Major step toward producing carbon-neutral steel with green hydrogen

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Credit: petrmalinak

A crucial part of modern life, steel is indispensable for construction,

infrastructure, machinery and household goods, but it also has a massive carbon footprint. According to a position paper by the World Steel Association, 1.83 t of CO_2 on average were emitted for every t of steel produced in 2017. "The steel industry generates between 7 and 9 percent of direct emissions from the global use of fossil fuel."

As part of the efforts to drastically reduce CO_2 emissions from steel production, various technologies are being developed and tested. Hydrogen is increasingly seen as a viable alternative for facilitating the energy transition. The EU-funded H2Future project aims at discovering new methods for energy supply and paving the way for gradual decarbonization of steel production. It has launched a pilot plant in Linz, Austria, for generating green hydrogen from renewable electricity.

The plant has a capacity of 6 MW and can generate 1,200 m^3 of green hydrogen, as noted in a joint press release on the website of project partner voestalpine. The press release adds that the project is "an important milestone for the industrial application of electrolysis as a cornerstone for future industrial applications in the steel industry, in refineries, the manufacture of fertilizers, and other industrial sectors requiring large volumes of hydrogen. It creates the basis for future projects on an industrial scale."

Balancing out volatile electricity

In addition to being deployed in the steelmaking process at the Linz site, hydrogen use as a storage medium will be tested to help balance fluctuations in the power grid that result from volatility in electricity generation from renewable energy sources. The general idea would be to use excess renewable energy to generate hydrogen when demand is low, and use the stored hydrogen to supplement renewables when demand is high.

Wolfgang Anzengruber, CEO of project coordinator VERBUND, says: "Hydrogen is green, i.e. CO_2-neutral, when produced using electricity generated from renewables. It allows us to store intermittent and volatile supplies of electricity generated from renewables such as wind and sun, allowing them to be better utilized."

How does it work?

The basic technology behind the new plant is electrolysis, in which water is split into hydrogen and oxygen using an electric current. The project website explains the process: "PEM technology works using a proton-exchange membrane as the electrolyte. This membrane has a special property: It is permeable to protons but not to gases like hydrogen and oxygen. This means that in a PEM-based electrolyzer the membrane acts as electrolyte and as a separator to prevent mixing of the gas products." It also notes that testing this "technology on an industrial scale (6 MW) and simulating rapid load changes in electricity generated from renewable energy sources and from electric arc furnace steelmaking (grid balancing) are the key elements of this European flagship project."

Project partners emphasize that although still relatively young, PEM technology has strong potential for applications in various areas like industry and transport, including freight and rail transport. "Furthermore, responsive electrolyzers can be used to provision power grids, offering services for increasingly overloaded transmission networks," the press release adds. The ongoing H2Future (HYDROGEN MEETING FUTURE NEEDS OF LOW CARBON MANUFACTURING VALUE CHAINS) project will end in mid-2021.

More information: H2Future project website: www.h2future-project.eu/