International Modeling Research Update

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ITS-DAVIS BOARD OF ADVISORS
CLEAN TRANSPORTATION RESEARCH UPDATE
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MODELS AND PROJECTS

• **GCAM**: Long-term global energy and environmental modeling
• **IEA MoMo**: Long-term transport sector modeling

• **ITEM**: Transport model comparison project
• **International travel survey of university students**
• **China & India – Transportation projections**
GCAM – Global Change Assessment Model

The Energy System

- Energy Supply
  - Coal, Gas, Oil
  - Renewables
  - Electricity
  - Hydrogen

- Energy Demand
  - Transportation
  - Buildings
  - Industry

- Energy Markets
  - Fossil fuel prices
  - Electricity prices
  - Hydrogen prices

- Energy System Emissions

Climate

- Climate
  - Concentrations
  - Radiative Forcing
  - Global Mean Temperature Rise
  - Sea Level Rise

Economy

- Regional Resource Bases
- Regional Energy Conversion Technologies
- Energy Demand Technologies

- Regional Labor Force
- Regional GDP
- Technologies/Farm
- Regional Land Characteristics

Agriculture & Land Use

- Agricultural Demand
  - Crops
  - Livestock
  - Forest Products

- Agricultural Supply
  - Crops
  - Livestock
  - Forest Products
  - Bioenergy

- Agricultural Markets
  - Crops prices
  - Livestock prices
  - Forest Product prices
  - Bioenergy prices

- Land Use & Land Cover

Commercial Biomass

Pacific Northwest National Laboratory
Projects involve both model application & model development

**MODEL APPLICATION**
- Projections of energy efficiency**
- Decompose roles of energy intensity & carbon intensity to achieve climate goals**
- Measure impacts of U.S. (shale) NG exports

**MODEL DEVELOPMENT**
- New transportation module
- Bioenergy and N20 emissions from fertilizer application
- Uncertainty – Monte Carlo simulation

** Project completed
GCAM – NEW UCDTransport MODULE

Detailed representation of transportation sector

Travel demand in 2050

Mode Shares in 2050
Fuel demand and CO₂ emissions from passenger transportation in 2050
**GCAM – PROJECTED EFFICIENCY OF ENERGY USE**

**Lifecycle Energy** (lighter columns) & **Exergy Efficiency** (darker columns) in 2005 + future climate policy scenarios

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**End-users**

**Energy Resources**

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[Image with bar charts showing lifecycle energy and exergy efficiency across different scenarios for various energy resources.]
Relative contribution of mitigation drivers in reducing CO$_2$ emissions from energy use

MCP & ACP scenarios target: restrict radiative forcing to 4.5 & 6.0 W/m$^2$ by 2100
Nordic Rapid Transition Project (RTS)
What would an ambitious transition to low-carbon LDVs look like for Nordic countries?

Bus Rapid Transit (BRT) System – Future Deployment Scenarios
Cost-benefit analysis and policy implications
TRANSPORTATION PROJECTIONS – MODEL COMPARISON

Transport Roadmap | MESSAGE | MoMo | GCAM | GCAM & MoMo

- Compare model methodologies, input assumptions, transport projections
- Calibrate input assumptions: population, GDP, base year energy, etc.
Transportation Projections by Fuel Type in 2040


Fuel: Electricity, H2, Liquids, NG, Others
• Do students travel in ways similar to general public?
• To what extent does university location affect travel choices?
• What are key “drivers” of student travel behavior?
• What aspirations do students have for future travel, in particular for two-wheeler and car ownership?
• Does travel behavior differ across regions? If yes, what factors account for differences?
  o Economic and/or cultural differences
  o Transport systems
  o Residential/land use patterns
India – Uncertainty in Historical Estimates

Combine bottom-up and top-down methods to estimate historical transport volume
THANK YOU!

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