

Potsdam-Institut für Klimafolgenforschung

The ReMIND model

(Potsdam Institute for Climate Impact Research Research Domain III: Sustainable Solutions)

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Tsukuba, Japan



Key Design Characteristics

Participating Model: ReMIND

(<u>Refined Model of Investment and Technological Development</u>)

Model Type: Ramsey-type macro-economic growth model coupled to energy system model, climate box model, (agro-economic land use model *MAgPIE*)

Participating Modelers: Marian Leimbach, Nico Bauer, Gunnar Luderer, Lavinia Baumstark, Markus Haller, Michael Lüken, Robert Pietzcker, David Klein, Sylvie Ludig

Time Step: 5 years

Time Frame: 2005 to 2150

Solution Type: Intertemporal Optimization

Equilibrium Type: Intertemporal equilibrium of capital, energy, goods markets

Underlying Computing Framework: GAMS



Inputs and Outputs

Key inputs

- **Demographics:** Population by region
- *Economic:* Labour & energy productivity
- Resources: Depletable resources by marginal extraction cost curves (after Rogner; coal, oil, gas, uranium); Renewable resources by grade (wind on & off-shore, solar, geothermal, hydro).
- *Emissions / forcing:* CO, NOx, VOC, halocarbons, SF6, OC, BC
- Technology: see sketch.
 CCS for coal, gas, biomass-fired power plants, coal & biomass to liquid technologies, H2 production

Key outputs

- Economic: GDP, Consumption, Investment, Shadow prices, Mitigation costs, Trade flows
- Energy: see sketch
- Agriculture (via MAgPIE): Land use pattern, Production costs, Shadow prices
 Investment in productivity improvements
- *Emissions:* CO₂ (by source), CH₄, N₂O, SO₂
- Climate: GHG Concentrations, Radiative Forcing, Temperature, (Ocean pH, Sea level rise)



Regional Scope & Other Detail

Regional Details:

- Regional Scope: Global
- Number of Sub-Regions: 11 world regions
- Asian Regions: China, India, Japan, Other Asia (basically SE Asia, Mongolia, Korea), (Middle East & North Africa), (Russia)

Other Details:

- Endogenous baseline
- Trade in fossil fuels, emission permits, industrial good
- Iterative Negishi approach calculating intertemporal market equilibrium
- 1st best: full when & where flexibility
- 2nd best: limited participation (regions & sectors), investment, technology



Asian Baselines



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PIK

Source: RECIPE project

Previous Work on Asia: Kaya Decomposition





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Source: RECIPE project

Regional Distribution of Mitigation Costs





Project China Economics of Climate Change

Coordinated by Chinese Economists 50 Forum & Stockholm Environment Institute

Focused on

- Regulatory instruments
- Allocation rules
- Financing technology diffusion
- China's options in an international regime

Results presented at Forum in Beijing, Sep 12

Synthesis report to be presented at EU-China Summit Nov 2009.



Welfare Impact of Allocation Rules



Source: Flachsland et al. 2009