Joint Program on the Science and Policy of Global Change

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MIT Joint Program on the Science and Policy of Global Change
Vision and Overview

We explore the interplay between our global environment, economy, and human activities, to discover new interactions and their relevance to policy.

We're supported by an international consortium of 32 companies/foundations & 8 USA federal Agencies.

Our Goals:

- **Objectively assess uncertainty in economic and climate projections**
- **Critically and quantitatively analyze environmental management and policy proposals**
- **Examine implication of technologies (e.g. CCS, solar, wind, nuclear, advanced fossil, biofuels, hydrogen, …)**
- **Understand connections among climate, air pollution, food, water, energy, urbanization, …**

Industrial Members and Government Research Sponsors

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Toyota Motor North America
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U.S. Department of Agriculture [USDA]
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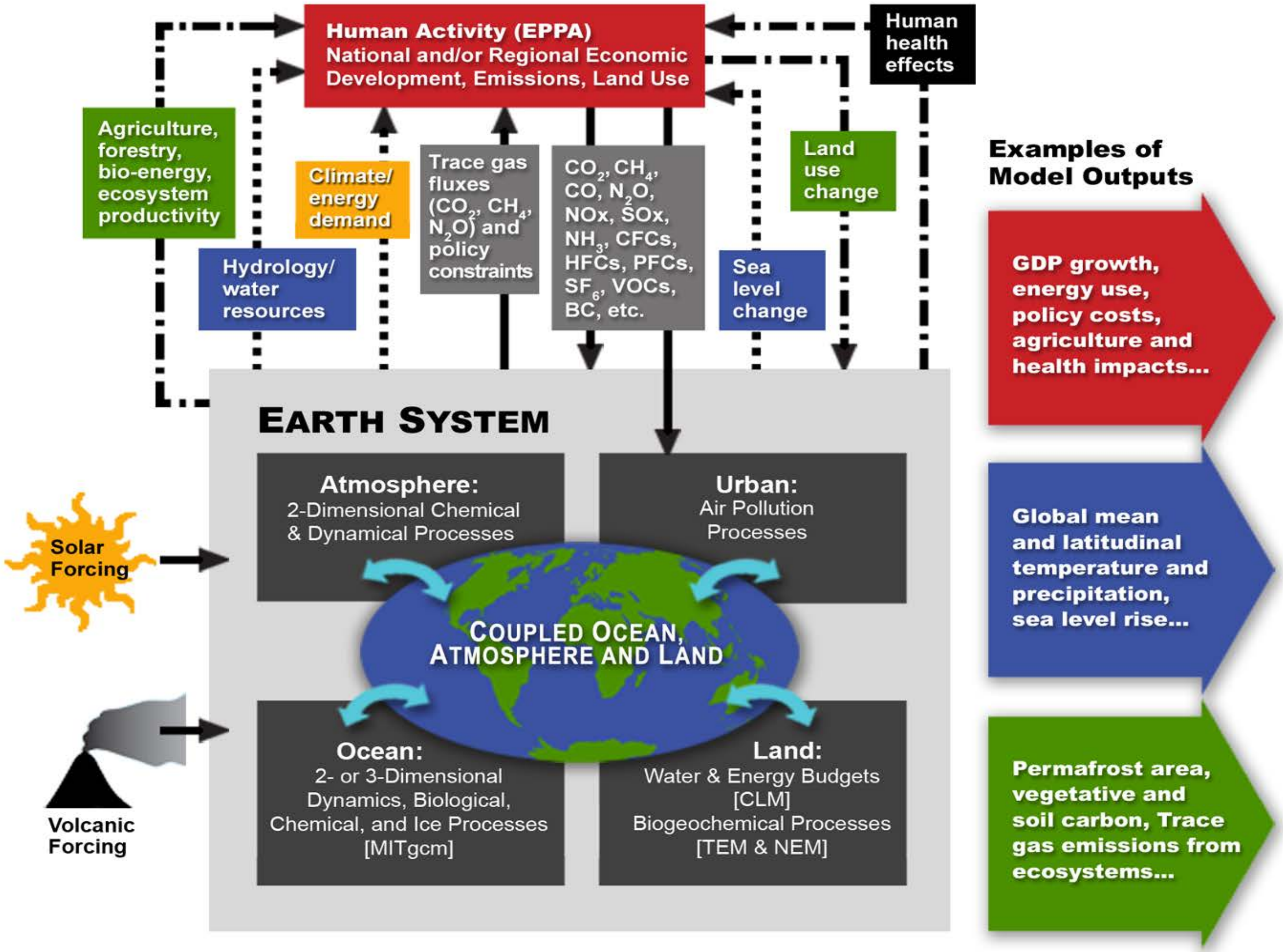
U.S. Environmental Protection Agency [EPA]
U.S. Federal Aviation Administration [FAA]
U.S. National Aeronautics and Space Administration [NASA]
U.S. National Renewable Energy Laboratory [NREL]
U.S. National Science Foundation [NSF]

THE MIT INTEGRATED GLOBAL SYSTEM MODEL (IGSM)
Earth and Human System Links



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SCIENCE POLICY
GLOBAL CHANGE

http://globalchange.mit.edu/

EPPA Model Structure

Sectors

Non-Energy
- Agriculture
- Energy Intensive Ind.
- Other Industry
- Services
- Industrial Transport
- Household Transport
- Other Household Cons.

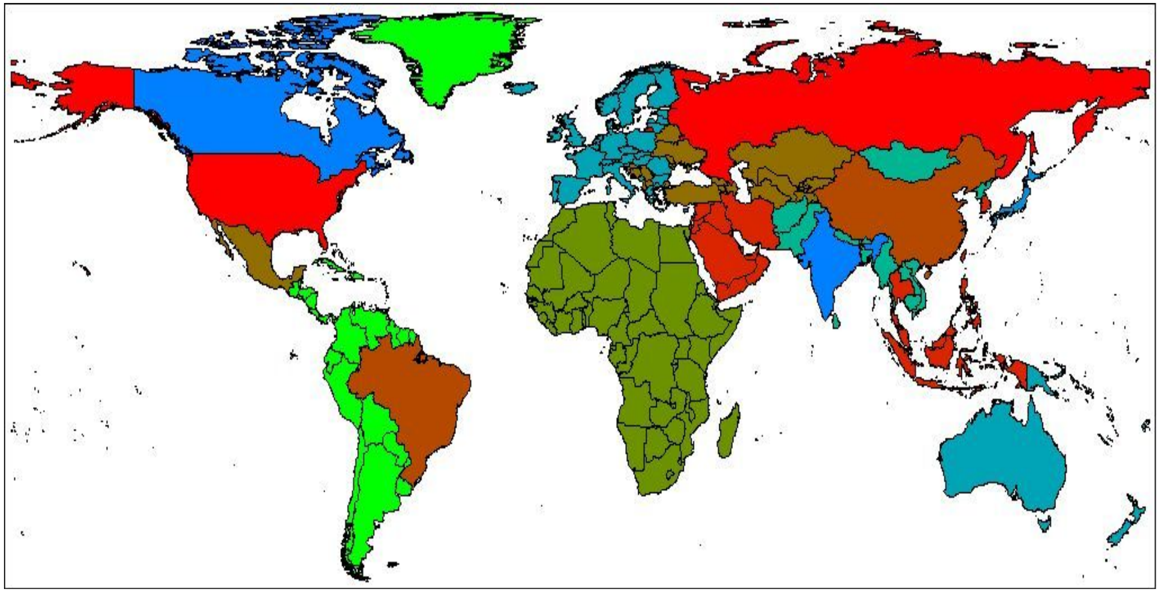
Fuels Supply
- Crude oil
- Refined oil
- Biofuel
- Shale oil
- Coal
- Natural gas

Electric Generation

Regions

USA, EU, Rest of Eurasia, Canada, Japan, Aus. & N.Z., Russia

China, India, Middle East, Africa, Mexico, Brazil, Rest of Latin Am., Dynamic Asia, Rest of Asia



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Electric Generation

Crops
Livestock
Forestry
Biofuel crops

Crude slate & gasoline, diesel, petcoke heavy oil, biodiesel, ethanol, NGLs & explicit upgrading

Transport
Gasoline & diesel
PHEV
Biofuels, CNG

Shale gas
gas from coal
coal liquids

Technologies Included
Fossil (oil, gas & coal)
Coal with CCS
Gas with CCS
Adv. gas without CCS
Nuclear
Hydro
Wind and solar
Biomass

Asia Water Stress: Change in decadal averaged water stress (2041-2050) Effect of Mitigation Policy

Unconstrained Emissions

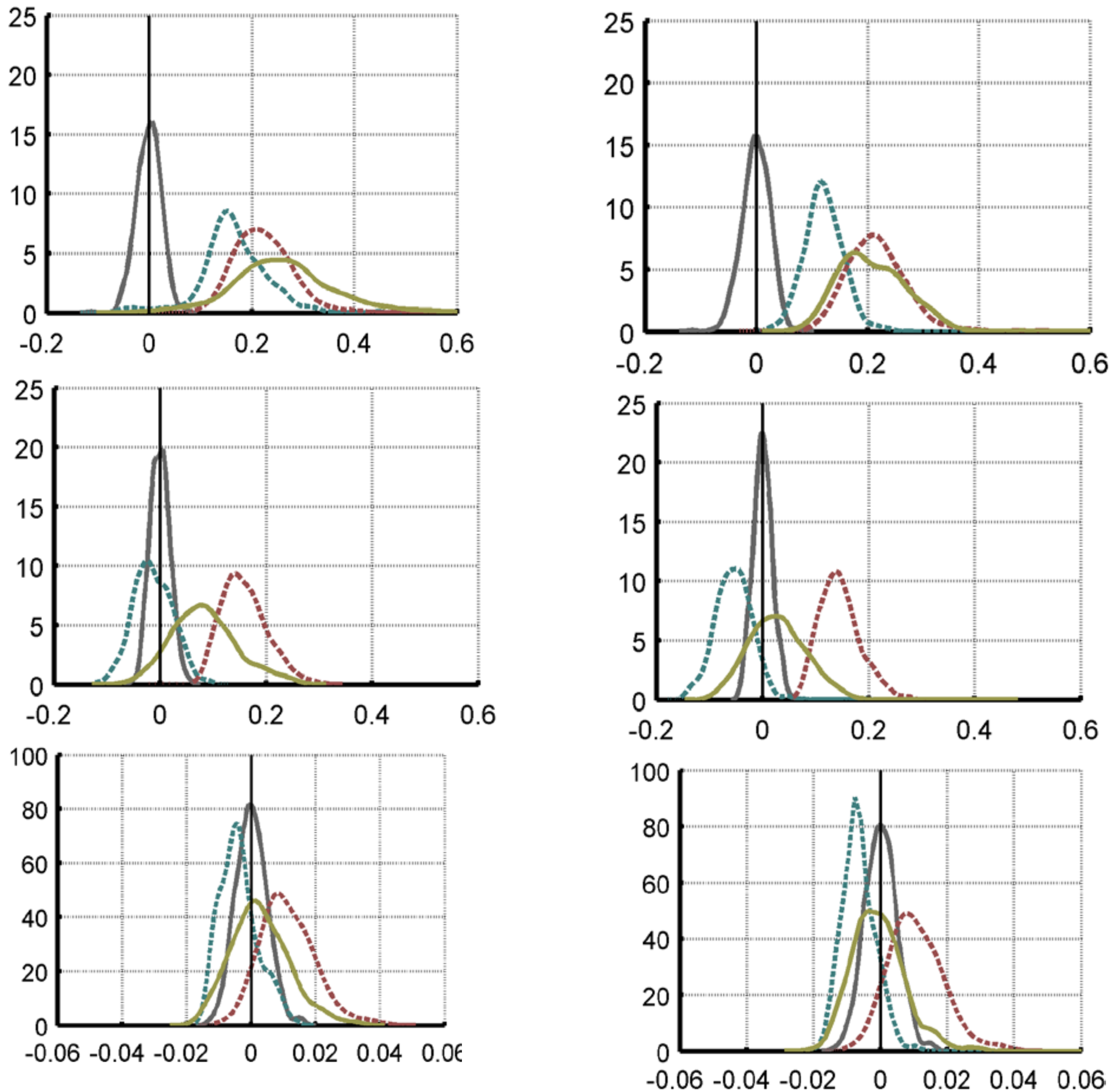
Baseline
Just Growth
Just Climate
Climate and Growth

~550 ppm

CHINA

INDIA

MAINLAND SEA



JP Report 269

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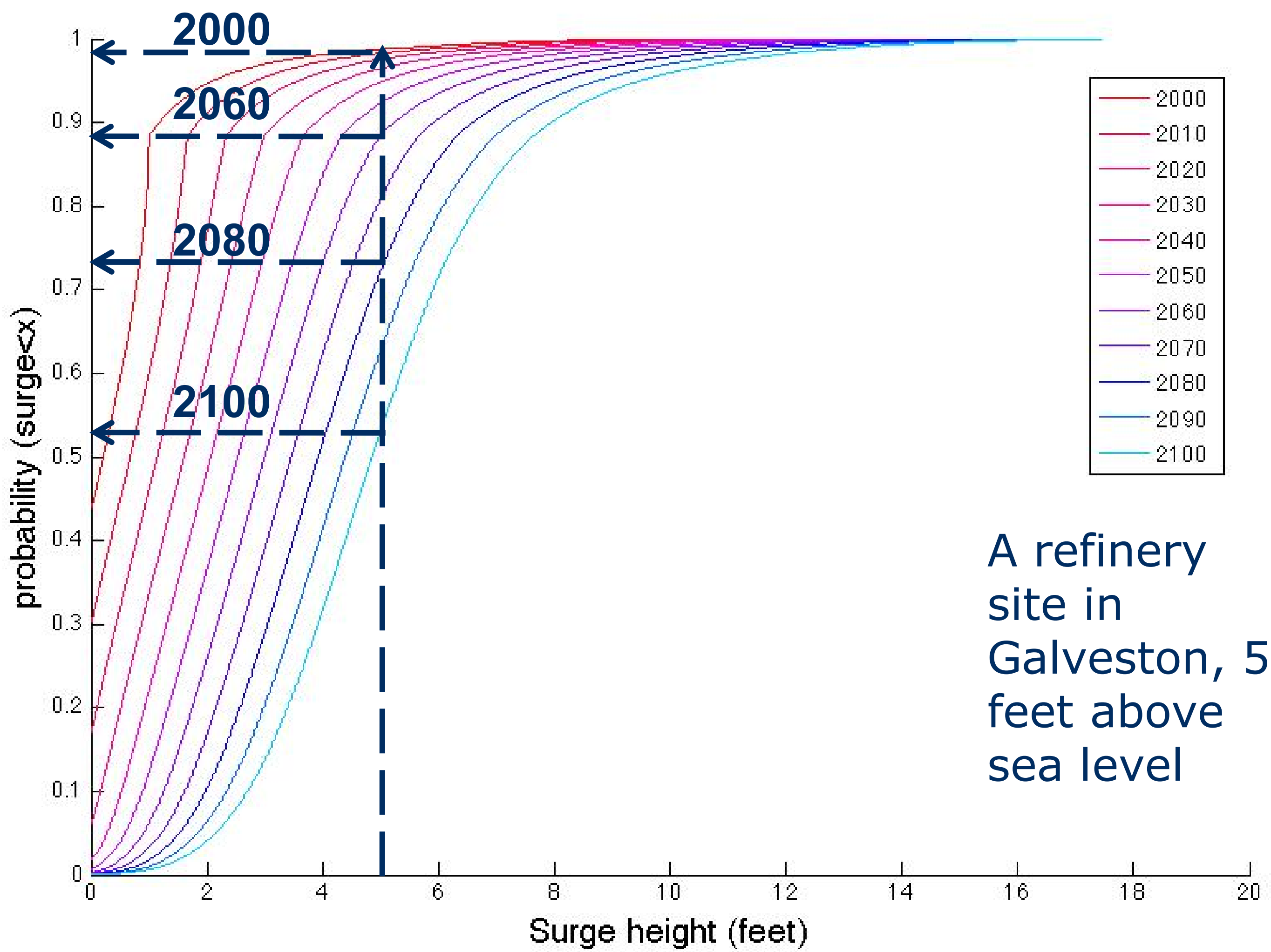
Shifting Surge Risk over Time, with change in frequency/intensity of tropical storms, subsidence, sea level rise combined



A refinery site in Galveston, 5 feet above sea level

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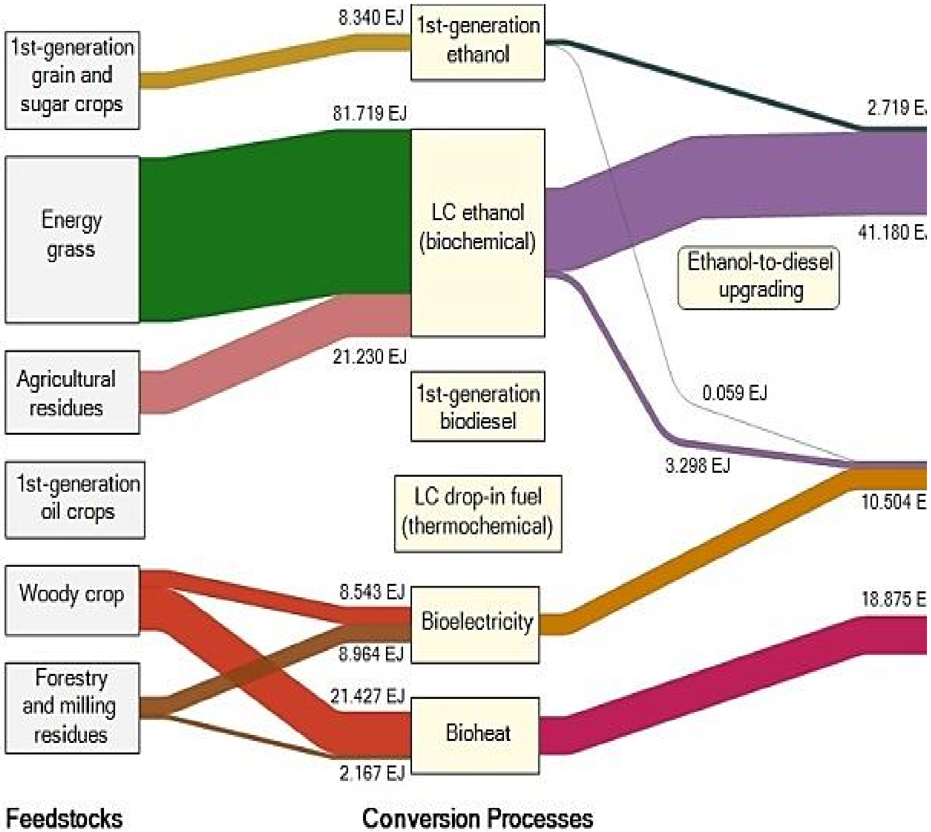
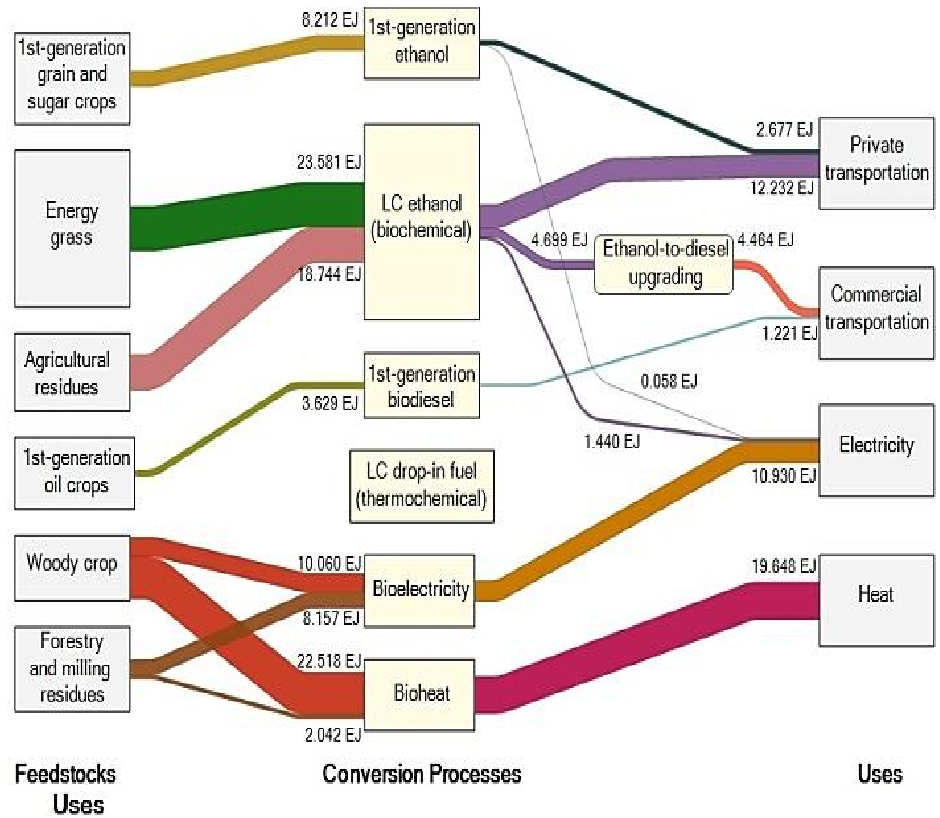
Global Biomass Energy

Base climate policy



Constraining ethanol blend wall



JP Report 273

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Many Other Topics

- Potential for new technology and the economic and environmental implications of widespread adoption—renewables, shale gas, oil sands, nuclear, advanced vehicles.
- Cost and effectiveness of policy proposals—broad cap and trade or GHG taxes, pollution policy compared with narrower measures (e.g. RFS2, RES, CAFE, RPS, EU ETS)
- Global environmental risks and effects on critical infrastructure and on food, land water, energy, air pollution.
- Sectoral studies on transportation, power generation, fuels, natural gas, agriculture, water
- Global and regional focus (e.g. US, Europe, China, Japan, Russia, Mexico, Africa)
- Earth system risks to Arctic, Oceans, Terrestrial Ecosystems