Hydrogen, Renewables and Energy Storage

A compilation of studies, reports and announcements

Updated: March 2020
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Reports and Assessments

A North Africa - Europe Hydrogen Manifesto
https://dii-desertenergy.org/wp-content/uploads/2019/12/Dii-hydrogen-study-November-2019.pdf

BloombergNEF - Hydrogen Economy Outlook: Key messages
https://data.bloomberglp.com/professional/sites/24/BNEF-Hydrogen-Economy-Outlook-Key-Messages-30-Mar-2020.pdf

Hydrogen for the energy transition: A programmatic approach for Hydrogen innovations in the Netherlands for the 2020-2030 period
https://www.topsectorenergie.nl/sites/default/files/uploads/TKI%20Gas/publicaties/7017-TSE%20Programmatische%20Aanpak%20Waterstof_EN-web.pdf

Path to hydrogen competitiveness: A cost perspective
https://cafcp.org/sites/default/files/Path-to-Hydrogen-Competitiveness_Full-Study-1.pdf
A new report published today by the Hydrogen Council shows that the cost of hydrogen solutions will fall sharply within the next decade, sooner than previously expected.

A new report from Wood Mackenzie shows promise for green hydrogen.
https://www.woodmac.com/news/editorial/the-future-for-green-hydrogen/

United Kingdom: Enabling the Gas Markets Plan 2019/2020
https://cafcp.org/sites/default/files/Enabling-the-Gas-Markets-UK-2019-2020.pdf

Road Map to a U.S. Hydrogen Economy: Reducing emissions and driving growth across the nation
https://cafcp.org/sites/default/files/Road%2BMap%2Bto%2Ba%2BUS%2BHydrogen%2BEconomy%2BFull%2BReport.pdf

Australia's National Hydrogen Strategy
https://www.industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf

British Columbia Hydrogen Study Executive Summary
https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/zen-bcbn-hydrogen-study-final-v6_executivesummary.pdf
Deployment of hydrogen in British Columbia will be required for the Province to meet 2030 and 2050 decarbonization goals and emissions reduction commitments.

Hydrogen: A renewable energy perspective
https://www.irena.org/publications/2019/Sep/Hydrogen-A-renewable-energy-perspective
International Renewable Energy Agency examines the potential of hydrogen fuel for hard-to-decarbonise energy uses: energy-intensive industries, trucks, aviation, shipping and heating applications.

Oil and gas company strategies regarding the energy transition
https://iopscience.iop.org/article/10.1088/2516-1083/ab2503/pdf

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The Future of Hydrogen
https://webstore.iea.org/the-future-of-hydrogen
International action can scale up hydrogen to make it a key part of a clean and secure energy future, according to new International Energy Agency report.

Economics of converting renewable power to hydrogen
https://www.nature.com/articles/s41560-019-0326-1
Stanford and German researchers apply their model to the current renewables environment in both Germany and Texas and find that renewable hydrogen is already cost competitive in niche applications.

ITM Power, Mitsui, Chiyoda and British Columbia Hydro in 300MW Power-To-Gas-Study
http://www.itm-power.com/news-item/itm-power-mitsui-chiyoda-and-bc-hydro-in-300mw-power-to-gas-study
The study highlights a number of attractive opportunities for BC to leverage its renewable electricity generation capacity to become a leader in the export of renewable electrolytic hydrogen.

Pathways for Deep Decarbonization in California: Summary for Policy Makers
https://static1.squarespace.com/static/58ec123cb3db2bd94e057628/t/5cadebd04cd61c00017a563b/1554901977873/EFI+California+Summary+DE+PM.pdf
11 breakthrough technologies were identified as major potential contributors to California's deep decarbonization over the long-term, including hydrogen produced by electrolysis, among others.

GLOBAL WARMING OF 1.5 °C: Summary for Policy Makers, Intergovernmental Panel on Climate Change, October 2018.
http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf
This new assessment notes that, among other things, reductions in carbon emissions can be "achieved through combinations of new and existing technologies and practices, including electrification, hydrogen..."

U.S. National Electrification Assessment, Electric Power Research Institute (EPRI), April 2018.
https://www.epri.com/#/pages/product/000000003002013582/?lang=en
The assessment calls for exploring the role of hydrogen as a clean carrier of energy and the economic and policy impediments to its development. It also identifies hydrogen as one of several options to explore for dealing efficiently with daily and seasonal variability.

Gas for Climate: How gas can help to achieve the Paris Agreement target in an affordable way
https://www.gasforclimate2050.eu/files/files/Ecofys_Gas_for_Climate_Feb2018.pdf
Ecofys (Navigant), concludes that it is possible by 2050 to scale up renewable gas (biomethane and renewable hydrogen) production in the EU to 122 billion cubic metres by 2050.

BRINGING NORTH SEA ENERGY ASHORE EFFICIENTLY, World Energy Council, 2018.
https://www.worldenergy.org/wp-content/uploads/2018/01/WEC-brochure_Online-offshore.pdf
The report concludes that to create an affordable and reliable energy supply in NW Europe, a hybrid system of (green) power and (green) hydrogen is key.

Study on Early Business Cases for H2 in Energy Storage and More Broadly Power to H2 Applications, Fuel Cell and Hydrogen Joint Undertaking, June 2017.
http://www.fch.europa.eu/publications/study-early-business-cases-h2-energy-storage-and-more-broadly-power-h2-applications
A study to identify early business cases and assess potential replicability within the EU, now until 2025.

Energy from Gas: Taking a Whole System Approach, Inst. of Mech. Engineers, May 2018.
http://www.imeche.org/policy-and-press/reports/detail/energy-from-gas-taking-a-whole-system-approach Government and industry should boost investment in technology to promote the use of hydrogen as a way of storing energy, which would make the UK energy system greener and more efficient.

GENerating energy secure COMMunities through Smart Renewable Hydrogen, 2017.
http://www.nweurope.eu/projects/project-search/gencomm-generating-energy-secure-communities/
GENCOMM will address the energy sustainability challenges of NWE communities through the implementation of smart hydrogen-based energy matrixes.

Commission Staff Working Document: Energy storage – the role of electricity, European Commission, February 2017.
https://ec.europa.eu/energy/sites/ener/files/documents/swd2017_61_document_travail_service_part1_v6.pdf

Direct Air Capture of Carbon Dioxide, ICEF Roadmap, Innovation for Cool Forum, Oct. 2018.
https://www.icef-forum.org/pdf2018/roadmap/ICEF2018_Roadmap_Draft_for_Comment_20181012.pdf
Describes carbon capture processes that have the benefit of generating hydrogen.

News stories and op-eds

Hydrogen-Fueled Climate Goals Need Radical Carbon Price Hike
https://www.bloomberg.com/news/articles/2020-03-30/hydrogen-fueled-climate-goals-need-radical-carbon-price-hike

'Hydrogen Economy' Offers Promising Path to Decarbonization
https://about.bnef.com/blog/hydrogen-economy-offers-promising-path-to-decarbonization/

L.A. Aims to be First to Power U.S. City With Green Hydrogen
https://www.bloomberg.com/news/articles/2020-03-10/l-a-aims-to-be-first-to-power-u-s-city-with-renewable-hydrogen

Green hydrogen gets real as utility business models and delivery solutions emerge
The fuel may be the only way to meet power system needs in zero emissions scenarios and the market signals to produce and use it are finally clear.
https://www.utilitydive.com/news/green-hydrogen-gets-real-as-utility-business-models-and-delivery-solutions/572412/

Germany Sees No Role for Natural Gas in Draft Plan for Hydrogen
https://finance.yahoo.com/news/germany-sees-no-role-natural-144730126.html

Tasmania invests $50m in green hydrogen exports
https://www.afr.com/companies/energy/tasmania-invests-50m-in-green-hydrogen-exports-20200304-p546oa
Tasmania will invest $50 million to kick start a renewable hydrogen industry as the state aims to become a major producer and exporter of the emission-free energy by 2030.

Green hydrogen to be 'the new oil' in the next 20 years, says Siemens Middle East
Siemens, DEWA and Expo 2020 Dubai collaborate to build the region's first solar-driven hydrogen electrolysis facility
https://www.arabianbusiness.com/energy/438001-green-hydrogen-to-be-the-new-oil-in-the-next-20-years-says-siemens-middle-east-chief-manuel-kuehn

Green hydrogen – The Potential Energy Transition Gamechanger
https://www.irena.org/newsroom/articles/2020/Jan/Green-hydrogen-the-potential-energy-transition-gamechanger - Ministers concluded by underlining IRENA's role in supporting the development of hydrogen from renewable power in Member countries.

Hydrogen Should Form Part of China's Energy Strategy, Former Minister Says
https://www.yicaiglobal.com/news/hydrogen-should-form-part-of-china-energy-strategy-former-minister-says

The (Green) Hydrogen Economy is About to Take Off
With a 12X increase in the capacity of electrolyzers on its way over the next five years, hydrogen is poised to begin delivering on its promise.
https://theenergytransition.org/article/the-green-hydrogen-economy-is-about-to-take-off/

'Particularly significant' year for Scottish energy sector as climate emergency came calling
by Paul Wheelhouse, Scottish Minister for Energy, Connectivity and the Islands
https://www.energyvoice.com/opinion/214861/particularly-significant-year-for-scottish-energy-sector-as-climate-emergency-came-calling/

How We Can Transition to a Low Carbon Future: An interview with Patrick Molloy of the Rocky Mountain Institute
https://blog.ballard.com/low-carbon-future-interview

Natural gas plant replacing Los Angeles coal power to be 100% hydrogen by 2045: LADWP
https://www.utilitydive.com/news/natural-gas-plant-replacing-los-angeles-coal-power-to-be-100-hydrogen-by-2/568918/

Greenfield Global and Hy2Gen Canada Announce a Joint Venture to Produce Green Hydrogen in Quebec
https://greenfield.com/news/2019/greenfield-global-inc-and-hy2gen-canada-announce-a-joint-venture-to-produce-green-hydrogen-in-quebec/

'Epic' clean energy storage project bound for Utah
https://www.ksl.com/article/46563317/epic-clean-energy-storage-project-bound-for-utah

Siemens building electrolysis plant for hydrogen-based steelmaking
https://press.siemens.com/global/en/pressrelease/siemens-delivers-pem-electrolyzer-salzgitter-ag

Solar + Hydrogen: The perfect match for a Paris-compatible hydrogen strategy?
https://www.solarpowereurope.org/blog-solar-and-hydrogen/
Norway's Statkraft: Green hydrogen will win on price
https://www.tu.no/artikler/statkraft-gront-hydrogen-vil-vinne-pa-pris/471446

German econ minister says hydrogen key part of future energy system
https://www.cleanenergywire.org/news/german-econ-minister-says-hydrogen-key-part-future-energy-system

Siemens Backs Mega Green Power Hydrogen Project in Australia
Project will convert power from solar and wind into hydrogen; Investment is estimated at A$10 billion
https://www.bloomberg.com/news/articles/2019-10-08/siemens-backs-mega-green-power-hydrogen-project-in-australia

Hydrogen's Plunging Price Boosts Role of Gas as Climate Solution
https://www.bloomberg.com/news/articles/2019-08-21/cost-of-hydrogen-from-renewables-to-plummet-next-decade-bnef

Rocky Mountain Institute: The Truth About Hydrogen
https://rmi.org/the-truth-about-hydrogen/

Europe Stores Electricity in Gas Pipes
https://www.scientificamerican.com/article/europe-stores-electricity-in-gas-pipes/
Converting excess wind and solar power into hydrogen can extend renewable energy's reach

Hydrogen can save unrealized small power plants
https://www.sintef.no/siste-nytt/hydrogen-kan-redde-urealiserte-smakraftverk
Small hydropower plants that do not sell electricity, but green hydrogen and oxygen instead, can become part of tomorrow's energy Norway.

Former salt cavern to be transformed into green hydrogen storage facility
https://www.gasworld.com/salt-cavern-to-be-transformed-into-h2-facility/2016687.article
Hydrogen Power Storage & Solutions East Germany (HYPOS) is developing the largest hydrogen storage unit in Europe.

Understanding Hydrogen Energy Storage
https://www.azom.com/article.aspx?ArticleID=17077
Interview with Nel Hydrogen about hydrogen as energy storage. A good and easy-to-understand overview of the subject.

What would it take to decarbonise the global economy?
Lots of clean electricity and a revolutionary shift towards the lightest gas, writes Henry Tricks
https://www.economist.com/technology-quarterly/2018/11/29/what-would-it-take-to-decarbonise-the-global-economy?fbclid=IwAR2GXR6USVfuw-3DGAAl2VH__9pZTCgvLiRqTyiPD1Y6gjHYsqaoCKHSNBo

Hydrogen, the missing link in the energy transition
https://www.iea.org/newsroom/news/2018/october/hydrogen-the-missing-link-in-the-energy-transition.html

EU countries agree to explore hydrogen as energy source
https://www.reuters.com/article/us-eu-power-hydrogen-co2/eu-countries-agree-to-explore-hydrogen-as-energy-source-idUSKCN1LY24N
The non-binding initiative, endorsed by 25 EU nations, calls for governments to increase cooperation on research into the potential for hydrogen use in energy storage, transport, power and heating.

UC Irvine Receives CEC Grant for California Renewable Hydrogen Deployment Roadmap
Roadmap to Provide Significant Detail Through 2025, Higher Level Outlook Through 2050
http://www.apep.uci.edu/NewsAndEvents/APEP_Receives_CEC_Grant_For_California_Renewable_Hydrogen_Deployment_Roadmap_090518.aspx

North America's First Multi-Megawatt Power-to-Gas Facility Begins Operations
Energy Storage Site to Help Grid Stabilization in Ontario
https://globenewswire.com/news-release/2018/07/16/1537941/0/en/North-America-s-First-Multi-Megawatt-Power-to-Gas-Facility-Begins-Operations.html

SoCalGas, Énergir, GRDF and GRTgaz Announce Collaboration on Low-Carbon and Renewable Gas Initiatives During World Gas Conference
http://markets.businessinsider.com/news/stocks/socalgas-énergir-grdf-and-grtgaz-announce-collaboration-on-low-carbon-and-renewable-gas-initiatives-during-world-gas-conference-1027331418

Massachusetts Power-to-Gas Feasibility Study
http://www.itm-power.com/news-item/massachusetts-power-to-gas-feasibility-study
The study will assess the potential for P2G energy storage and hydrogen fuel for the Massachusetts region and determine the feasibility for P2G and hydrogen fuel derived from renewable energy sources.

"Hydrogen caverns are a proven, inexpensive and reliable technology"
An engineer by training, Louis Londe has been working on underground storage since the early 1990s.
https://medium.com/@cH2ange/louis-londe-technical-director-at-geostock-hydrogen-caverns-are-a-proven-inexpensive-and-346dde79c460

Electrification and clean hydrogen key to decarbonising economies
https://windeurope.org/newsroom/press-releases/electrification-and-clean-hydrogen-key-to-decarbonising-economies/
Wind energy together with clean hydrogen can play a vital role in decarbonizing economies, saod WindEurope CEO Giles Dickson.

The Unique Potential of Hydrogen in Energy Infrastructure, Storage and Resiliency
https://www.rdmag.com/article/2017/10/unique-potential-hydrogen-energy-infrastructure-storage-and-resiliency?platform=hootsuite
Op-ed by Dr. Sunita Satyapal, Director of DOE's Fuel Cell Technologies office.

Hydrogen and wind: Allies for sustainable energy
http://m.dw.com/en/hydrogen-and-wind-allies-for-sustainable-energy/a-19330382

Svalbard's electric power could come from hydrogen
https://www.sintef.no/en/latest-news/svalbards-electric-power-could-come-from-hydrogen/

Energy solution: Renewable proposal for Svalbard
Svalbard, between Norway and the North Pole, receives its electricity from a coal power plant. Statkraft proposes using renewable hydrogen from wind power in Finnmark and shipped by boat to Svalbard.
https://explained.statkraft.com/articles/2018/energy-solution-renewable-proposal-for-svalbard/

Websites and pages

European Power to Gas, European Power to Gas Platform**.**
http://europeanpowertogas.com/projects-in-europe/
Description: Map shows the power-to-gas demonstration projects that are operational or planned at this moment.

Hydrogen, the Fabulous Fuel, Siemens.
https://www.siemens.com/innovation/en/home/pictures-of-the-future/energy-and-efficiency/the-future-of-energy-wonder-fuel-hydrogen.html

For more stories about hydrogen and fuel cell technologies, visit the CaFCP news page https://cafcp.org/news.