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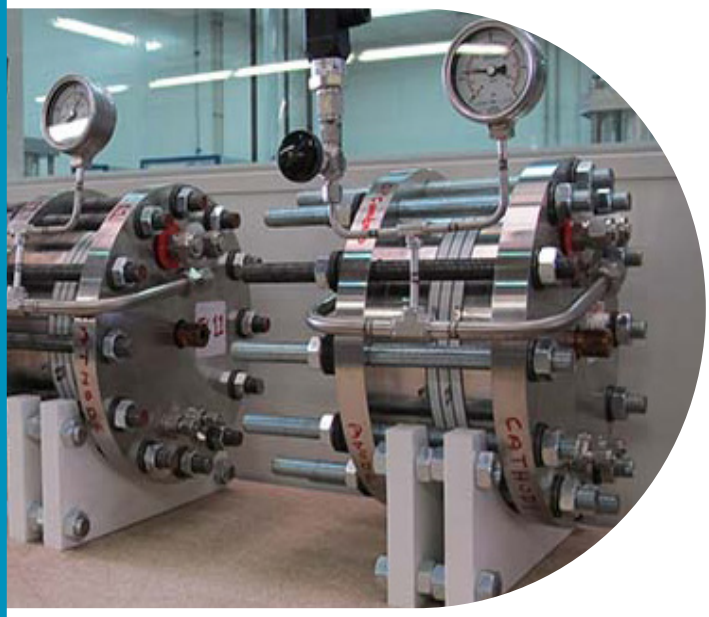
Europe's largest PEM electrolyser was manufactured by ITM Power in Sheffield, UK. Picture credit: electrolyser stacks, ITM Power



PLATINUM IN ELECTROLYSERS

Electrolyser capacity for the production of green hydrogen has started the growth that will significantly benefit future platinum demand

Electrolyser markets could grow from almost nothing today to one quarter of a terawatt by 2030, and over three terawatts by 2050, to meet the demand for fossil-fuel free green hydrogen, according to a recent Hydrogen Council report*.

The electrolysis of water – when an electric current is used to separate water into its component elements of hydrogen and oxygen – is a well-established way of producing hydrogen. If the electric current is derived from a renewable source – solar photo voltaic panels or a wind turbine, for example – the hydrogen made is 'green'.

Proton exchange membrane (PEM) electrolysers and alkaline electrolysers are the two leading electrolysis technologies commercially available. PEM electrolysis creates a reaction using an ionically conductive solid polymer, rather than a liquid, as in an alkaline electrolyser.

PEM electrolysers, which contain a platinum catalyst, were first developed during the 1950s for the space programme; today, they have moved from the niche to the mainstream as the case for green hydrogen has strengthened, driven by: the need to find solutions for decarbonisation; the improving business case for green hydrogen, based on growing renewable generation capacity and falling renewable electricity costs; and innovation in PEM technology.

For example, Johnson Matthey is working with newly-established Norwegian company Hystar AS on its next-generation PEM electrolyser system to improve performance by 10 per cent, enabling greater hydrogen production or lower power consumption, ultimately reducing the costs associated with green hydrogen production.

Earlier this year, Europe's largest PEM electrolyser was installed at Shell's Energy and Chemicals Park Rheinland, near Cologne, Germany. The electrolyser can produce up to 1,300 tonnes of green hydrogen a year, which will initially be used to produce fuels with lower carbon intensity.

Modular electrolyser unit. Picture credit: ITM Power

PEM electrolysers were used at the Rheinland site as they are more compact than a conventional alkaline electrolyser. In addition, they are suited to working with renewable energy sources because they can operate dynamically using varying loads of electricity, allowing them to operate when wind and solar energy generation are cheapest.

Platinum across leading electrolyser technologies

However, no single electrolyser technology performs better across all applications and, in all likelihood, the future technology mix will see the deployment of both PEM and alkaline electrolysers as the market expands. It is therefore especially interesting to note that platinum catalysts for use in alkaline electrolysers are currently under development.

The Hydrogen Council believes that annual demand for hydrogen could rise from about 90 million metric tons (MT) today to 140 MT in 2030, with green hydrogen having a 20 per cent share – compared to less than one per cent today. Supplying the almost 30 MT of green hydrogen that this growth would require necessitates the build-out of over 250 gigawatts of electrolyser capacity before the end of the decade. Looking further ahead to 2050, it is estimated three to four terawatts of electrolysis capacity will be required to meet demand for green hydrogen.

While the platinum needed to produce green hydrogen is gradually increasing in line with the expansion of electrolyser capacity, electrolysers use relatively small amounts of platinum and are built to last, meaning infrequent replacement. Cumulatively, over the next 15 years, platinum demand from electrolysers is likely to be between one and two million ounces, dependent on technology development over that period and including the volume of platinum that could potentially be used in alkaline electrolysers.

*Hydrogen for Net-Zero, Hydrogen Council, November 2021

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