Comments on “Insights from Review of EMF-21 Multigas Scenarios”

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Sir Nicholas Stern’s figures may well turn out to be wrong. That is no excuse for inaction.

- headline in The Economist

Overview

- Congratulations on massive, detailed, helpful study
  - Highlights importance of including non-CO2 gases
  - To save time, I will not elaborate. Great job!
- GWP vs intertemporal optimizing
  - 100-year GWP akin to 1% discount rate
  - Puzzling results for non-GWP models
- Why non-CO2 gases provide good reduction opportunities
  - Decentralized, low-tech (and poorly measured) activities
  - No reason (except religious belief) to reject negative-cost or zero-cost reduction opportunities
- Is equal weighting of 21 models the right way to forecast climate problems?

Time, discounting, and GWP

- Climate change involves costs, benefits, impacts spread over centuries
  - Intertemporal comparison often uses discounted present values
  - Choice of discount rate well-known to be crucial
  - Low discount rate “justifies” more active, immediate policy
- GWP calculation also combines multiyear impacts
  - Sums impacts over (e.g.) 100 years without discounting
- Consider a constant, eternal cost of $X per year
  - Summing N years without discounting produces same answer as discounting infinite series at 1/N discount rate
  - Thus 100-year GWP is akin to 1% discount rate
- Discounting, GWP offer rival standards for combining multiyear data; choices may be incompatible

Puzzling results in non-GWP models

- Four non-GWP models produce different results
  - Less early CH4 reduction, vs. other models
- Half-lives in atmosphere:
  - ~ 100 years for CO2, N2O
  - 12 years for CH4
- Higher discount rate or shorter-term GWP should increase importance of CH4 reductions
  - But study seems to show the opposite
- Other differences between models may account for the observed effect
  - MERGE and IMAGE must make different assumptions for N2O reduction opportunities (much more in MERGE)
  - Not due to GWP, since CO2, N2O have similar half-lives

Where the non-CO2 gases are

- Methane (CH4) – the largest
  - Half agriculture
    - **Cows belching (aka “enteric fermentation”)**
    - **Manure decomposing**
    - **Rice paddies rotting**
  - Almost one-fourth waste
    - **Landfills and dumps (anaerobic if > 1 m deep)**
    - **Wastewater**
  - One-fourth energy
    - **Coal mine emissions**
    - **Biomass combustion**
    - **Natural gas leaks**
- N20 – next largest
  - Almost all agriculture
    - **Mainly soil emissions from fertilizer, etc.**
    - **Some from manure, other farm activity**

Why these are cheap to reduce

- Agriculture, waste management, biomass energy are decentralized, low-technology sectors
  - Limited use of capital, especially worldwide
  - Traditional practices may not be optimal for changing world
  - Market-driven changes (feedlots) may make things worse
- New technologies not yet developed or deployed
  - Changing cattle feed to reduce belching
  - Capturing methane from manure ponds, landfills
  - Fertilization, cropping patterns to reduce N20
- Data uncertainties MUCH greater than for CO2
  - Landfill methane estimated with elaborate models, minimum of data; rarely tested against observations
  - IPCC's developed country data are based on several inconsistent approaches; developing country estimates look like wild guesses

Reality is (still) not Pareto-optimal

- EPA, other studies find negative and zero-cost opportunities to reduce non-CO2 GHGs
  - Obviously top priorities – if they exist!
- Longstanding debate among economists, other modelers: is the market already optimal (efficient)?
  - Bottom-up, end-use, technology-based models: *NO*
  - Top-down, econometric, general equilibrium models: *YES*
- Conclusions driven by methodology, not data
  - Low-cost / no-cost reduction opportunities could have hidden costs, making them not actually free
  - Are hidden costs identifiable, or just theoretical deductions?
- Agriculture, waste management, biomass combustion are not optimally efficient, worldwide

Coverage: choice of models

- EMF-21 – well established pattern for evaluating wide range of models
- PAGE2002 not included
  - Used by recent European Commission reports, and by the Stern Report (UK government)
  - Monte Carlo estimation of uncertain outcomes
  - Results broadly compatible with other models
- Should all 21 count as equal data points?
  - If one or two are extreme outliers, do they belong in average?
- Potentially clashing assumptions about discount rates, coverage of gases and policy options, etc.
- Much harder job: pick the ones that make the right choices!