Scenarios to support decision-making

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Motivation

- Working with mitigation and adaptation decision-makers has been our starting point.
- We find that in these situations, policy-makers often need a way to think about future conditions, and especially regarding exogenous factors outside their locus of control – but important for their decisions.
- We realized that it may be useful to examine these decision-making contexts in more detail to identify key uncertainties that seem to matter; and the attributes of scenarios that would help decision-makers think through the implications of these uncertainties.
Case 1: India’s Low Carbon Expert Group

- **Origin / context:** Copenhagen Accord pledge and follow-up to the National Action Plan on Climate Change. Mandated to produce a road-map for low-carbon growth, with the Planning Commission as the client. Supported by the government, but not a formal inter-ministerial process.

- **Framing:** Low-carbon development for inclusive growth – not mitigation, but policy choices that meet growth objectives with lower emissions; Explicit adoption of a co-benefits framework.

- **Policy choices and the decision space:** Fuel prices; investments; regulations (example appliance standards, building codes); Determining level of climate mitigation desired – policy scenarios (determined effort – 23-25% emission intensity reduction by 2020, aggressive effort – 33-35% reduction).

- **Endogenous factors (criteria, variables):** Economic growth target (real GDP growth of 8-9% till 2020); Meeting demand projections.

- **Exogenous factors / uncertainties:** Technology availability & cost (particularly for renewables); Global and domestic growth projections (feasibility of growth target and dependence on global conditions); Resource distribution & availability (availability of oil, coal, gas); Policy / institutional issues (coal sector restructuring; geopolitics with regard to access to fossils; investment flows).

(http://planningcommission.nic.in/reports/genrep/Inter_Exp.pdf)
Low-carbon policies that are inclusive need to be differentiated across sectors based on national priorities and transaction costs of implementing the policy. In sectors such as land, water and forests; livelihood considerations such as income generation and poverty alleviation must dominate our policy choice, even if it requires overriding carbon emission concerns. Who bears the burden and whether it is equitably distributed, need to be examined and considered explicitly during the formulation and implementation of low-carbon strategies.
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Scenarios: Options for policy choices

1. Determined Effort [Lower End of the Emission Reduction Range]
Determined Mitigation Effort implies policies that are already in place or contemplated are pursued vigorously and implemented effectively up to 2020. This is by no means automatic as it requires continuous up-gradation of technology as well as finance from both public and private sources.

2. Aggressive Effort [Higher End of the Emission Reduction Range]
Aggressive Mitigation requires, in addition to the above, introduction as well as implementation of new policies. This requires new technology as well as additional finance.
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Case 2: Responding to flooding in Mumbai

- **Origin (context):** Extreme precipitation in July 2005 (944 mm rainfall in 24 hours) led to massive flash floods; Development of local disaster management plan and revamping of the century old storm water drainage system; Monsoon flooding is a chronic hazard in Mumbai; Actual flooding a complex outcome of land use, pre-monsoon actions (drain cleaning), tidal state and rainfall.

- **Framing:** Disaster management / mitigation; Slum redevelopment; City growth and changes in patterns of economic activity (and associated land-use) in the city.

- **Policy choices and decision space:** Disaster management plan and institutional response (state and city government); Upgradation of storm water drainage system (city with local and central support); 30-year development plan (city); Major urban infrastructure investments (central and city).

- **Endogenous factors (decision criteria):** Costs and benefits of infrastructure investments; Observation & warning capability; Economic & non-economic losses with flooding – non-insured loss.

- **Exogenous variables / uncertainties:** Population growth and distribution; Finance / investment constraints; Climate outcomes (sea level rise and precipitation); Coordination among city and state; Political pressures and policies for implementation (slum redevelopment); Private responses.

APN Science bulletin March 2013, paper in preparation
High tide at 14.30
High tide at 20.30

July 26, 2005
July 27, 2005

Fact-Finding Committee on Mumbai Floods
Underground Storm Water Drainage System of Island City Area
Drawing No.: - 2

Reference - Gazetteer of India, Maharashtra State, History of Bombay, Modern Period 1687
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Vulnerability: Are we measuring (and projecting) what matters?

Public sector (municipal) losses: $55 million
Insured losses (approximate): $400 million
Household losses (uninsured, primary survey, likely underestimate): $270 million
Business losses (uninsured, primary survey, likely underestimate): $150 million

**Indirect effects**

<table>
<thead>
<tr>
<th>Problem</th>
<th>% among surveyed households (n=1168)</th>
<th>% among surveyed commercials &amp; small industries (n=792)</th>
</tr>
</thead>
<tbody>
<tr>
<td>House/office flooded with water</td>
<td>70</td>
<td>82</td>
</tr>
<tr>
<td>Non-availability of local transportation</td>
<td>87</td>
<td>82</td>
</tr>
<tr>
<td>Price rise of essential commodities</td>
<td>67</td>
<td>65</td>
</tr>
<tr>
<td>Non-availability of food and other household supplies</td>
<td>62</td>
<td>-</td>
</tr>
<tr>
<td>Non-availability of raw materials</td>
<td>-</td>
<td>56</td>
</tr>
<tr>
<td>Disruption in communication services</td>
<td>61</td>
<td>66</td>
</tr>
<tr>
<td>Disruption of electricity</td>
<td>83</td>
<td>88</td>
</tr>
<tr>
<td>Non-availability of clean drinking water</td>
<td>75</td>
<td>79</td>
</tr>
<tr>
<td>House flooded with sewerage/garbage</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>Non-availability of fuel</td>
<td>51</td>
<td>46.5</td>
</tr>
</tbody>
</table>

**Impact vs. recovery**

- **Power supply during July 11 and August 20, 2005**
- **Time taken for complete restoration of electricity supply in flood affected areas**
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Adaptation: Private response – are we observing (and analyzing) what matters?

<table>
<thead>
<tr>
<th>Item</th>
<th>% of commercial &amp; industrial establishments (n=792)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase the height of the surrounding plot</td>
<td>72.9</td>
</tr>
<tr>
<td>Reconstruction with stilt parking</td>
<td>12.5</td>
</tr>
<tr>
<td>Repairing and/or elevating electrical meters</td>
<td>50.1</td>
</tr>
<tr>
<td>Repairs inside the office premises</td>
<td>42.6</td>
</tr>
<tr>
<td>Repairs outside the office premises</td>
<td>17.2</td>
</tr>
<tr>
<td>Repairs done to elevate and protect inventory</td>
<td>7.3</td>
</tr>
</tbody>
</table>

Small business / commercial responses

<table>
<thead>
<tr>
<th>Item</th>
<th>% of households (n=1168)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing height of surrounding ground</td>
<td>42</td>
</tr>
<tr>
<td>Reconstruction of house with stilt parking</td>
<td>11</td>
</tr>
<tr>
<td>Repairing &amp; elevating electrical meters</td>
<td>27</td>
</tr>
<tr>
<td>Repairs inside house to elevate furniture</td>
<td>31</td>
</tr>
<tr>
<td>Repairs inside house to elevate electronic gadgets</td>
<td>33</td>
</tr>
<tr>
<td>Repairing/ modifying toilets</td>
<td>11</td>
</tr>
</tbody>
</table>

Household responses
Case 3: Electricity system planning (US ISO’s)

- **Origin / context**: stakeholder engagement in model development project: independent system operators, utilities, regulatory agencies, bioenergy and agricultural interests, consumer and environmental groups
- **Framing**: Evolution of electric system including implications of climate policy options, socioeconomic conditions, and climate change for choice of generation technology, transmission requirements, etc.
- **Policy choices and decision space**: investment decisions in generation and transmission capacity; plant up-grades; investment in bioenergy production
- **Endogenous factors (decision criteria)**: electricity prices, crop prices, employment impacts, GHG emissions
- **Exogenous conditions/uncertainties**: demographic and economic conditions; oil and gas prices; technology cost and performance; EPA regulations (e.g., coal ash disposal); cooling water regulations/temperatures; agriculture commodity prices
  - Factors affected by interactions at regional, national, and even global scale
Key exogenous factors & uncertainties

- Demographics & progress towards development goals
- Magnitude & distribution of growth
- Policy and institutional context and public & private response
- Technology / resource price and performance
- Climate / environmental outcomes
Approaches

• Parametric analysis
• Uncertainty analysis
• Scenario-based exploration
Parametric approach

• Vary uncertain factors jointly to develop a few scenarios with combinations of high and low values that affect demand, supply, and/or price of inputs or outputs, and / or exposure / hazard
• Test for plausibility, i.e., do not include combinations that defy logic
• Evaluate against a (limited number) of cases – reference and policy

<table>
<thead>
<tr>
<th>Key Uncertainties</th>
<th>Variables</th>
<th>Base case</th>
<th>Worst case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate outcomes</td>
<td>Sea level rise; 24-hour precipitation</td>
<td>Choices &amp; outcomes</td>
<td>Choices &amp; outcomes</td>
</tr>
<tr>
<td>Development outcomes</td>
<td>Housing stock; Slum population; Sanitation</td>
<td>Choices &amp; outcomes</td>
<td>Choices &amp; outcomes</td>
</tr>
<tr>
<td>Policy &amp; institutional context</td>
<td>Development plan includes SLR; Implementation of DRM</td>
<td>Choices &amp; outcomes</td>
<td>Choices &amp; outcomes</td>
</tr>
</tbody>
</table>
Narrative/quantitative scenarios

• Explore points of divergence in global outcomes
• Address three sets of inter-related uncertainties:
  – Economics/demographics
  – Technology price/performance
  – Policy
• Provide an underlying logic for assumptions and values for driver variables
• Provide approach for communicating with high level decision makers
• Do not consider climate or other environmental aspects but incorporate these through climate scenarios
Key sources of divergence in global outcomes

• Global growth: Magnitude and distribution and the role of emerging markets
  – ADB: The Asian Century vs. the Middle Income trap
  – McKinsey: Emerging markets as the engines of global growth

• Governance & power: Concentrated, top-down and organized vs. Distributed, bottom-up and sometimes chaotic
  – Shell: Mountains vs. Oceans

• Balance between social progress and growth:
Scenarios for Asia in 2050 (ADB, 2011)

McKinsey scenarios (2011)

[Diagram showing four scenarios:
- **Scenario 1**: The world rebalanced
  - Both developed world and emerging markets regain solid growth trajectories
  - No major economic crises
- **Scenario 2**: Emerging markets derailed
  - Developed world resumes growth; emerging markets slow down
- **Scenario 3**: Decade of the dragon and the tiger
  - Developed world slows down; emerging markets sustain robust growth rates
- **Scenario 4**: Globalization stalled
  - Developed world eventually drags emerging markets down with them
  - Multiple economic crises]

http://www.mckinsey.com/features/growth/scenarios
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• Balance between social progress and growth
Conventional economic progress may be slow, but effective governance and institutions ensure progress towards social goals.

Economic progress goes together with strong improvement in social indicators.

Growth (magnitude & distribution)

Weak economic progress is combined with lack of progress in social indicators lead to a future with large developmental challenges including poverty and inequality.

Economic growth may be rapid, but may be concentrated and not widespread, and is prioritized over social goals leading to questions about its sustainability and ability to meet developmental challenges.
Scenarios for end state or scenarios for the dynamics of the pathway?

Source: New lens scenarios from Shell
Where do we need to go? Expectations

• Scenario logic is translatable across different scales of decision-making (spatial, institutional)
• Users can tailor the logic to their own needs – avoid over-specification, be minimalist
• Ability to lead to divergent, but not implausible futures – capture the points of divergence
• Provides a logic and framework that helps users place their decisions and choices in the broader context