IMAGE scenario work
IMAGE greenhouse gas stabilisation scenario project (2007)

4 SRES scenarios differentiated in:
- Population
- Income /equity
- Technology assumptions (energy, land)
- Fuel and food preferences
- Trade assumptions (fuels, food)
- Taxes
- [governance, development focus]

Exploration of different stabilisation levels

Emissions

Strengers, B. et al. (2004). The land-use projections and resulting emissions in the IPCC SRES scenarios as simulated by the IMAGE 2.2 model GeoJournal 61 (4), pp. 381-393
Bio-energy potential

Costs as function of baseline

Climate policy here introduced in the form of a carbon tax. But in reality there might be a relationship between the SRES scenario and the policy-instruments (or SSP and the CPA).

Importance of uncertainty

Scenario independent (e.g. oil resource)

Uncertainty

Scenario dependent

Importance of uncertainty

Monte-Carlo sampling from conditional probability distribution functions and run the model.

(conditionality preserves the consistency among the parameters)

Importance of uncertainty

Energy use

CO2 emissions

There is not a single representation of an SSP in one IAM

Runs by other IAMs, obviously, allows to exploring even larger range of uncertainty space for different SSP

Selecting illustrative scenarios risks imprinting a particular scenario interpretation on the scientific literature but increases comparability

So for ‘Shared Socio-economic Pathways’ trade-off between increasing consistency in the literature vs. decreasing uncertainty.

In single studies, obviously, we would like to have high degree of consistency (so a particular impact study may decide only to use MODEL-X scenarios if it wants a high degree of consistency across 1 or 2 axes).

Argument for strong emphasis on the basic SSPs and the use of multiple models
<table>
<thead>
<tr>
<th>Economic optimism</th>
<th>SRES</th>
<th>Millennium Ecosystem Assessment</th>
<th>GEO3/GEO4</th>
<th>Global Scenario Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic optimism</td>
<td>A1</td>
<td>Markets first</td>
<td>Market forces</td>
<td></td>
</tr>
<tr>
<td>Sustainable development</td>
<td>B1</td>
<td>Technogarden</td>
<td>Sustainability first</td>
<td>New sustainability Paradigm</td>
</tr>
<tr>
<td>Regional sustainability</td>
<td>[B2]</td>
<td>Adapting mosaic</td>
<td>Eco-communalism</td>
<td></td>
</tr>
<tr>
<td>Regional competition</td>
<td>A2</td>
<td>Order from Strenght</td>
<td>Security first</td>
<td>Barbarization</td>
</tr>
<tr>
<td>Business-as-usual</td>
<td>[B2]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Van Vuuren et al.. The use of scenarios in global environmental assessments. Global Environmental Change (under review)
Table 3. Key assumptions in different ‘scenario families’

<table>
<thead>
<tr>
<th>Economic development</th>
<th>Reformed Markets</th>
<th>Global SD</th>
<th>Regional competition</th>
<th>Regional SD</th>
<th>Business as Usual</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic optimism</strong></td>
<td>Rapid</td>
<td>ranging from slow to rapid</td>
<td>slow</td>
<td>ranging from mid to rapid</td>
<td>medium (globalisation)</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>high</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>Rapid</td>
<td>Rapid</td>
<td>ranging from mid to rapid</td>
<td>slow</td>
<td>ranging from slow to rapid</td>
<td>medium</td>
</tr>
<tr>
<td><strong>Population growth</strong></td>
<td>various</td>
<td>global</td>
<td>security</td>
<td>local</td>
<td>not defined</td>
</tr>
<tr>
<td>Low</td>
<td>goals</td>
<td>sustainability</td>
<td>reactive</td>
<td>sustainability</td>
<td>proactive</td>
</tr>
<tr>
<td><strong>Technology development</strong></td>
<td>both reactive and proactive</td>
<td>globalisation</td>
<td>trade barriers</td>
<td>trade barriers</td>
<td>weak globalisation</td>
</tr>
<tr>
<td>Slow</td>
<td>globalisation</td>
<td>globalisation</td>
<td>strong national governments</td>
<td>strong national governments</td>
<td>mixed</td>
</tr>
<tr>
<td><strong>Main objectives</strong></td>
<td>economic</td>
<td>trade barriers</td>
<td>local steering; local actors</td>
<td>local steering; local actors</td>
<td></td>
</tr>
<tr>
<td><strong>Environmental protection</strong></td>
<td>growth</td>
<td>barriers</td>
<td>strong national governments</td>
<td>strong national governments</td>
<td></td>
</tr>
<tr>
<td><strong>Trade</strong></td>
<td>reactive</td>
<td>proactive</td>
<td>both reactive and proactive</td>
<td>both reactive and proactive</td>
<td></td>
</tr>
<tr>
<td><strong>Policies and institutions</strong></td>
<td>policies create open markets</td>
<td>strong global governance</td>
<td>local steering; local actors</td>
<td>local steering; local actors</td>
<td></td>
</tr>
</tbody>
</table>

Note: This table summarises key assumptions in very general terms. Where differences within a set of scenario families exist, broad ranges are indicated.

Van Vuuren et al.. The use of scenarios in global environmental assessments. Global Environmental Change (under review)
ADAM-project (Adaptation and Mitigation)

Run IAM model output (population, income, temperature, precipitation) in impact models

Sea level rise impacts (adaptation costs + damage in 2000-2100, $)

- B2 (4°C)
- B2-450 (2°C)

In the category CPA we tend to focus on mitigation (defines RF-level).

Van Vuuren et al. (2011). The use of scenarios as the basis for combined assessment of climate change mitigation and adaptation. Global Environmental Change 21 (2), pp. 575-591
ADAM-project (Adaptation and Mitigation)

*Run IAM model output (population, income, temperature, precipitation) in impact models*

**Water stress (people exposed)**

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People at water stress

Arnell, N, Van Vuuren, D.P. and Isaac, M. (2011). The implications of climate policy for the impacts of climate change on global water resources. GEC
People at water stress

Arnell, N, Van Vuuren, D.P. and Isaac, M. (2011). The implications of climate policy for the impacts of climate change on global water resources. GEC
Pattern of climate change may be much more important for some impacts than climate sensitivity of the model or whether a model is wet/dry on a global scale.

It is difficult to determine a priori which models is going to lead to the largest impacts; also depends on the impact.

So again, there is a strong trade-off between increasing consistency among the community to facilitate assessment and reducing uncertainty.

Important to define a minimum set of of **shared** parameters that is sufficient to allow comparability; ensures consistencies.

In addition, make sure that other sets of richer data are available for modellers at the discretion of the individual modellers.
Special Issue Climatic Change

- 1. Overview paper (van Vuuren et al.)
- 2. MESSAGE paper (Riahi et al.)
- 3. AIM paper (Matsui et al.)
- 4. GCAM paper (Thomson et al.)
- 5. IMAGE paper (van Vuuren et al.)
- 6. Land use paper (Hurtt et al.)
- 7. Emission inventory paper (Garnier et al.)
- 8. Atm. Chemistry paper (Lamarque et al.)
- 9. GHG conc. & extension (Meinshausen et al.)