Capturing CO2 emissions needed to meet climate targets

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Biomass energy production. Credit: Thinkstock

Technologies that are discussed controversially today may be needed to keep the future risks and costs of climate change in check. Combining the production of energy from fossil fuels and biomass with capturing and storing the CO2 they emit can be key to achieving current climate policy objectives such as limiting the rise of the global mean temperature to below 2 degrees Celsius.

This is shown by the most comprehensive study to date on technology strategies to combat climate change, published in a special issue of the journal *Climatic Change*. It is based on the analysis of 18 computer models by an international team of scientists under the roof of the Stanford Energy Modelling Forum (EMF 27).

"Versatile technologies seem to be most important to keep costs in check," says lead author Elmar Kriegler from the Potsdam Institute for Climate Impact Research. Both bioenergy and CCS can help reduce emissions from non-electric energy use that would be hard to decarbonize otherwise. Examples are the burning of coke in blast furnaces in the steel industry which can be equipped with CCS, and the combustion of petrol for transport which can be replaced by biofuels. "If combined, energy from biomass and CCS can even result in withdrawing CO2 from the atmosphere and hence compensate remaining emissions across sectors and over time, because grasses and trees absorb CO2 before they are used to produce energy," explains Kriegler.

In contrast, the availability of individual low carbon technologies in the electricity sector was shown to be less important. This is due to the fact that the electricity sector has a number of mitigation options, like nuclear, solar, and wind power, but also gas and coal power with CCS. So the lack of one of them can more easily be compensated by the others.

Bioenergy and CCS are important to keep costs in check, but also have risks

Many simulations in the study could not at all achieve emissions reductions in line with the 2 degrees target without the use of bioenergy combined with CCS. Among those that could, mitigation costs on average more than doubled in scenarios without CCS. "Concerns

regarding bioenergy and CCS are highly relevant, but given the potential importance of these technologies, it becomes clear that their opportunities and risks urgently need to be investigated in greater detail," Kriegler concludes.

Energy from biomass indeed risks competing with food production for land, and sequestering CO2 from power plants underground on an industrial scale is a yet unproven method.

The technology strategies exist – but depend on climate policy

A robust feature of the transformation that was identified in the study is an accelerated electrification of energy used by consumers, for instance by increasing the number of electric cars or of electric blast furnaces in the steel industry. Moreover, increasing energy efficiency has proven to be an important strategy to support climate policy, cutting mitigation costs in half. However, energy efficiency improvements alone, without strong policies to decarbonize energy production, would be insufficient to reach the 2 degrees target.

"Our study shows that there are technology strategies that can enable us to reach ambitious climate policy targets with some degree of confidence," says John Weyant, head of the Stanford Energy Modeling Forum. "But these strategies will only be possible if effective climate policies are implemented very very soon."

More information: Kriegler, E., Weyant, J.P., Blanford, G.J., Krey, V., Clarke, L., Edmonds, J., Fawcett, A., Luderer, G., Riahi, K., Richels, R., Rose, S.K., Tavoni, M., van Vuuren, D.P. (2014): The role of technology for achieving climate policy objectives: overview of the EMF 27 study on global technology and climate policy strategies.

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