6 kWh low-carbon economy

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Advances in low-carbon energy resources and carriers such as next-generation biofuels, hydrogen produced from electrolysis, synthetic fuels, and carbon-neutral ammonia would substantially improve the economics of net-zero energy systems.

Adding up the net energy cost and the net capacity cost of the five low-carbon alternatives, far and away the most expensive is solar. It costs almost 19 cents more per KWH than power from the...

This study sets up four low-carbon transition scenarios, clean energy generation (CEG) scenario, carbon capture, utilization and storage (CCUS) scenario, natural gas generation (NGE) scenario,...

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a System boundaries and hydrogen production configurations. b Input data. c Geospatial analysis (method). d Data from optimal hybrid energy systems. e Output data from geospatial analysis. f Optimization (method) of hybrid energy systems. g Hydrogen demand scenarios with production technologies. PEM polymer electrolyte membrane, PV photovoltaic, SMR steam methane reforming, w. CCS with carbon capture and storage, IRENA International Renewable Energy Agency, GHG greenhouse gas.

Recent techno-economic and environmental life cycle analyses8,13,14,19 reveal the impacts of location-specific conditions on hydrogen production. Data from these studies shown the environmental burdens of hydrogen production now and in the future (2050) as provided in Supplementary Figs. 8, 10, and 11.

We focus on wind-based (onshore and offshore) and solar PV-based electrolytic hydrogen production in Fig. 2, i.e., potential global electrolytic hydrogen production locations. The left column demonstrates specific global hydrogen production cost in each grid cell--from 1-5 EUR kg-1 H2--for the reference situation and three future scenarios considered. The right column illustrates the specific life cycle GHG emissions from electrolytic-based hydrogen production (from 0-4.4 kg CO2-eq. kg-1 H2).

a, c, e, g Specific electrolytic hydrogen production cost for reference, business-as-usual, 2 ?C, and 1.5 ?C, respectively. b, d, f, h Specific life cycle GHG emissions of electrolytic hydrogen production for reference, business-as-usual, 2 ?C, and 1.5 ?C, respectively. Geographical areas in white represent unsuitable hydrogen production locations due to spatial constraints. GHG greenhouse gas.

The more ambitious climate scenarios indicate that electrolytic hydrogen production costs of less than 2 EUR kg-1 H2 are reachable for large geographical regions, mainly areas in Australia, USA, Canada, the North-West of Europe, and the Sahara. Similar results in terms of best-performing regions are obtained concerning GHG emissions.

a, c, e, g Cost supply curves in year 2050 for business-as-usual, 2 ?C, 1.5 ?C, and 1.5 ?C (IRENA), respectively. b, d, f, h Selected economical locations for business-as-usual, 2 ?C, 1.5 ?C, and 1.5 ?C (IRENA), respectively. i-j Net H2 supply for 2 ?C and 1.5 ?C, respectively. IRENA International Renewable Energy Agency, REMIND The REgional Model of INvestments and Development.