Company Climate Risk: Developing a technical foundation for companies, investors, & others

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UNFCCC COP24, Katowice, Poland
December 13, 2018
Background

- Companies and investors should be considering and managing business risks
- Stakeholders increasingly requesting that companies analyze the policy cost risk of managing climate change (such as limiting global warming to 2°C)
  - Similarly, companies are receiving requests to set GHG emissions reductions targets
- Organizations are creating recommendations, methodologies, and tools they would like companies to apply (e.g., TCFD, Science Based Targets, Ceres, UNEP FI)
- However, the analyses are technically challenging for companies to undertake and for stakeholders and the public to evaluate
- Sound scientific understanding is a requisite first step for companies, methodologies, and dialogue – need to slow down and characterize current scientific knowledge
An Initial Scientific Foundation for Companies Considering Climate Scenarios & GHG Goals

Steven Rose (Energy & Environmental Analysis)
Morgan Scott (Sustainability)

UNFCCC COP24, Katowice, Poland
December 13, 2018
Global climate goals and the relationship to companies?

Climate goals (e.g., limit < 2°C)
Global climate goals and the relationship to companies?

We evaluate scientific understanding of the relationship between a company and a global average temperature goal.

Climate goals (e.g., limit < 2°C)

- Global GHGs?
- National GHG?
- Subnational GHGs?

Potential energy systems, economic activity, and policy?
Significant global emissions scenario resources available, appropriate interpretation critical

- Large relevant global emissions scenarios peer literature (>1000)
- A single scenario misleading
- Sets of scenarios appropriate and useful
- Results represent aggregate sectors, not individual companies
Global climate goals and the relationship to companies?

We evaluate scientific understanding of the relationship between a company and a global average temperature goal.

Climate goals (e.g., limit < 2°C)

- Global GHGs?
- National GHG?
- Subnational GHGs?

Potential energy systems, economic activity, and policy?
A broad range of global CO₂ budgets consistent with 2°C

A 2°C carbon budget range

IPCC scenarios category (CO₂eq concentration in 2100, ppm)

<table>
<thead>
<tr>
<th>IPCC scenarios category</th>
<th>2011-2050 CO₂ budgets in scenarios (GtCO₂)</th>
<th>Probability of staying below 2°C</th>
<th>Probability of staying below 3°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>430-480</td>
<td>504-1423</td>
<td>63-88%</td>
</tr>
<tr>
<td>2</td>
<td>480-530</td>
<td>465-1692</td>
<td>39-68%</td>
</tr>
<tr>
<td>3</td>
<td>530-580</td>
<td>809-1999</td>
<td>16-46%</td>
</tr>
<tr>
<td>4</td>
<td>580-650</td>
<td>1037-1925</td>
<td>7-26%</td>
</tr>
<tr>
<td>5</td>
<td>650-720</td>
<td>1245-1767</td>
<td>5-12%</td>
</tr>
<tr>
<td>6</td>
<td>720-1000</td>
<td>1424-2026</td>
<td>0-3%</td>
</tr>
<tr>
<td>7</td>
<td>&gt; 1000</td>
<td>1524-2694</td>
<td>0%</td>
</tr>
</tbody>
</table>

Developed from IPCC WGIII (2014) and IAMC (2014)
A broad range of global CO$_2$ pathways consistent with 2°C

- Broad ranges for regions & sectors too
- Ranges reflect many types of uncertainties

Global CO$_2$ Pathways Consistent with 2°C

Range and select scenarios shown (n = 408)

Developed from IAMC (2014) data
Assumptions matter to properly using results – technology & policy design important for sectors and companies

- Should the electric sector reduce emissions by a larger fraction than the overall economy? Not necessarily!
  - Policy design & technology matter
  - Current assumptions facilitate decarbonization with electricity:
    1. Global policy and coordination
    2. Availability of cost-effective low-carbon generation technologies

<table>
<thead>
<tr>
<th>Emissions Changes</th>
<th>2050 emissions changes relative to 2010</th>
<th>Global electricity CO2 w/o negative emissions</th>
<th>Global net CO2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2% to -163%</td>
<td>-13% to -100%</td>
<td>14% to -96%</td>
</tr>
<tr>
<td>Cumulative 2011-2050 CO2 emissions (GtCO2)</td>
<td>94 to 642</td>
<td>144 to 512</td>
<td>465 to 1692</td>
</tr>
<tr>
<td># of scenarios</td>
<td>373</td>
<td>55</td>
<td>408</td>
</tr>
</tbody>
</table>

Developed from IAMC (2014)
Increasing electricity use & dependence (above baseline) may or may not be consistent with a 2°C goal

Current scenarios suggest that increasing global electricity consumption and share of final energy consistent with 2°C (see figures).

However, depends on technology and policy design – for electrification and for the attainability of 2°C pathways.

Global Electrification Consistent with 2°C with economy-wide policies and w/ and w/o negative emissions

Developed from IAMC (2014)
In other work, EPRI assessing electrification in detail

Modeling end-use services and technology choices and different futures (e.g., U.S. National Electrification Assessment)
Policy design a key additional uncertainty for companies

- **Policy design uncertainty absent from existing scenarios**
  - Most assume global economy-wide action and coordination. Unlikely.

- **Uncertain policy design features...**
  - Sector/emissions coverage
  - Sector/emissions coordination
  - Eligible technologies
  - Policy instrument type
  - Offsets (uncovered emissions)
  - International partnerships

- **Policy design features affect cost, environmental effectiveness, and cost-effective role of sectors and companies**
Applying uniform GHG targets (e.g., 80% in 2050) across companies unlikely to be cost-effective for society

Scenarios find cost-effective country % reductions differ from global % reductions (also true for sectors and GHG intensities)

Developed from EMF-27 study data (Weyant and Kriegler, 2014). Sample of results shown. Some models did not report results for each country.
Global emissions pathway attainability is another uncertainty for companies

- Companies don’t know whether the world can achieve the global pathways suggested
  - 2°C (and below) pathways found to be extremely challenging – geophysically, technologically, economically, and politically
  - And realization of near-term country pledges (NDCs) uncertain

- Other global pathways are plausible
  - e.g., when global emissions might peak is an uncertainty for companies (e.g., 2020, 2030, 2040, 2050)
Model infeasibilities one indication of the challenge

<table>
<thead>
<tr>
<th></th>
<th>Full default technology</th>
<th>CCS unavailable (fossil and bioenergy)</th>
<th>New nuclear unavailable and phase out of existing</th>
<th>Solar and wind electricity share constrained</th>
<th>Biomass supply constrained</th>
<th>CCS and new nuclear unavailable*</th>
<th>CCS and new nuclear unavailable, and solar, wind, and biomass constrained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher atmospheric concentration target (550 ppm CO$_2$eq)</td>
<td>13/13</td>
<td>12/12</td>
<td>11/11</td>
<td>11/11</td>
<td>13/13</td>
<td>12/12</td>
<td>6/9</td>
</tr>
<tr>
<td>Lower atmospheric concentration target (450 ppm CO$_2$eq)</td>
<td>10/11</td>
<td>4/11</td>
<td>9/10</td>
<td>9/10</td>
<td>9/11</td>
<td>6/11</td>
<td>0/10</td>
</tr>
</tbody>
</table>

Source: Krey et al. (2014)
Pathway attainability uncertainty implies even larger range of global emissions pathways relevant for companies.

- Global net CO₂ pathways consistent with 2°C
- Global net CO₂ pathways peaking before mid-century

For companies, range expands due to pathway attainability uncertainty. Probabilities could also be considered.

Range and select scenarios shown
(n = 408)

(n = 742)

Developed from IAMC (2014)
Non-climate-policy risks and current company strategy also matter

- Climate policy risk for companies needs to be put in context with respect to other risks
- Also need to consider current company climate-related policy planning

Ranges of 2050 changes in baseline levels relative to 2020 for a subset of economic and technological projections

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>World</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min</td>
<td>max</td>
</tr>
<tr>
<td>GDP</td>
<td>42%</td>
<td>95%</td>
</tr>
<tr>
<td>Energy Consumption</td>
<td>-10%</td>
<td>26%</td>
</tr>
<tr>
<td>Electricity Consumption</td>
<td>9%</td>
<td>58%</td>
</tr>
<tr>
<td>Transportation Electricity Consumption</td>
<td>-7%</td>
<td>3327%</td>
</tr>
<tr>
<td>Natural Gas Price</td>
<td>-20%</td>
<td>183%</td>
</tr>
<tr>
<td>Capital Cost NGCC</td>
<td>-24%</td>
<td>1%</td>
</tr>
<tr>
<td>Capital Cost Nuclear</td>
<td>-13%</td>
<td>34%</td>
</tr>
<tr>
<td>Capital Cost Solar CSP</td>
<td>-26%</td>
<td>-3%</td>
</tr>
<tr>
<td>Capital Cost Solar PV</td>
<td>-65%</td>
<td>-10%</td>
</tr>
<tr>
<td>Capital Cost Wind Onshore</td>
<td>-56%</td>
<td>-6%</td>
</tr>
</tbody>
</table>

Developed from EMF-27 study data (Weyant and Kriegler, 2014)
Despite broad ranges, there are robust insights

Insights found consistently across models and assumptions that provide a solid decision-making foundation for companies and others

For instance:

- An emissions pathway cost-effective for a given set of assumptions will not be cost-effective for every plausible future
- The cost-effective emissions reduction role of an economic sector is highly uncertain
- The emissions relationship with global temperature becomes increasingly uncertain the finer the resolution of the source
Key insights for companies, investors, and others

- Individual company perspective essential
- Approaches and strategies should be based on scientific understanding

- Cost-effective societal role of a company:
  - Highly uncertain
  - Difficult to identify a unique cost-effective company-level pathway/target
  - Cost-effective company pathway/target will differ from cost-effective global, country, sector levels, and across companies

- Uncertainty, flexibility, and robust strategies:
  - Characterizing and incorporating the numerous uncertainties important
  - Having flexibility in emissions reduction levels and how they are met important
  - A robust strategy that makes sense in different futures important. More than a target.
Scenario ranges valuable information: Florence lessons

- The set of results informs planning by identifying possibilities

- All decision-relevant information. Anything less can mislead.

- Note: key difference from global emissions projections – hurricane paths are forecasts (vs. projections)
# Operationalizing the insights

Insights represent principles for evaluating methodologies, developing analyses, setting expectations

<table>
<thead>
<tr>
<th>Company analysis issues for methodologies</th>
<th>General steps for operationalizing insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Emissions scenarios used?</td>
<td>1. Utilize existing science</td>
</tr>
<tr>
<td>▪ Uncertainties considered and how?</td>
<td>2. Develop emissions ranges</td>
</tr>
<tr>
<td>– Temperature-emissions</td>
<td>– Uncertainties in the literature support emissions futures that exhibit slower growth, no growth, and declining, low, zero, and negative emissions</td>
</tr>
<tr>
<td>– Global pathway attainability</td>
<td></td>
</tr>
<tr>
<td>– Policy design</td>
<td></td>
</tr>
<tr>
<td>– Non-climate-related</td>
<td></td>
</tr>
<tr>
<td>▪ Consideration of company-specific context?</td>
<td>3. Specify alternative policy designs</td>
</tr>
<tr>
<td>▪ Uniform vs. varied GHG targets across companies?</td>
<td>4. Overlay company-specific context</td>
</tr>
<tr>
<td>▪ Consideration of flexibility options?</td>
<td>5. Run preliminary analysis</td>
</tr>
<tr>
<td>▪ Quantitative comparison of alternatives?</td>
<td>6. Implement a scenario design</td>
</tr>
<tr>
<td>▪ Evaluation of strategy robustness?</td>
<td>7. Identify risk management alternatives</td>
</tr>
<tr>
<td></td>
<td>8. Develop a robust strategy</td>
</tr>
</tbody>
</table>
### Evaluating methodologies – sample

<table>
<thead>
<tr>
<th>Issue to consider</th>
<th>This study</th>
<th>SBTi</th>
<th>Ceres</th>
<th>UNEP FI pilot</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emissions</strong></td>
<td>Consistent with 2°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncertainty in global temperature-CO₂ relationship for 2°C (cumulative 2011-2050 GtCO₂)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global net</td>
<td>465 to 1692</td>
<td>–</td>
<td>–</td>
<td>1139</td>
</tr>
<tr>
<td>Global energy</td>
<td>324 to 1636</td>
<td>1085</td>
<td>–</td>
<td>1022</td>
</tr>
<tr>
<td>Global electric</td>
<td>94 to 642</td>
<td>335</td>
<td>–</td>
<td>261</td>
</tr>
<tr>
<td>Uncertainty in global temperature-CO₂ relationship for 2°C (annual changes in 2050 relative to 2010)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global net</td>
<td>14% to -96%</td>
<td>–</td>
<td>–</td>
<td>-72%</td>
</tr>
<tr>
<td>Global energy</td>
<td>9% to -99%</td>
<td>-52%</td>
<td>–</td>
<td>-58%</td>
</tr>
<tr>
<td>Global electric</td>
<td>-2% to -163%</td>
<td>-89%</td>
<td>–</td>
<td>-94%</td>
</tr>
<tr>
<td>U.S. net CO₂ eq</td>
<td>-58% to -110%</td>
<td>–</td>
<td>-81% (80% relative to 1990)</td>
<td>–</td>
</tr>
<tr>
<td>U.S. electric</td>
<td>-44% to -170%</td>
<td>–</td>
<td>-92% (90% relative to 1990)</td>
<td>–</td>
</tr>
<tr>
<td>Uniform vs. varied GHG targets across companies</td>
<td>Uniform targets found unlikely to be cost-effective</td>
<td>Proposes globally uniform sectoral targets</td>
<td>Proposes uniform target for all utilities</td>
<td>Implies uniform targets within sector segments</td>
</tr>
</tbody>
</table>

- Recent methodologies do not represent the uncertainty evident in the literature regarding emissions pathways consistent with limiting warming to 2°C.
- They also propose applying uniform targets across companies
Closing thoughts

- Significant knowledge available – need to take advantage of it

- Understanding and proper use essential
  - Ranges appropriate and relevant
  - Results represent aggregate responses, not companies
  - Uncertainty increases with higher resolution
  - Sub-global results are dependent on policy, technology, and market assumptions

- For companies and investors, embrace uncertainty, want flexibility, develop robust strategies

- New EPRI study an initial step in informing analyses, discussions, decisions
Thank you!

- New publication – informing dialogue, methodologies, and decisions
- Sound scientific understanding is a requisite first step for companies, stakeholders, methodologies, and dialogue
- The study analyzes and characterizes current scientific understanding and identifies technical issues and insights
- A public technical resource

Additional information: srose@epri.com, mmscott@epri.com
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Panel Discussion

Steven Rose  
Senior Research Economist

Daniele Agostini  
Head of Energy & Low Carbon Policies

Ani Kavookjian  
Sustainable Business & Finance

Moderator: Morgan Scott, EPRI Sustainability Research Lead