What impacts would we want to consider in PNNL/JGCRI IA modeling?

- Goal #1: Pick things that are important.
- Goal #2: Pick things that involve interactions among the various systems represented in IA models.
- Goal #3: Pick things that we actually have a chance of doing.

Expanding on #3: A primary benefit of IA models is their ability to capture interactions between systems. This leads to a perspective on impacts in which we distinguish between

- Those which are most amenable to an integrated perspective.
- Those which can “hang” off of the model and not feed back to other systems in the model.

Although integrated analysis brings impacts together in an integrated system, aggregating and monetizing all impacts is not inherently core to considering impacts in GCAM.
CLIMATE FEEDBACKS IN BUILDINGS
Climate Change Effects on Buildings

Change in fuel consumption in US buildings:
Ref emissions scenarios
- CCSM-Ref-Fix
- GISS-Ref-Fix
- HADLEY-Ref-Fix

Change in fuel consumption in US buildings:
550 emissions scenarios
- CCSM-550-Fix
- GISS-550-Fix
- HADLEY-550-Fix

Change in fuel consumption in China buildings:
Ref emissions scenarios
- CCSM-Ref-Fix
- GISS-Ref-Fix
- HADLEY-Ref-Fix

Change in fuel consumption in China buildings:
550 emissions scenarios
- CCSM-550-Fix
- GISS-550-Fix
- HADLEY-550-Fix
CLIMATE FEEDBACKS ON AGRICULTURE AND LAND USE
Climate Change Leads to Changes in Crop Prices (e.g. Corn)

Changing climate leads to changes in:

- Crop yields and prices,
- Land area under cultivation,
- Deforestation rates, and
- Less bioenergy supply.

Range of Crop Prices Across Climate and Crop Models
Mitigation regimes also affect crop prices and land use

- Price of corn under three different regimes in which the price of carbon to stabilize atmospheric CO₂ concentrations is incorporated into land rental rates.
FOREST DISTURBANCES
Forest Disturbance, Energy and the Cost of Limiting Radiative Forcing to 4.5 Wm$^{-2}$

**Impacts of increased disturbances on mitigation strategy**

- Terrestrial ecosystems turn into a potentially large source of carbon.
- Achieving mitigation requires a faster and more pronounced decarbonization, driven by much higher carbon taxes/subsidies.
- Higher food and energy prices increase the burden on the population.
IMPACTS ON ELECTRICITY
We are just beginning to look into impacts in general in electricity

- Impacts on solar insolation.
- Impacts on wind power.
- Derating of power plants because of climate, for example, temperature and water.
- Effects on hydro power.
WATER
Climatic Future Projections ($Q_{2100} - Q_{2000}$) for the GCAM Hydrology Model

<table>
<thead>
<tr>
<th>Model</th>
<th>Long name</th>
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<tbody>
<tr>
<td>CGCM2</td>
<td>Canadian Centre for Climate (Modelling and Analysis) (Canada)</td>
<td>7</td>
</tr>
<tr>
<td>CSIRO mk 2</td>
<td>Commonwealth Scientific and Industrial Research Organisation (Australia)</td>
<td>10</td>
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<tr>
<td>DOE PCM</td>
<td>Parallel Climate Model (NCAR - USA)</td>
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</tr>
<tr>
<td>HadCM3</td>
<td>Hadley Centre Coupled Model</td>
<td>23</td>
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</tbody>
</table>
Energy systems are moving toward increased use of cooling towers rather than once-through cooling: USA – no climate policy