FONDAZIONE ENI ENRICO MATTEI

A World Induced Technical Change Hybrid Model

http://www.feem-web.it/witch/

WITCH

FEEM, Italy

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Tsukuba, Japan, 17 September 2009

Key Design Characteristics

- **Participating Model**: World Induced Technical Change Hybrid model
- **Model Type**: Optimal Growth Integrated Assessment Model (IAM), (MAGICC for climate cycle)
- **Participating Modelers**: Andrea Bastianin, Valentina Bosetti , Carlo Carraro, Enrica De Cian, Alice Favero, Emanuele Massetti, Lea Nicita, Elena Ricci, Fabio Sferra, Massimo Tavoni
- **Time Step**: 5 years
- **Time Frame**: 2005-2100
- **Solution Type**: Intertemporal, perfect foresight
- **Equilibrium Type**: Market Equilibrium (General Equilibrium, Aggregate)
- **Underlying Computing Framework**: GAMS (works from basically every environment)

Inputs and Outputs

- **Key inputs**
  - **Demographics:** Population by regions (UN medium fertility rate)
  - **Economic:** Total Factor Productivity, factors elasticities
  - **Resources:** Depletable resources by grade (e.g. fossil fuels and uranium); renewable resources by grade (e.g. wind, solar)
  - **Technology: 13 technologies**
    - endogenous TC in the energy sector
      - Learning-by-Doing in W&S
      - Energy intensity R&D
      - Breakthrough Technologies (two factors learning curves)
    - Endogenous TC in adaptation
- **Key outputs**
  - **Economic:** GDP, World energy prices, CC Damage, Adaptation Expenditure.
  - **Energy:** Production and trade. Technology portfolio. R&D investments
  - **Agriculture:** Forestry Emissions and abatement
  - **Emissions:** Endogenous fossil fuel CO2 emissions, exogenous land use CO2 and non-CO2 emissions: CH4, N2O, SLF (short-lived fluorinated gases <100 years) and LLF (long-lived fluorinated), SO2 aerosols. Endogenous Abatement.
  - **Climate:** GHG concentrations, RF, temperature change

Regional Scope & Other Detail

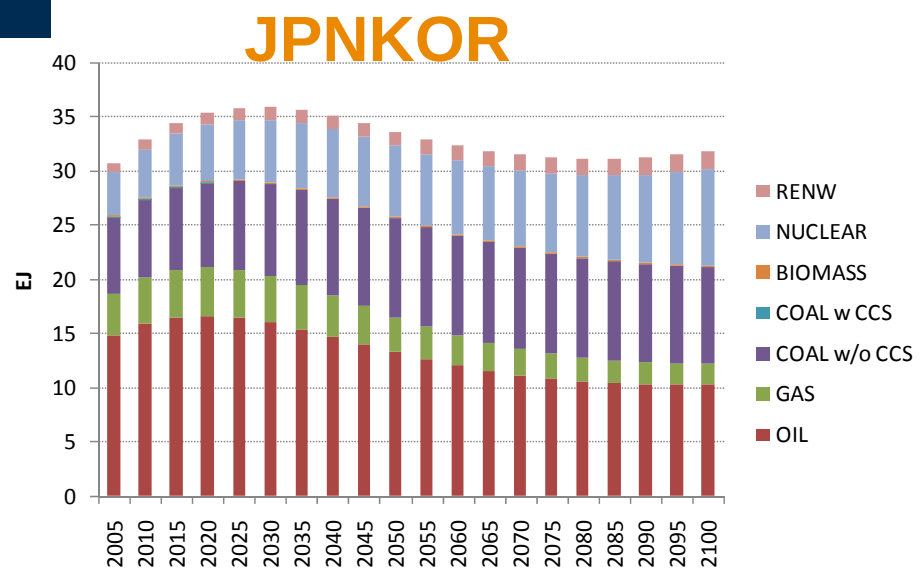
Regional Details:

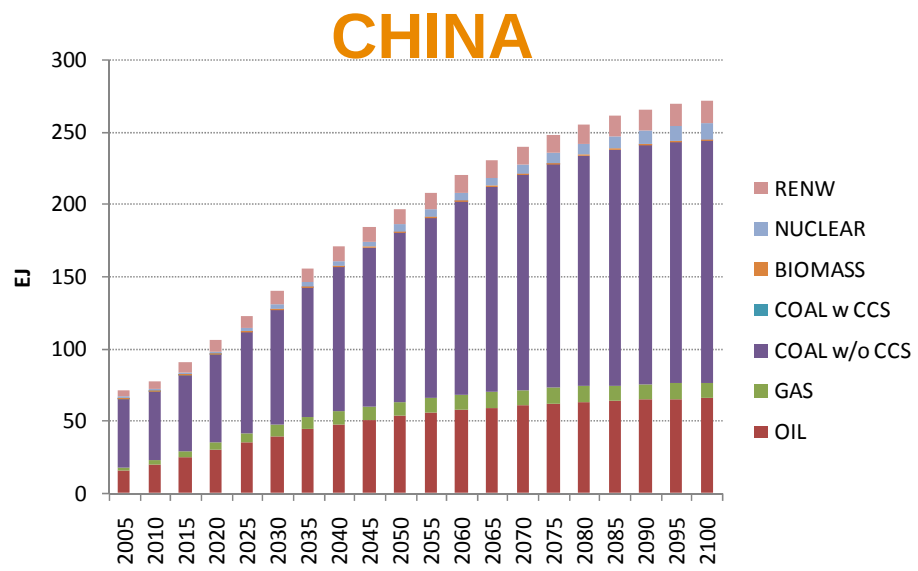
- **Regional Scope:** Global
- **Number of Sub-Regions:** 12
- **Asian Regions:** China including Taiwan , South Asia including India, Japan and Korea, South East Asia
  - Easily increase disaggregation as code runs in parallell

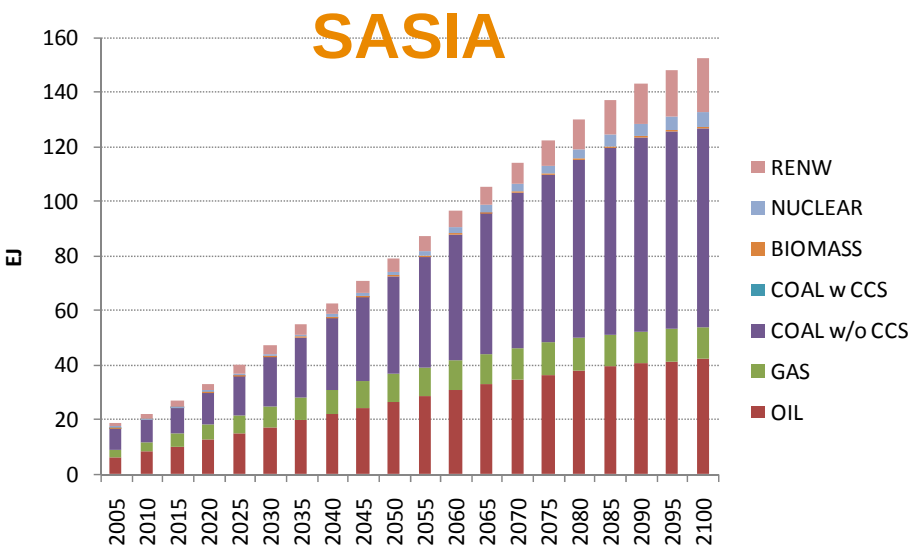
Other Details:

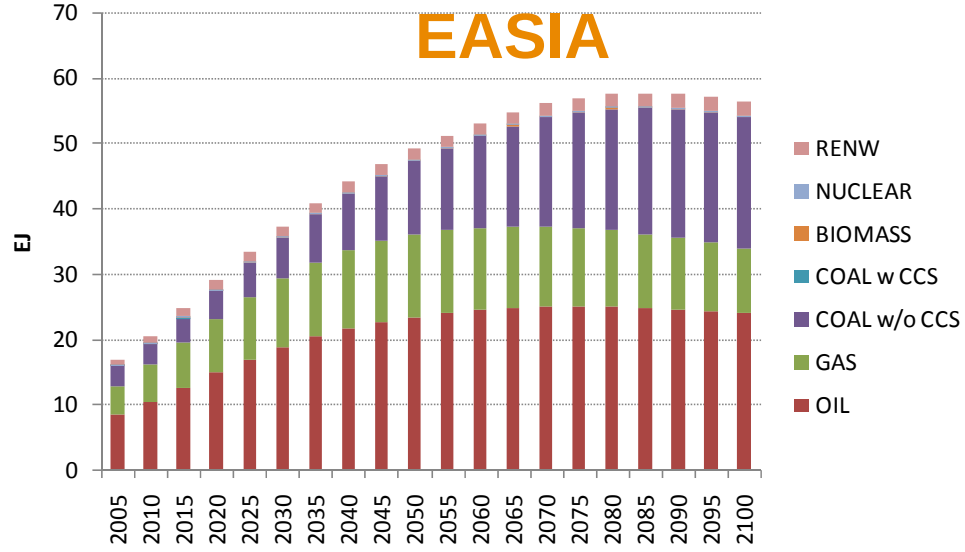
- **Energy Demand Sectors:** NA
- **Energy Supply Sectors:** Electricity Generation, Non Electricity energy sector
- **Other Sectors:** land-use and land cover, adaptation**.**

Asian Baseline





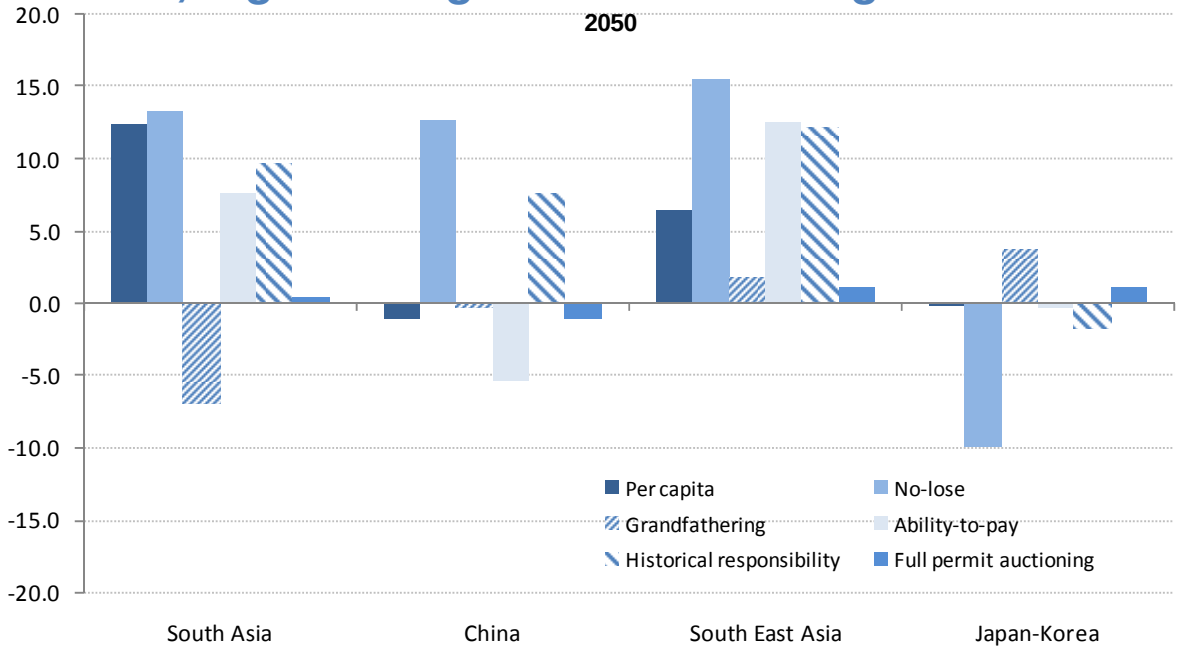




Previous Work on Asia: OECD Study on Coalition

1) Full Participation: Regional Distribution of Costs

Difference in consumption levels relative to BAU, high-damage/low discounting rate



2) Partial Participation: Leckage effects (via technology improvements / price of fossil fuels) on non participating countries

Bosetti, V., C. Carraro, E. De Cian, R. Duval, E. Massetti and M. Tavoni (2009). "The Incentives to Participate in and the Stability of International Climate Coalitions: A Game-Theoretic Approach Using the WITCH Model." OECD Economics Department Working Papers No. 702, June 2009.

Previous work on Asia: EMF 22

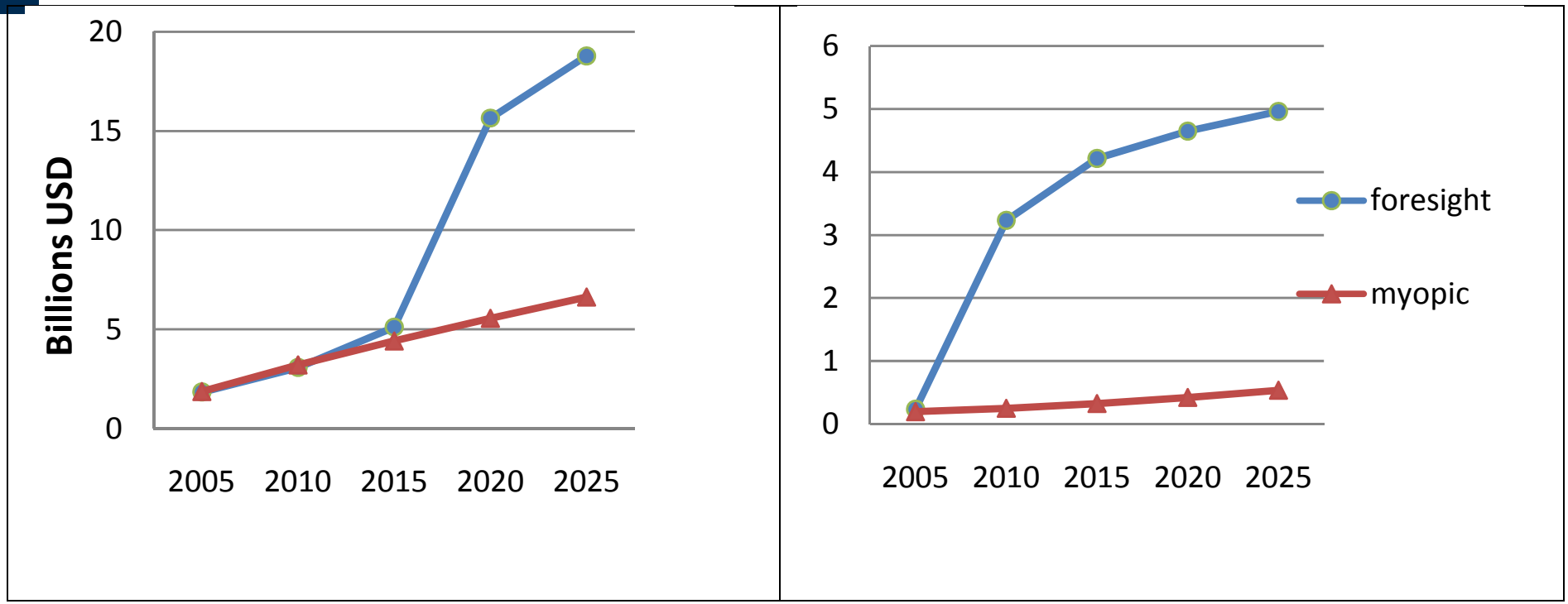


Figure 1. Investments in China in nuclear power (left) and energy R&D (right) before joining the climate coalition in 2030.

- **Regional Technology Investments in response to different carbon policies (timing/anticipation/etc)**

Bosetti, V., C. Carraro, M. Tavoni (2009) "Climate change mitigation strategies in fast-growing countries: The benefits of early action", Energy Economics, In Press, DOI: 10.1016/j.eneco.2009.06.011.

Previous Work on Asia

- Technology-Oriented Cooperation and Strategies in India and China: Reinforcing the EU dialogue with Developing Countries on Climate Change Mitigation
- Started in January 2007, final meeting in Brussel, 12 October
- Baseline check with Asian partners
- Web site (models description, main results, databases) launched **http://tocsin.ordecsys.com/**

• FOCUS: Non carbon policies, role of technological transfers and knowledge spillovers in carbon free technologies and policy to foster them

Partners

China	*Tsinghua University, 3E Institute*
	Hong Kong Baptist University, Center of Game Theory
India	*Indian Institute of Management Ahmedabad, Public Systems Group*
France	*KANLO Consultants*
Italy	*Fondazione Eni Enrico Mattei*
UK	*University of Cambridge, Electricity Policy Research Group*
Switzer-land	*ORDECSYS/CORDEE*

Proposals

1. DATA (REGIONAL MODEL INPUT)
   - Base Year (energy R&D??)
   - Projections (more problematic, alternative senarios)
2. OUTPUT FROM GLOBAL MODELS
   - Reality Check
3. COMMON EXERCISES:
   - Alternative Baselines
   - Policy Scenarios:
     - carbon price –alternative timing and fragmentation
     - alternative policies (standards/land use/techno policies, etc.)
   - Fostering Technological Change

Special Issue of *International Environmental Agreements: Politics, Law and Economics* (INEA) on:

Reconciling Domestic Energy Needs and Global Climate Policy: Challenges and Opportunities for China and India.

Editors: Carlo Carraro and Emanuele Massetti

1. Papers due by February 2010
2. Workshop in Venice in March 2010 and beginning of refereeing process
3. Completion expected by July 2010

Major trends in energy sector (2 papers)

Modelling exercise/comparison (1 paper)

Crucial Issues for China and India (2 papers)

A policy framework for a post-2012 agreement: A perspective from China, India, the EU and the US (3 papers)