

Green Hydrogen's Rise in Emerging Markets

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The term green hydrogen probably conjures up images from a science fiction movie rather than an energy source, but it is emerging as a key decarbonization solution in the global push towards net-zero. Green hydrogen is hydrogen produced by splitting water into hydrogen and oxygen using renewable electricity, and it was featured in a number of emission-reduction pledges at the United Nations Climate Change Conference, or COP26, as a means to decarbonize heavy industry, long-haul freight, shipping, and aviation. Hydrogen is the simplest and smallest element in the periodic table, which, regardless of its production method, ends up with the same “**carbon-free**” molecule—i.e., no emissions at the point of use—and explains its attractiveness. Depending on production methods, hydrogen can be [grey, blue, or green](#)—and sometimes even pink, yellow, or turquoise.

Color	GREY HYDROGEN	BLUE HYDROGEN	TURQUOISE HYDROGEN*	GREEN HYDROGEN
Process	SMR or gasification	SMR or gasification with carbon capture (85-95%)	Pyrolysis	Electrolysis
Source	Methane or coal 	Methane or coal 	Methane 	Renewable electricity 

Note: SMR = steam methane reforming.
* Turquoise hydrogen is an emerging decarbonisation option.

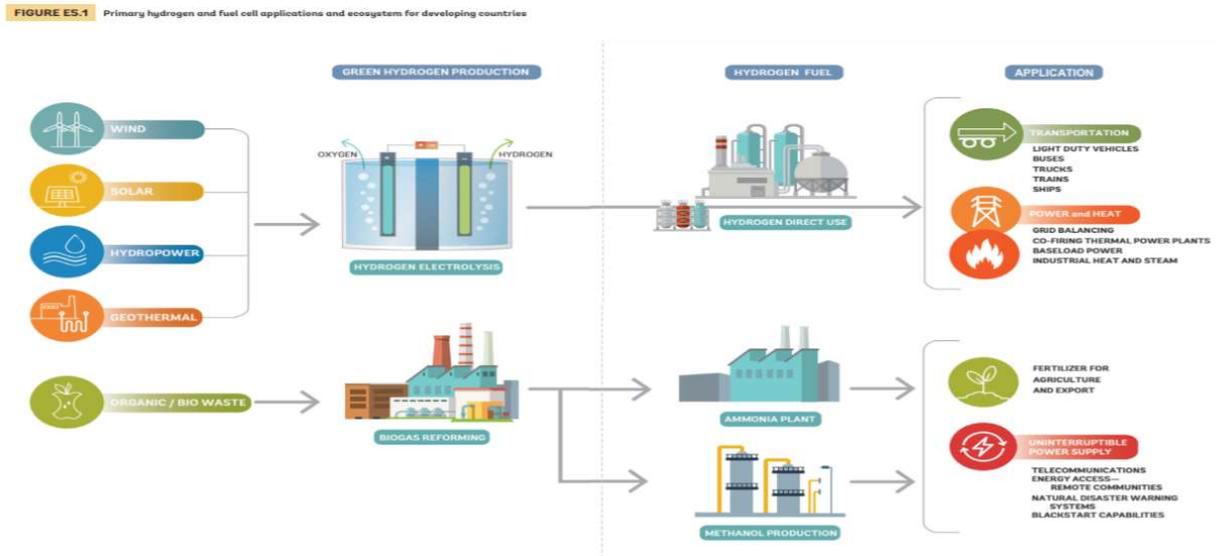
Source: International Renewable Energy Agency. As of February 10, 2022.

Merits of Energy Transition Toward a Green Hydrogen Economy

In the quest to limit the impacts of global warming, green hydrogen (or hydrogen produced with renewable power) is emerging as a viable substitute fuel to decarbonize non-electrifiable or hard-to-abate sectors. In emerging markets, the nascent green hydrogen industry is shaping up as an alternative to improve countries' energy security and diversify EM economies from predominantly extractive industries, while simultaneously helping reduce their carbon footprint. Hydrogen's popularity is explained through:

- high efficiency, with the ability to store energy over long periods of time;
- low-polluting characteristics, with water and small amount of heat as by-products;
- the ability to transport over long distances using existing infrastructure; and,
- complement to renewable power generation.

Hydrogen demand currently stems from its use as a feedstock across key industrial processes, such as refining, ammonia/methanol production, and steel. Policy, affordability, and scalability seem to be converging to create unprecedented momentum for the clean hydrogen economy.



Source: ESMAP/ World Bank: Green Hydrogen in Developing Countries. As of February 10, 2022.

Opportunities and Challenges of Green Hydrogen in Emerging Markets

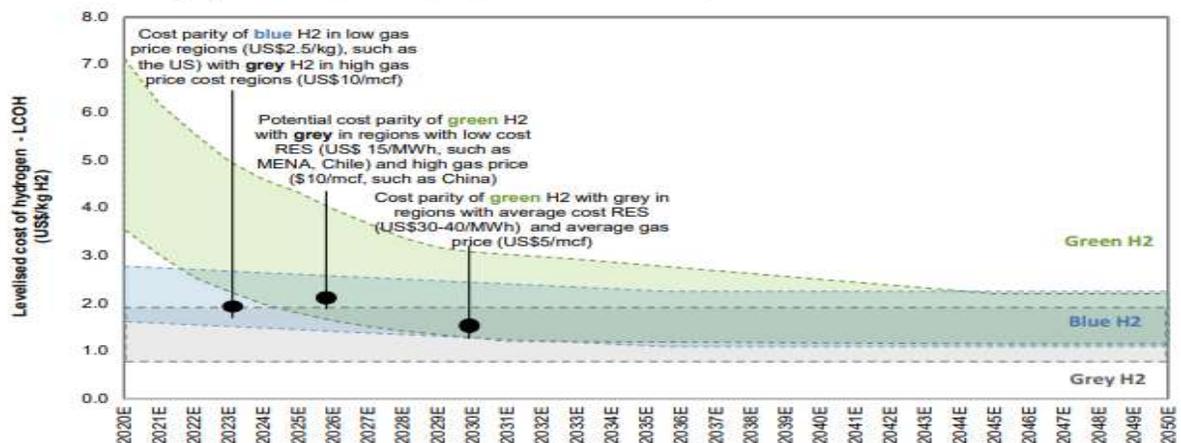
Green hydrogen provides a wide array of opportunities for emerging markets; from a national security standpoint and sovereign decarbonization strategy, using green hydrogen can displace imported fossil fuels (coal, diesel, and natural gas), reducing exposure to market prices and potentially reducing energy costs. From an infrastructure development perspective, having a stable and reliable energy mix provides an opportunity to attract capital for heavy industries. Finally, from an external accounts viewpoint, certain countries are working on becoming green hydrogen exporters, generating hard-currency revenues while simultaneously creating skilled jobs (Goldman Sachs estimates Middle East and North Africa, or MENA, Chile, and other LatAm countries could emerge as key clean hydrogen exporting regions). Given a high percentage of fossil fuels in the emerging markets energy mix, developing nations have the opportunity, under certain conditions, to skip transition fuels such as natural gas and move directly into green hydrogen. Development of green hydrogen is also expected to lead to an incremental annual demand for nickel/platinum group metals (PGMs) and specific metals used in electrolyzers, which would be advantageous to EM producers of such metals.

Both Japan and South Korea have developed strategies that largely focus on the wider domestic adoption of hydrogen across end markets and the creation of a hydrogen economy, including an emphasis on transport. Chile's strategy stands out in terms of scale, with the country having laid out its ambition to have 25GW of capacity in projects, with committed funding by 2030 (this represents the largest single-country target), leveraging on the country's vast, low-cost renewable energy resource. Oman has a national hydrogen strategy due, with press/industry reports (e.g., S&P) suggesting targets of 1GW by 2025, 10GW by 2030, and around 30GW by 2040. The United Arab Emirates revealed the Hydrogen Leadership Roadmap at COP26, aiming to support domestic decarbonization through hydrogen while also becoming a key global export hub of the clean energy carrier by targeting a 25% market share by 2030. In LatAm, Paraguay has followed Chile and Colombia in developing a hydrogen roadmap, while Uruguay is also creating its own green hydrogen strategy. Finally, India appears to have joined the global hydrogen race with the release of its National Hydrogen Mission and additional interest growing in the region.

Despite the benefits of developing green hydrogen as an energy pillar in emerging economies, countries and companies face several hurdles before it can be deployed commercially, the most obvious being the scalability (linked to growth of installed renewable and electrolyzer capacity) and affordability.

The scalability obstacle for green hydrogen is hindered by the pace at which emerging markets can increase the installed renewable power capacity. The affordability obstacle is also one to consider; according to the International Energy Agency (IEA), green hydrogen could become as competitive as grey or blue hydrogen only by 2030. Furthermore, building out the necessary renewable power generation infrastructure, electrolyzers, and fuel cells' installed capacity is capital-intensive and requires significant funding, which could be a disincentive, especially in countries that have access to low-cost natural gas or coal. Finally, there is the resource obstacle, as the deployment of solar/wind power and electrolyzers can only happen in areas with the right irradiation, wind patterns, and water availability. Most renewable power operates at low-capacity factors, and a combination of different renewable technologies will be needed in order to increase the electrolyzer utilization and subsequently reduce green hydrogen production costs.

Levelized cost of grey, blue and green hydrogen over time (US\$/kg H₂)



Source: Goldman Sachs Research, Carbonomics Report. As of February 10, 2022.

Developments in Green Hydrogen for EM Corporates

In Emerging Markets Corporates, companies are increasingly pursuing hydrogen-related projects. In 2021, Czech Gas (a utility company in Czech Republic) issued a green bond to fund replacing older steel pipes with polyethylene pipes that can transport a blend of clean hydrogen and gas through the gas network. Chilean energy companies Enel and ENAP joined forces to build the Cerro Pabellón geothermal plant/green hydrogen plant, helping to reliably electrify isolated mining camps and water treatment facilities around the clock. Russian energy corporation Gazprom is working on its own hydrogen strategy to become a global hydrogen exporter.

Despite some progress, to improve scalability of the green hydrogen industry, a combination of public policies (carbon taxes, subsidies, government-led auctions, guarantees of origin and targets), equipment cost reduction, and funding from stakeholders such as multilaterals is imperative in order for the industry to advance and to attract private capital. [According to the IEA](#), if all of the announced to-date industrial plans and projects are realized, low-carbon hydrogen production could reach more than 17 Mt by 2030—one-eighth of the production level required in the net-zero scenario.

16 March 2022 | Research Note

If the 2000s were the decade of renewable power development and the 2010s were the decade of electro-mobility and storage development, the 2020s are shaping up to be the green hydrogen decade. The emerging markets investor community has thus far been focused on solar/wind/hydro funding; however, this is about to change.

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