AN ECONOMIC PERSPECTIVE ON OCEAN ACIDIFICATION AND ATMOSPHERIC CARBON DIOXIDE STABILISATION

The Ocean in a high CO$_2$ world: Symposium in Monaco 6-9 October

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Economic Reasons for Concern

Potential impact chains triggered by ocean acidification:

• Marine food webs
  → commercial fish stock
  → food security for millions of people
    & multi-billion dollar industry

• Area & integrity of coral reefs
  → multi-billion dollar industry from tourism

• Oceanic carbon pump – pricing?
CO$_2$-Emissions
Business as Usual (BAU) vs EU’s 2°C-Target

Climate-Economists until 2006:

„2°C target costs >5% GWP

Too expensive!! Too dangerous!!“
Mass Production lowers Costs

Electric Technologies in EU 1980-1995

Experience Curves for Energy Technology Policy
International Energy Agency

Source: IEA (2000): Experience Curves for Energy Technology Policy; p. 21
Options for CO$_2$ emissions abatement

Coal/Oil/Nat.Gas cheap, pure time preference rate 1%

Energy-induced emissions

- **nuclear**
- renewables
- biomass + CCS
- fossil + CCS
- efficiency

Edenhofer et. al. 2007
Carbon Capture & Sequestration

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Economists claim carbon cuts won’t break the world’s bank

Transforming the world’s energy industry to stop the flood of greenhouse gases into the atmosphere might actually be quite cheap.

Figures of tens of trillions of dollars are often cited, and used to question whether measures such as the Kyoto Protocol, which attempts to limit carbon emissions, are too expensive. But according to a suite of economic models released late last month, the costs of stabilizing carbon dioxide levels could be tiny — equivalent to setting back the growth of global GDP (gross domestic product) by less than 1% over 100 years; global GDP generally grows 2–3% each year. In some cases, the right policies for limiting carbon emissions could even create a surprising win–win situation, leading London. “But only if we do the right things.”

The models simulate a complex issue in economics: how government climate policies such as research investment or greenhouse-gas regulation can bring about technological development. It is obvious that technologies evolve, but the processes involved have been factored into economic models only since the late 1990s, in part because it is difficult to untangle how advances occur. The Innovation Modelling Comparison Project, published in a special issue of The Energy Journal, is a two-year effort involving eleven different models that represent the latest thinking on the problem.

The results are striking. Nine of the models predict that stabilizing carbon dioxide levels at 450 parts per million, widely seen as the most
Economic Costs of Climate Protection

• **Stabilisation @450ppm**
  \[\Delta 0.5...1.5\% \text{ GWP loss}\]

• **Induces momentum in climate policy:**
  – Environmentalists may be satisfied as the $2^\circ$ target gets a chance
  – Economists are satisfied as costs are low.

• **Society can act...**
• **...in spite of ongoing normative discrepancies**

Held & Edenhofer, 2008
Potential interconnected renewable energy domains (2030)

Sources: Own calculations based on European Wind Atlas, [www.windatlas.dk](http://www.windatlas.dk)
EEA - How much bioenergy can Europe produce without harming the Environment
European Contribution to Mitigation

Edenhofer et al., 2008
As long as there is no Global Deal: Coalitions & Climate Policy

Edenhofer et al., 2008
Edenhofer meets Schwarzenegger on Linking

Sep 2008: Elected IPCC WG III CoChair;

Aug 2007
Pricing Carbon

• These climate policies correspond to a carbon price of 20...200$/tC.

• The ocean absorbs 2GtC/yr.

• → 0.1% ... 1% GDP - Carbon pump’s value under emission cap

• However: 2Gt/yr would even push up the carbon price – above numbers are lower bounds.
Consequences for a new Global Carbon Protocol

• Stricter CO$_2$ emission targets

• Emphasis on carbon rather than radiation management

• Need for intensified research on the impacts of sub-seabed CO$_2$ sequestration & potential leakage
Carbon Sequestration in Geological Formations: An Example Operated *at Present*

(by Statoil; platform off-shore Norway)
Ocean Acidification Community may Contribute to Honest Brokering

- How much CO$_2$ mitigation?
- At the expenses of which side effects?
- OA-community could offer consistent metric to discuss
  - Reduction of atmospheric CO$_2$ vs.
  - Leakage from sub-seabed CO$_2$
Summary

• Large economic numbers at risk – yet indirect effects still to be researched

• ’Willingness to pay‘ to be researched

• The oceanic carbon pump obtains an economic value under a climate policy regime.
  – Such a regime appears economically feasible (0.5...1.5% GDP costs only for transforming the energy system)

• The ocean acidification community could provide objective metrics to weigh benefits and side-effects of sub-seabed CO₂ sequestration.