

# **Global Public Goods and IEAs:**

**Global climate change**

# Climate change

- Greenhouse gases (GHG) form a “blanket” around the Earth, keeping the temperature 30° C higher than it would otherwise have been.
- Industrialization, deforestation and other land use changes have led to an anthropogenic (man-made) increase in GHG.
- The Intergovernmental Panel on Climate Change - IPCC (2001) - predicts this will lead to an average temperature increase between 1.4-5.8° C over the period 1990 to 2100.

We're at a 370 ppm concentration of CO<sub>2</sub> now. 500-1000 ppm expected by 2100.

This is not debated. What has been debated is anthropogenic emissions' part of it... or rather the economic impact of climate change. Do the expected benefits of reducing emissions outweigh the net costs of mitigation?

The last century saw a temperature increase of 0.6 C.

Existing signs of climate change:

-declining snow cover, increased floods.

Impact: increased temperature gives increased incidence of vector-borne diseases like malaria. Agricultural crop yield effects. And much more...

## Climate change negotiations

- 1988: The Intergovernmental Panel on Climate Change (IPCC) was created by WMO and UNEP.
- 1990: IPCC's First Assessment Report
- 1992: United Nations Framework Convention on Climate Change (UNFCCC): "the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic (man-made) interference with the global climate system"

IPCC reviews scientific research and issues assessment reports.

UNFCCC: open for signature June 1992 to June 1993, by then 166 signatures. It came into effect on 21<sup>st</sup> March 1994. Currently 189 signatories.

UNFCCC specifies a non-binding target to return GHG emissions to 1990 levels by the year 2000.

## Climate change negotiations

- 1995: COP 1 – the Berlin mandate to negotiate emission reduction objectives.
- December 1997: COP 3 - Kyoto Protocol to the UNFCCC adopted.
- November 1998: The Clinton Administration signs the Protocol.
- November 2000: COP 6 negotiations break down in The Hague on emissions trading issues and compliance.
- March 2001: President George W. Bush rejects the Kyoto Protocol.
- July 2001: The Conference of the Parties agree to allowances for carbon sinks, and no quantitative limit on the use of emissions trading (COP 6 bis in Bonn).

Byrd-Hagel Resolution, U.S. Senate 1997.

December 1997 : 84 signatories.

The Buenos Aires plan of action (1998) was only implemented in Marrakesh 2001.

## Climate change negotiations

- 2001: COP 7 –the Marrakesh Accords: carbon sinks allowed and compliance issue settled. Operative rules established for the CDM.
- 2004: Russian Federation ratifies the Protocol.
- 02.16.2005: The Kyoto Protocol enters into force.

## Cost-Benefit Analysis

- U.S. damage estimates range from positive to - 0.5% (Nordhaus and Boyer, 2000) and 1.1% (Cline, 1992) of GDP.
- Costs from the Energy Modeling Forum (1999): 0.2-0.6% of GDP.
- Global estimates of the marginal benefit of avoiding a doubling of carbon equivalent concentration: 6-150 USD/ton CO<sub>2</sub>.
- Divide between “top-down” and “bottom-up” models.

Cost-benefit analyses are not well adapted to deal with problems implying large catastrophic events occurring with a small probability.

Discount rate debate...

## Discount rates

- Use private market rate of return?
- Valuation estimates of climate change impact depend crucially on the discount rate chosen since most of the impacts occur with a long time lag.
- Inter-generational equity versus intra-generational equity concerns.

OMB: 7% interest rate.

Time preferences and valuation of the environment are interdependent.

Future discount rates are uncertain.

Use hyperbolic discounting (discount rate declines over time).

Intergenerational concerns: use zero discounting.

# The Kyoto Protocol

- 149 countries representing 62% of 1990 CO<sub>2</sub> emissions of Annex I Parties (as of April 2005).
- Quantified emission reduction objectives for the Parties listed in Annex 1
- Flexible mechanisms for emission reductions:
  - JI
  - emission trading
  - CDM

# The Kyoto Protocol

- What GHGs?
    - carbon dioxide (CO<sub>2</sub>)
    - methane (CH<sub>4</sub>)
    - nitrous oxide (N<sub>2</sub>O)
    - hydrofluorocarbons (HFCs)
    - perfluorocarbons (PFC)
    - Sulphur hexafluoride (SF<sub>6</sub>)
- Measured in CO<sub>2</sub> equivalents.

# The Kyoto Protocol

- Parties listed in Annex B have assigned amounts for the “first commitment period” 2008-2012 (5% overall emission reduction).  
In percentage terms of 1990 emissions:

EU-15	-8%
U.S.	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0
Australia	+8%

UNFCCC Annex I: OECD countries, Turkey +EIT

Annex B: Annex I less Belarus and Turkey.

## Burden-sharing

- “Common but differentiated responsibilities” : Annex 1 Parties versus non-Annex 1 Parties (China, India, Brazil)
- Bubble concept included: The European Union distributes its aggregate reduction goal of 8% among its member states.
- The Clean Development Mechanism and the Adaptation Fund.

## Flexible Mechanisms: JI

- Joint Implementation (Article 6):  
An Annex 1 Party can implement an emission reduction project in the territory of another Annex 1 Party and count those emission reduction units towards its own target.

Emission Reduction Units (ERUs)

## Flexible Mechanisms: CDM

- The Clean Development Mechanism (Article 12):  
Annex 1 Parties may implement emission reductions in non-Annex 1 Parties and count the resulting certified emission reductions towards their own target.

Aims at helping Non-Annex 1 Parties to implement sustainable development and contribute towards the Protocol's objective.

Certified Emission Reduction Units (CERs)

## Flexible Mechanisms: ET

- Emissions Trading (Article 17)  
on a nation-to-nation basis.  
An Annex 1 Party may transfer some of its emissions (assigned amount units) to another Annex 1 Party.
- Banking
  - Def: saving emission reductions for use in future commitment periods.
  - Allowed for AAUs (and to a certain extent CERs and ERUs) but not for removal units from carbon sinks.

Parties are required to hold a commitment period reserve of assigned amounts.

EU had insisted on meeting the objectives primarily by domestic action, but abandoned quantitative limits on ET at COP6 bis. Currently, the Protocol states that “significant efforts be made for achieving emission reductions domestically”.

# Carbon Sinks

- Carbon sequestration: the uptake and storage of carbon.
- Carbon sink: any reservoir that takes up carbon released from another part of the carbon cycle: the atmosphere, the ocean, forests are major carbon sinks.
- Land Use, Land Use Change and Forestry (LULACF)
- Land-use change activities approved in the Kyoto Protocol to calculate carbon sinks: afforestation, reforestation, and deforestation. The Marrakesh Accords added: forest management, crop land management, grazing land management, revegetation. Example from agriculture: no-tillage management practices.
- Afforestation: allowed if land has been left deforested for 50 years with respect to 1990 land use (otherwise re-forestation): removal units (RMUs).

# Compliance

- Not agreed upon until the Marrakesh Accords:
  - If a party fails to meet its obligations, must make up for its commitment + 30% penalty in the next commitment period.
  - The Party will be ineligible for selling emission reductions.

Very ineffective compliance rule:

There are no economic incentives for complying; if a party failed to comply in the first commitment period, why would it have incentives to make 1.3 times the reduction in the second commitment period? Can delay compliance into subsequent periods...

Above all, the emission reduction periods for the second commitment period (2013-2017) are not yet negotiated, so they are endogenous ; a party that anticipates a compliance problem in the first commitment period will negotiate for weaker objectives in the second commitment period.

Compliance rules can only be changed by an amendment to the Protocol that requires 2/3 majority vote.

## Compliance problems

- No economic incentive to comply... can delay compliance into subsequent commitment periods (snowball effect).
- The emission reduction objectives for the second commitment period (2013-2017) are not yet negotiated, so they are endogenous.
- Alternative policy (rejected at COP 6 in The Hague): a safety valve that installs a floor and a ceiling on the price of emission reductions.

Above all, the emission reduction periods for the second commitment period (2013-2017) are not yet negotiated, so they are endogenous ; a party that anticipates a compliance problem in the first commitment period will negotiate for weaker objectives in the second commitment period.

The safety valve: If a party's compliance costs turn out to be high, they would pay a unit amount per ton of CO<sub>2</sub>. Such a hybrid mechanism is preferable when there is uncertainty.

## Burden-sharing and economic efficiency

- The Marrakesh Accords instituted a levy on CDM projects to fund an Adaptation Fund (basically a tax on such projects – reduces the quantity of emission reductions from the CDM).

Show incidence of a tax on the use of the CDM. May limit the use of CDM with respect to the other flexible mechanisms.

## Leakage

- Def: indirect effects that lead to emission increases outside of the territory of the Parties to the Protocol.
- Example: decrease in demand for fossil fuels depresses world fossil fuel price and increases the demand for fossil fuels elsewhere.
- Border tax adjustments difficult to implement.

## Policies to implement carbon emission reductions

- Carbon taxes: Finland, Denmark, Norway and Sweden.
- Carbon trading schemes: Denmark (power sector), UK (voluntary).
- The European Union Greenhouse Gas Emission Trading Scheme. (EU ETS)
- CAFE standards?

## EU ETS: 1 January 2005

The European Union Greenhouse Gas Emission Trading Scheme:

- A cap-and-trade system. First phase: 2005-2007.
- 12 000 installations representing 45% of EU total CO<sub>2</sub> emissions.
- Large industrial emitters only (power, iron and steel, cement, oil refineries etc.)
- Penalty for non-compliance: EUR 40/ton CO<sub>2</sub> (EUR 100/tonne in 2008).
- Allowance price: currently around EUR 14.

## A Flawed Protocol or a First Step?

- Two contradicting views:
  - 1) An inherently flawed protocol,
  - 2) Not perfect, but just the first step towards further emission reduction commitments.

## A Flawed Protocol?

- A quantity approach was chosen when economic theory would have advocated a policy based on pricing (carbon taxes).  
...but problems with international harmonization of taxes.
- The Protocol is badly designed because of weak compliance incentives.
- Even if the Parties comply, the environmental effect is negligible, due to compromises on carbon sinks.

Analysis on the lines of the Weitzman Theorem for stock pollutants show that a price policy tends to dominate a quantity policy for climate change policy (Hoel and Karp, 2001; Newell and Pizer, 2003).

## A First Step towards Stronger Policy?

- Yes, the environmental impact has been diluted by the Marrakesh Accords on carbon sinks amongst others, but the framework is there to set further emission reduction objectives for the second commitment period (2012-2017).
- The Montreal Protocol started out modestly, but then added more ODS at subsequent renegotiations.

## Alternative propositions

- International emissions trading with a safety valve. Set emission reduction targets in per capita levels.
- Coordinate on carbon levy. Developing countries to participate once their GDP per capita reaches a certain level.
- Coordination of domestic policy measures such as R&D of less carbon-intensive technologies.
- Set international technology standards.

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