Green hydrogen from expanded wind power in China: Reducing costs of deep decarbonization

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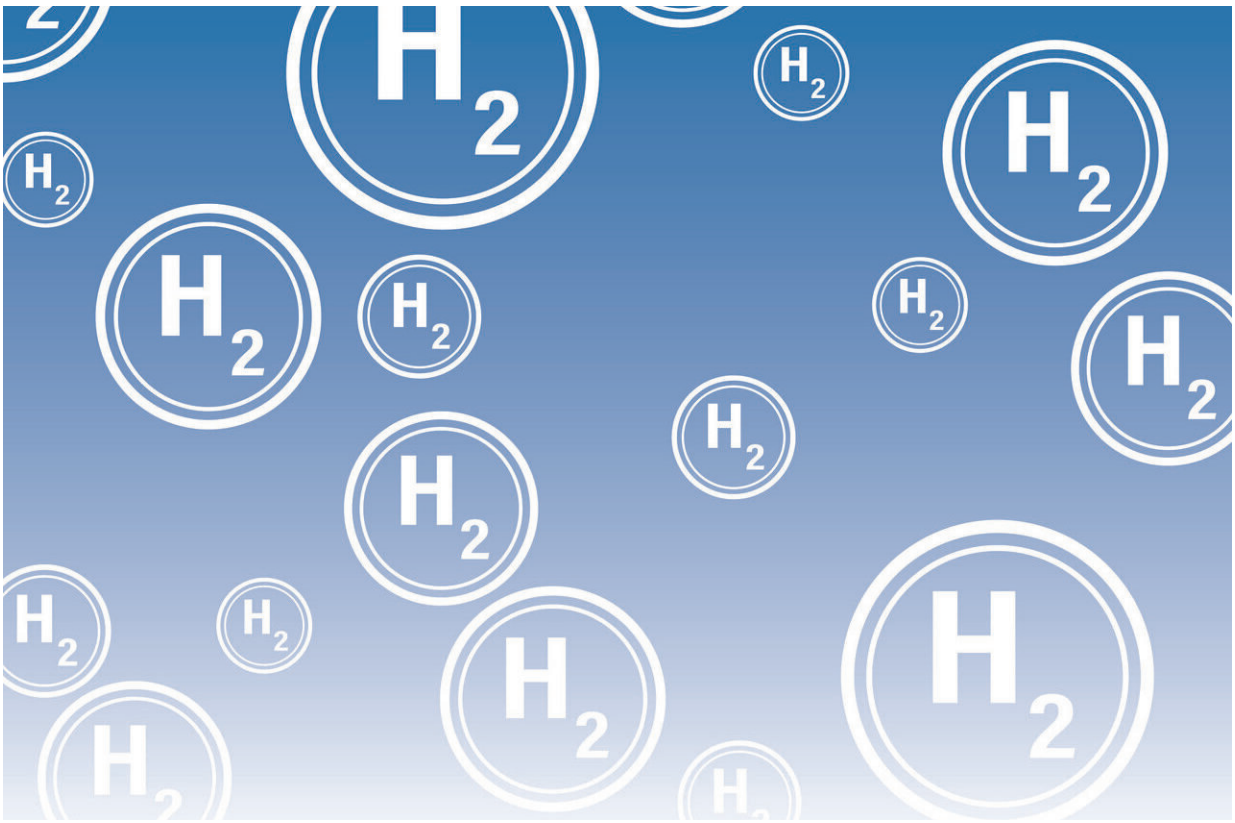

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China is the world's largest producer of hydrogen—currently chiefly an industrial feedstock consumed by the chemical and refining

industries—and overwhelmingly produces it from coal emitting CO_2, termed "black" hydrogen. China also leads the world in wind power generation, with 61% of its onshore wind capacity located in windy northern regions, where it must sometimes be wasted because the grid cannot accommodate its inherent variability. But renewable power can be used to produce hydrogen without CO_2 emissions, called "green" hydrogen, through electrolysis of water that can be timed to accommodate variations in renewable generation.

Now a team of researchers from Harvard University, Shandong University and Huazhong University of Science and Technology have explored the potential harnessing of China's wind energy to produce carbon-free green hydrogen at a cost lower than that of coal-derived black hydrogen. If green hydrogen can prove cost-competitive with black carbon for existing industrial uses, it may have even greater decarbonization potential as a zero-carbon energy source in key sectors that are otherwise difficult to decarbonize, including iron & steel production, cement making, and heavy-duty transportation.

The researchers chose Western Inner Mongolia, with its high wind power generation and large coal and black hydrogen production, as a representative region to estimate the technical and economic feasibility of producing green hydrogen using wind power. The results show that green hydrogen produced from wind power is competitive with black hydrogen, with large production levels possible at less than US$2/kg—a widely recognized threshold for cost-competitiveness. And by 2030, shifting black hydrogen to green hydrogen derived from Western Inner Mongolia's growing wind power for use as industrial feedstocks alone could reduce about 100 million tons of CO_2 emissions per year, equal to roughly half of the entire carbon footprint of the megacity of Beijing.

More information: Haiyang Lin et al, Economic and technological feasibility of using power-to-hydrogen technology under higher wind

penetration in China, *Renewable Energy* (2021). DOI: 10.1016/j.renene.2021.04.015