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### Hydrogen's role in an uncertain energy future

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#### Abstract

This study explores global energy demand, and hydrogen's role, over the 21st century. It considers four illustrative cases: a high (1000 EJ) and a low (300 EJ) energy future, and for each of these conditions, a high (80%) and low (20%) fossil fuel energy share. We argue that neither high energy future is probable, because of resource limitations, and rising energy, environmental and money costs per unit of delivered energy as annual energy demand rises far beyond present levels. The low energy/low fossil case is most likely, followed by the low energy/high fossil case, although both require large cuts in energy use, and most probably, lifestyle changes in high energy use countries. Hydrogen production would be best favoured in the low fossil fuel options, with production both greater, and implemented earlier, in the higher energy case. It is thus least likely in the low energy/high fossil fuel case.



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## Keywords

Hydrogen; Energy consumption; Renewable energy; Global warming; Carbon capture and storage

## Abbreviations

ASPO, Association for the Study of Peak Oil; CCS, carbon capture and storage; CO<sub>2</sub>, carbon dioxide; EIA, Energy Information Administration (US); EJ, exajoule (10<sup>18</sup> J); EWG, Energy Watch Group; FC, fuel cell; GJ, gigajoule (10<sup>9</sup> J); Gt, gigatonne (10<sup>9</sup> tonne); H<sub>2</sub>, hydrogen; H<sub>e</sub>, high energy (1000 EJ); H<sub>f</sub>, high fossil fuel (80%); IEA, International Energy Agency; IPCC, Intergovernmental Panel on Climate Change; L<sub>e</sub>, low energy (300 EJ); L<sub>f</sub>, low fossil fuel (20%); Mt, megatonne (10<sup>6</sup> tonne); RE, renewable energy; WETO, World Energy Technology Outlook

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