

Tyndall° Centre

for Climate Change Research

On decarbonising the global economy

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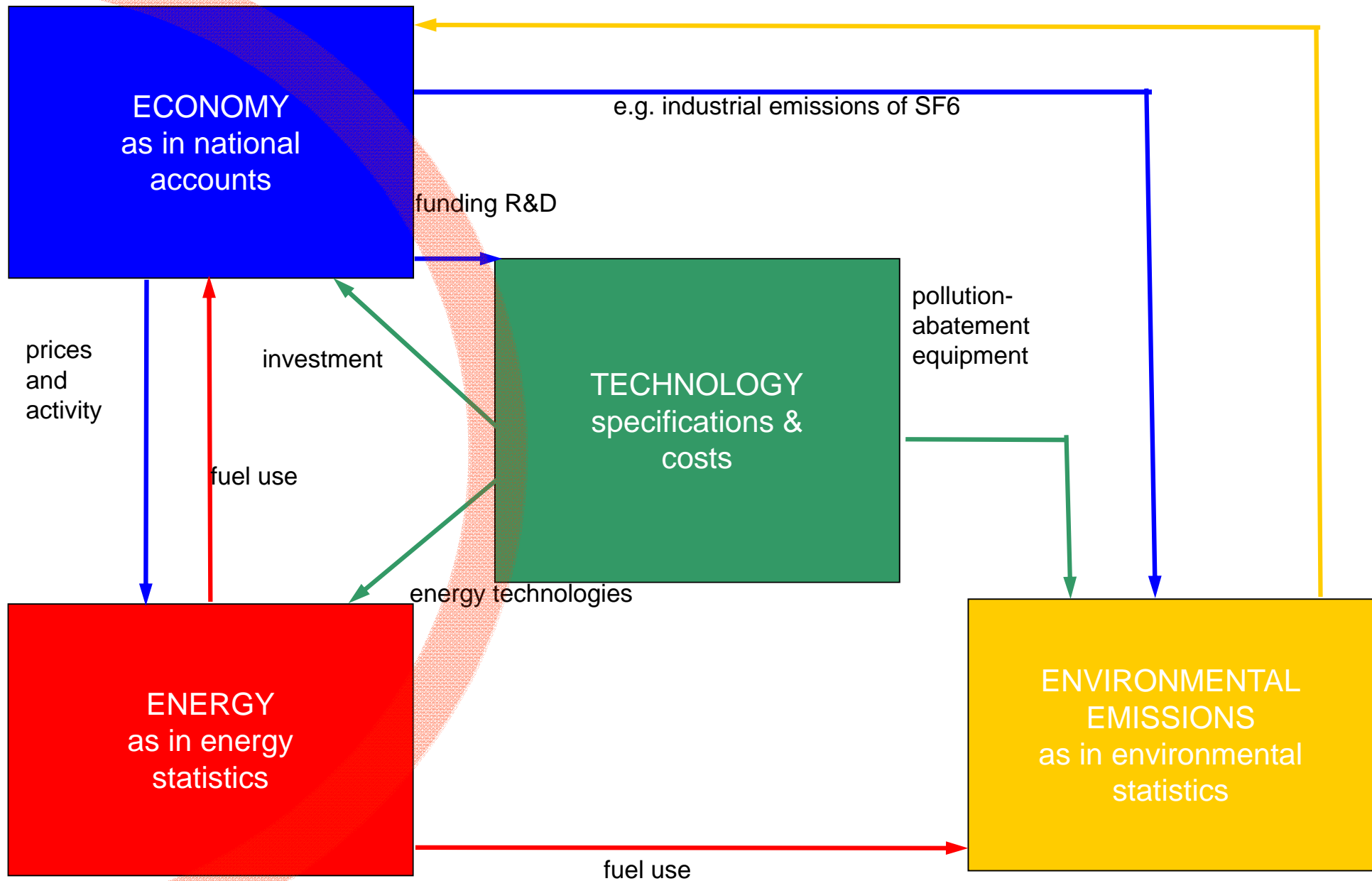


A workshop arranged by the Cambridge Trust for New Thinking in Economics
Thursday 4 July and Friday 5 July 2013, Madingley Hall, Cambridge, UK

Energy-Environment-Economy(E3) Model at the Global level - **E3MG**

- 21 political regions including 14 countries (incl. India, China, Brazil)
- forecasting up to 2100 (annually up to 2050)
- sector and product disaggregation (42 categories)
- an input-output framework
- regions linked using international bilateral trade data
- two-way linkages between the economy and the energy system
- 14 atmospheric pollutants (GHG and non-GHG)
- dynamic econometrically-estimated equations (data 1970-2010)
- Not a CGE model, post-Keynesian

E3MG structure



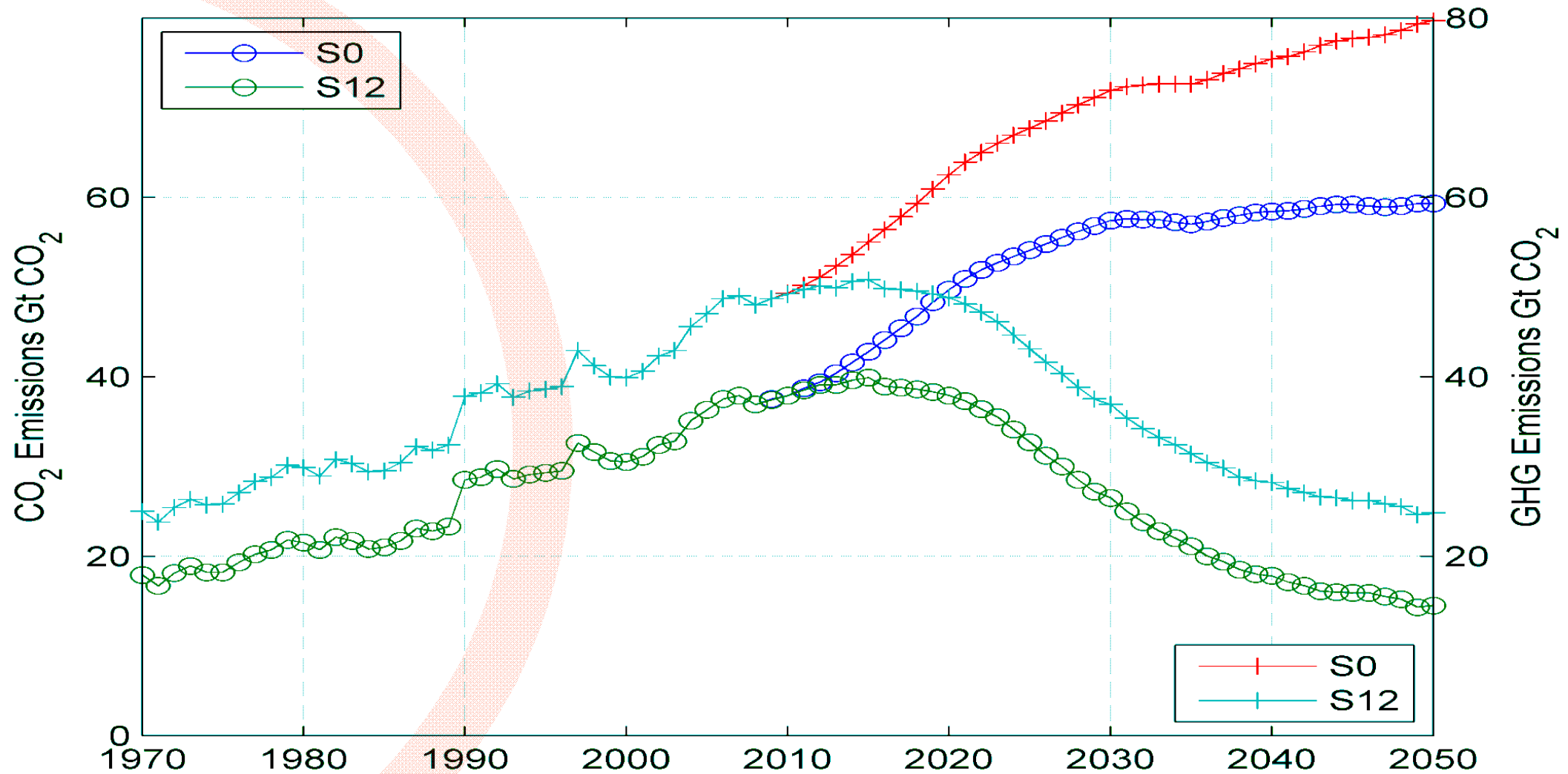
A study looking at decarbonising global economy to have a medium chance to achieve 2 degrees target by 2100

Focus on 2050

Reference scenario (S0) - no new climate change policies, but all currently existing policies in place over the entire study period 2013 - 2050

Decarbonisation scenario (S12) with a portfolio of climate policies to achieve the target (450 ppm)

Altogether 20+ different scenarios were modelled



Permit prices in Emission Trading Schemes for energy-intensive sectors, the decarbonised scenario, \$/tCO₂ (2009) prices

	2015	2020	2030	2050
USA	20	45	105	179
EU	31	45	105	179
China	2	7.5	105	179
World average all sectors	5.7	10.2	25.2	56.5

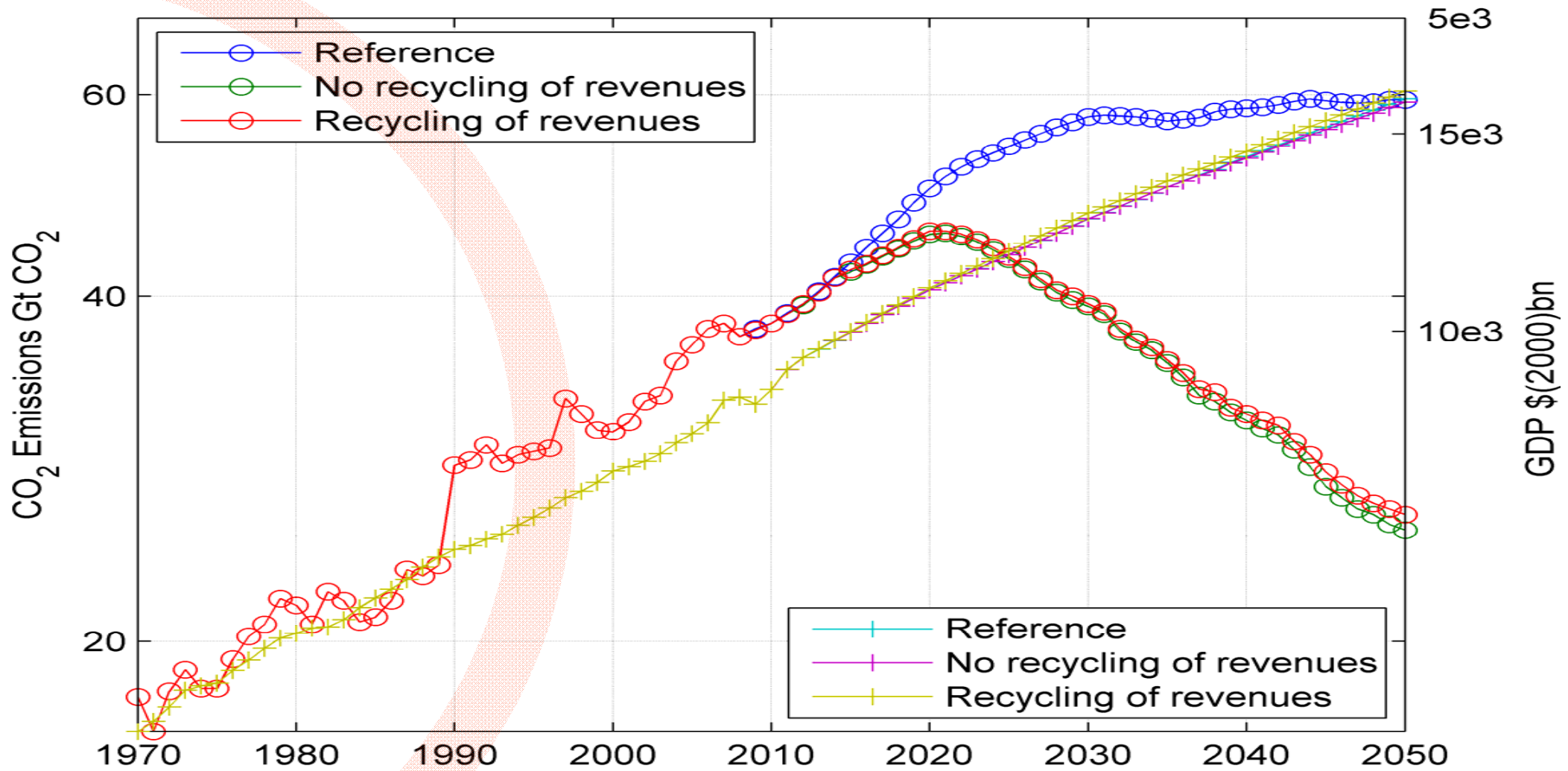
Source: E3MG modelling, Barker and Anger, 2013 – work in progress

Average annual world growth rates

	1970-2010	2010-2050	
Scenario	Reference	Reference	Decarbonisation
CO ₂ Emissions	1.9	1.1	-2.4
Final Energy Demand	2.4	1.6	0.3
GDP	3.0	2.6	2.7
Price index consumers' expenditure	4.3	2.4	2.3
Employment	1.6	0.6	0.7

Source: E3MG modelling, Barker and Anger, 2013 – work in progress

Growth rates



Source: E3MG modelling, Barker and Anger, 2013 – work in progress

Oil price falls in the decarbonisation scenario – less demand for fossil fuels and is 127 USD per barrel in 2050 compared to 207 USD per barrel in the reference scenario (in 2009 USD)

This fall needs to be compensated by increasing carbon prices and gradual removal of fossil fuel subsidies

Regulation support to avoid switching back to fossil fuels

Emissions trading systems for EU, USA, China and other major economies, developing countries benefit from technology spillovers

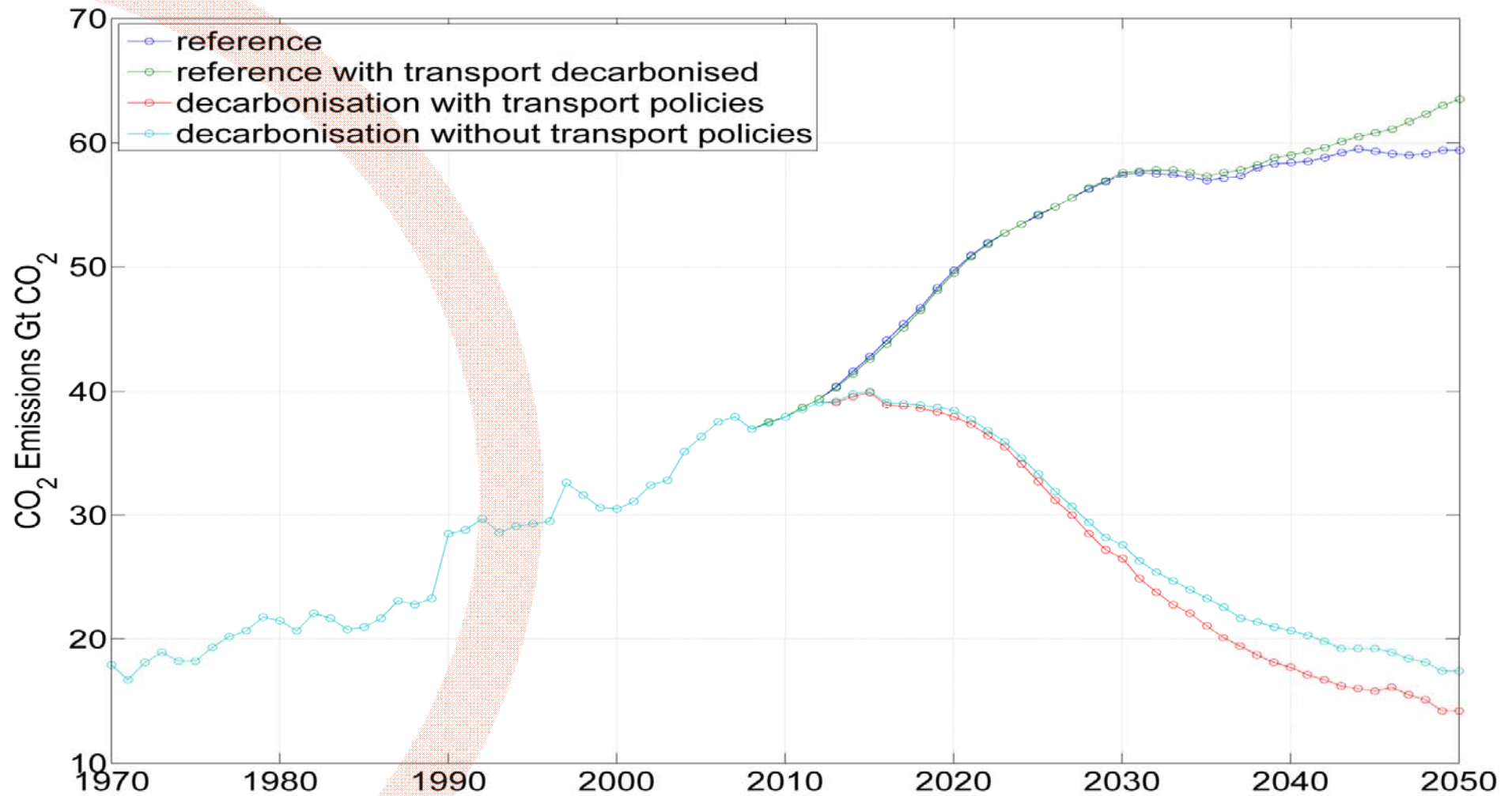
Average global carbon price 57 USD (in 2009 USD)

Additional investment and investment multiplier in 2020 in the decarbonisation scenario (billion 2000US\$)

Region	Additional investment	Total investment
United States	82.1	126.3
European Union	74.6	87.5
China	70.2	104.4
RoW	133.3	51.8
of which OPEC	15.6	- 65.2
World	360.2	370.1

Source: E3MG modelling, Barker and Anger, 2013 – work in progress

Global decarbonisation



Source: E3MG modelling, Barker and Anger, 2013 – work in progress

Market-based measures alone cannot achieve the targets, but can incentivise changes in technologies and cause spillovers

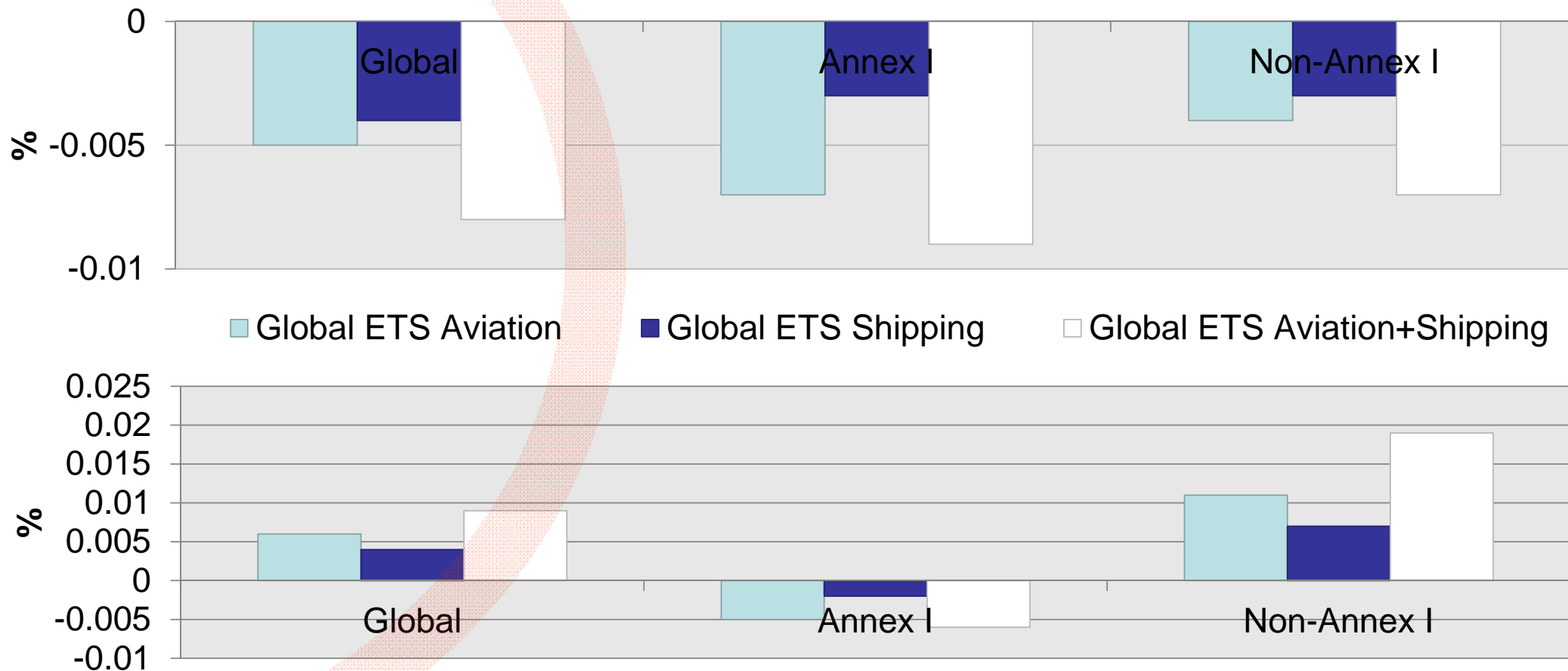
The measures include regulation, government and private investment, removal of fossil fuel subsidies and recycling of auctioning revenues by reducing personal taxes

Carefully designed and coordinated policy portfolio can benefit global economy

International co-operation inevitable, however there will be regional differences

A portfolio of various climate policy measures are needed to decarbonise the global economy

GDP impacts in 2025 when revenues are used to reduce personal taxes [15% allowances are auctioned and 100% opportunity costs are passed through to consumers, carbon price \$30 tCO₂] without and with CDM revenue usage



Source: Anger et al, 2013 – to be published

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Thank you!

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