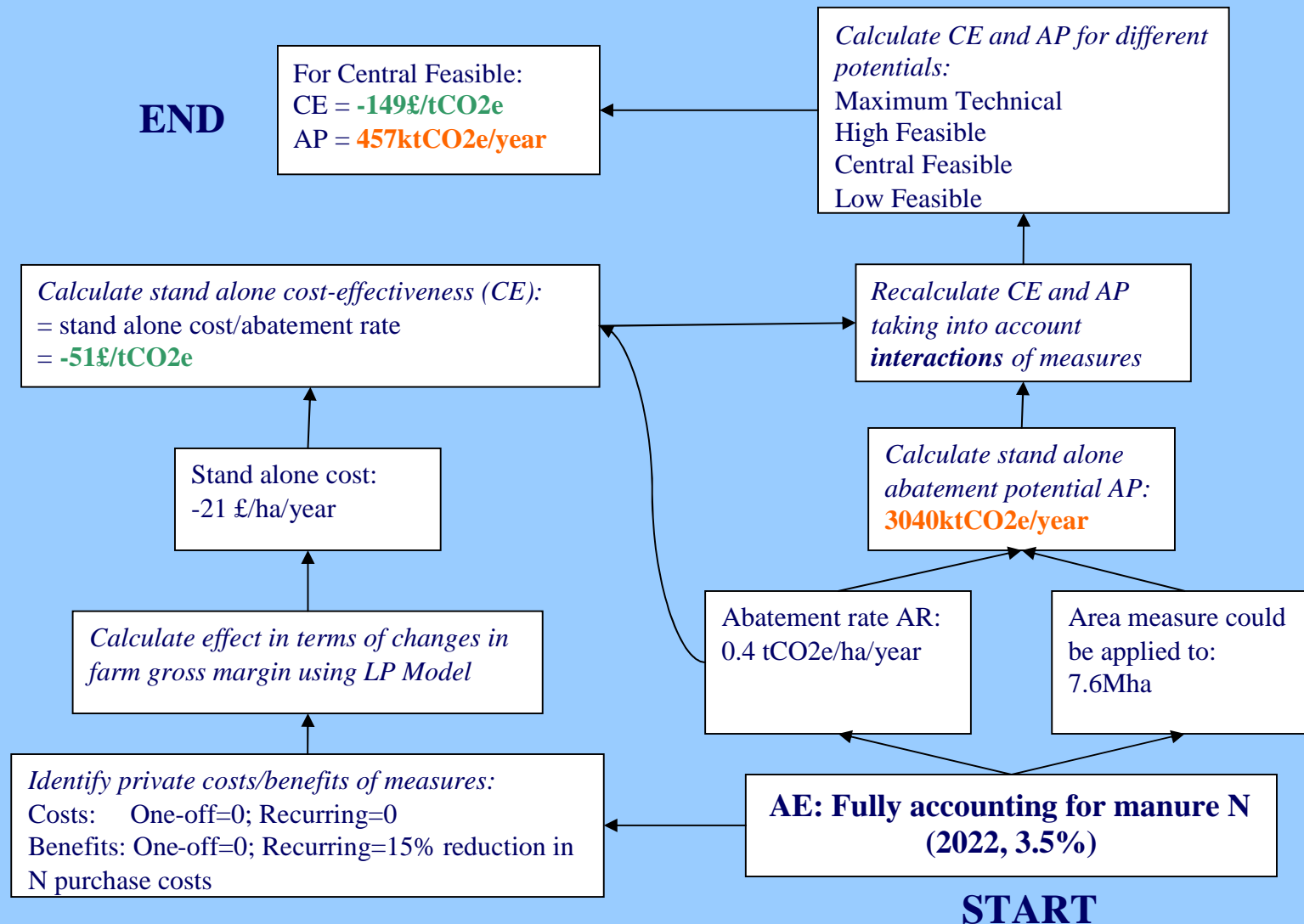
Build on existing studies: provide analysis with empirical basis and explicit assumptions.

CCC wanted all sectors to develop MACCs using a common framework (e.g. in terms of discounting, abatement potentials etc.).

Approach



Example: Fully accounting for manure N

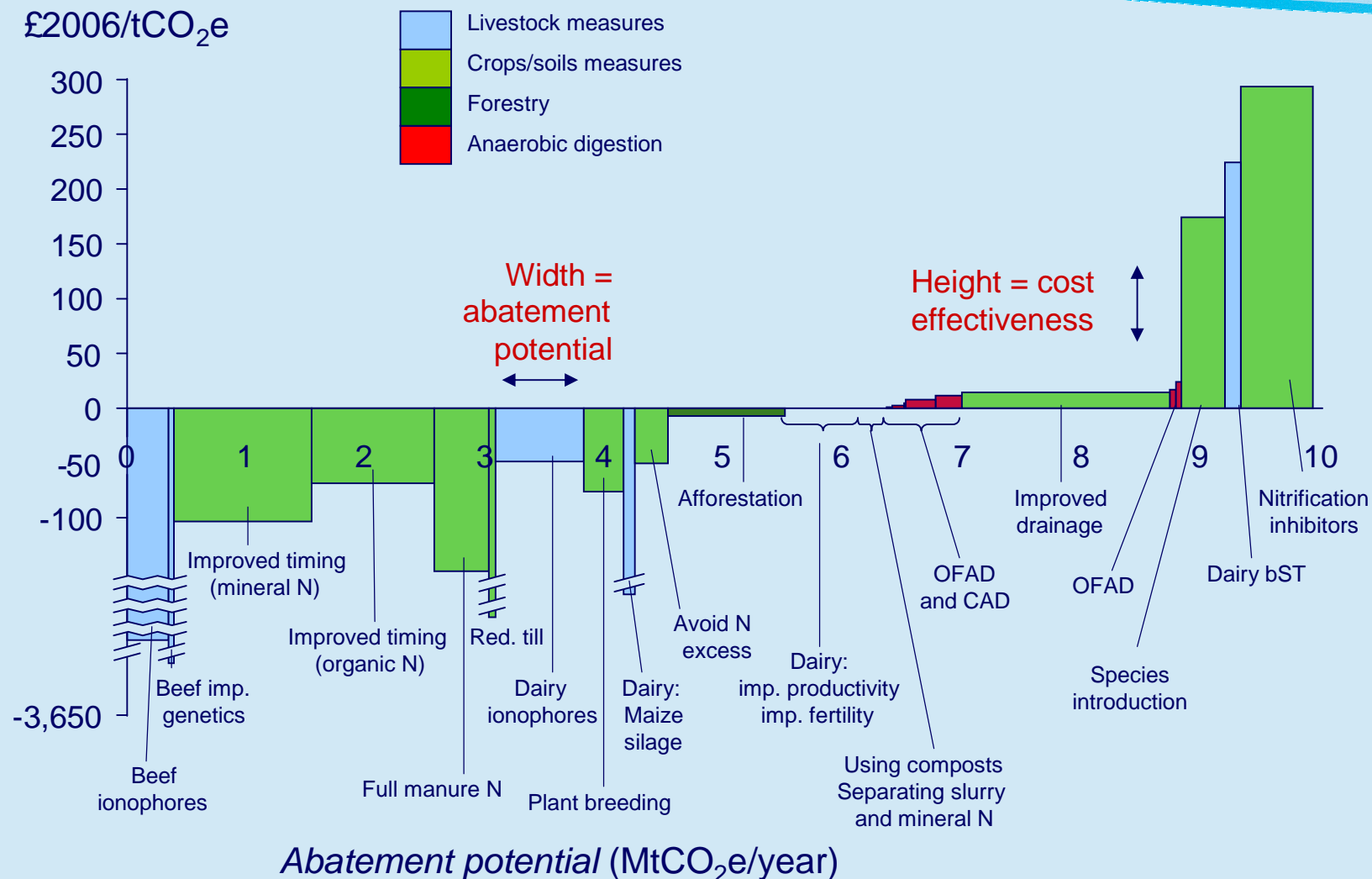


MACC for ALULUCF (2022, CFP, 3.5%)



Cost effectiveness

£2006/tCO₂e



Results for livestock measures

(2022, CFP, 3.5%)



Measure	ktCO2e abated	CE [£2006/tCO2e]
Beef Ionophores	347	-1,748
Beef Improved Genetics	46	-3,603
Dairy Ionophores	740	-49
Dairy Maize Silage	96	-263
Dairy Improved Productivity	377	0
Dairy Improved Fertility	346	0
OFAD-Pigs, Large	48	1
OFAD-Beef, Large	98	3
OFAD-Pigs, Medium	16	5
OFAD-Dairy, Large	251	8
CAD-Poultry, 5MW	219	11
OFAD-Beef, Medium	51	17
OFAD-Dairy, Medium	44	24
Dairy-bST	132	224
Dairy-Transgenics	504	1,691
Beef Concentrates	81	2,705

Results for crops/soils measures

(2022, CFP, 3.5%)

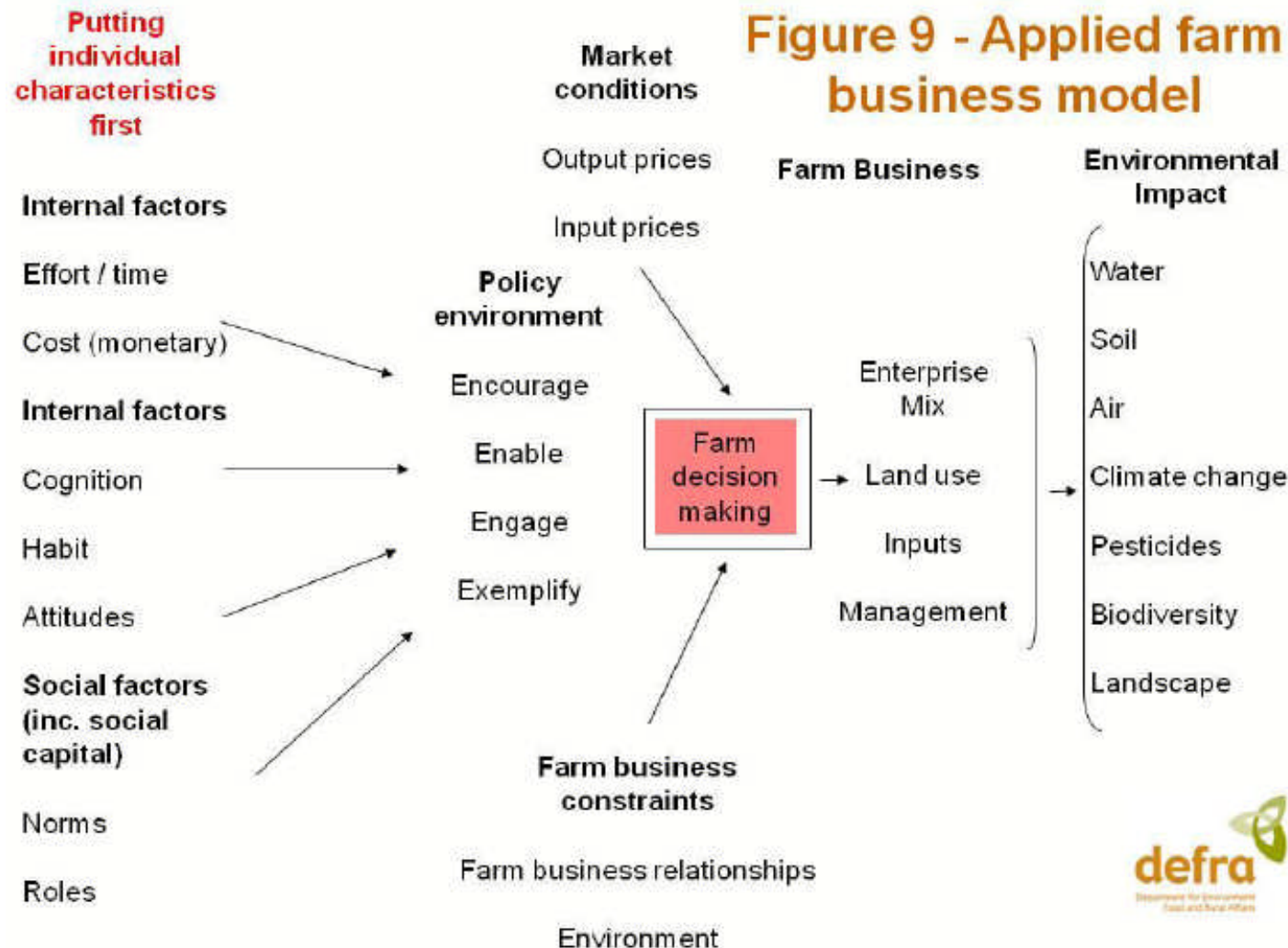


Measure	ktCO ₂ e abated	CE [£2006/tCO ₂ e]
Improved Timing, Mineral N	1,150	-103
Improved Timing, Organic N	1,027	-68
Fully accounting for manure N	457	-149
Reduced tillage	56	-1,053
Improved N-Use Plants	332	-76
Avoiding N Excess	276	-50
Using Composts	79	0
Separating Slurry and Mineral N	47	0
Improved Drainage	1,741	14
Species Introduction	366	174
Nitrification inhibitors	604	293
Controlled release fertilisers	166	1,068
Reducing N Fertiliser	136	2,045
Adopting Systems Less Reliant On Inputs	10	4,434
Biological fixation	8	14,280

Why isn't there 100% uptake of win-win measures?



Figure 9 - Applied farm business model



Source: Defra (2008)
 UNDERSTANDING BEHAVIOURS IN
 A FARMING CONTEXT: Bringing
 theoretical and applied evidence
 together from across Defra and
 highlighting policy relevance and
 implications for future research
 November 2008 Defra Agricultural
 Change and Environment Observatory
 Discussion Paper

Conclusions: ALULUCF mitigation is complex



UK: 300,000 small/micro firms managing biological systems = complexity

One of the first attempts for develop transparent MACCs for agriculture

“The analysis does however illustrate that there is significant potential in agriculture which merits further analysis.” (CCC 2008, p344)

Policy & delivering ag emissions budget



Making the right choices for our future

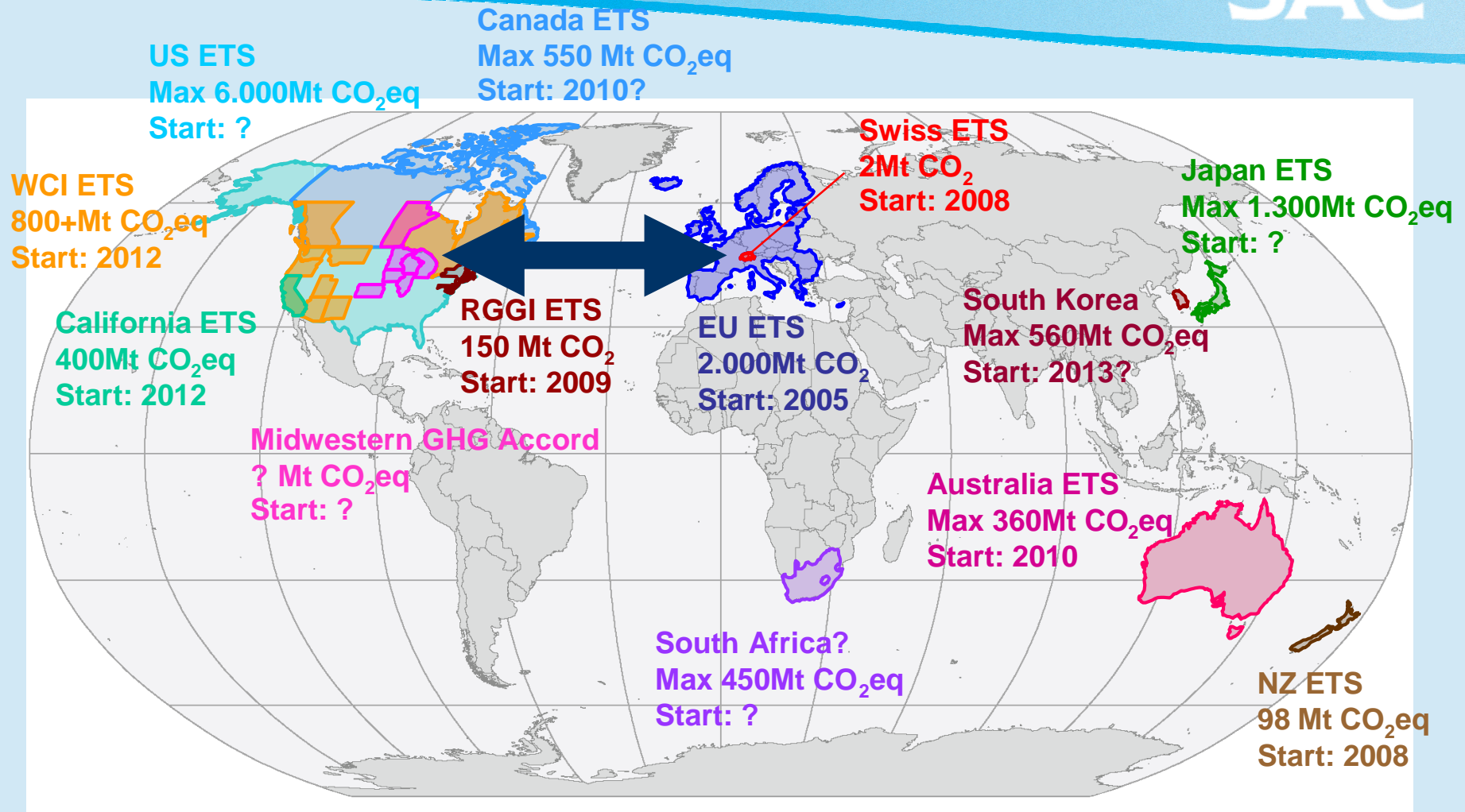
An economic framework for designing policies to reduce carbon emissions

Department of Energy and Climate Change
Department for Environment, Food, and Rural Affairs

March 2009

- Modifying behaviours
- Agricultural codes
- Bio energy infrastructure
- R&D
- Demand side measures
- Need to avoid displacement
- Emissions trading?

Regional carbon markets



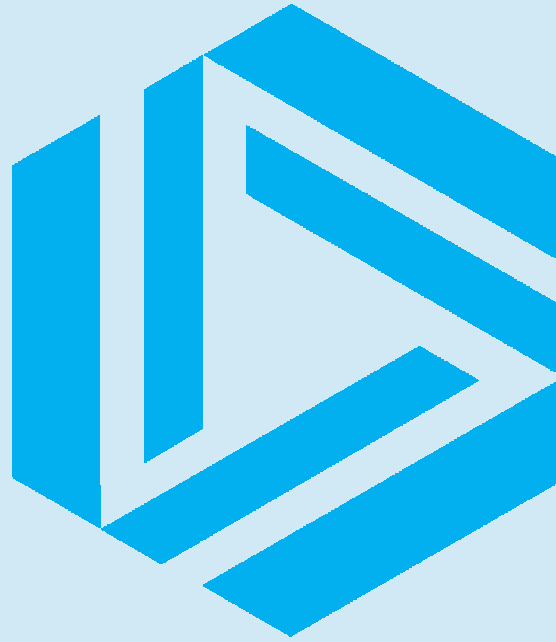
How do we reduce the uncertainty?



1. *Refine existing assumptions* e.g. in terms of abatement rates, additional abatement potential (e.g. what are current baselines?)

2. *Revise approach*

- Ancillary costs/benefits
- LCA
- Finer-grained analysis: e.g. farm type MACCs
- Integrate with models to account for interactions with region and climate
- Adopt a demand-side perspective?



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