

Abstract – Dissertation Jan Steckel

DEVELOPING COUNTRIES IN THE CONTEXT OF CLIMATE CHANGE MITIGATION AND ENERGY SYSTEM TRANSFORMATION

This thesis addresses the role of developing countries in the context of climate change mitigation and energy system transformation. It starts from the hypothesis that mitigation of climate change might form a major dilemma for developing countries, as it potentially negatively affects their development.

In order to provide robust costs estimates of mitigating climate change, three state-of-the-art integrated assessment models are compared taking into account different dimensions that are relevant for the structure of mitigation costs: technologies, the stabilization target, and the timing of mitigation policy.

First, it is found that renewable energy and CCS are most critical for achieving low mitigation costs. Second, a more ambitious climate stabilization target can significantly increase global mitigation costs. Third, delaying collective international climate policy until 2030 renders the stabilization of CO₂ at 450 ppm impossible, while a delay to 2020 increases global costs by at least 50%. In this case, Europe and the US can benefit from early participation. Exporters of emission allowances, i.e. developing countries like India, in contrast, can profit from delayed action, as the value of their exportable carbon permits increases.

Particular emphasis is put on China due to its outstanding success with respect to poverty alleviation in recent decades, going hand in hand with highly increased carbon emissions. Applying an extended Kaya analysis we can identify economic growth to be the major reason for emissions growth, outnumbering the continuous carbonization of the energy system. Numerical model results underline the importance of future decarbonization efforts in China for climate change mitigation on the global scale. Its current domestic climate policy is in line with model results for a medium ambitious stabilization target.

Some argue that the production-based accounting scheme applied today by the United Nation's Framework Convention on Climate Change (UNFCCC) disadvantages carbonexporting developing countries and is thus not in line with its basic principles, such as 'common but differentiated responsibilities'. In this line of argument, changing towards a consumption-based accounting scheme might facilitate the participation of developing countries. In this thesis it can be shown that in the presence of a global carbon market the role of the accounting scheme can be neglected, as soon as the initial allocation of emissions is negotiated. This puts in perspective recent calls from developing, carbonexporting countries like China to change from the current production-

based accounting scheme. Whether the accounting scheme is beneficial for carbon-exporting countries depends on the chosen allocation scheme. High transaction costs related to consumption-based accounting would favor the current, production-based, accounting scheme once a carbon market with binding caps is in place.

Finally, the role of energy in development processes is assessed and found to be tremendously important. Countries that have achieved high or very high development levels all have crossed a certain threshold in energy consumption. One explanation for the existence of thresholds is identified to be the demand for energy-intensive goods in developing processes generated by the up-take of infrastructure. Scenarios by numerical models generally project that reductions of carbon emissions in developing countries will be achieved not only by means of decreasing the carbon intensity, but also by making a significant break with the historically observed relationship between energy use and economic growth. The existence of energy thresholds in development processes challenges the generally optimistic results of numerical models: on time scales acceptable for developing countries the decreases in energy consumption implied in numerous mitigation scenarios are unlikely to be achieved without endangering sustainable development objectives, such as universal energy access.