Why increasing shale gas production won't reduce greenhouse gas emissions

March 9 2018, by Joachim Schleich, Vicki Duscha And Jan Kersting

Fracking wellpad in Tioga County, Pennsylvania, within state forest lands (2012). Credit: SkyTruth Galleries/Flickr, CC BY-NC

The boom in hydraulic fracturing (fracking) has led to an increase in the production of natural gas in the United States by about one-third since

2006. Production of has remained strong even when oil prices were low following the significant price drop in 2014. In light of the recent recovery of oil and gas prices, a 2017 report by the International Energy Agency (IEA) predicts the shale revolution to get a second wind.

A number of policy makers and scientists expect increased shale gas production to both reduce gas prices and lower greenhouse gas emissions . By replacing coal in electricity generation, shale gas has already contributed substantially to the observed 11% reduction in US greenhouse gas emissions since the shale gas boom started in 2007, as documented in a recent report by the US Environmental Protection Agency (EPA).

To date, countries have responded in different ways to the multi-faceted consequences associated with shale gas use, which is also feared to hurt the environment by contaminating groundwater and surface water, harming local air quality via gas leakages, triggering earthquakes, and depleting freshwater reserves.

Outside of Europe, many countries with significant shale gas resources – such as Argentina, China, and Mexico – have proceeded with their plans for extraction. In Europe, the response has been more diverse. While Poland and the United Kingdom developed their first exploratory wells, Bulgaria, Czech Republic, France, and Luxembourg banned shale gas extraction using fracking. Repercussions from the Ukraine-Russia crisis, as well as renewed concerns over energy security, have led some European countries, including Germany, to reconsider their initial sceptical position towards shale gas extraction.

So what if the US shale gas boom were replicated in other countries? What would be the implications on global emissions and costs to mitigate greenhouse gases if available shale gas resources were exploited in other regions as well?

In a recent publication in the journal (*Climate Policy*), a French-German team of researchers from the Grenoble Ecole de Management, Fraunhofer ISI and Enerdata explored whether shale gas lowers the costs of meeting global climate targets (*Umweltbundesamt*), in particular to limit global mean temperature to rise by more than 2°C above pre-industrial levels agreed upon within the United Nations' climate negotiations.

Their analyses, conducted on behalf of the German Federal Environmental Agency, rely on simulations with a global techno-economic model (POLES) that includes a broad variety of electricity-generation technologies and allows for a differentiated analysis of impacts for numerous countries and regions.

The impact of shale gas availability on greenhouse gas emissions can be explained by the following mechanisms:

- According to the *fossil-fuel substitution effect*, shale gas replaces coal and oil in the energy mix, resulting in lower greenhouse gas emissions.
- In contrast, the *low-carbon substitution effect* means that – in addition to replacing conventional natural gas – shale gas crowds out technologies such as renewable energy sources and nuclear power, leading to higher greenhouse gas emissions.
- Finally, since energy consumption increases in response to lower prices of natural gas and other energy carriers, the *demand effect* causes a rise in greenhouse gas emissions.

The net impact of shale gas availability depends on the relative magnitude of these three effects.

Findings that challenge the conventional wisdom

The results of the model simulations suggest that in the long run (up to the year 2050), global greenhouse gas emissions would increase by about 0.8 percent if shale gas was available everywhere compared to a scenario where shale gas was exploited only in the United States. But the results also suggest differences across countries: some countries like Japan and India would experience a small decrease in emissions, while others, such as Argentina, Canada, Mexico or the Russian Federation, would face an increase in emissions of up to 3 percent in the case of Argentina.

These developments also have repercussions on the costs of meeting the 2°C target. On the one hand, a higher shale gas availability tends to lower the costs of mitigating CO_2 emissions per ton. On the other hand, a higher shale gas availability may also increase emissions and thus require stronger mitigation efforts to meet the given climate targets.

To estimate the implications of global availability of shale gas on greenhouse gas mitigation costs, the researchers estimate the costs of additional policies that need to be implemented to meet the given climate targets for two scenarios. In one scenario, shale gas is assumed to be available in the United States only. In a second, shale gas is allowed to be exploited in all countries with a shale gas resource base. Comparing the costs of additional policies for both scenarios suggests that at the global level, availability of shale gas increases the costs of meeting the 2°C target for most countries. Yet, there are differences as well. For example, for Argentina and Mexico, global shale gas availability leads to an increase in mitigation costs of 9 percent. Mitigation costs decline for Japan and India only.

Conservative estimates

These findings on the role of shale gas availability for meeting ambitious climate targets are conservative, since they did not account for fugitive emissions from shale gas production or for additional emissions from the

transport of liquefied natural gas. While the magnitude of fugitive emissions is uncertain, they reduce the benefits of the lower greenhouse gas emissions of shale gas compared to other fossil fuels. If these effects were taken into account, the findings would be even more strongly against shale gas.

The study's findings warrant a re-evaluation of the role of shale gas to meet climate targets in many countries. They imply that a large-scale global expansion of shale gas would increase greenhouse gas emissions and also the costs of meeting climate targets for many countries. These results cast doubt on shale gas's potential as a low-cost option for meeting ambitious global climate targets.

This article was originally published on The Conversation. Read the original article.

Provided by The Conversation