What does a 1.5-degree warming limit mean for China?

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As part of the Paris Agreement, nearly all countries agreed to take steps to limit the average increase in global surface temperature to less than 2 degrees C, or preferably 1.5 degrees C, compared with preindustrial levels. Since the Agreement was adopted, however, concerns about global warming suggest that countries should aim for the "preferable" warming limit of 1.5 degrees C.

What are the implications for China of trying to achieve this lower limit? Prof. Duan Hongbo from the University of Chinese Academy of Sciences and Prof. Wang Shouyang from the Academy of Mathematics and Systems Science of the Chinese Academy of Sciences, together with their collaborators, have attempted to answer this question.

Their results were published in an article entitled "Assessing China's efforts to pursue the 1.5 degrees C warming limit," which was published in Science on April 22.

The authors used nine different integrated assessment models (IAMs) to make their evaluation of China's effort to achieve the warming limit of 1.5 degrees C.

The various models show different emission trajectories for carbon and noncarbon emissions. The majority of the IAMs will achieve near-zero or negative carbon emissions by around 2050, with a range from -0.13 billion tons of CO₂ (GtCO₂) to 2.34 GtCO₂ across models. However, one highly consistent finding among all models is that the 1.5 degrees C warming limit requires carbon emissions decrease sharply after 2020.

The researchers discovered that a steep and early drop in carbon emissions reduces dependency on negative emission technologies (NETs), i.e., technologies that capture and sequester carbon. One implication of this finding is that there is a trade-off between substantial early mitigation of carbon emissions and reliance on NETs, which may have uncertain performance. At the same time, the model showing the lowest carbon emissions by 2050 shows the greatest reliance on carbon capture and storage (CCS) technology—suggesting that NETs have an important role in reducing carbon emissions.

Although carbon emissions were an important focus of the study, the researchers also noted that reducing noncarbon emissions is necessary to stay under the warming limit. Specifically, carbon emissions must be reduced by 90%, CH₄ emissions by about 71% and N₂O emissions by about 52% to achieve the 1.5 degrees C goal.

The study showed that mitigation challenges differ across sectors, e.g., industry, residential and commercial, transportation, electricity and "other." Among these sectors, industry plays a big role in end-use energy consumption. Therefore, substantial changes in industrial energy use must occur to reach deep decarbonization of the entire economy and realization of the given climate goals. Indeed, a highly consistent finding across all
models is that the largest proportion of emission reduction will come from a substantial decline in energy consumption.

The study also highlights the importance of replacing fossil fuels with renewables, a strategy that plays the next most important role in emission reduction behind reducing energy consumption. The study suggests that China needs to decrease its fossil energy consumption (as measured by standard coal equivalent, or Gtce) by about 74% in 2050 in comparison with the no policy scenario.

The researchers estimate that achieving the 1.5 degrees C goal will involve a loss of GDP in 2050 in the range of 2.3% to 10.9%, due to decreased energy consumption and other factors.

The study also noted that China's recently announced plan to become carbon neutral by 2060 largely accords with the 1.5 degrees C warming limit; however, achieving the latter goal is more challenging.

More information: H. Duan el al., "Assessing China's efforts to pursue the 1.5°C warming limit," Science (2021). science.sciencemag.org/cgi/doi ... 1126/science.aba8767

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