GRETCHEN
policy mix for renewables

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Green change: renewable energies, policy mix and innovation

Results of the GRETCHEN project concerning the influence of the policy mix on technological and structural change in renewable power generation technologies in Germany

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Policy Mix in Germany successfully supports technological innovations, exports and jobs in renewable power generation

German policy makers are relying on a policy mix made up of ambitious targets, technology-push, demand-pull and systemic instruments to increase the share of renewable energy technologies and to foster the German Energiewende. The impact on innovation resulting from this mix was analyzed in the research project "GRETCHEN", which was funded by the German Federal Ministry of Education and Research (BMBF), and jointly conducted by the Fraunhofer Institute for Systems and Innovation Research ISI, the Friedrich Schiller University (FSU) Jena and the Institute of Economic Structures Research (GWS) Osnabrück. The results indicate that rapid technological change has taken place in renewable energies over the last few decades. The consistency and credibility of the policy mix played a key role here. More recently, however, this green change in Germany has shown signs of slowing down.

There is a specific focus on developing new energy technologies and improving existing ones in light of the German Energiewende and globally ambitious climate targets. These green innovations should help to meet targets like the limitation of global temperature rise to two degrees Celsius, or an 80 percent share of renewable energies in Germany's gross electricity generation by 2050. Over time, several policy instruments have been introduced to implement these ambitious energy and climate policy objectives. These include demand-pull instruments like the German Renewable Energy Sources Act (EEG), technology-push ones such as energy research programs, and systemic measures such as collaborative research projects aimed at connecting different actors and promoting knowledge exchange. With regard to the interaction of the different policy instruments, in the GRETCHEN project, the Fraunhofer ISI together with the FSU Jena and the GWS Osnabrück analyzed this policy mix's impacts on innovation in renewable energy technologies in Germany.

The results of the GRETCHEN project show that rapid technological progress in renewable power generation technologies has taken place in Germany over the last few decades. This is indicated by the strong increase in scientific publications in photovoltaics, or the rise in the number of patent applications in wind power and photovoltaics. Professor Uwe Cantner from the Friedrich Schiller University Jena also highlights "that the intensified knowledge exchange among different actors in the innovation system and the sharp drop in technology costs are other indications of the policy mix's positive impact on innovation". As a result, the majority of German manufacturers of renewable energy technologies were able to develop new export markets which in turn had a positive effect on macroeconomic development and employment. However, the innovation dynamics are currently showing signs of slowing down in Germany. In addition, fast-paced technology catch-up is taking place in Asian countries, in particular.

The project team's analyses make it clear that technology-push, demand-pull and systemic instruments each have a clear impact on green change in the technologies regarded. Examining the policy mix as a whole additionally shows that the various instruments mutually reinforce each other's positive influence on innovation. The GRETCHEN analyses indicate the central role played by demand-pull measures in the instrument mix. Depending on technology-specific learning potentials, the resulting positive impacts on green innovation can trigger a self-reinforcing process of cost reduction and expansion of renewable energies that helps to overcome current path dependencies in the energy system. Dr. Karoline Rogge, coordinator of the GRETCHEN project at the Fraunhofer ISI and Lecturer in Energy Policy and Sustainability at the University of Sussex, also emphasizes the high relevance of the credibility of political support as a driver of innovation in green electricity generation technologies: "Our GRETCHEN survey of technology manufacturers based in Germany shows that the credibility of the policy mix plays a decisive role for their green innovation expenditures."

The project team recommends that the policy instruments used to transform the energy system should always be carefully coordinated and regarded as a whole package. The resulting policy mix should be credible and as inherently consistent as possible – otherwise uncertainties regarding future market development may result which hinder investment and threaten the long-term competitiveness of Germany in these green technologies. In practice this is not an easy task for policy making, given dynamic developments, conflicting policy objectives and multiple interests. Monitoring the German innovation climate can help to identify such developments at an early stage. Dr. Christian Lutz from the GWS Osnabrück summarizes further implications for policy makers: "On the one hand, in the supranational context, climate and energy policy measures have to be much better coordinated. On the other hand, the political discussion within Germany should more strongly stress the resulting benefits like export opportunities, new jobs or stronger international climate protection". The energy and innovation experts of the three research institutions also recommend cross-country comparisons to clarify the transferability of the findings to other contexts.

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