Mitigating the climate action gap with technology policies

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Overview

Mid-term emission targets have so far been in the focus of both the international climate negotiations as well as most studies analysing the appropriateness of near-term climate policies vis-a-vis long-term aspirational climate protection targets such as the 2°C target. The general finding is that the currently pledged short-term emission reductions are weaker than what would be required in cost-optimal scenarios[1–3], leading to higher costs if the target is implemented later on[4–6]. Here we evaluate different plausible medium ambition policy scenarios – combinations of two alternative carbon pricing mechanisms with three additional technology policy packages – with respect to their ability to alleviate the adverse impacts of sub-optimal carbon prices in the near-term on long-term economic challenges of 2°C stabilization. We find that while additional technology policies only have a limited impact on actual emission reductions in the year 2030 they are quite effective in leaving the 2°C option open and close 50-100% of the “climate action gap” as measured in four socio-economic indicators. Another crucial finding is that additional technology policies work more effectively if the moderate pricing policy is implemented as a carbon tax rather than a quantity cap.

Methods

We employ the state-of-the-art energy-economy-climate-model REMIND[7,8] to analyse a variety of two-staged scenarios. In the initial period of 2013 until 2032, we assume a moderate carbon pricing regime deducted from a emission level target of 60.8 Gt CO_2eq in 2030 consistent with the lenient end of currently pledged emission reductions[3,6]. The carbon price is implemented either as an explicit tax of 7.4 US\$/tCO_2 in 2013 increasing at a yearly rate of 5%, or as an emissions cap yielding the same carbon price in absence of technology policies. In addition to a reference case without any technology policies, we consider three plausible complementary technology policy packages, which accelerate the energy system transformation by fostering the phase-in of low-carbon technologies or by banning the construction of new coal-based energy conversion technologies, or a combination of both. To evaluate how well the policy packages prepare the energy system for the transitions necessary for a later achievement of a 2°C target, we then assess the costs and challenges for achieving the 2°C target with first-best policies from 2033 onwards. During the 2013-2032 period, the model does not anticipate the later increase of policy stringency. We contrast these cases to the (counterfactual) first-best benchmark, which assumes optimal policies starting in 2013.

Results

Fig. 1 a) shows 2030 carbon prices and emissions that result from different combinations of technology and carbon pricing policies. Complementary technology policies can result in a decrease of emissions by up to ~4 GtCO2e at a given price level (tax regime), or up to ~70% lower prices to reach a given emissions level (cap regime). We also see that the combination of weak carbon pricing with technology policies falls short of closing the gap to the emission level resulting from optimal carbon pricing, which would limit emissions to ~45 GtCO2e at a carbon price of close to 60 \$/tCO2.

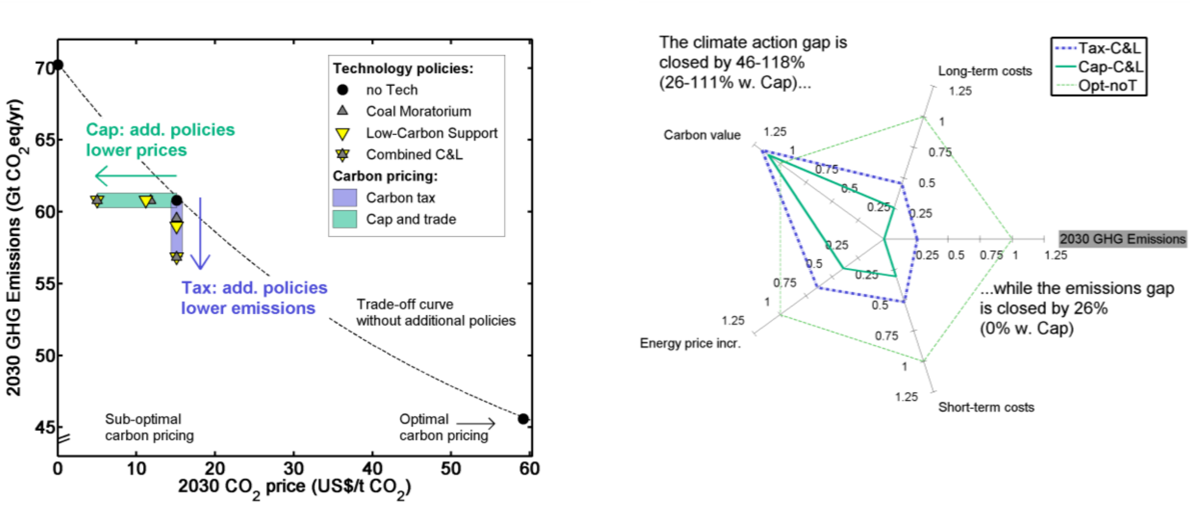

Figure 1: a) Relationship between carbon prices and total greenhouse gas emissions in 2030. b) Closing the climate action gap in five indicators. Comparison of the impact on the climate action gap of technology policy C&L combined with carbon tax and cap-and-trade carbon pricing, measured in GHG emissions and the four socio-economic indicators. The impacts are normalized to the respective gap between the Cap-noT scenario and the optimal 1st best scenario Opt-noT.

The degree to which weak near-term action exacerbates medium to long-term mitigation challenges is a more policy relevant measure of the climate action gap. As Fig. 1 b) shows, additional policies help to considerably lower the economic challenges (as measured in the four economic indicators) and partly offset the additional cost arising from suboptimal carbon pricing: Adding the combined technology policy package C&L to the Tax scenario closes roughly half (LTC,STC,EPI) or even the full gap (CTV) to the first-best scenario Opt-noT. The effect of the technology policies on the four socio-economic indicators is thus much more pronounced than the effect on 2030 emissions, which is not impacted at all in the case of the cap-and-trade regime. The additional technology policies work much more effectively when combined with a carbon tax compared to the combination with a cap-and-trade system. The difference is roughly equivalent to 20% of the gap between the Cap-noT and Opt-noT scenarios, with the exception of the carbon trade value indicator, where the difference is smaller, as lower carbon prices before 2030 in Cap scenarios partly offset the higher prices post-2030.

Discussion

Our results show clearly how much of an effect dedicated technology policies can have in supporting the start of an energy system transformation compatible with the 2°C target if the political will or the political opportunity to impose the optimal price signal is too low. They further show that a coal moratorium and support for low-carbon technologies are good complements and that the interaction with carbon prices favours a carbon tax over a cap-and-trade scheme.

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