On the Economics of Climate Change

Political and Social Implications

Visit by a High-Level Delegation from Qatar

Potsdam, 13 July 2012

Prof. Dr. Ottmar Edenhofer
Economic Growth in Perspective

Edenhofer et al. 2012
“Tipping processes of the climate system” show a strong reaction already to small climate changes.

Schellnhuber, 1996; Lenton et al., 2008
Burning Embers Diagram

Prognosis for 2100 (IPCC 2007)

Global warming above present temperature (°C)

- Arctic summer sea ice
- Greenland ice sheet
- Boreal forest
- West Antarctic ice sheet
- Amazon rainforest
- Sahara/Sahel and West African monsoon
- El Niño Southern oscillation amplitude
- Atlantic meridional overturning circulation

2 °C above pre-industrial level

Climate Policy as an Insurance

GHG emissions resulting from the provision of energy services contribute significantly to the increase in atmospheric GHG concentrations.
We are not on Track – Renaissance of Coal!

Kaya decomposition of global CO2 emissions.

SRREN (IPCC, 2011)
Renaissance of Coal?

Prices of Energy Commodities
(U.S. dollars a barrel of oil equivalent)

- Asian liquefied natural gas
- U.S. gas
- Australian coal
- Oil

Source: IMF (2011)
The BAU Scenarios could exceed the Level of Greenhouse Gas Concentration of 600ppm (~4°C Temperature Increase)

SRREN (IPCC, 2011)
... and What About Energy Efficiency?

Mitigation technologies: 450ppm World

Luderer et al. 2011
The Atmosphere as a Global Common

Atmosphere: Limited Sink
~ 230 GtC

Resource Extraction
> 12,000 GtC
Managing the Global Commons

1) Defining the Atmospheric Disposal Space
   → Balance Costs & Risks of Climate Change with Mitigation

2) Adopt efficient Policy Instruments: Carbon Tax or ETS

3) Distribute the Climate Rent
Seven Ideas to Enhance Climate Cooperation

- Complement UN negotiations
- Technology Policies
- Green Climate Fund
- Linking Emission Trading Systems
- Trade Sanctions Against Free-Riders
- Deforestation Policy
- No-Regret Policies
New Perspectives for International Negotiations

- Emissions Trading
- Promoting Renewables
- Investment in System Solutions for Renewables
Creation and ‘Linking’ of Emissions Trading Systems

- Canada 0.74Gt
- USA 6Gt
- USA 6Gt
- RGGI 0.17Gt
- MGGA 0.83Gt
- EU ETS 2Gt
- Australia 0.45Gt
- New Zealand 0.098Gt
- Japan 1.4Gt
- Tokyo 0.012Gt
- South Korea 0.6Gt
- China 6Gt
- California 0.4Gt
- Mexico 0.64Gt
- Chile 0.073 Gt
- Brazil 1Gt
- India 1.5 Gt
- Australia 0.45Gt
- New Zealand 0.098Gt

⇒ Reduction of mitigation costs by establishing access to low-cost abatement options
⇒ Potential for strategic incentives
Increasing Investments in Renewable Energy

The following renewable energy projects are included: all biomass, geothermal, and wind power projects of more than 1 MW, all hydropower projects between 1 MW and 50 MW. Small scale projects <1 MW are reported separately.

Source: REN21 (2012)
The current Global Energy System is Dominated by Fossil Fuels

Shares of energy sources in total global primary energy supply in 2008

- Coal: 28.4%
- Gas: 22.1%
- Oil: 34.6%
- Nuclear Energy: 2.0%
- Bioenergy: 10.2%
- Renewable Energy (RE): 12.9%
- Direct Solar Energy: 0.1%
- Ocean Energy: 0.002%
- Wind Energy: 0.2%
- Hydropower: 2.3%
- Geothermal Energy: 0.1%
The Costs of Renewables are often still higher than those of Non-Renewables but…

IPCC SRREN (2011)
...some RE Technologies are already competitive

IPCC SRREN (2011)
Learning-by-Doing

[Graph showing the decline in average price of solar photovoltaic modules and onshore wind power plants over time, with specific years and price points marked.]
Integration Options for Renewables

• **Improved weather forecast**
  → better planning of renewable electricity feed-in

• **Demand side management**
  → adjust demand to renewable electricity feed-in

• **Flexible power plants**
  → provide residual load

• **Grid extension**
  → large area pooling of uncorrelated fluctuations (>300km):
    Import / Export between countries

• **Energy storage**
  → remove electricity from the grid in times of high renewable
generation and feed-in electricity in times of low generation
Aggregated Transmission in 2050 in an Electricity Sector model of Europe

Baseline, no climate policy:

90% CO₂ reduction in electricity sector:

Haller et al., 2012
System LCOE increase with higher share of variable renewables

- huge challenge with high shares: VRE LCOE increase due to curtailment
- fossil system LCOE increase with VRE
- these additional system costs are small (~10%) when added to VRE generation LCOE
- with variability: medium increase of VRE LCOE (for shares <50%, in Germany)
- total system LCOE increase with high shares of VRE

- system implication fully considered
- social cost perspective → indicator for policy maker
- method not very simple → improve framework
Green Climate Fund

Current standing: For 2010 industrialized countries have earmarked US$ 12 billions

Fast start finance (FSF)

Long-term climate finance

US$

ramp up phase

100 bn

10 bn

2010

2020

years

Brunner (2011)
Conclusions

• Climate Change is a Global Commons Problem: The atmospheric sink is being overused

• Key Question: Is it possible to transform the „Tragedy of the Commons“ into a „Drama of the Commons“?

• Appears difficult, but there are some promising technological and institutional options

• Need to explore options at a global, regional and local scale
http://srren.ipcc-wg3.de/report