

Technology funding makes climate protection cheaper

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To cost-effectively protect the climate, not only an emissions trading scheme but also financial support for new technologies is needed. Economising on targeted funding, for example for renewable energies, makes climate protection more expensive - as scientists of the Potsdam Institute for Climate Impact Research (PIK) now calculated for the first time, using a complex computer simulation that spans the entire 21st century. Without funding, energy technologies with high cost reduction potentials will hardly stand a chance, since they require a significant initial investment: a case of market failure.

"Companies in the global energy sector often rely on familiar technologies instead of striving for innovation – they are more hesitant than companies in other industries, our analysis shows," says Matthias Kalkuhl, lead author of the study published in the scientific journal *Resource and Energy Economics*. Behind this behaviour stands not just inertia. Pioneers are paying the bill for the development and the risk of innovation, whose results are beneficial to everyone, and are then copied by competitors. Additionally, there is uncertainty for companies about the long term profitability of investments into new technologies, since the political framework – for example future CO₂ emission prices – is unreliable: "The result is a self-reinforcing lock-in effect," explains Kalkuhl. "Inferior and therefore more expensive technologies dominate the market for decades. From a management point of view, it is rational. But economically it is fatal."

The reason for this particular restraint of the energy sector is this: the

product – electricity or heat – is the same to the consumer, no matter which technology was used to produce it, according to Kalkuhl. As the product is homogenous, consumers have a low incentive to pay a significantly higher price for an innovative technology. This is in stark contrast to the case of smart phones or e-book readers. These can successfully capture new markets with clever product differentiation.

Effective political actions to promote new technologies, the computer simulation shows, are a feed-in tariff or quotas for energy produced by particular technologies. According to the scientists, only funding targeted at emerging technologies is effective: offshore wind power, usage of biomass, solar energy. The cost-benefit ratio is especially positive, if the financial support is limited to a period of, for example, 30 years. However, it is not economically beneficial to support already well-developed CO₂-reducing technologies: nuclear reactors, water power, or highly efficient gas power plants.

For their analysis, the scientists have designed a new computer model which calculates the interplay of companies, households, and political actors as well as the resulting welfare effects. This so-called dynamic multi-agent model "shows robust results for a big range of scenarios, even though we had to include a few simplifications," says Kalkuhl. The model assumes a working [emissions trading](#) scheme with ambitious climate protection targets which promotes low carbon technologies.

The results are in contrast to conventional economic wisdom that emissions trading paired with technology funding is an inefficient duplication, and that innovation is sufficiently ensured by patent protection and general research funding. "We found that although it is possible to reduce the greenhouse gas emissions through emissions trading only, this is at a higher cost," says Ottmar Edenhofer, chief economist of PIK and co-author of the study. Only targeted funding "can introduce new technologies to the market which then show a steep

learning curve - in other words which improve and become cheaper quickly." Higher costs make political measures to protect the climate more difficult to achieve, thus making emissions trading and technology funding two sides of the same coin.

The effects only show up when the investment behaviour of many decades is taken into account. Previous studies were often only on the short term. "But climate policy is a long-term project," says Edenhofer. The government does not know any better than the companies which technologies are viable, but especially because of this uncertainty, it is the only player who can afford funding technology. However, without the introduction of a price on CO₂ emissions paired with an emissions' cap, even the best technology funding is, says Edenhofer, rather useless. "Fighting climate change with subsidies only is simply not affordable."

More information: Kalkuhl, M., Edenhofer, O., Lessmann, K. (2012): Learning or Lock-in: Optimal Technology Policies to Support Mitigation. *Resource and Energy Economics*, 34(1), 1-23
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