Marginal Abatement Curves in the Energy-Systems GMM Model

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ETSAP Meeting, Paris, June 21, 2004

Outline

- The energy-systems GMM model
- Multi-gas mitigation
- Implementing marginal abatement curves
- Some results
- Concluding remarks

The Energy-Systems GMM Model

- Global, five-region, energy-systems MARKAL model (Barreto, 2001; Rafaj *et al*., 2004)
- Calibrated to year-2000 statistics
- Endogenized technology learning
- Time horizon 2000-2050, 10-year steps
- Relative detail in energy supply technologies
- Stylized representation of end-use technologies

Multi-gas Mitigation

- Inclusion of non-CO_2 GHGs is important for the examination of strategies to mitigate climate change
- The consideration of non-CO_2 GHGs may lead to noticeable effects on costs and composition of mitigation measures (Reilly *et al*., 2003)
- Marginal abatement curves or bottom-up representation of mitigation technologies

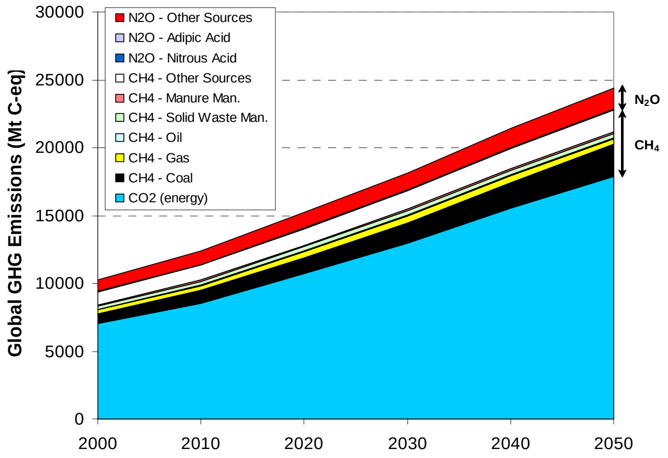
Marginal Abatement Curves (MAC)

- Implementation of MACs for methane (CH_4) and nitrous oxide (N_2O) following approach of MERGE (Manne and Richels, 2003)
- Three categories: exogenous baseline, endogenous baseline, non-abatable emissions
- Data from the U.S EPA (2003) study, potentials are relative to baseline emissions
- Technical-progress multipliers to extrapolate abatement potentials beyond 2020

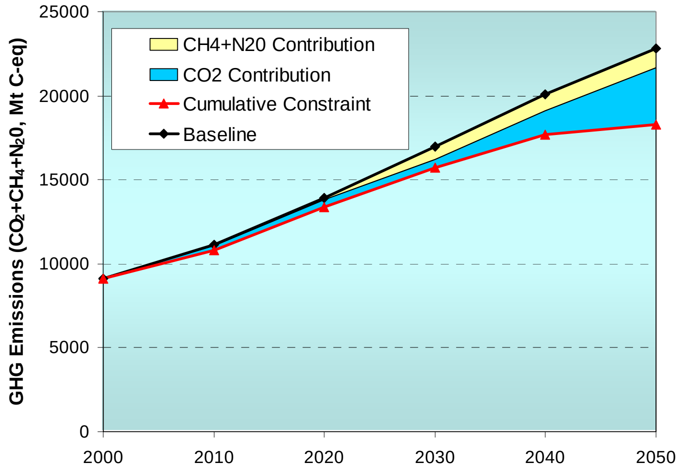
Marginal Abatement Curves - 2

- Methane (CH_4):
  - Energy-related baseline emissions are endogenous (coal, oil and gas)
  - Non-energy related baseline emissions are exogenous (solid waste and manure management)
- Nitrous oxide (N_2O): exogenous baseline emissions (adipic and nitric acid production)
- Exogenous, non-abatable emissions: CH_4 from enteric fermentation and rice paddies, N_2O from soils

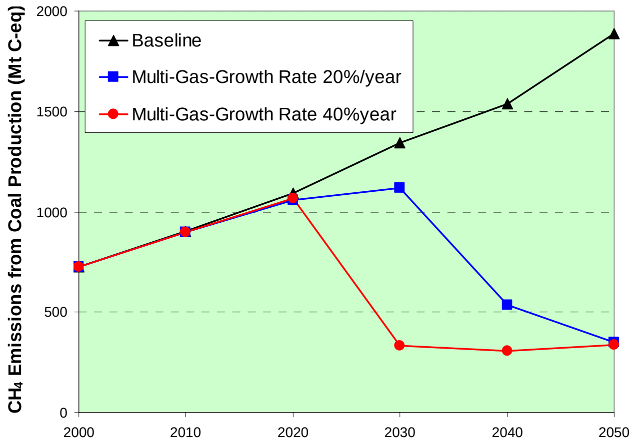
A Multi-gas Baseline Scenario



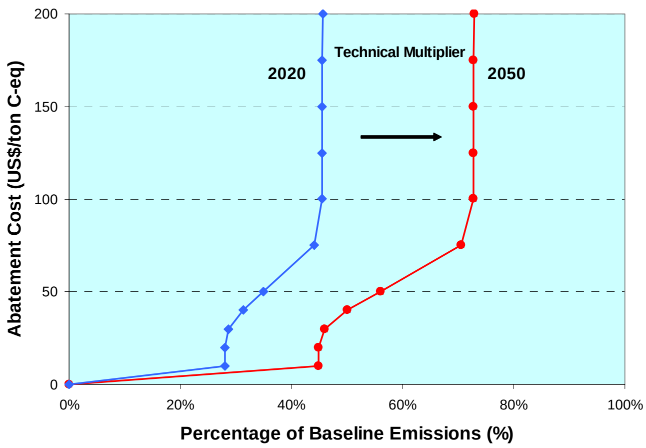
An Illustrative Mitigation Scenario



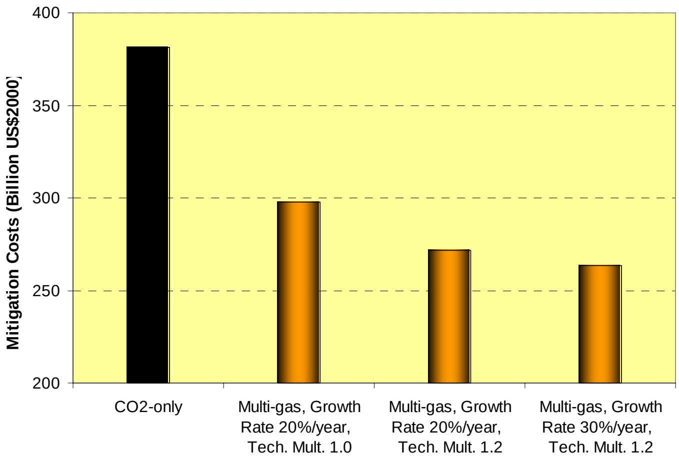
Maximum Growth Rates for Non-CO_2 Abatement



Technical Multipliers for Non-CO_2 Abatement Potentials



Mitigation Costs



Concluding Remarks

- Marginal abatement curves allow incorporating the effects of non-CO_2 GHGs (CH_4,N_2O) into the energy-systems GMM model
- Composition of mitigation strategies and mitigation costs depend on assumptions about potentials (technical multipliers) and growth rates for abatement of non-CO_2 GHGs
- Further work: technical multipliers as a function of cumulative abatement (experience)?

Acknowledgements

- The collaboration with Hal Turton from the Environmentally Compatible Energy Strategies (ECS) project at IIASA is highly appreciated