Alternative carbon price trajectory can avoid excessive carbon removal

Jessica Strefler

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CDR use in current scenarios

• Many climate change mitigation scenarios show peak-and-decline behavior in global temperature
• Reason: large-scale deployment of CDR $\rightarrow$ net-negative emissions
• Driven by exponentially increasing carbon price path perceived to be economically optimal (Hotelling path)
• Risky pathways: technical feasibility, sustainability, governance
Research Questions

• Is Hotelling really optimal?

• Can the high demand for CDR in IAMs be reduced?

• How do risks and efficiency of different carbon price pathways compare?
Methodology

• Integrated Assessment Model REMIND

• Well below 2°C target, formulated as global CO₂ budget
  • In 2100: cumulative emissions 2018-2100 match the budget → **overshoot** possible
  • Full century: cumulative emissions do no exceed the budget at any point in time → Always **below** target

• Prescribed carbon price pathway
  • **Exponential** increase at 5% per year (Hotelling)
  • **Linear** increase

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<th>Overshoot</th>
<th>Below target</th>
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<tbody>
<tr>
<td>Exponential carbon price</td>
<td>EXPo</td>
<td>EXPb</td>
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<tr>
<td>Linear carbon price</td>
<td>LINo</td>
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Hotelling vs. Linear carbon price path

Carbon price path

Temperature
Carbon dioxide removal

Total CO$_2$ emissions

CDR deployment

Jessica Strefler, PIK
Consumption loss

![Bar chart showing consumption loss for different scenarios: linear below, linear overshoot, exponential below, exponential overshoot. The y-axis represents consumption loss in percentages, and the x-axis lists the scenarios. The chart indicates a significant difference in consumption loss between the scenarios, with exponential overshoot showing the highest loss.]
Risk profile

- Near- to medium-term development depends on peak temperature only!
- Linear carbon price path reduces long-term risks
Summary & Outlook

• Peak temperature determines development until 2050
• Exponential CO₂ price path drives long-term CDR deployment and peak-and-decline behaviour
• Linear carbon price path allows to stay well below 2°C at much lower risks
• Economically optimal carbon price path?