

THREE FACTORS ARE DRIVING THE RAPID DECLINE OF GLOBAL GREEN HYDROGEN COSTS

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As an important part of the "carbon neutral" strategy, hydrogen energy is favored by major countries and regions around the world. Although hydrogen production from renewable energy currently accounts for only about 4% of global hydrogen production, it has huge potential and will lead the future direction of the hydrogen industry.

At present, there are three main factors that are driving the accelerated decline of the cost of green hydrogen.

First, the levelized cost per kilowatt hour (LCOE) of renewable energy is declining. The cost of electricity is the main part of the cost of hydrogen production, accounting for 60-70%. Due to the large-scale application of renewable energy worldwide, the cost of renewable energy will continue to decrease. By 2030, the cost of photovoltaic power generation is expected to drop by 25% to around 0.043 USD/kWh, and the cost of onshore wind power will drop by 33% to around 0.026/ kWh, the cost of offshore wind power is expected to drop by 24%. From a global perspective, the regions with the best resources are expected to have the largest decline in the cost of

electricity, such as Australia, Western Latin America, North Africa/Middle East and other places.

Chart 1 Global Renewable Energy LCOE(USD/kwh)

	2020	2025E	2030E	2035E	2040E	2045E	2050E
Onshore wind LCOE (USD/kwh)	0.039	0.03	0.026	0.025	0.024	0.023	0.02
Offshore wind LCOE (USD/kwh)	0.084	0.07	0.064	0.06	0.055	0.052	0.05
Photovoltaic LCOE (USD/kwh)	0.057	0.05	0.043	0.04	0.035	0.032	0.03

Second, the cost of electrolyzers is accelerating decline. Refer to data from IRENA, it is estimated that by 2050, the capital expenses of the electrolyzer will drop significantly-the system level (including the electrolyzer, power supply and rectifier, drying/purification).

The third is the cost reduction brought about by technological progress. The current hydrogen production efficiency of electrolyzed water is about 55Wh/kg hydrogen; with the larger scale of hydrogen production projects, better manufacturing processes, and better quality control, supplemented by the optimization of technology and materials in other links, the future electrolysis The efficiency of the tank is expected to be reduced to 40kWh/kg hydrogen. At the same time, due to the optimization of materials and catalysts, equipment depreciation and other raw material costs are also expected to be reduced by more than 50%, which will promote the continuous decline of green hydrogen production costs.

Based on this, our model shows that the costs of green hydrogen expect to see dramatic reductions from 4.2-5.2 USD/kg to 2.1-3 USD/kg by 2030, and below 2 USD/kg by 2050.

Figure 1 Green Hydrogen Cost and Predict (2020-2050)

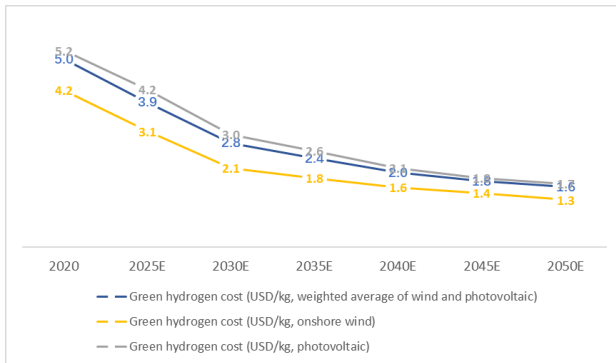
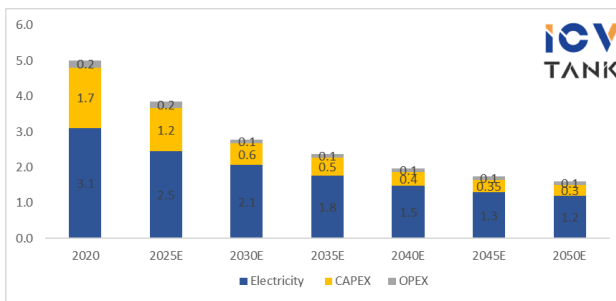
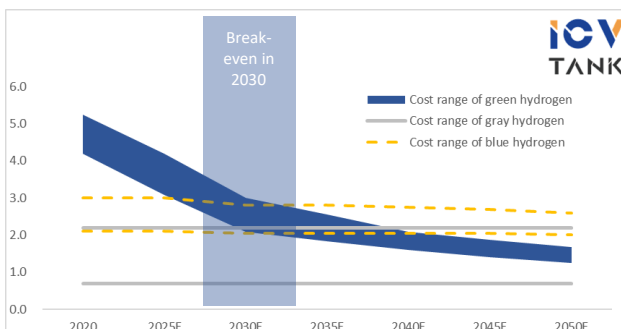


Figure 2 Major Cost Prediction (USD/KG)



While compare to the grey hydrogen and blue hydrogen, green hydrogen costs are likely to fall below blue hydrogen costs before 2030 and in most by 2050. Also to the point where it can compete with grey hydrogen in 2030.

Figure 3 Cost Comparison of Green Hydrogen and Grey Hydrogen (USK/KG)





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