FP6 project no. 018476-GOCE : Adaptation and Mitigation Strategies: Supporting European Climate Policy

Foreseeing Mitigation

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Achieving the EU's 2˚C target through carbon trading

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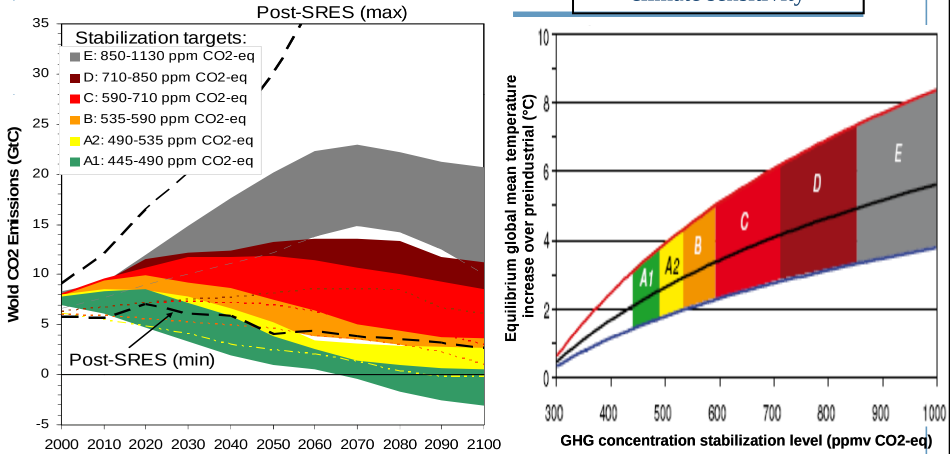
Outline

- The EU's 2˚C target and climate change
- Implications for GHG reductions and carbon prices
- Current and prospective EU policies
- Global policy implications
- Feasibility and costs of rapid decarbonisation

Figure 2: Average global temperatures, GHG concentrations and emissions 2000-2100

Range comes from diferent models

Range comes from alternative estimates of climate sensitivity



Multigas and CO_2 only studies combined

Note lack of studies below 450ppmv-CO_2-eq

Source: IPCC WG3 SPM 2007

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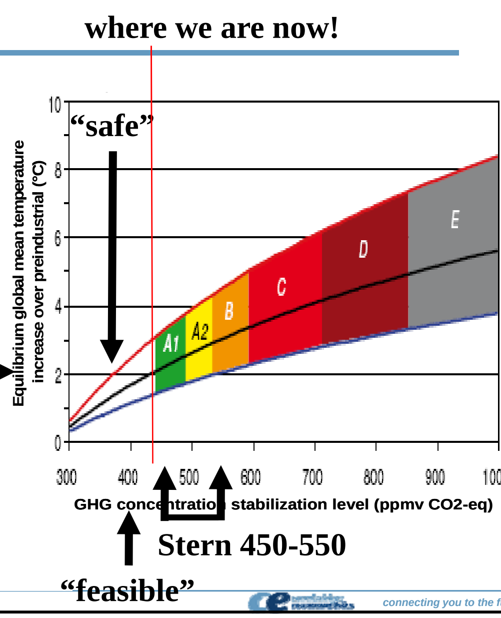
EU temperature target, Stern's concentration range and "safe" and "feasible" concentration targets

EU interpretation: global mean temperature increase at less than 2ºC above pre-industrial level



Source: IPCC WG3 SPM 2007

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Targets to avoid "dangerous" climate change

- "dangerous" is an ethical and political issue
- EU's target of 2ºC above pre-industrial is very stringent and requires stabilisation below 450ppm CO_2eq to have a 50% probability of being met
  - stabilisation below 400ppm CO_2e is more likely to achieve less than 2˚C
- Stern, p. 284: "The current evidence suggests aiming for stabilisation somewhere within the range 450 - 550ppm CO_2e. Anything higher would substantially increase risks of very harmful impacts.."
  - but costs of <450 are unreliable and may be small
- Most modelling scenarios have been for targets c 650ppm CO_2eq (EMF19, EMF21). Innovation Modelling Comparison Project (IMCP) had one scenario around 550 CO_2eq (450 CO_2 only)
  - ADAM project is assessing the 400ppm CO_2e target (4 models)

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Implications for avoiding dangerous climate change

- To have a good probability of achieving <2ºC rise
  - CO_2-eq concentrations have to be <450ppm CO_2 eq (c/f c430 now)
  - global GHG emissions have to fall by >70% below baseline by 2050
  - technologies have to be developed to capture CO_2
- Fossil-fuel GHG stocks cause damages and industrialized countries are responsible for most of current stocks
  - hence reduction in OECD of c90% below BAU/1990 by 2050
- Risks are asymmetric
  - so precaution suggests a zero-carbon economy as soon as possible (without excessive costs)
- Eventually all countries & sectors have to decarbonize
  - not "How much?" but "When?" for each business and government
  - With a policy portfolio that is effective, efficient, equitable and flexible

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Implications for the carbon price for the EU to 2030

- A 400ppmv CO_2-eq target implies
  - 40% global CO_2 reduction below baseline by 2020
  - carbon prices rising to about 80 €/tCO_2 by 2020 ($100/t$CO_2$, 2000 prices) and continuing to rise after 2020
- The literature:
  - insufficient and inadequate modelling studies for more stringent stabilisation below 450ppmv CO_2-eq (implied by 2ºC target)
  - (current levels: c430ppmv CO_2-eq)
- The EU and other OECD countries bear more responsibility of the stock of GHGs (from historical emissions) and for action
- In consequence, large-scale funding of CDM and other instruments to support low-GHG options in developing countries
- EU-wide ETS and ETR should be designed to provide the carbon price signal for lowest costs

Current EU policies to achieve GHG targets

- EU Regulation (e.g. energy efficiency for auto-engines, appliances, clean coal) but
  - upward trends in energy use from income growth and new products e.g. hi-definition TVs, heavier cars
  - rebound effects
- EU ETS but
  - large combustion plants
  - excess profits (free allowance allocation)
  - transaction costs
- EU additional taxes on energy products: now at low rates
- Member State policies
  - Environmental tax reforms (ETR) including carbon taxes for household and small business GHG emissions

Policies for global decarbonisation

- Policy portfolios (market-based, regulation, voluntary) suited to national conditions could be effective, efficient equitable and flexible
- Market economies respond to price signals, hence the need for a global carbon price that will achieve net zero GHG emissions by an agreed date (2050?)
- Market and political forces will encourage wider cap-and-trade
- Technological standards and agreements support low-cost deployment of low-GHG processes and products
- Gains from co-ordination
  - +sum game and room for negotiation
  - climate change threatens long-term growth, so funding of mitigation benefits all as well as being equitable
  - Substantial demand-side low-GHG investment can utilise resources otherwise wasted (construction downturn)

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Environmental tax reform – political economy

- **Very attractive political-economic idea e.g. carbon tax replace labour tax**
  - **carbon use is very small in relation to labour use: therefore large increase in carbon prices and small reduction in labour costs**
- **Many winners and few losers**
  - **winners are diffused across the economy, not well organised, and winnings are very small and hardly noticed**
  - **losers are concentrated (energy-intensive industries), they face larger loses and are much better organised**
- **Tax increases more certain and immediate, and effects more certain, whereas labour cost reductions less sure, and effects more delayed and uncertain**
- **In consequence ETR can be highly controversial**

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Environmental tax reform – political acceptance

- History: political attractions, but repeated defeats
  - 1993 EU carbon-energy tax – recycled revenues via lower employment tax – but unacceptable to business
  - ETRs have failed in France and Italy
- ETRs have not been understood or accepted by voters (PETRAS project Energy Policy 2006)
- ETR has to be flexible depending on local labour market conditions
  - recycling via employment or more general tax reductions
- EU ETR should combine
  - EU-wide additional energy taxes (for single-market efficiency)
  - Member State use of revenues to suit local conditions

The macroeconomic costs of environmental tax reform (ETR)

- Costs not observable from market prices because
  - outcome of complex energy-environment-economy (E3) system interactions
  - involve changes in environment that have no market valuations
  - hypothetical: comparison of 2 states of E3 systems over future years
- Macroeconomic costs are usually measured in terms of future loss of GDP, comparing one hypothetical state of the world with another
  - but GDP often a poor measure of welfare – distribution of income and unemployment also count
  - Include benefits from use of tax or emission permit revenues
- Such costs can be offset by environmental benefits from lower GHGs and air pollution

Contribution from COMETR: evidence from Member State policies

- Few studies in the literature are on *ex post* analysis – nearly all are *ex ante* evaluations of proposed policies (e.g. effects of Kyoto)
- The COMETR project has studied a diverse set of innovative, experimental policies in ETRs for 6 Member States 1994-2005, with projections to 2012
- Assessment of effects on competitiveness and carbon leakage
  - in the context of the single market
  - macroeconomic and sectoral effects
  - 3 lines of evidence: industrial analysis and case studies, detailed dynamic counterfactual modelling, & panel-data econometric study
- Confirms OECD findings that effects are small but there may be localized hot spots

Member State ETRs 1990-2005

- COMETR: identified 6 ETRs to study in the EU (Sweden, Denmark, Finland, the Netherlands, UK and Germany)
- Very diverse: started in 1990s, but over different periods, sectors, rates, exemptions, design, politics
- Most ETRs very weak– one of strongest was in Denmark, with substantiated effects
- Reasons:
  - elements of experimentation
  - wish to be gradual and incremental
  - concerns for competitiveness and carbon leakage

Conclusion on MSs ETRs

- The ETRs led to modest drop in fuel use in all six countries, but more in Sweden and Finland
- Recovery in fuel use (2004-05) in several countries
- Drop in GHGs little more than for fuel demand; largest cuts due to highest tax rates
- Finland and Sweden show largest GHG cuts
- Macroeconomic impact (B-R) depends on how revenue recycling occurs with ETR
  - cost to economy small
  - a rise in GDP <0.5pp; gains can be with lag (Sweden)

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Conclusion

- Critical time in environmental policy in EU
- Targets supported by ETS and regulations, but "price-signal" gap in policy for small GHG emitters
- ETR fills that gap
  - very attractive politically (e.g. UK politics)
  - many EU countries have experimented
  - but there have been, and are, industrial concerns

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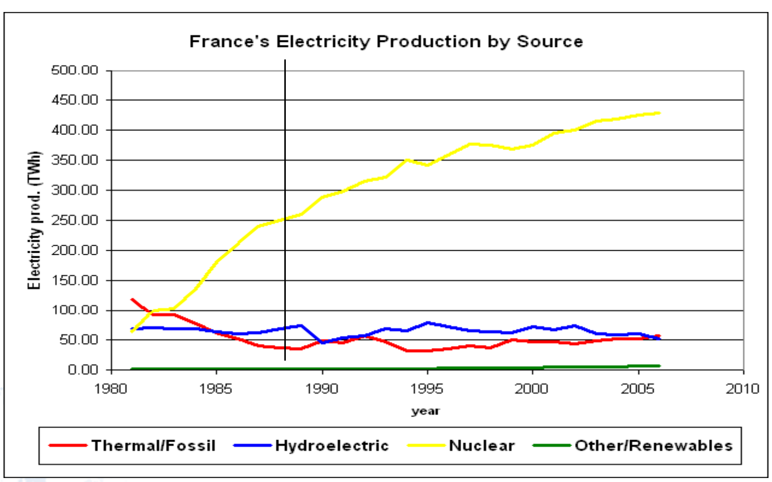
Examples of accelerated decarbonisation

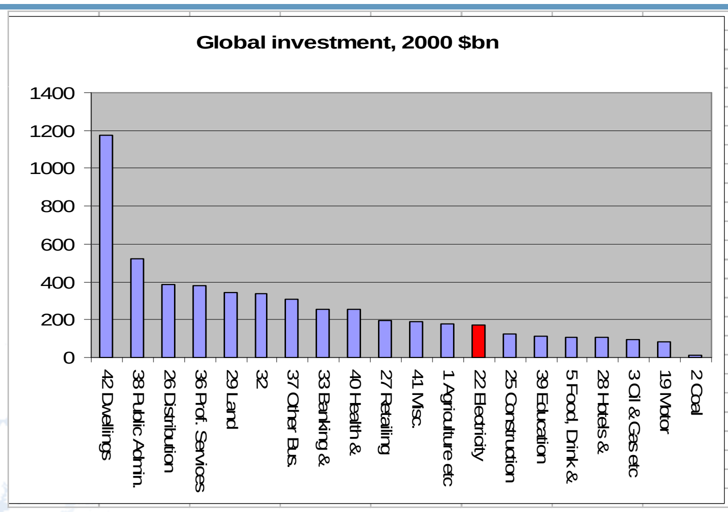
- France's move to nuclear power in the 1980s
- Copenhagen's 25% reduction in CO_2 emissions below 1990 levels
- Studies of 30% reduction in US CO_2 emissions required for Kyoto ratification

France: decarbonising electricity production from 50% thermal in 1980 to 10%in 1987



Source: http://www.eia.doe.gov/emeu/international/electricitygeneration.html

Electricity investment in context: global investment, 2000 $bn



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Copenhagen’s 25% cut in per capita CO_2 emissions by 2005 below 1990 levels

- ***“Every citizen has reduced his input to global warming from 7 tons to 4.9 tons, by 2.1 tons in fact compared to the 1990 figures.” … despite remarkable growth in the city … due to connecting the district heating system and generating stations to cleaner fuels, especially …natural gas.”***
- ***“So, we dare to set an ambitious new goal of reducing CO_2 emissions by a further 20% by 2015 compared to today (2005 figures). This means that by 2015 we will have reduced emissions by 40% compared to 1990.”***

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US study of accelerated reductions in CO_2 emissions

US Administration EIA study (1998) for Congress on effects of ratifying the Kyoto Protocol on the US economy, assuming action from 2006

	2010		2020	
number of years to adjust:	3 to 4		13	
trade in emission permits:	none	Annex I	none	Annex I
CO_2 change (%)	-30.6	-18.4	-35.1	-23.9
GDP cost (incl co-benefits) (%)	-1.2	-0.7	0.1	0.0

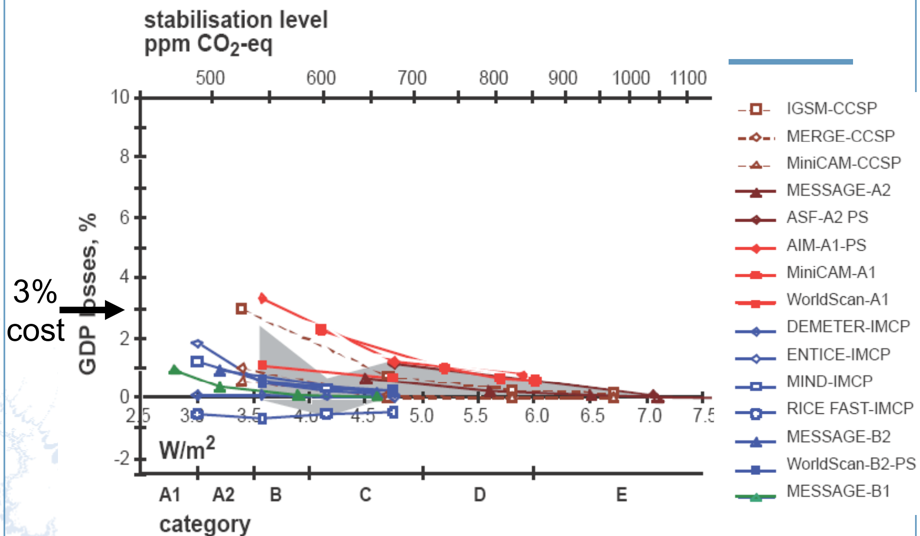
Note: GDP cost allows for co-benefits not included in original study.
Sources: US Energy Information Administration (EIA) (1998). *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity.* Washington DC.
Barker, T., Ekins, P. (2004) 'The costs of Kyoto for the US economy', *The Energy Journal*, Vol. 25 No. 3, 2004, pp.53-71

What are the macro-economic costs by 2030 for different stabilization levels?

Stabilization levels (ppm CO_2-eq)	Median GDP reduction[1] (%)	Range of GDP reduction [2] (%)	Reduction of average annual GDP growth rates [3] (percentage points)
590-710	0.2	-0.6 – 1.2	< 0.06
535-590	0.6	0.2 – 2.5	<0.1
445-535[4]	Not available	< 3	< 0.12

[1] This is global GDP based market exchange rates.
[2] The median and the 10th and 90th percentile range of the analyzed data are given.
[3] The calculation of the reduction of the annual growth rate is based on the average reduction during the period till that would result in the indicated GDP decrease in 2030.
[4] **The number of studies that report GDP results is relatively small and they generally use low baselines.**

3% maximum global cost by 2030



Source: IPCC AR4, WG III Report 2007, Chapter 3, Figure 3.25 (a)

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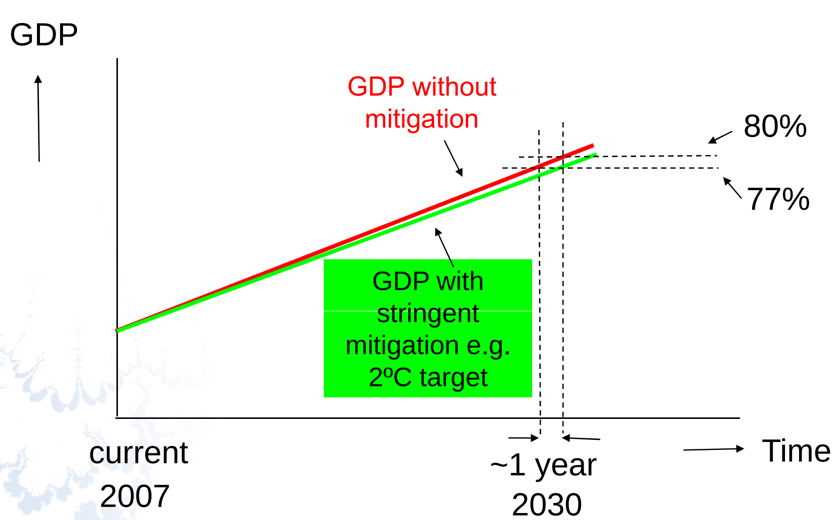
Illustration of the maximum 3% cost number



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Summary: the costs of achieving the 2º C target

Key conclusion from IPCC AR4: not enough studies on stringent mitigation have been done!

Extrapolating from current studies:

The macro-economic costs of the 2ºC target appear to be negligible (even beneficial) for global GDP and welfare, provided policies are "well-designed"

- Equilibrium models (providing nearly all the cost estimates) *assume* that mitigation will be costly, despite evidence from econometric models and business
- Low-cost, low-GHG technologies are likely to be developed both directly and through rising carbon prices
- But this requires international co-operation on allocation of burdens and benefits

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Conclusions for policy

- 450ppmv CO2-eq is not stringent enough to avoid dangerous climate change
- A rising real carbon price is required of about \$100/tCO_2 by 2020 (rising thereafter) to be on the safe side, e.g. by a trading scheme
  - the price should be guaranteed by government so as to reduce the risks of investing in low-GHG technologies
  - a portfolio of supporting policies (regulation, ecotax reform, information) reduces costs and accelerate change
- A zero-carbon economy appears feasible at negligible (but uncertain) macroeconomic costs, with high carbon prices and strong regulation
  - costs critically depend on international co-ordination

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Memo: Relationship between $50/t$CO_2$ and US fuel prices

		2005 base	Added cost of $50/t$CO_2$	
		$	$	%
Crude Oil	($/bbl)	60	22.4	37%
Regular Gasoline	($/gal)	2.39	0.48	20%
Heating Oil	($/gal)	2.34	0.53	23%
Wellhead Natural gas	($/tcf)	10.17	2.73	27%
Residential Natural gas	($/tcf)	15.3	2.75	18%
Utility Coal	($/short ton)	32.6	101.4	311%
Electricity	(c/kWh)	9.6	3.23	34%

Source: Derived from Table ES.5, US CCSP, 2006, sourced in turn from Bradley et al. 1991, updated with U.S. average prices for the 4th quarter of 2005 as reported in DOE, 2006.
Note: This table does not include any adjustments in producer prices due to changes in energy demands under stabilization.

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