

Energy transition: Carbon pricing more effective than subsidizing renewables

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Energy market researchers from WU (Vienna University of Economics and Business), FAU Erlangen-Nürnberg, and UAS Grisons have crunched the numbers to find out which strategies are most efficient at reducing CO₂ emissions. According to their study, much greater reductions in CO₂ emissions can be achieved by increasing the prices of carbon certificates than by subsidizing wind and solar power.

The research has been published in the “Journal of Environmental Economics and Management,” one of the leading journals in the field of environmental economics.

The EU’s goal is to cut greenhouse gas emissions by 55% by the year 2030. By 2050, the Union plans to become mostly climate neutral. To achieve these goals, many countries rely first and foremost on a strategy of subsidizing renewable power, for example wind and solar power.

Less emphasis is placed on carbon pricing: In the European Emissions Trading System (EU ETS), the price of carbon certificates long lingered significantly below the level of €10 per ton of CO₂. However, prices below €10 per ton of carbon are not enough to achieve significant reductions in emissions.

UK and EU taking different routes

Economists Klaus Gugler from WU, Mario Liebensteiner from FAU Erlangen-Nürnberg, and Adhurim Haxhimusa from UAS Grisons have looked at the situation in Germany and the UK to investigate which policies are most effective for cutting greenhouse gas emissions from power generation. The two countries are taking different routes in this field. While Germany has relied on heavy subsidies for renewables, the UK introduced a carbon tax for the power sector, effectively raising carbon prices to over €35 per ton.

Which policy is more effective?

For their comparison, the researchers analyzed country data from the past few years, including the daily carbon emissions produced by the power sector, carbon prices, wind and solar power feed-in levels, and other variables such as demand for electricity, coal and natural gas prices, and seasonal effects.

The result: While Germany only managed to achieve a relatively moderate reduction in emissions generated by the power sector, the UK has been able to cut emissions by 55% since the introduction of the British power sector carbon tax in 2013.

Coal replaced by gas

The researchers discuss two key aspects that explain this difference: First, subsidies for renewable power fail to deliver the desired effects. At low carbon price levels, wind and solar power first replace the relatively “clean” gas-powered plants, while “dirty” coal – especially brown coal – continues to survive in the market. It is only when the amount of renewable energy fed into the grid reaches very high levels that coal power starts to be pushed out of the market as well.

Second, as illustrated by the UK, higher taxes on carbon emissions result in coal gradually being replaced by natural gas. In power generation, natural gas produces only about half the amount of carbon emissions as coal. Even moderately high carbon prices mean that coal is no longer economically viable, which leads to a significant drop in emissions.

An example: What can be achieved by spending one billion euros?

The model developed by the researchers makes it possible to calculate the costs of different climate policies. For example, the economists crunched the numbers to find out what amount of emissions a country would be able to cut by spending one billion euros. They found that in Germany, one billion euros spent on a low carbon price of €8 per ton is equivalent to an additional reduction in CO2 emissions of roughly 20 million tons. If the money is used to subsidize wind power, it would reduce emissions by 5 million tons. Spending it on solar subsidies would result in emission cuts equivalent to 1 million tons. In the UK, the effects are much greater: At a moderately high carbon price of €36 per ton, one billion euros would buy an emissions reduction of 33 million tons. Based on the current wind power feed-in tariffs, a reduction of around 18.5 million tons could be achieved.

Market-based incentives strengthen bridging technologies

According to the researchers, the decisive advantage of the British strategy lies in the fact that carbon pricing creates market-based incentives without mandating which specific technologies should be used. Under these conditions, relatively clean gas-fired power plants are able to push the much more problematic coal-fired power plants out of the market almost entirely. In contrast, heavy subsidization of renewable energy currently means that it's mostly natural gas that is being pushed out of the market, while coal-fired power plants remain on the grid. The results show that even moderately high carbon prices can help countries achieve large carbon emission cuts in the short term and at low costs, as long as enough gas-fired power plants are available that can serve as a bridging technology.

The study

Klaus Gugler, Adhurim Haxhimusa, Mario Liebensteiner: "Effectiveness of Climate Policies: Carbon Pricing vs. Subsidizing Renewables." Available at: <https://doi.org/10.1016/j.jeem.2020.102405>

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