Socio-economic opportunities

in Europe from a more comprehensive Circular Economy Package

A Presentation to the DYNAMIX/POLFREE Policy Platform
'An ambitious Circular Economy Package for Europe'

Paul Ekins
Professor of Resources and Environmental Policy
Director, UCL Institute for Sustainable Resources
University College London

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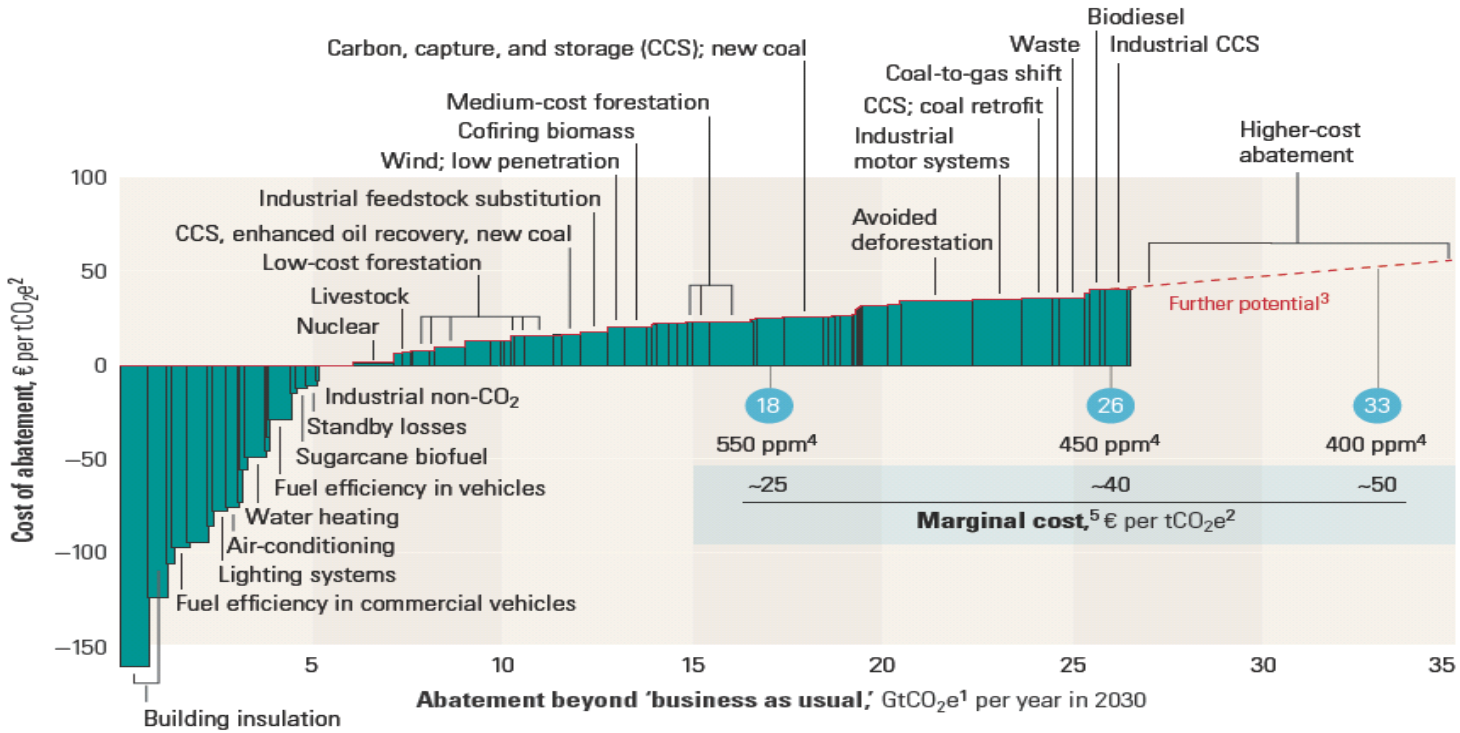
Sources of evidence on the economic implications of increasing resource productivity

- Microeconomic insights (cost analysis)
- Macroeconomic insights (from modelling)
- Sectoral insights (from partial equilibrium analysis)
- Labour market insights (from experience with labour market interventions)
- Whistle-stop tour of the issues and results

The (micro)economic cost: global cost curve for greenhouse gas abatement



[1]$GtCO_2e$ = gigaton of carbon dioxide equivalent; "business as usual" based on emissions growth driven mainly, by increasing demand for energy and transport around the world, and by tropical deforestation.
[2]tCO_2e = ton of carbon dioxide equivalent.
[3]Measures costing more than €40 a ton were not the focus of this study.
[4]Atmospheric concentration of all greenhouse gases recalculated into CO_2 equivalents; ppm = parts per million.
[5]Marginal cost of avoiding emissions of 1 ton of CO_2 equivalents in each abatement demand scenario.

Source: A cost curve for greenhouse gas reductions, The Mckinsey Quarterly, February 2007

Estimating the macro-economic cost of increasing resource productivity

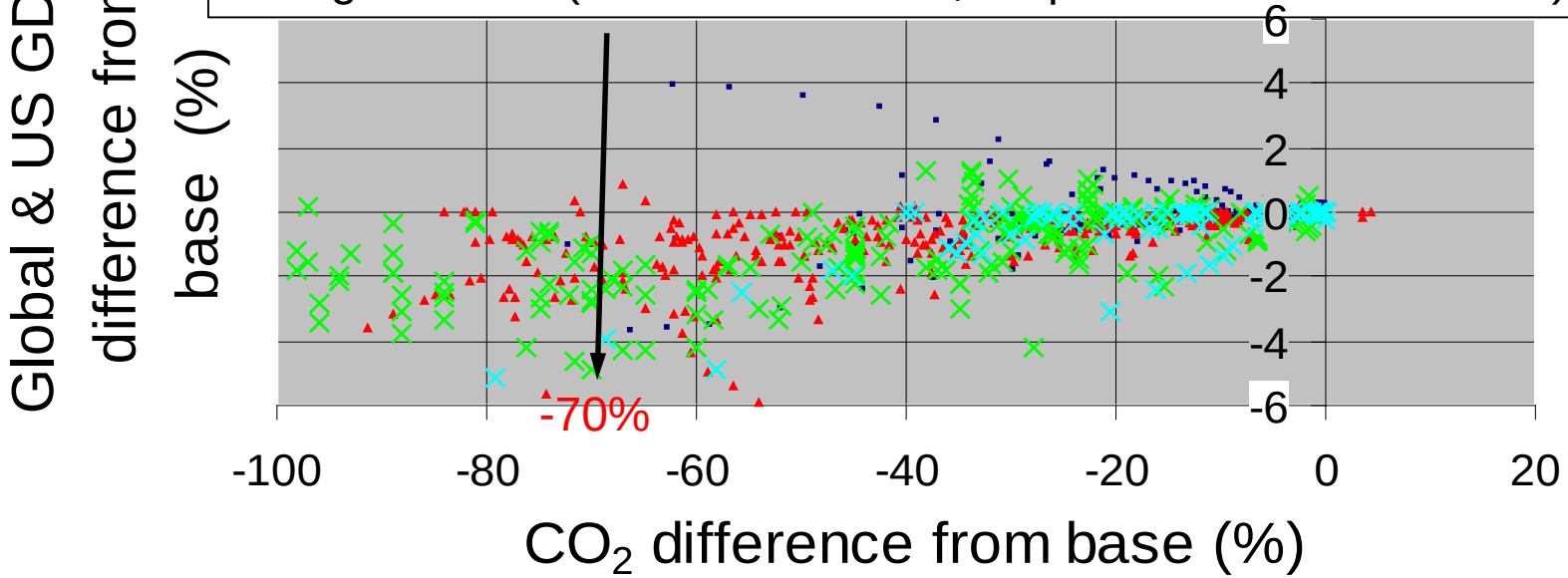
- Models are essential to integrate cost data in a representation of
  - The economy: macro-econometric/general equilibrium models
  - Good models are 'garbage in – garbage out'; getting the inputs right
- Model results depend on three crucial factors:
  - *The robustness of the model structure.* The model should be theoretically sound, well represented in the scientific literature, and based on robust data.
  - *The plausibility of the input assumptions*. The input assumptions should be plausible.
  - *The quality of the data*. The data should be recent, and come from expert, independent sources, generated in the main by official agencies or engineering consultancies on official contracts.
- No time in this presentation to present these issues but they are really important

Macroeconomic modelling issues

- Major issues with macroeconomic modelling
  - **Lack of representation of environmental damage, so that baselines lack credibility and climate change mitigation nearly always shows up as costs (unless it is possible to correct other economic distortions [e.g. through reducing labour taxation])**
  - Inadequate representation of innovation processes
  - Standard CGE representation of full employment (not so in macro-econometric models, e.g. MDM-E3, GINFORS)

Scatter plot of model cost projections, 2000-2050

Each point refers to one year's observation from a particular model for changes from reference case for CO2 and the associated change in GDP (from four sources, for periods over 2000-2050)



- IMCP with ITC dataset
- post-SRES dataset
- WRI dataset (USA only)
- EMF-21 with multigas

- Source: Barker et al. 2006 (cited in Stern 2007, p.270).

Projections from the 2011 UNEP Green Economy Report

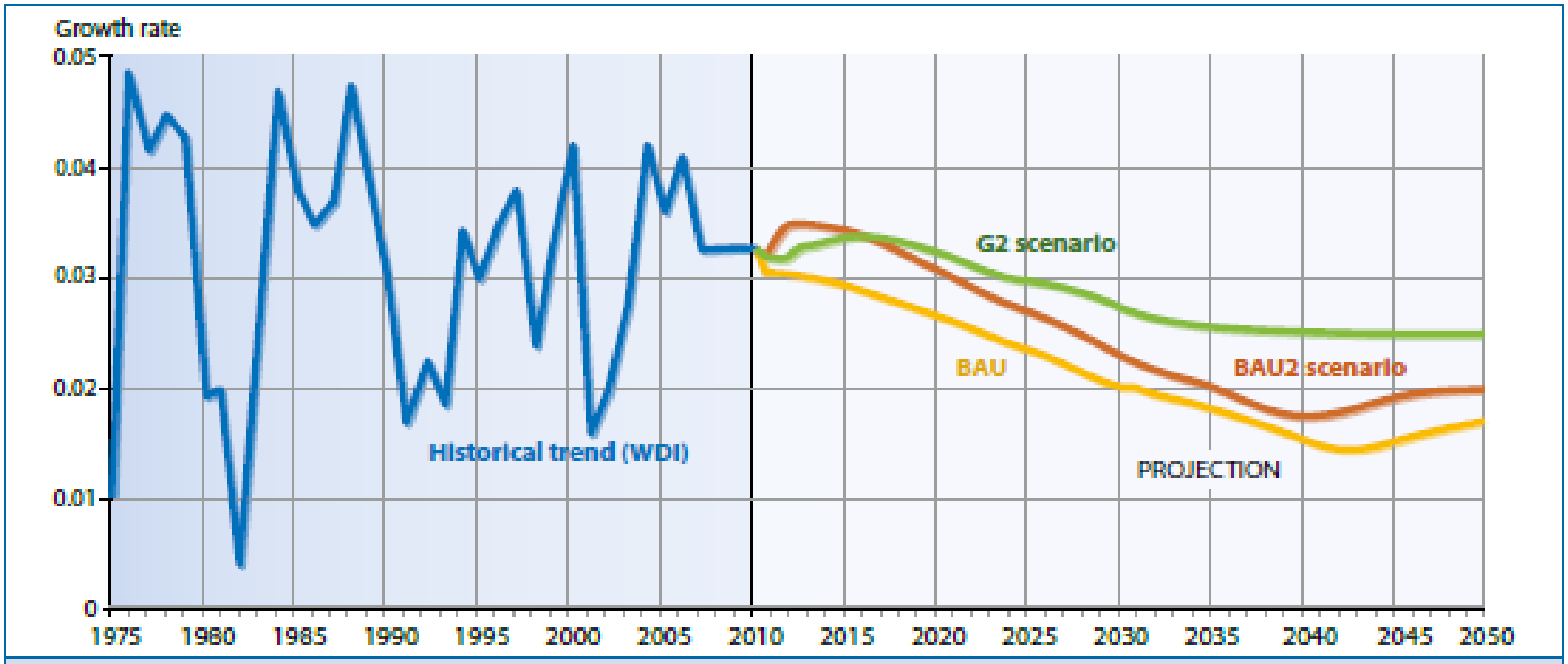


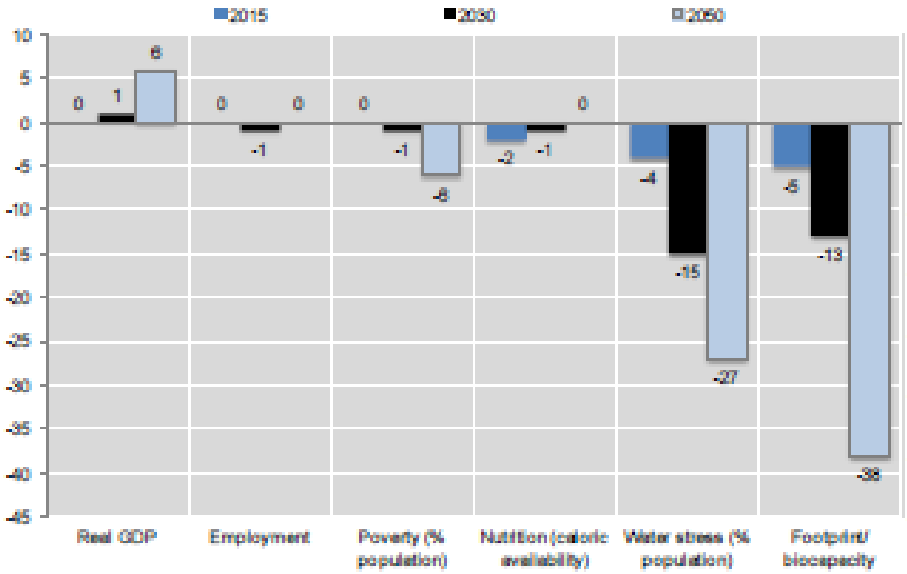
Figure 13: Trends in annual GDP growth rate, historical data (WDI, 2009) and projections in BAU, BAU2 and G2 scenarios

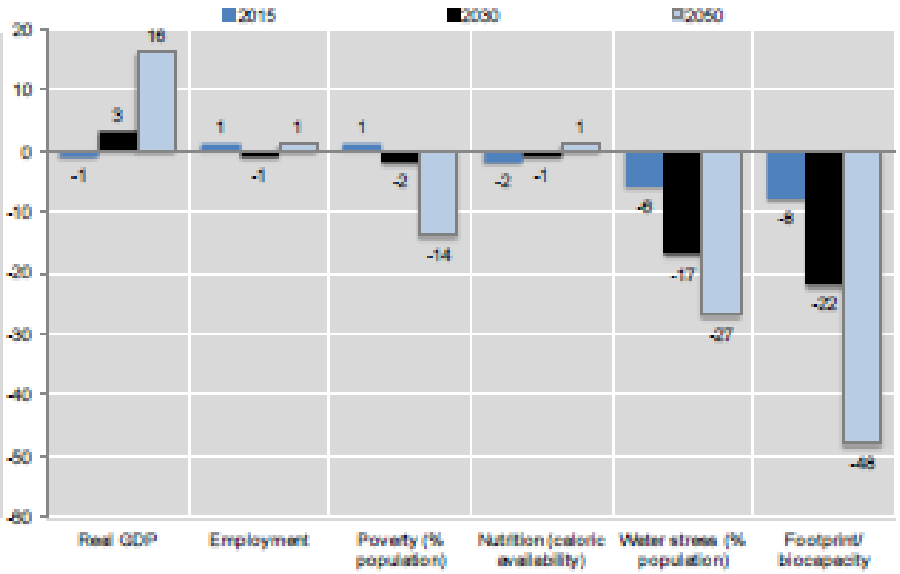
Source: UNEP 2011, Figure 13, p.519

Projections from the 2011 UNEP Green Economy Report

Source: OECD 2014 *Greener Skills and Jobs*, OECD Green Growth Studies, OECD, Paris

RESULTS OF GREEN 1 AND 2 SCENARIOS AGAINST BUSINESS-AS-USUAL





Cambridge Econometrics' E3ME

- Integrated treatment of the world's economies, energy systems, emissions and material demands
- High level of disaggregation
- Strong empirical basis for analysis (econometric model)
- Not limited by many of the restrictive economic assumptions

Resource Efficiency: RMC Study

Study on Modelling of the Economic and Environmental Impacts of Changes in RMC
(DG Environment, European Commission, 2013)

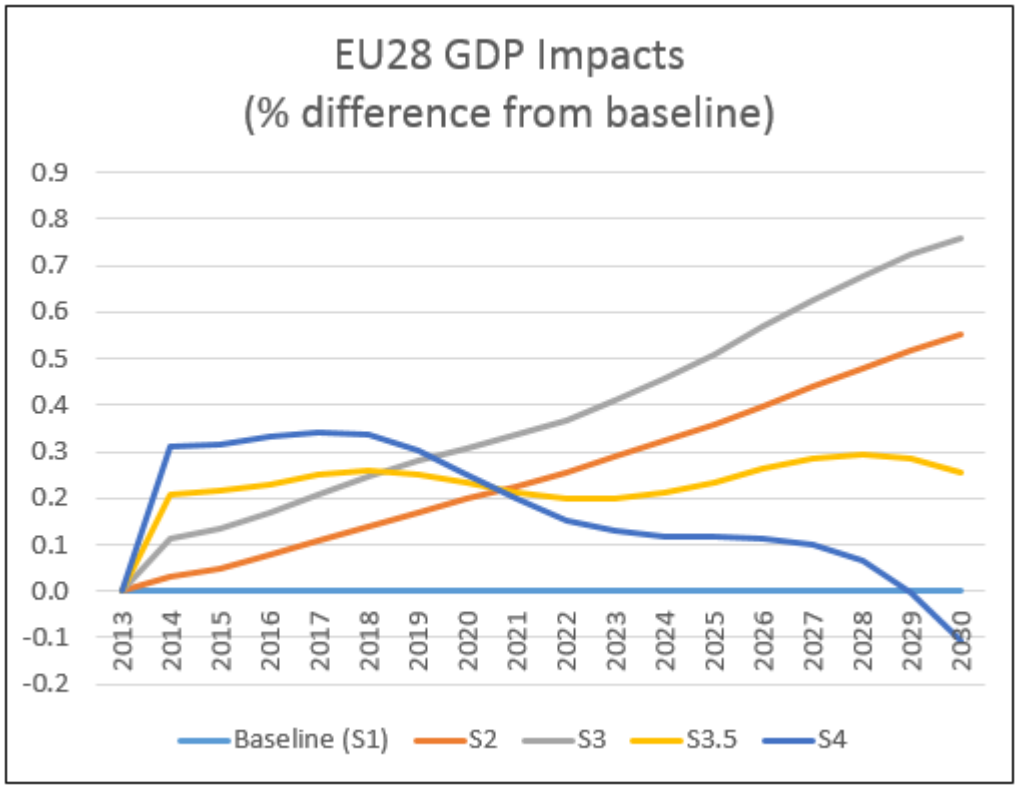
"To assess the economic, social and environmental impacts of alternative policy packages to improve European resource productivity (RP), as measured by Raw Material Consumption (RMC) per unit of GDP"

e3me

Policy Assumptions

- The final policy mix includes:
  - 1/3 publicly funded investments in the capital stock to improve resource efficiency
  - 1/3 privately funded business measures (such as recycling systems)
  - 1/3 market-based instruments (MBI) (such as tax)
- RMC reductions in the scenarios come from the least cost (or highest benefit) options first and move on to more expensive ones as the resource productivity targets become more ambitious

Macroeconomic Impacts



Overall resource productivity improvement between 2014 and 2030

Scenario	Description	Approximate Improvement (2014-30)
S1	Baseline	14 %
S2	Modest and flexible improvement	15%
S3	Enhanced and flexible improvement	30%
S3.5	Further enhanced and flexible improvement	40%
S4	Ambitious and flexible improvement	50%

e3me

Summary of Findings

- Absolute decoupling of material consumption is possible
- Cutting down resource consumption helps boost EU28 GDP by
  - promoting resource and energy efficiency R&D investment
  - reducing EU dependency on raw material imports
  - boosting household income by using tax revenues to reduce other tax rates
- Two million additional jobs in the EU could be created in S3
  - from higher investment and reduction in labour costs
- Beyond RP improvement of 2%pa (S3) improvement options are becoming more expensive

Impact Assessment of the Circular Economy Package

http://ec.europa.eu/environment/circular-economy/

Options assessed:

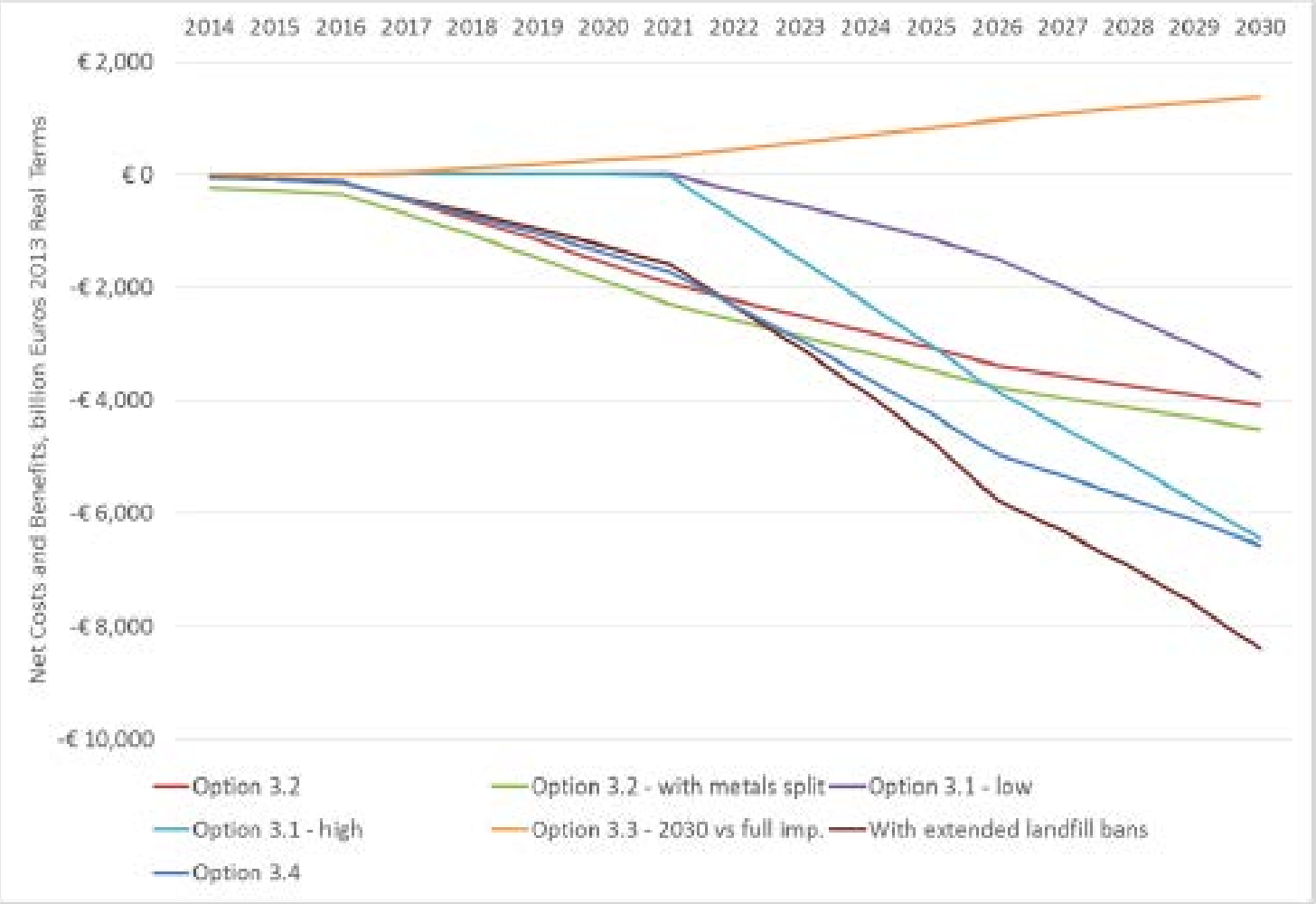
- **Option 1:** Ensuring full implementation of existing EU target commitments
- **Option 2:** Simplification, improved monitoring, diffusion of best practices
- **Option 3:** Upgrading EU targets, with various sub-options:
- Option 3.4: combination of 3.1 (Increase the recycling/reuse target for municipal waste by 2030 to 70% (or 60%)); 3.2 (Increase the re-use/recycling targets for packaging waste by 2030 to 80% overall reuse/recycling)); 3.3 (Phasing out landfilling of recoverable municipal waste (ban on plastic/paper/glass/metals by 2025 (max 25% landfilling), global ban by 2030 (max 5%))
- Options 3.5, 3.6: Same as option 3.4 with different deadlines for different countries
- Option 3.7: Same as option 3.4 with landfill ban on all similar waste

Costs and benefits

Option	Financial costs (NPV 2014-2030), € billion (1)	External costs (NPV 2014-2030) € billion (2)	Net social costs (1+2)	Jobs (FTEs in 2030)	GHG million tonnes $CO2_{eq}$ (2030)	GHG million tonnes $CO2_{eq}$ (2014-2030)
Option 3.1- low	-3.73	-3.96	-7.69	78,519	-23	-107
Option 3.1- high	-8.41	-8.49	-16.91	137,585	-39	-214
Option 3.2	-11.2	-8.45	-19.66	107,725	-20	-183
Option 3.2 – metal split	-13.48	-10.05	-23.53	107,643	-24	-250
Option 3.3	5.64	-0.65	4.99	46,165	-13	-49
Option 3.4	-12.65	-13	-25.65	177,637	-44	-308
Option 3.5 and 3.6	-13.62	-13.58	-27.2	177,628	-44	-320
Option 3.7	-10.7	-18.3	-29		-62	-443

Note, negative costs represent a benefit

Net social costs compared to Option 1



Conclusions of the Impact Assessment

- Reduction in the administrative burden, in particular for SMEs, through simplification and better implementation including by keeping the targets 'fit for purpose'
- The creation of more than 180.000 direct jobs by 2030
- GHG emission reduction of around 443 millions of tons of GHG between 2014 and 2030
- Positive effects on the competitiveness of the EU waste management and recycling sectors as well as on the EU manufacturing sector
- Marine litter levels 13% lower by 2020 and 27.5% lower by 2030
- Reinjection into the EU economy of some 50 million tonnes more secondary raw materials (paper/cardboard, plastics, metals, glass) than were recycled in 2011

Macroeconometric modelling evidence on environmental tax reform (ETR) or green fiscal reform (GFR)

Definition: ETR is the shifting of taxation from 'goods' (like income, profits) to 'bads' (like resource use and pollution)

- COMETR: Competitiveness effects of environmental tax reforms, 2007. http://www2.dmu.dk/cometr/ (What is the experience to date of ETR in Europe?)
- petrE: 'Resource productivity, environmental tax reform (ETR) and sustainable growth in Europe'. One of four final projects of the Anglo-German Foundation under the collective title 'Creating Sustainable Growth in Europe'. Final report published October 29, Berlin, November 25, London. www.petre.org.uk
- UK Green Fiscal Commission. Final report published October 26, London. www.greenfiscalcommission.org.uk

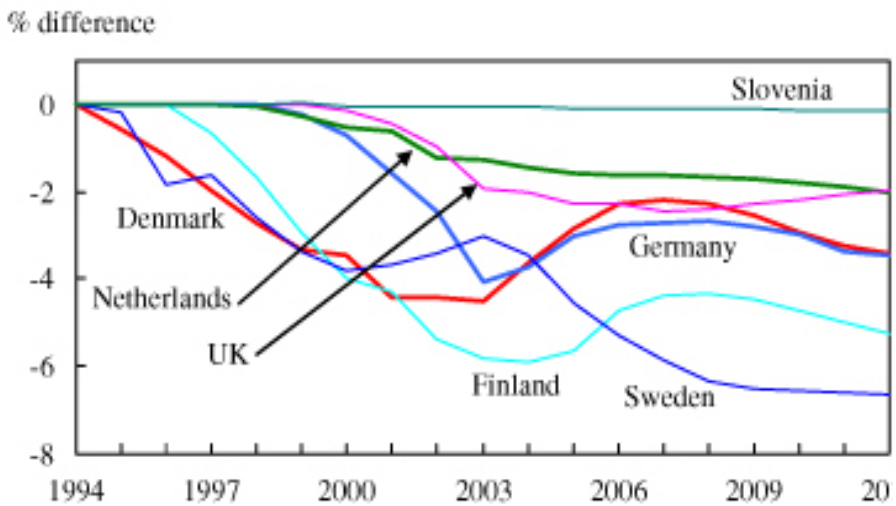
What is the experience to date of ETR in Europe?

- Six EU countries have implemented ETRs: Denmark, Finland, Germany, Netherlands, Sweden, UK
- The outcomes – environmental and economic – have been broadly positive: energy demand and emissions are reduced; employment is increased; effects on GDP are very small
- Effects on industrial competitiveness have been minimal, BUT
- ETRs so far have been very small

- See Andersen, M.S. & Ekins, P. (Eds.) *Carbon Taxation: Lessons from Europe*, Oxford University Press, Oxford/New York, 2009

Environmental and economic impacts of ETR, from COMETR study, 2007

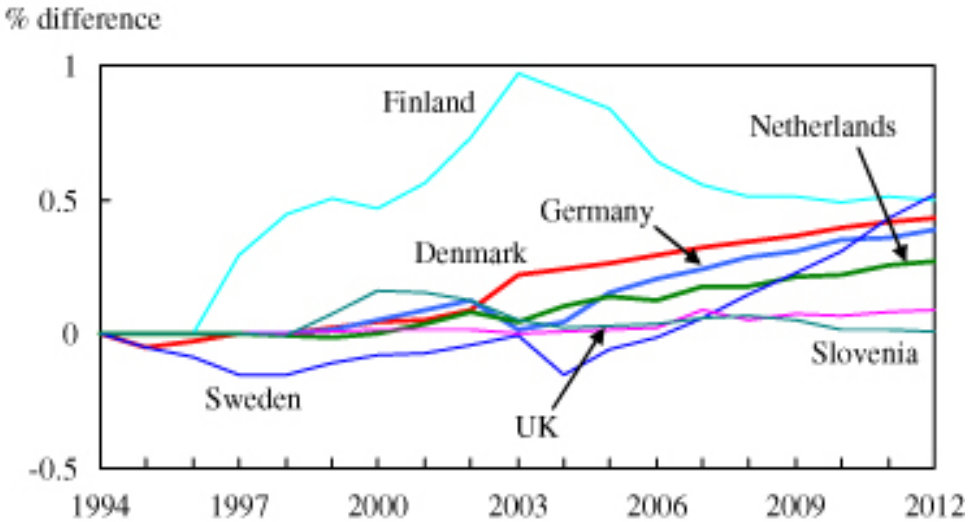
CHART 2: THE EFFECT OF ETR ON GHG EMISSIONS



Note(s) : % difference is the difference between the base case and the counterfactual reference case.

Source(s) : CE.

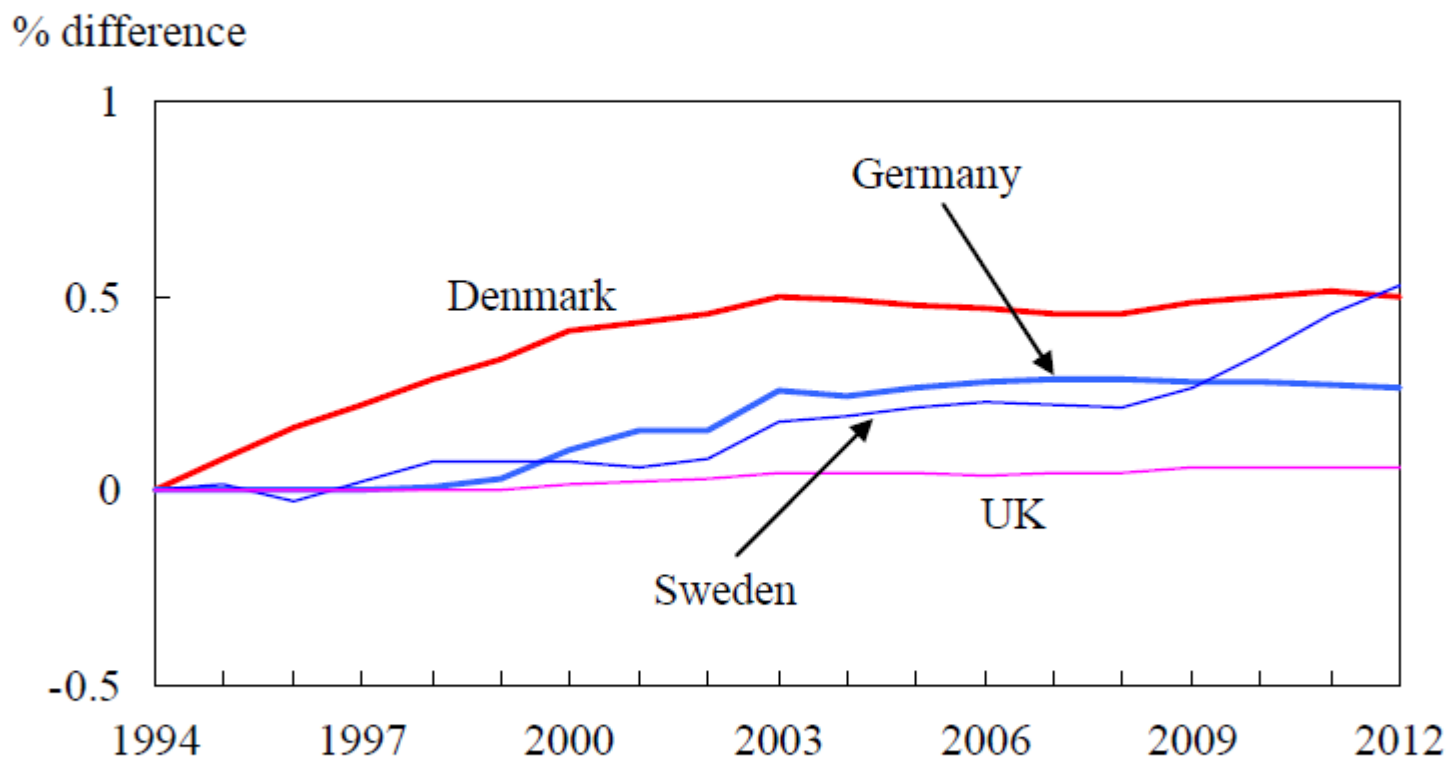
CHART 3: THE EFFECT OF ETR ON GDP



Note(s) : % difference is the difference between the base case and the counterfactual reference case.

Source(s) : CE.

CHART 7.6: THE EFFECT OF ETR ON EMPLOYMENT



Note(s) : % difference is the difference between the base case and the counterfactual reference case.

Source(s) : CE.

What might a large-scale ETR in Europe look like?

- Two European macro-econometric models: E3ME, GINFORS
- Six scenarios that meet EU carbon reduction targets in 2020 (20%/30% reductions)

Ekins, P. & Speck S. Eds. 2011 *Environmental Tax Reform: A Policy for Green Growth*, Oxford University Press, Oxford

What might a large-scale ETR in Europe look like?

Scenario	CO_2 price Euro2008/t	GDP % change from baseline	Employment % change from baseline	Labour productivity % change from baseline
S1(L)				
E3ME	142	0.6	2.2	-1.6
GINFORS	120	-3.0	0.0	-3.0
S1(H)				
E3ME	59	0.2	1.1	-0.9
GINFORS	68	-0.6	0.4	-1.0
S2(H)				
E3ME	53	0.8	1.1	-0.3
GINFORS	61	-0.3	0.4	-0.7
S3(H)				
E3ME	204	0.5	2.7	-2.1
GINFORS	184	-1.9	0.8	-2.6

Conclusions on employment effects of Environmental Tax Reform

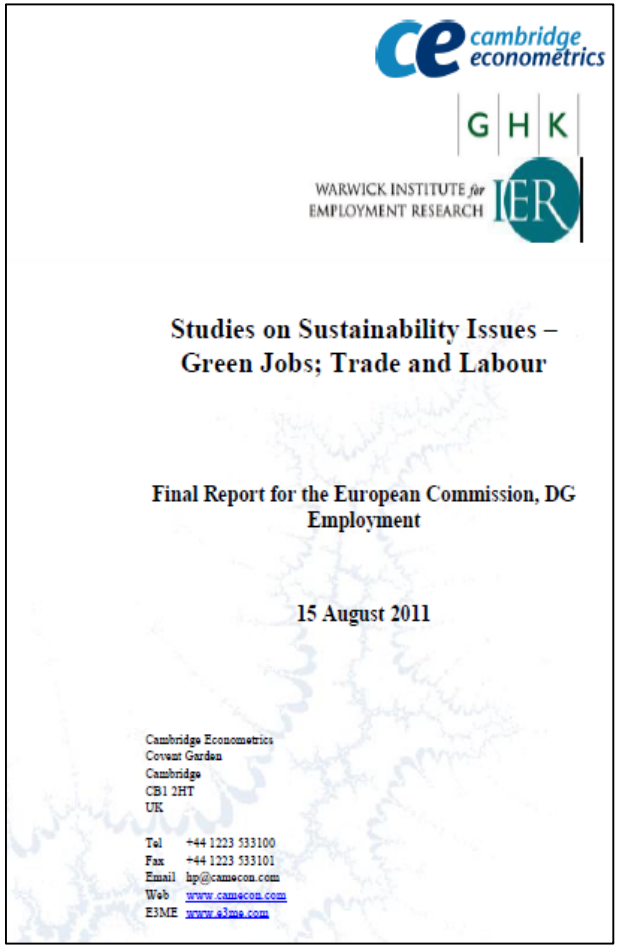
- Effect on labour market is small (no huge boost to net employment from ‘green jobs’)
- Might be positive with certain kinds of revenue recycling
- NO evidence of significant and negative overall effects on the labour market

Modelling 'Green Jobs'

With thanks for slides to Cambridge Econometrics

- Three European Commission studies from the past four years:
  - 'Green Jobs' – carried out for the European Commission, DG Employment, with a focus on the effects of environmental policy on labour markets
  - 'Green Skills' – carried out for CEDEFOP (the EU skills agency), with a focus on training and skills requirements
  - 'Employment effects of the energy roadmap' – carried out for the European Commission, DG ENER, with a focus on EU labour markets and potential bottlenecks
- Each study has a slightly different focus, although many of the underlying issues are similar
- Emphasis in this presentation on macroeconomic effects rather than skills issues

The ‘Green Jobs’ study



cambridge econometrics

GHK

WARWICK INSTITUTE for EMPLOYMENT RESEARCH IER

Studies on Sustainability Issues – Green Jobs; Trade and Labour

Final Report for the European Commission, DG Employment

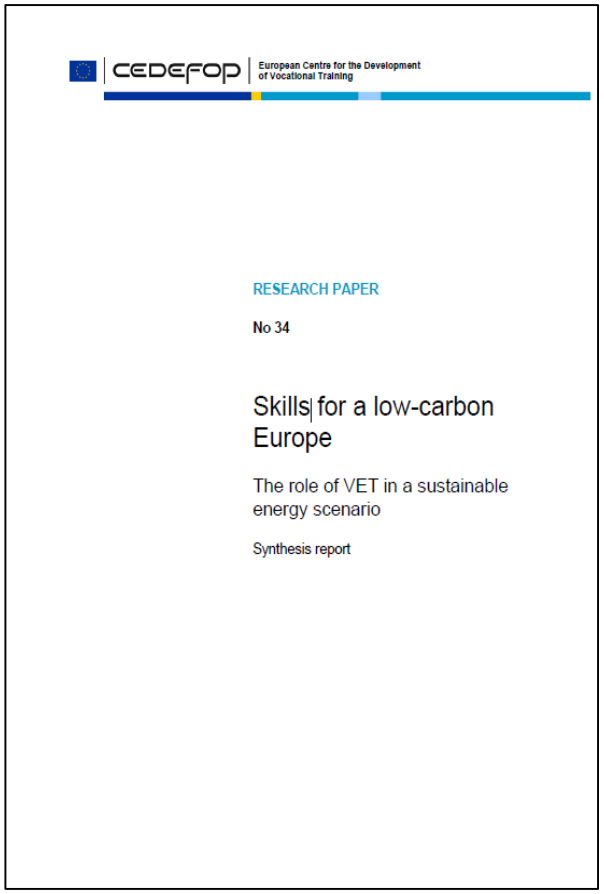
15 August 2011

Cambridge Econometrics
Covent Garden
Cambridge
CB1 2HT
UK

Tel +44 1223 533100
Fax +44 1223 533101
Email hp@camecon.com
Web www.camecon.com
E3ME www.e3me.com

- The first comprehensive overview of the issue at EU level
- Team involved Cambridge Econometrics, GHK Consulting and IER (Warwick)
- Combined qualitative and quantitative assessment approaches to assess the EU’s ‘20-20-20’ targets
- Available online: http://ec.europa.eu/social/BlobServlet?docId=7436&langId=en

The 'Green Skills' study


CEDEFOP | European Centre for the Development of Vocational Training

RESEARCH PAPER

No 34

Skills for a low-carbon Europe

The role of VET in a sustainable energy scenario

Synthesis report

- Expanded on the previous work for DG Employment
- Team included GHK, Cambridge Econometrics and IER (Warwick)
- Analysed a combination of the EU's environmental and employment targets
- Particular emphasis on skills
- CEDEFOP's publication: http://www.cedefop.europa.eu/EN/Files/5534_en.pdf

Employment Effects of the Energy Roadmap

WARWICK INSTITUTE for EMPLOYMENT RESEARCH IER

cambridge econometrics

exergia ENERGY & ENVIRONMENT CONSULTANTS

ERNST & YOUNG

E3M - Lab

Employment Effects of selected scenarios from the Energy roadmap 2050

Final report for the European Commission (DG Energy)

October 2013

Cambridge Econometrics
Covent Garden
Cambridge
CB1 2HT
UK

Tel +44 1223 533100
Fax +44 1223 533101
Email hp@camecon.com
Web www.camecon.com

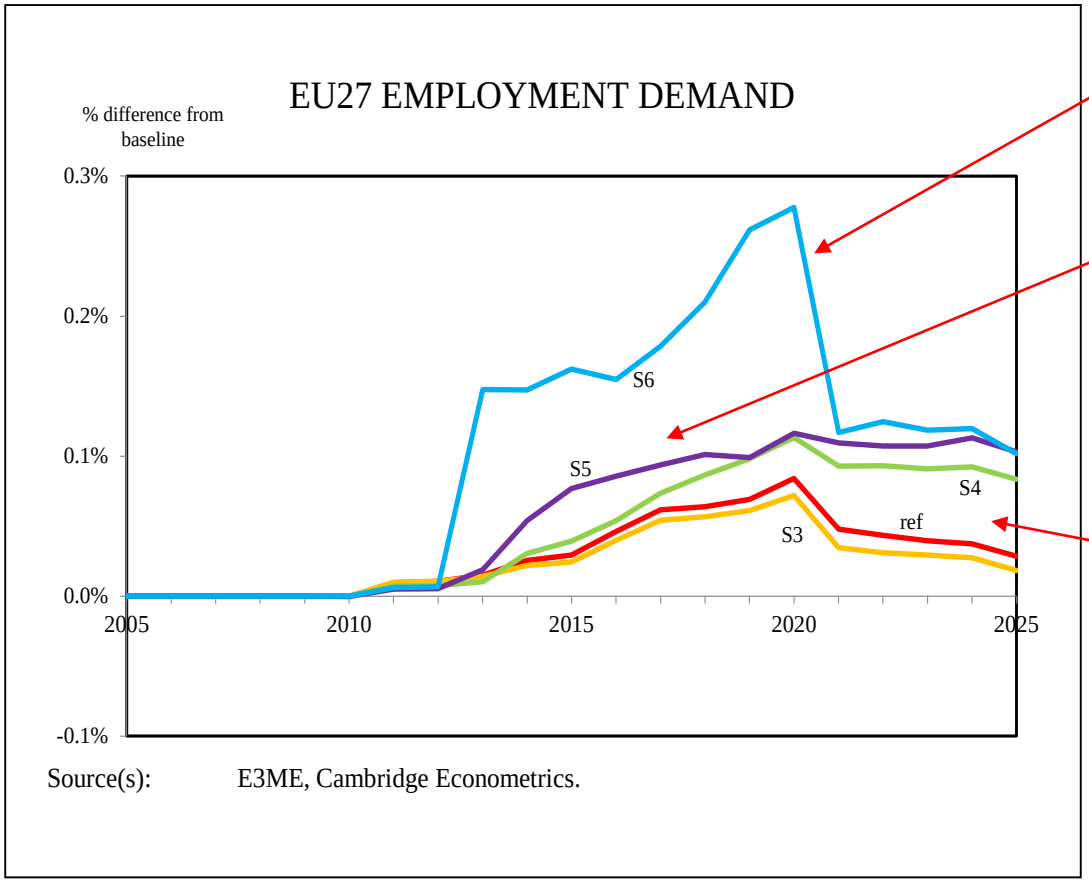
COWI

- Expanded on the previous work for DG Employment
- Team included Cambridge Econometrics, E3M-Lab (NTUA), Ernst & Young, Exergia, GHK and IER (Warwick)
- Considered longer-term (2050) impacts and used both macro-econometric and CGE modelling approaches
- DG ENER published results in early 2014: http://www.cedefop.europa.eu/EN/Files/5534_en.pdf

Macroeconomic modelling of labour markets

- When considering whole economy (net) impacts, there are two standard approaches. However, there are important conceptual differences between the two modelling approaches; and these are particularly relevant for labour market modelling
  - CGE modelling (e.g. GEM-E3, or GTAP): tend to operate according to the basic theoretical insight that markets clear, economy tends to optimal equilibrium, with no involuntary unemployment, government interventions show up as costs unless inefficiencies have been deliberately introduced into the baseline; other usual characteristics include single representative agents (households and firms) and equation parameters for the starting year imported from elsewhere
  - macro-econometric modelling (e.g. E3ME, or GINFORS): theoretically plausible relationships are parametrised using econometric estimation base of extensive data time series
- Both approaches will tell you roughly the same thing – the impacts of environmental policy on GDP and sectoral employment
  - they will probably not tell you the impact on occupations or skills, or the number of ‘green’ jobs

Selected Results (Green Jobs study)



High energy efficiency

30% GHG reduction target

Different ways of meeting the 20-20-20 targets

Source: 'Green Jobs' report, Cambridge Econometrics et al (2011)

Employment Effects of the Energy Roadmap

- The scenarios show different ways of meeting the EU's 2050 decarbonisation targets
- Two models were run – the macro-econometric E3ME model and the CGE GEM-E3 model
- Employment results are shown on the next slide; first GDP impacts
  - S1 – High energy efficiency
  - S2 – Diversified energy supply
  - S3 – High renewables
  - S4 – Delayed CCS
  - S5 – Low nuclear

Table 8.2: Comparison of the two models' results for the impacts on GDP in the scenarios

	S1	S2	S3	S4	S5
					% difference in GDP from CPI baseline in 2050
E3ME	2.9	2.3	2.0	2.2	2.2
GEM-E3	-0.6	-0.8	-0.8	-0.9	-0.7

Sources: E3ME and GEM-E3 models.

Source: Employment Effects of the Energy Roadmap, Cambridge Econometrics et al (2013)

Employment Effects of the Energy Roadmap

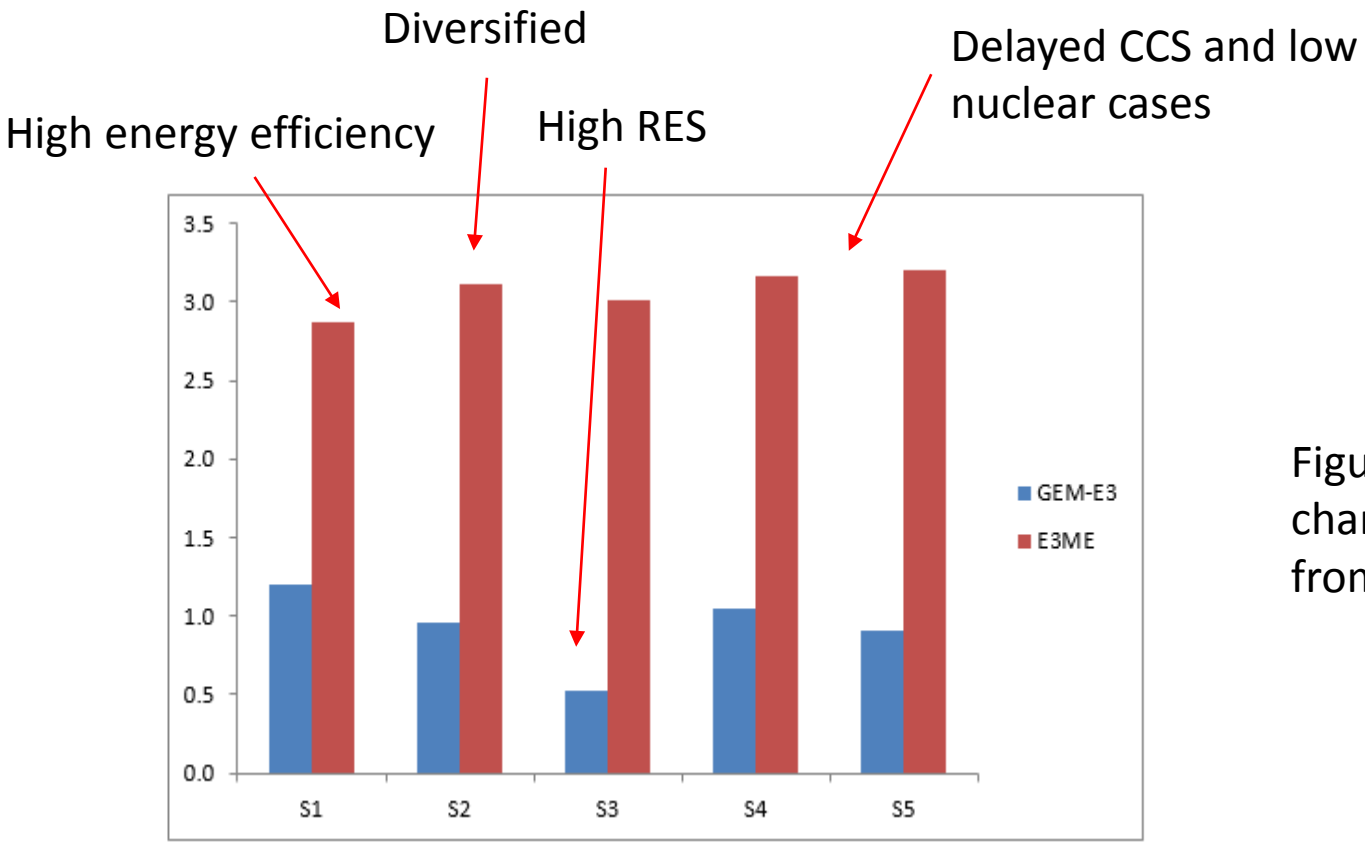


Figure shows % change in employment from baseline, 2050

Source: Employment Effects of the Energy Roadmap, Cambridge Econometrics et al (2013)

Overall conclusions

- The available modelling tools tend to suggest that environmental policy will have a modest economic impact (could be positive or negative depending on the model) at macro level
- There are some very consistent trends in the sectors that could gain or lose out, with the most uncertainty about the energy-intensive manufacturing sectors
- Employment effects will also be modest, and small when compared to the job creation and destruction that goes on in the economy anyway
- There is the potential for skills mismatches at the very detailed level, both in terms of vacancies that cannot be filled and workers that cannot find suitable jobs – but this goes beyond the level of detail offered by macroeconomic modelling
- A combined quantitative/qualitative approach is therefore required to give a comprehensive overview

Sectoral issues (1)

from discussion at CEDEFOP/OECD Green Skills Forum

- Substantial market-induced labour market churn (sectoral shifts in employment) in OECD economies (20%, 1995-2005)
- Very small labour market effects from green growth policies (1% projection) BUT
- Large losses in employment in some sectors
  - More likely to be older and low-skilled workers
  - May be in sectors with lower labour mobility
  - May be geographically concentrated by region ('unemployment hotspots')
  - May be geographically concentrated by country – some countries have higher concentrations of polluting industry
  - **Substantial adjustment cost, hard to address, political clout and lobbying power – proving a major political constraint on carbon-reduction policy**

Sectoral issues (2)

- Net jobs not gross jobs – despite their superficial political attraction, reckless estimates of gross jobs in particular sectors are misleading and could be counter-productive
- Meaninglessness of 'green jobs'
  - Central challenge is to make *all* jobs greener
  - Useful to quantify jobs in environmental goods and services (EGS) sectors or environment-related activities (ERA): pollution management, cleaner production and technologies, resource management [Eurostat]; environmental consultants, planning administration, nature and landscape conservation (Germany)
  - Jobs are getting greener if sectoral resource efficiency improves over time (e.g. vehicle efficiency, school facilities managers)

Conclusions on increased resource productivity: glass half empty

(good policy will minimise the impacts of the 'buts')

1. Increasing resource productivity can save firms money: some firms, *but* others will lose out
2. Increasing resource productivity can yield macro-economic benefits (GDP and employment), especially from reduced imports, *but* some sectors will lose out
3. Increasing resource productivity can increase resource security, giving insulation from price increases and volatility, *but* the extent of future resource insecurity is uncertain and addressing it requires a long-term approach
4. Increasing resource productivity can increase environmental quality, *but* this has a low political priority, especially where it is seen to require regulation

Conclusions on increased resource productivity: glass half full

- Negative cost opportunities for resource efficiency
- Innovation and investment: new technology, economic activity, exports
- Increased resource security (reduced vulnerability): food, water, energy, rare materials
- Environmental improvement: reduced GHG emissions, waste to landfill, extraction of virgin materials
- International credibility, and exports, as the global community gradually goes in the same direction
- None of these benefits can be achieved without government intervention to provide massively increased information through a new knowledge infrastructure, and incentives and regulation to guide innovation in the direction of greater resource productivity

References for some of the figures

- Barker, T., Qureshi, M. & Köhler, J. 2006 'The costs of greenhouse gas mitigation with induced technological change: A meta-analysis of estimates in the literature', mimeo, Cambridge Centre for Climate Change Mitigation Research (4CMR), University of Cambridge, Cambridge
- Stern, N. 2007 *The Economics of Climate Change: the Stern Review*, Cambridge University Press, Cambridge
- UNEP (United Nations Environment Programme) 2011 *Green Economy Report*, UNEP, Nairobi, http://www.unep.org/greeneconomy/GreenEconomyReport/tabid/29846/Default.aspx

Thank you

p.ekins@ucl.ac.uk

www.bartlett.ucl.ac.uk/sustainable