Monetary Value of Carbon Sequestration:
Two Central Measurement Problems

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Overview: 2 Measurement Problems

1. Identifying the physical quantity of C pools & changes

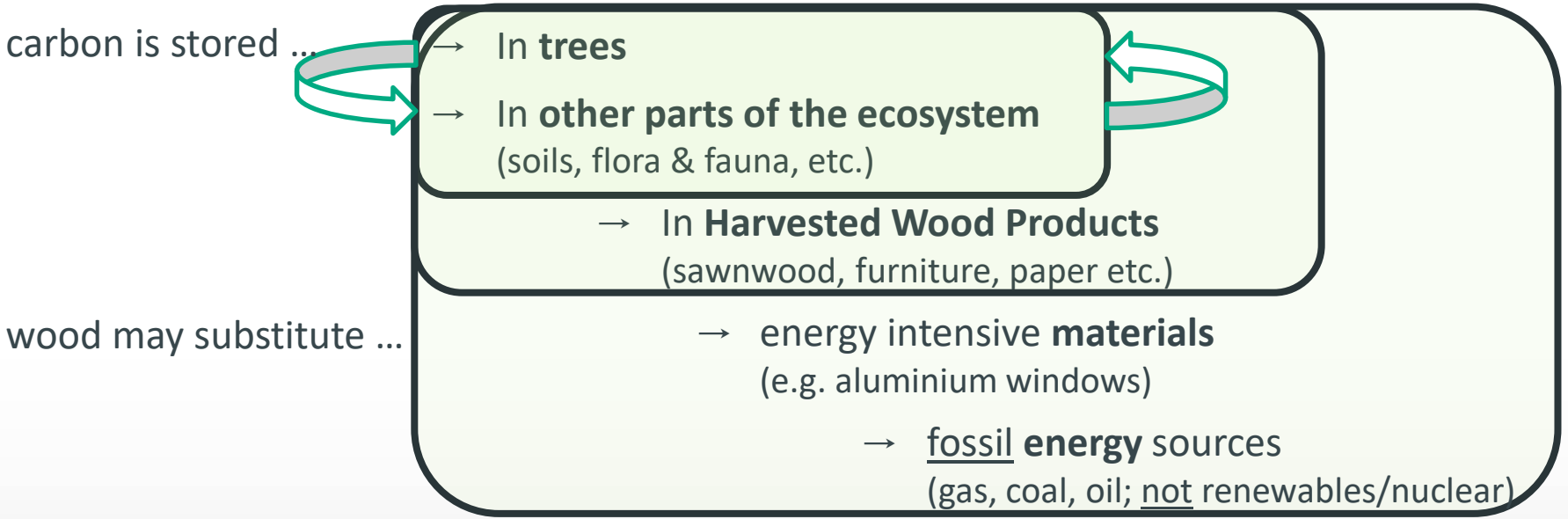
2. Determining appropriate monetary values

Overview: 2 Measurement Problems

1. Identifying the physical quantity of C pools & changes

- Directly influenced by two human activities:
  - Exploitation of fossil reservoirs → *Measurement of C changes easy (good news!)*
  - Land use decisions → *(Here the good news end…)*

1. Physical quantification problems: e.g. forests

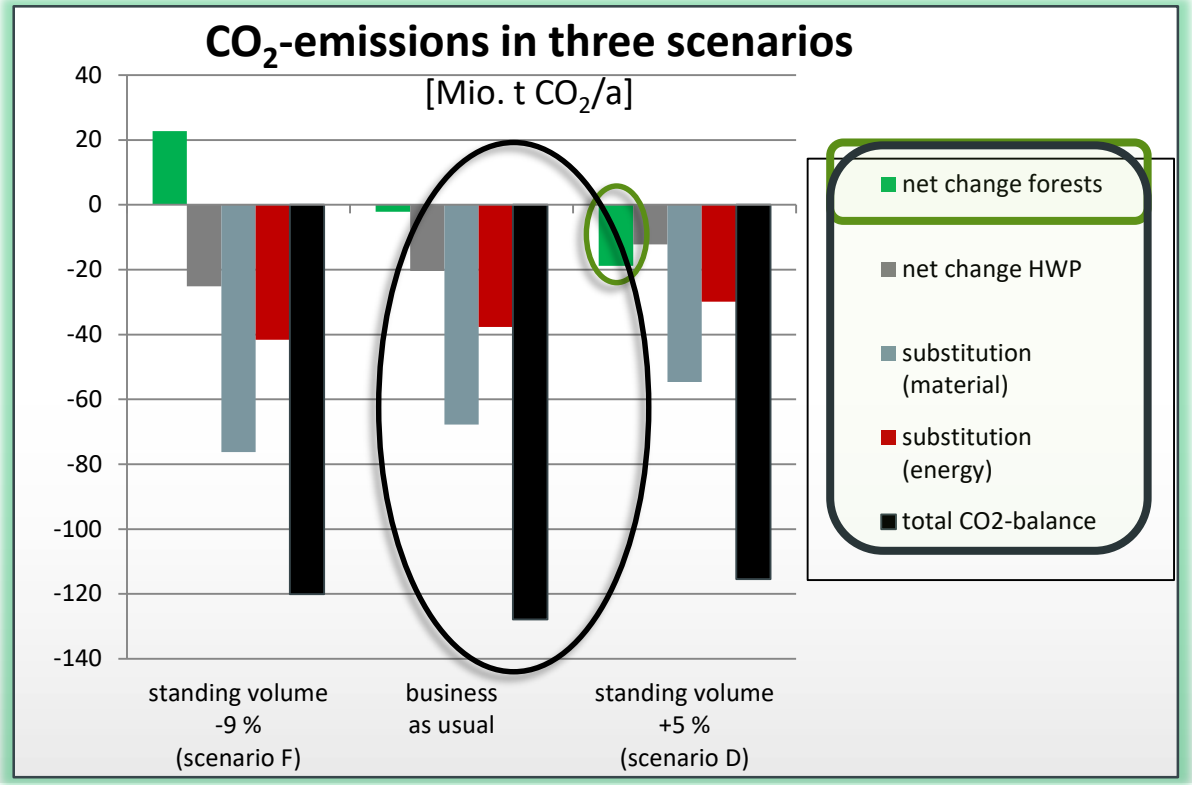


⇒ *System boundary definition influences C accounting results*

Example: Kyoto Protocol

- *2008-12: only forests*
- *>2012: forests & HWP*
- *(substitution in other sectors)*

1. Physical quantification: e.g. Germany's forests, 2013-20



Caveat: several assumptions!
E.g.,

- *Utilisation structure of timber*
- *Time horizon of forecasts*
- *Long-term composition of energy mix*

Interim result

1. Identifying the physical quantity of C pools & changes

- Possible *(again, good news!)*
- But may be elusory

⇒ ***Take care of the specific context when interpreting results …***

Overview: 2 Measurement Problems

2. Determining appropriate monetary values $

- Carbon prices (ETS, VER)?
- Damage cost estimates?
- Benefit estimates (revealed/stated Willingness-To-Pay)?

2. Monetary Valuation: Carbon Prices

good news: markets exist!

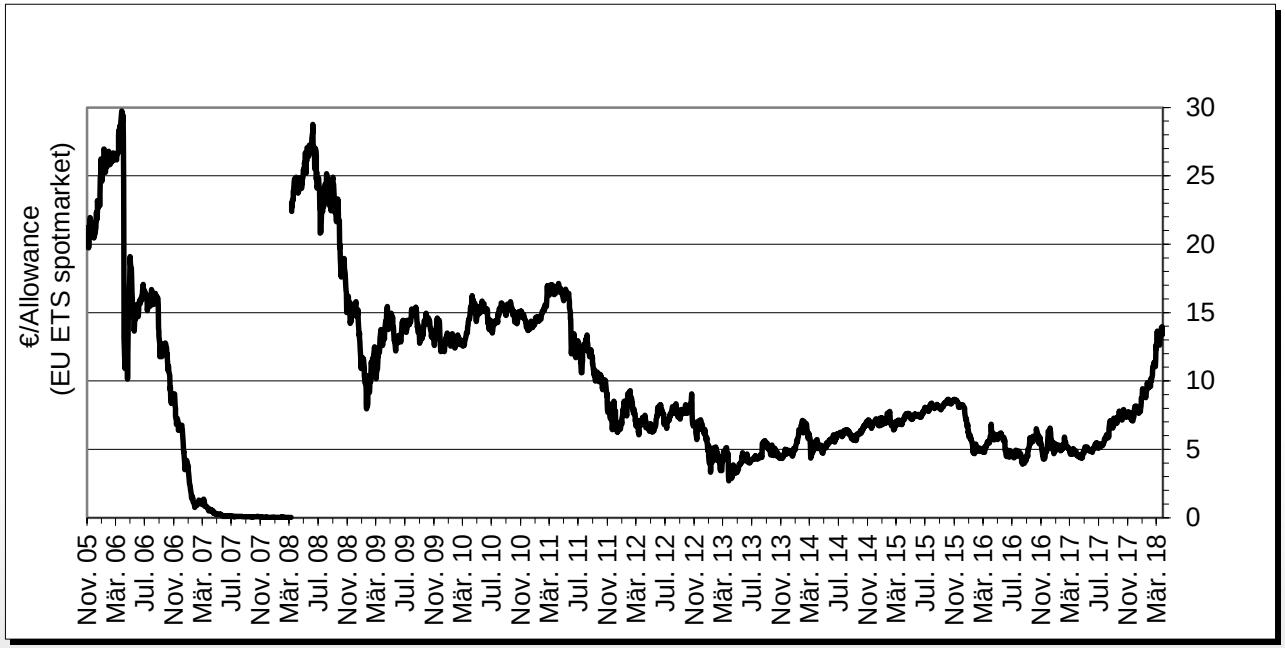
Voluntary carbon offset markets

- ~3 US$/$tCO_2e$ in 2016 (global volume: 63 $MtCO_2e$ ≈ 0.0002% of emissions)
- influenced by free riding, moral persuasions, etc. (no "equilibrium price")

→ ***Not suitable for National Accounting purpose***

2. Monetary Valuation: Carbon Prices

Mandatory carbon markets, e.g. EU-ETS (European Union Emission Trading Scheme)

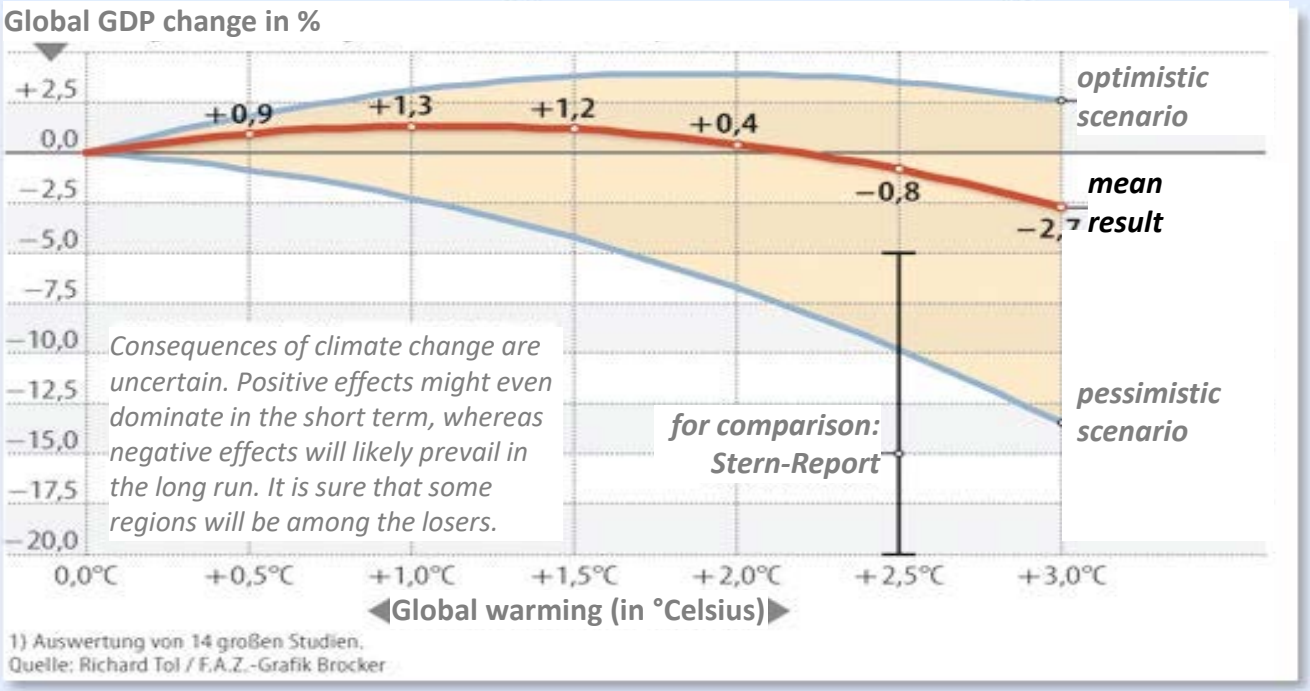


- Highly volatile
  - Max: 29,75 (4/2006)
  - Min: 0,01 (3/2008)
  - Factor ≈ 1 : 3,000
- Politically influenced
- Covers stationary & big plants; excludes
  - transport sector
  - land use sector

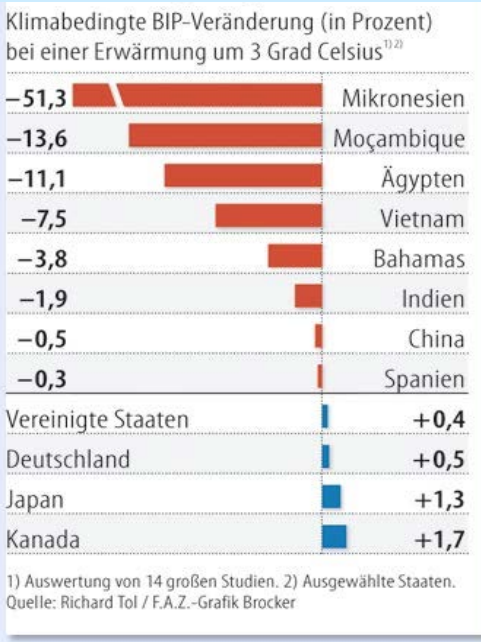
  → ***Half of the economy!***

2. Monetary Valuation: Cost estimates

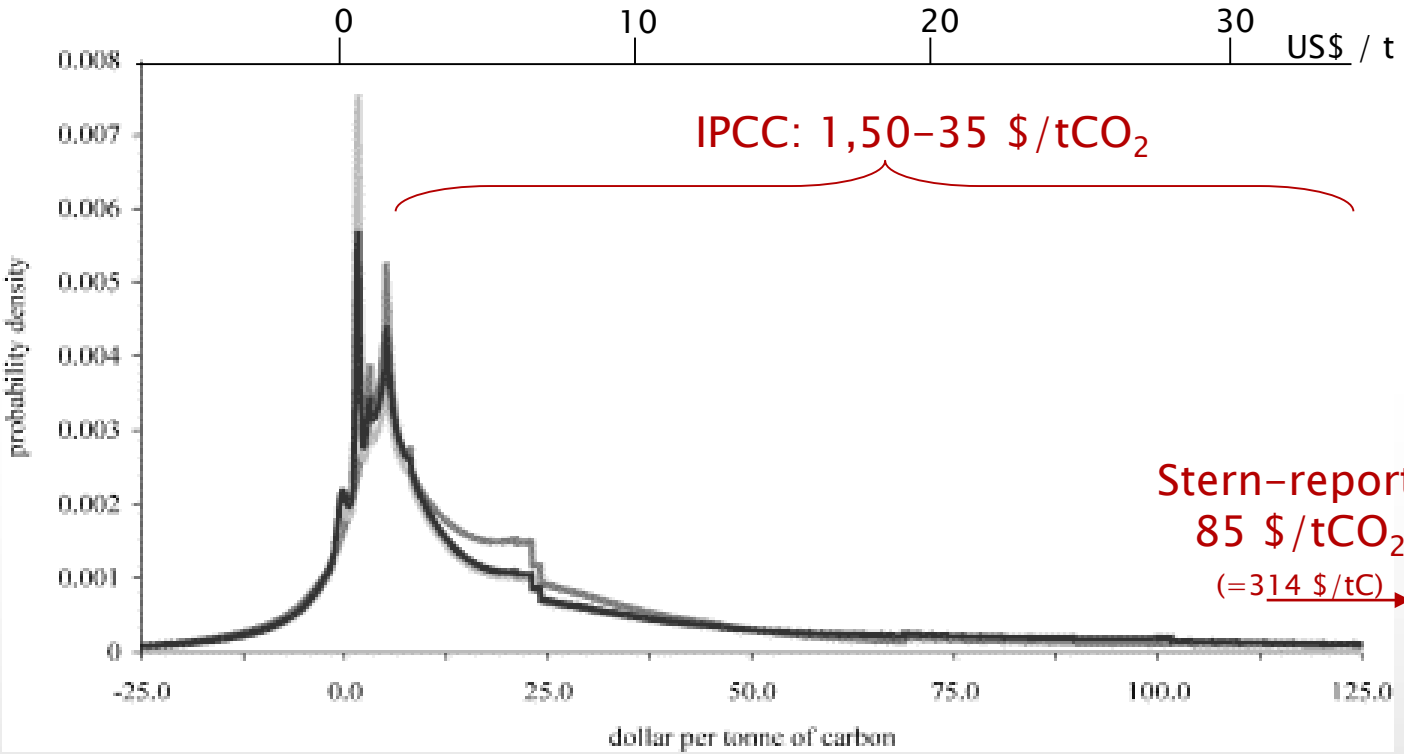
Economic consequences of global warming (Metaanalysis R. Tol)



Many losers, some winners



2. Monetary Valuation: Cost estimates in $/tCO$_2$

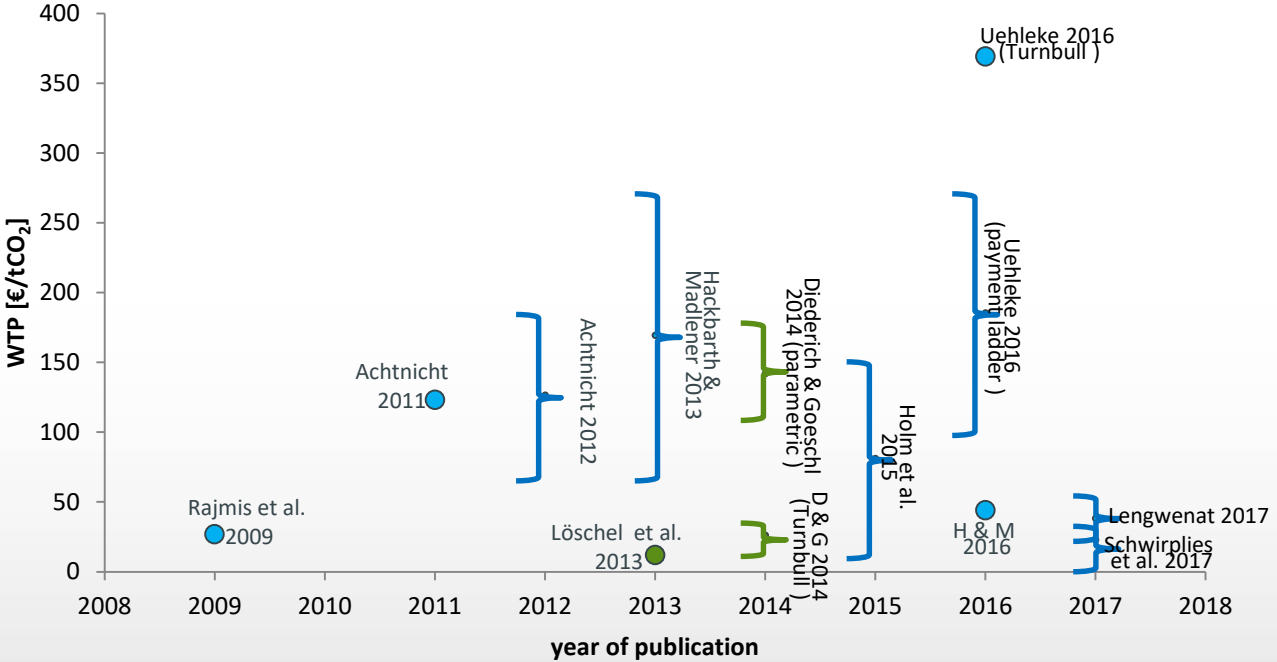


- Broad range of cost estimates:
  - -7…+35 (+85) $/tCO$_2$
  - Highest prob. density: 0…+7 $/tCO$_2$
- Again, based at myriads of assumptions
  - Physical changes
  - VOSL
  - Time preference rate
  - etc. pp.

→ *Prone to political manipulation!*

2. Monetary Valuation: Revealed/stated WTP

Results of 11 valuation studies among German residents



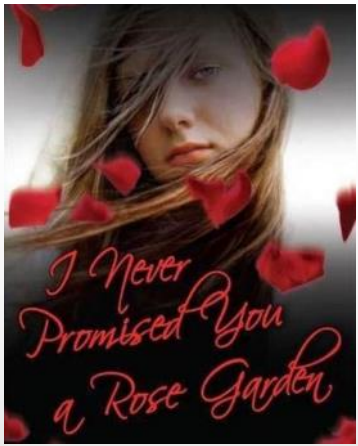
- range of mean WTP estimates:
  - ~10…250 (370) €/tCO_2
  - (and I don't tell you the confidence intervals)
- Lab experiments often lower than survey experiments
- Estimated WTP strongly dependent on assumed functional form

Conclusion

1. Identifying the physical quantity of C pools & changes → *possible! but:*

- Dependent on context and system boundaries

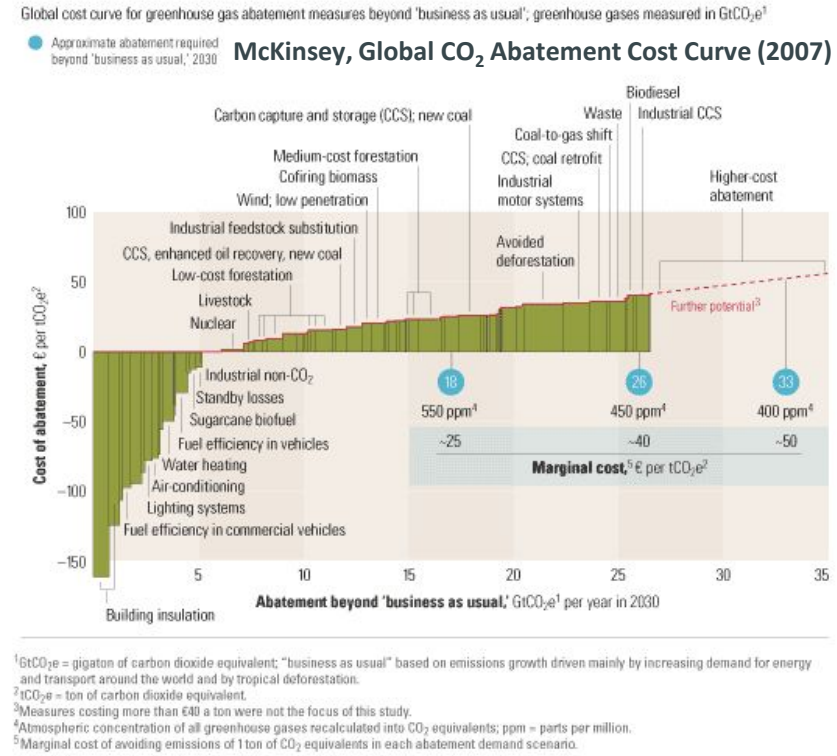
2. Determining appropriate monetary values → *possible! but:*



- ETS Prices: politically influenced; don't cover whole economy
- Cost estimates: many assumptions, susceptible to manipulation
- WTP estimates: quite dependent on data analysis approach


Thank you for your attention!

Annex @Monetary Valuation: Avoidance costs



[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.