

**Activities of the Joint Program on the Science and Policy of Global Change,  
Massachusetts Institute of Technology, GTAP Advisory Board Meeting, June 2005.**

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The MIT Joint Program on the Science and Policy of Global Change made extensive use of the GTAP data set for research and analysis conducted in the program over the past year (See following publication list). GTAP data serves as the principal economic data for the Program's Emissions Prediction and Policy Analysis (EPPA) Model, a global CGE model of the world economy with details on the energy sector and on emissions of greenhouse gases and other air pollutants. The EPPA model is a component of the Program's Integrated Global Systems Model (Figure 1), a model that represents the earth's oceans, atmosphere, and terrestrial systems as they are affected by emissions of greenhouse gases and other pollutants. It has been revised to a version 2 that includes EPPA version 4. The sectoral and regional disaggregation of EPPA 4 is shown in Table 1.

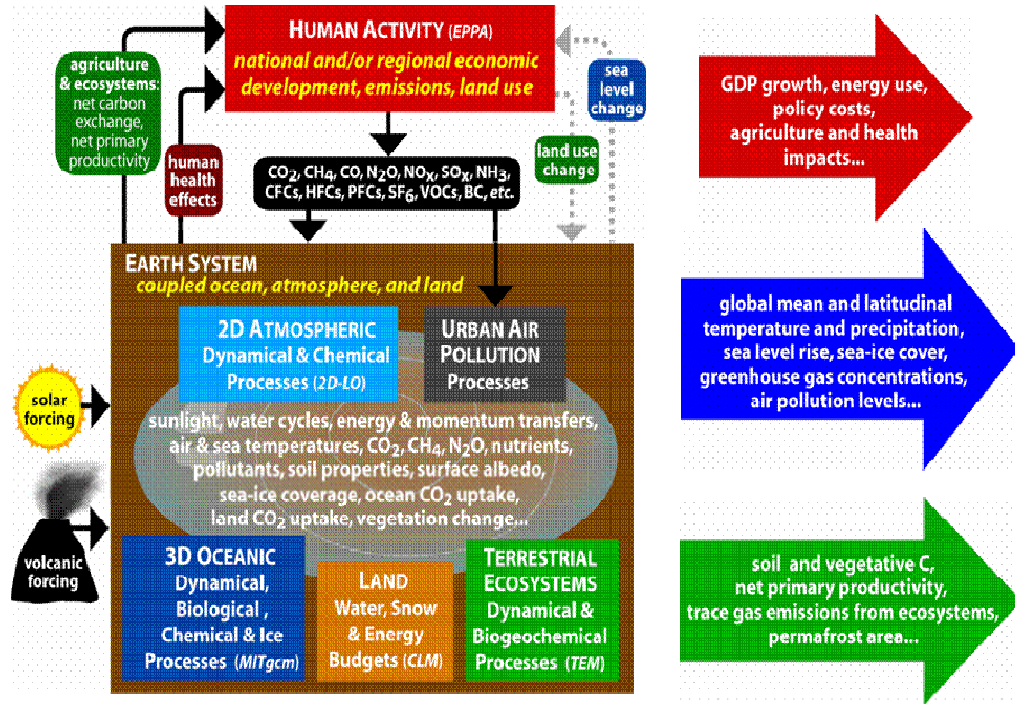
We have continued a process of updating our EPPA model to use GTAP 5.0 data, and look forward to soon incorporating the GTAP 6.0 data particularly with regard to breakout for Russia. A major effort over the coming year is participation in a US Government effort to create stabilization scenarios as part of a set of research products identified by the Climate Change Science Program. We are in the process of recruiting a longer-term post doc (3 year term) to take on some of EPPA modeling work for which we have funding support.

The main areas of work, partly reflected in publications but in some cases still ongoing is:

- (1) Economic costs of climate policy recognizing the existence of significant economic distortions in energy markets, and in capital and labor markets. Various aspects of this has now been published.
- (2) Interactions of climate change and air pollution. There are many elements of this work that reflect interactions throughout the systems modeled in our IGSM. The main work of direct interest to GTAP and economic modeling has been an effort to endogenously value health effects within the CGE framework. The US work was updated, and it was extended to China in a thesis. Interesting related work has developed a model to describe the evolution of spatial distribution of population of the globe, and used the output of our EPPA model of future emissions of pollutants, to distribute the pollutants to urban areas.
- (3) Personal Transportation (i.e. automobile) disaggregation. We have completed and will present at the GTAP conference work to produce a household transportation sector in EPPA that disaggregates personal automobile use for all EPPA regions. We are responding to reviewer comments on a GTAP technical paper we submitted for consideration. Various papers have now been published or are in review.
- (4) Agriculture and Land. Reilly is a co-PI on an EPA sponsored GTAP project to produce supplemental physical accounts for land in the GTAP data base. This would be similar to the physical accounts for energy. We are now testing this data, and beginning to work with it. We have been working on an approach to adjust over time as function income growth the homogenous of degree 1 CES consumption and production functions we use in MPSGE-GAMS based EPPA to reflect more accurately the response of demand to income as estimated in the AIDADS consumption approach.
- (5) Technology and technical change. We have a visiting Ph.D student, Vincent Otto, from Wageningen University whose thesis is on technical change, and as part of his visit here is working on modeling endogenous technical change. We have also added more technologies to EPPA, including various biomass technologies.

Figure 1

## MIT Integrated Global System Model (IGSM) Version 2



(6)

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Table 1. Countries, Regions, and Sectors in the EPPA Model

Country or Region	Sectors
<b>Annex B</b>	<b>Non-Energy</b>
United States (USA)	Agriculture (AGRI)
Canada (CAN)	Services (SERV)
Japan (JPN)	Energy Intensive products (EINT)
European Union <sup>a</sup> (EUR)	Other Industries products (OTHR)
Australia/New Zealand (ANZ)	Transportation (TRAN)
Former Soviet Union <sup>b</sup> (FSU)	<b>Energy</b>
Eastern Europe <sup>c</sup> (EET)	Coal (COAL)
<b>Non-Annex B</b>	Crude Oil (OIL)
India (IND)	Refined Oil (ROIL)
China (CHN)	Natural Gas (GAS)
Indonesia (IDZ)	Electric: Fossil (ELEC)
Higher Income East Asia <sup>d</sup> (ASI)	Electric: Hydro (HYDR)
Mexico (MEX)	Electric: Nuclear (NUCL)
Central and South America (LAM)	Electric: Solar and Wind (SOLW)
Middle East (MES)	Electric: Biomass (BIOM)
Africa (AFR)	Electric: Natural Gas Comb.Cycle (NGCC)
Rest of World <sup>e</sup> (ROW)	Electric: NGCC w/ Sequestration (NGCCS)
	Electric: Integrated Coal Gasification w/ Combined Cycle and Sequestration (IGCC)
	Oil from Shale (SYNO)
	Biomass Liquids (BIOL)
	Synthetic Gas from Coal (SYNG)
	<b>Household</b>
	Own-Supplied Transport (OTS)
	Purchased Transport Supply (PTS)

<sup>a</sup>The European Union (EU-15) plus countries of the European Free Trade Area (Norway, Switzerland, Iceland).

<sup>b</sup>Russia and Ukraine, Latvia, Lithuania and Estonia (which are included in Annex B) and Azerbaijan, Armenia, Belarus, Georgia, Kyrgyzstan, Kazakhstan, Moldova, Tajikistan, Turkmenistan, and Uzbekistan which are not. The total carbon-equivalent emissions of these excluded regions were about 20% of those of the FSU in 1995. At COP-7 Kazakhstan, which makes up 5-10% of the FSU total joined Annex I and indicated its intention to assume an Annex B target.

<sup>c</sup>Hungary, Poland, Bulgaria, Czech Republic, Romania, Slovakia, Slovenia.

<sup>d</sup>South Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand

<sup>e</sup>All countries not included elsewhere: Turkey, and mostly Asian countries.

## **PUBLICATIONS USING GTAP (NEW OR UPDATED STATUS FROM 2004 REPORT).**

(Available at <http://web.mit.edu/globalchange/www/reports.html#pubs> )

### Journal articles and other publications

- Babiker, M., J. Reilly and L. Viguier: Is international emissions trading always beneficial?, *Energy Journal*, 25(2): 33-56 (Report 93)
- Felzer, B., J. Reilly, J. Melillo, D. Kicklighter, C. Wang, R. Prinn, M. Sarofim, Q. Zhuang and H. Jacoby, 2005: Effects of ozone on net primary production and carbon sequestration using a global biogeochemical model. *Climatic Change*, in press; MIT JPSPGC Report 103, (revised) January, 2004.)
- McFarland, J.R., J. Reilly and H.J. Herzog: Representing energy technologies in top-down economic models using bottom-up information, *Energy Economics*, 26(4): 685-707 (Report 89)
- Sarofim, M.C., C.E. Forest, D.M. Reiner and J.M. Reilly: Stabilization and global climate policy, *Global and Planetary Change*, in press
- Schafer, A.: Passenger demand for travel and energy use, *Encyclopedia of Energy*, Academic Press/Elsevier Science, in press
- Schäfer, A., and H. Jacoby, 2005a: Technology Detail in a Multi-Sector CGE Model: Transport Under Climate Policy. *Energy Economics*, in press.
- Schäfer, A., and H. Jacoby, 2005b: Vehicle Technology Under CO<sub>2</sub> Constraint: A General Equilibrium Analysis. *Energy Policy*, in press.
- Matus, K., T. Yang, S. Paltsev and J. Reilly, 2005: Economic benefits of air pollution regulation in the USA: An integrated approach. *Climatic Change*, in review.
- Reilly, J.M., B.S. Felzer, S. Paltsev, J.M. Melillo, R.G. Prinn, C. Wang, A.P. Sokolov and X. Wang, 2004a: The economic impact of climate, CO<sub>2</sub>, and tropospheric ozone effects on crop yields in China, the US, and Europe. *Eos Transactions*, 85(47), American Geophysical Union, Fall Meeting (San Francisco, Dec. 13-17) Supplement, Abstract B33A-0239.
- Reilly, J., M. Sarofim, S. Paltsev and R.G. Prinn, 2004b: The Role of Non-CO<sub>2</sub> Greenhouse Gases in Climate Policy: Analysis Using the MIT IGSM. JPSPGC Report 114, August, 18 p.; *Energy Journal*, in press.
- Yang, T., J. Reilly, S. Paltsev, Air Pollution Health Effects: Toward an Integrated Assessment, Coupling Climate and Economic Dynamics, Kluwer (in press).

### MIT Joint Program Reports

- Jacoby, H., J. Reilly and J. McFarland, 2004: Technology and Technical Change in the MIT EPPA Model. MIT JPSPGC Report 111, July, 25 p
- Paltsev, S., L. Viguier, M. Babiker, J. Reilly and K. Tay, 2004a: Disaggregating Household Transport in the MIT-EPPA Model. MIT JPSPGC Technical Note 5, July.
- Paltsev, S., H. Jacoby, J. Reilly, L. Viguier and M. Babiker, 2004b: Modeling the Transport Sector: The Role of Existing Fuel Taxes in Climate Policy. MIT JPSPGC Report 117, November, 22 p.; also to appear in: *Energy and Environment*, 25<sup>th</sup> Anniversary volume of the Group for Research in Decision Analysis (GERAD), Kluwer Academic Publishers, in press.

- Paltsev, S., J.M. Reilly, H.D. Jacoby and K.H. Tay, 2004: The Cost of Kyoto Protocol Targets: The Case of Japan. MIT JPSPGC *Report 112*, July, 27 p.
- Paltsev, S., H.D. Jacoby, J. Reilly, L. Viguier & M. Babiker, 2004: Modeling the Transport Sector: The Role of Existing Fuel Taxes in Climate Policy MIT JPSPGC *Report 117* ((November)
- Paltsev, S., J.M. Reilly, H.D. Jacoby & K.H. Tay, 2004: The Cost of Kyoto Protocol Targets: The Case of Japan JPSPGC *Report 112* (July)
- Prinn, R., J. Reilly, M. Sarofim, C. Wang & B. Felzer, 2005: Effects of Air Pollution Control on Climate , MIT JPSPGC *Report 118*, (January)
- Sarofim, M., C.E. Forest, D.M. Reiner & J.M. Reilly, 2004: Stabilization and Global Climate Policy JPSPGC *Report 110* (July)
- Yang, T., K. Matus, S. Paltsev & J. Reilly , 2005: Economic Benefits of Air Pollution Regulation in the USA: An Integrated Approach, JPSPGC *Report 113* (January)

#### Master's Theses

Matus, K., 2005: *Health Impacts from Urban Air Pollution in China: The Burden to the Economy and the Benefits of Policy*, S.M. Thesis, MIT Technology and Policy Program, Engineering Systems Division, May

Cheng, A., 2005: *Economic Modeling of Intermittency in Wind Power Generation*, S.M. Thesis, MIT Technology and Policy Program, Engineering Systems Division, May

Franck, T., 2005: *Quantifying the Cost Uncertainty of Climate Stabilization Policies*, S.M. Thesis, MIT Technology and Policy Program, Engineering Systems Division, May

Wang, X., 2005: *The Economic Impact of Global Climate and Tropospheric Ozone on World Agricultural Production*, S.M. Thesis, MIT Technology and Policy Program, Engineering Systems Division, May

Wee Chiang, S., 2005: *The European Emissions Trading System: A Stochastic Analysis*, S.M. Thesis, MIT Technology and Policy Program, Engineering Systems Division, May

#### Selected Presentations of Joint Program Staff

##### **Malcolm Asadoorian**

“Simulating the Temporal Evolution and Spatial Distribution of Urban Air Pollutants to 2030,” presented to the Workshop on Global Air Pollution Trends to 2030, sponsored by the International Institute for Applied Systems Analysis (IIASA), Vienna, Austria, 27-28 January 2005.

##### **Henry D. Jacoby**

Member, Program Committee on an Experts Meeting on Future Emissions Scenarios, Intergovernmental Panel on Climate Change, July 2004 to the present.

“Le politiche de controllo dei cambiamento climatici,” presentation at Ateneo Veneto, Venice 8 June 2004.

- “Global Climate Policy,” presentation to the CMI-EnBW Electricity Conference, Berlin, 15 June 2004.
- “Meeting the Climate-Energy Challenge,” presentation delivered to the Norwegian Research & Technology Forum in the U.S./Canada, organized by the Norwegian Embassy and the Carnegie Foundation, Washington, DC, 5 October 2004.
- Participation in a meeting of the Climate Policy Network (an activity of the MIT Joint Program, RFF and the Center for European Economic Research), Washington, DC, 7-8 October 2004.
- “Geologic Sequestration: The Value of Storage of Unknown Duration,” presentation to the Carbon Sequestration Forum, Cambridge, Massachusetts, 2 November 2004.
- Plenary speaker on “Methane Science and Policy” at the Methane to Markets Ministerial Meeting organized by the U.S. Environmental Protection Agency, Washington, DC, 15 November 2004.
- “Formulating Climate Policy In Terms of Risk Management,” presentation at a session on Beyond the Kyoto Protocol: Science and the Long-Term Approach to Climate Policy, American Geophysical Union Fall Meeting, San Francisco, California, 17 December 2004.

### **James McFarland**

- “The Future of Coal Consumption in a Carbon Constrained World,” presentation of a paper (co-authors Herzog and Jacoby) at the 7th International Conference on Greenhouse Gas Control Technologies, Vancouver, BC, Canada, 5-9 September 2004.

### **Sergey Paltsev**

- “Air Pollution Health Effects: Toward an Integrated Assessment,” presentation of a paper (co-authors Reilly and Yang) at the Conference of the International Society for Environmental Epidemiology: Addressing Urban Environmental Problems, New York University, New York, August 2004.
- “Air Pollution Health Effects: Toward an Integrated Assessment,” presentation of a paper (co-authors Reilly and Yang) at the International Conference on Policy Modeling, Université Paris I Pantheon Sorbonne, Paris, France, July 2004.
- “Disaggregating Household Transport in the MIT-EPPA Model,” presentation of a paper (co-authors Viguier, Babiker, Reilly, and Tay) to the GTAP Conference on Global Economic Analysis: Trade, Poverty, and the Environment, The World Bank, Washington DC, June 2004.
- Member of the Second Generation Model Advisory Panel, Science Advisory Board, U.S. Environmental Protection Agency, 2004-2005, ongoing.

### **John Reilly**

- “Agriculture, Ecosystems & Pollution Policy: Is There a Link to Climate?”, XXII MIT Global Change Forum & 6th FEEM Climate Policy Workshop, Venice, Italy, 8-11 June 2004.
- “Climate Impacts of Air Pollution Policy,” Climate Change Impacts and Integrated Assessment Workshop, Snowmass, CO, 1-6 August 2004.
- “How (and Why) Do the Costs of Climate Policy Differ Among Countries,” Climate Change Impacts and Integrated Assessment Workshop, Snowmass, CO, 1-6 August 2004.
- “The MIT Integrated Global System Model, Applications to Economics and Policy,” 1st Atlantic Workshop on Energy and Environmental Economics: Economic Modeling Of Climate Change Policies, A Toxa, Spain, 9-12 September 2004.
- “Climate Change, Tropospheric Ozone, and Carbon Policy,” EPRI Global Climate Change Area Council, Boston, 28-29 September 2004.

- “Issues in Forestry and Agriculture Greenhouse Gas Emissions Modeling,” Forestry and Agriculture Greenhouse Gas Modeling Forum, Shepherdstown, West Virginia, 12-15 October 2004.
- “Emissions Trading and Transportation,” International Petroleum Industry Environment and Conservation Association, Baltimore, Maryland, 12-13 October 2004.
- “Agriculture, Ecosystems & Pollution Policy: An Integrated Look,” Final TranSust Conference: Modeling the Transition to Sustainable Economic Structure, Organized by The Fondazione Eni Enrico Mattei (FEEM) and The Austrian Institute of Economic Research (WIFO), Venice, Italy, 28-29 October 2004.
- “Possible Next Steps for Climate Policy,” Climate Policy Post 2012, European Commission Director General, Research, Technology, and Development, Brussels, Belgium, 9 November 2004.
- “Challenges To Incorporating Black Carbon and Organic Carbon in Integrated Assessment Models,” Energy Modeling Forum 22: Climate Policy Scenarios for Stabilization and in Transition, Brussels, Belgium, 10-12 November 2004.
- “Possible Next Steps for Climate Policy in a Multigas World,” Energy Modeling Forum 22: Climate Policy Scenarios for Stabilization and in Transition, Brussels, Belgium, 10-12 November 2004.
- “The Economic Impact of Climate, CO<sub>2</sub>, and Tropospheric Ozone on Crop Yields in China, the US, and Europe,” presentation of a poster paper (co-authors Felzer, Paltsev, Melillo, Prinn, C. Wang, Sokolov and X. Wang) at the American Geophysical Union Fall Meeting, San Francisco, California, 13-17 December 2004.
- “Managing the Carbon Cycle: Interactions between the Economy and Biosphere,” BIOCAP Canada Foundation, First National Conference, Ottawa, Canada, 2-3 February 2005.
- “Economic Effects of Environmental Change on Agriculture,” Colloquium on Interfaces between Climate and Economic Dynamics, Interlaken, Switzerland, 3-4 March 2005.
- Ongoing participation in the U.S. Climate Change Science Program, Product 2.1: “Scenarios of Greenhouse Gas Emissions and Atmospheric Concentrations and Review of Integrated Scenario Development and Application,” meetings in Washington, DC, 4 October 2004, 11 January 2005.