

## Five Characteristics of Economically Efficient Climate Stabilization

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Climate stabilization presents unprecedented challenges. Associated emissions reductions will require dramatic changes to global energy and land-use systems. We offer five characteristics of economically efficient responses to the challenge of stabilizing anthropogenic global climate change.

1. *Carbon emissions should be priced.* Anthropogenic climate change is an intergenerational, global public goods problem in which private decisions taken in the context of private markets will not achieve a socially optimal solution. Until greenhouse gases are valued, emissions will always exceed the socially desirable level and key technologies, such as CO<sub>2</sub> capture and storage, that directly address climate change but at additional cost, will remain on the shelf.
2. *All carbon emissions count the same to the atmosphere.* All carbon affects the Earth's climate and the introduction of an additional ton of carbon from any source has exactly the same effect regardless of the activity that produced it or the location of the emissions. Whenever the marginal cost of emissions reductions varies from one activity to another or one place to another, there is room for society to have more reductions and at lower total cost. This means, for example, that all of the carbon in the terrestrial biosphere needs to carry the same value as fossil fuel and industrial carbon emissions. Leaving that carbon unvalued creates the potential for ancillary environmental consequences from over-deployment of bioenergy.
3. *Expectations should be that the price of carbon will rise at a regular rate.* To stabilize CO<sub>2</sub> concentrations at any level, emissions must eventually be driven to **zero**, requiring increasingly stringent emissions reductions over time and, therefore, an increasing price of carbon. Cost minimization over time calls for a price path that rises at roughly the rate of interest adjusted by the rate of ocean carbon uptake. This does not mean that future prices can be set today at this rate and be entirely predictable for a century; however, it does mean that subsequent to each price revision rate of change of the price over time should return to its upward trajectory.
4. *Climate policy should be predictable.* A succession of a dozen emissions limitation regimes that each last five years without a meaningful expectation about the consistency between regimes is a recipe for high cost and delayed introduction of technologies associated with capital stocks living longer than five years.
5. *Technology instruments are fundamental to a climate policy portfolio.* The role of technology is to help control the cost of reducing greenhouse gas emissions. While it is always feasible to stabilize concentrations of CO<sub>2</sub> at any level with any technology, the cost society bears depends critically on the suite of available technologies. Near-term emissions mitigation must inevitably rely on existing technology, but in the mid- and long-term, better technologies could potentially be made available. Policies are

needed to establish the conditions that encourage the creation of improved versions of existing technologies and completely new technologies can be brought into being.