

How Should Targeted Carbon Dioxide Removal Be Governed?

15 Guiding Questions for the Assessment of Policy Instruments to Manage CO₂ Removal

Germany aims to be greenhouse gas neutral by 2045 and negative from 2050 onwards. To achieve this, emissions which cannot be avoided or are very hard to avoid — so called residual emissions— must be balanced out with “negative emissions”. The way to do this is the targeted removal of CO₂ from the atmosphere (Carbon Dioxide Removal, CDR). To remove sufficient CO₂, it is necessary to incentivize CDR processes and projects through appropriate policy instruments—such as regulations, funding programs, or public information campaigns. Developing and implementing these policy instruments poses a challenge for decision makers. Our new **assessment framework for policy instruments** can assist in this process. In it, we propose **fifteen guiding questions** that decision makers should use for orientation when developing **policy instruments to control, promote, and regulate CDR**. These guiding questions help incorporate various societal values and goals into the decision making process and enable transparent and traceable communication of decisions.

Choice and design of policy instruments are crucial for developing rapid CO₂ Removal in Germany that generates positive side effects and minimizes negative ones.

When decision makers plan how CDR should be managed in Germany, they should pursue two central goals. Firstly, they should promote **rapid** implementation of CDR processes and projects. Relying solely on voluntary initiatives for the necessary scale-up of CDR is not effective but would likely result in Germany removing less CO₂ than necessary for greenhouse gas neutrality by 2045. One reason for this is that private companies are unlikely to gain sufficient profits from CDR projects if these are not supported by the state. Secondly, policy instruments should foster a development of

CDR that **produces positive side effects and minimizes negative ones**. To promote a rapid and beneficial development of CDR processes and projects, a variety of policy instruments can be used. Examples include the trading of CO₂ removal certificates, guidelines for the use of CDR, subsidies, tax advantages, bidding competitions, informational offerings, and much more.

With our assessment framework, a desirable future vision for CO₂ Removal can be developed. This vision can serve as both a benchmark and a compass when concrete options for managing CO₂ Removal are devised.

Our assessment framework for policy instruments can be integrated into different phases of the decision making process. In the early phases of consultation, planning, and policy design, an assessment framework can help to develop comprehensive visions of how CDR management can be realized and what it should look like. These visions help to clarify the direction in which policy instruments should evolve. They act as a compass by which decision makers can continuously orient themselves during policy development. Later, when specific policy instruments are under consideration, the same assessment framework can be used as a benchmark to assess their potential advantages and disadvantages, thereby enabling a systematic comparison of alternative options.

The guiding questions in our assessment framework ask whether a policy instrument can be implemented (its feasibility) and whether it should be implemented (its desirability). While feasibility considerations are about natural or societal constraints on policy instruments, their desirability depends on value conceptions that can be derived

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from widely shared societal goals, normative theories, or surveys regarding visions of a good future. The guiding questions consider various value conceptions and systematically structure the decision making process. Ultimately, the assessment framework allows for a transparent and comprehensible communication of the decision for or against a policy instrument. For example, one might state: "After considering the question of distributive justice, we conclude: because we share the value that emitters should bear higher costs and we assume that this policy instrument will

result in those who have emitted more CO₂ also bearing higher costs for CDR, we will adopt this policy instrument."

Our assessment framework offers 15 guiding questions to evaluate how the political management of CO₂ Removal can and should be structured.

The guiding questions are organized into six dimensions and address a variety of factors that play a role when policy instruments are used to manage CDR. The 15 guiding questions were developed based on an extensive literature review and refined in a stakeholder workshop to ensure that they cover a broad spectrum of values, perspectives, and priorities.

Political decision makers, legislators, representatives of industry, or civil society can use these questions to develop and evaluate policy instruments that serve rapid and beneficial CDR.

Our guiding questions are listed in Table 1 below. They are formulated openly in some instances to allow users to incorporate different understandings of values. For example, Guiding Question 15 asks whether the burden distribution created by the policy instrument aligns with established fairness principles. Which fairness principles are regarded as established may differ between groups; decision makers should therefore agree on a common definition in each specific application.

Dimensions	Guiding Question
Feasibility	<ol style="list-style-type: none"> 1. Can the policy instrument be implemented with the available administrative resources, such as an established bureaucratic infrastructure and trained personnel? 2. Can the policy instrument be implemented with the available financial resources, such as the federal budget? 3. Can an the policy instrument be implemented while fully adhering to existing national and international agreements and laws? 4. Can the policy instrument be implemented given the current political and societal climate?
Procedural Fairness	<ol style="list-style-type: none"> 5. Are the potentially affected groups and their representatives involved in the decision making process, for example through participatory procedures? 6. Is relevant information about the decision making process and its outcomes communicated transparently and comprehensibly to the participants and the public?

<h2>Climate Effectiveness</h2>	<ol style="list-style-type: none"> 7. What is the net amount of greenhouse gases removed from the atmosphere through the implementation of the policy instrument? 8. What changes in land use and vegetation cover result from the implementation of the policy instrument, and how do these changes affect local and global temperatures (for example, through changes in the albedo, i.e. the reflectivity of incoming solar radiation)? 9. How long does it take for the policy instrument to become effective and sustain the desired management of CDR, and how does this time frame align with the predicted progression of climate change? 10. Can reliable methods be applied to measure and validate the impact of the policy instrument on CDR and overall climate protection?
<h2>Impacts on Individuals and Society</h2>	<ol style="list-style-type: none"> 11. To what extent does the policy instrument improve or diminish the quality of life of individuals, for example by affecting natural, economic, or cultural resources that are essential for a good life? 12. How does the policy instrument strengthen or weaken societal and governmental structures? For instance, strong and publicly visible resistance to the policy instrument could hinder its implementation and negatively affect long term public trust in the government.
<h2>Effects on Nature</h2> <p>(excluding humans, see 11 and 12)</p>	<ol style="list-style-type: none"> 13. <ol style="list-style-type: none"> a.) To what extent does the policy instrument adversely affect sentient animals? b.) To what extent does the policy instrument adversely affect living beings (i.e. animals, plants, and unicellular organisms regardless of their capacity for sensation)? c.) To what extent does the policy instrument adversely affect individual organisms, species, and entire ecosystems?
<h2>Ration and Distribution of Impacts</h2>	<ol style="list-style-type: none"> 14. How does the cost-effectiveness of the policy instrument compare to other policy instruments in achieving a specific reduction in greenhouse gas emissions? 15. How are the benefits and disadvantages of the policy instrument distributed among countries, industrial sectors, individuals, and generations, and is this distribution in line with established principles of fairness?

For a more detailed description of the PoEt Assessment Framework please see "Holland-Cunz, A. & Baatz, C. How to govern carbon dioxide removal: an assessment framework for policy instruments. Climate Policy, 1-16 <https://doi.org/10.1080/14693062.2025.2459315>"

About CDR-PoEt (2021 - 2025)

Carbon Dioxide Removals – Policies and Ethics (CDR-PoEt) examines the ethical and equity implications of policy instruments for CDR, based on interdisciplinary research and stakeholder deliberations. The project specifically evaluates the feasibility ('what can we do from an economic, socio-cultural, and institutional perspective?') and the desirability ('what do we want to do?') of CDR policies and methods in their specific contexts, providing a foundation for developing policy recommendations at local, national and international levels.

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