# A Shift to Clean Hydrogen in China and the World

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**Executive Summary**

In 2015, representatives from 195 countries and the European Union signed the Paris Agreement to combat climate change. Over the following four years, the signing parties actively planned and acted to reduce carbon emissions and limit the rise in global average temperature. Among others, the Chinese government made extensive efforts to promote climate change mitigation. As a result, China's 2018 carbon emission intensity ($CO_2$ per unit of GDP) fell 45.8% from the 2005 rate, meeting the target of a 40 to 45% reduction by 2020 ahead of schedule.

However, since the Paris Agreement was signed, global greenhouse gas (GHG) emissions have steadily increased, and there is no indication that emissions have peaked or will peak in the coming years. To significantly reduce the impacts of GHG emissions on the environment and achieve global decarbonization, it is imperative to promote and transition to clean energy alternatives, on top of boosting energy utilization efficiency and reducing consumption of fossil fuels.

Hydrogen is seen as the green energy source with the highest potential in the 21$^{st}$ century. As a clean, efficient, and sustainable energy medium, hydrogen promises to become a key tool in the fight against climate change. Widespread use of water electrolysis based on renewable energy to produce hydrogen—which emits zero $CO_2$ in both the production and consumption processes—is expected to be a decisive factor in achieving GHG reduction targets.

In addition to its industrial applications in petroleum refining, ammonia synthesis, and methanol synthesis, hydrogen has widespread use potential in sectors such as steel, transportation, and heating and cooling buildings. Due to its environmental friendliness and usability, the European Union, the United States, and Japan have taken measures to encourage hydrogen energy development, including setting out national hydrogen

strategies, supporting hydrogen technology R&D, and fostering hydrogen supply and demand markets.

With recent investments from governments, industries, and research bodies into hydrogen energy and fuel cell R&D, many technological barriers to hydrogen development and deployment have been broken. However, the production, storage, transportation, and application of low-carbon hydrogen energy remain costly. Moreover, high costs for hydrogen-related technology R&D hinder innovation and the achievement of economies of scale. These challenges demand urgent attention.

For China, the development of hydrogen energy, especially green hydrogen, is significant in four aspects:

1. Building on progress in improving energy utilization efficiency, addressing excess capacity, and increasing carbon sinks, substituting green hydrogen for fossil fuels can become a new engine for reducing China's carbon emissions. Hydrogen can help fulfill China's Nationally Determined Contribution (NDC) goal under the Paris Agreement and reinforce its leadership in global climate governance.

2. The development of the hydrogen industry can further reduce the share of coal in China's total energy consumption, reduce dependence on imported oil and gas resources, help optimize the energy mix, and strengthen the country's energy security.

3. As an electricity medium, hydrogen can be stored in large volumes for extended periods of time, and can also be transported long distances. As such, hydrogen can help overcome challenges like regional imbalances in supply and demand for renewable energy, periodic fluctuations in electricity demand, and the waste associated with wind and solar curtailment.

4. Proactive plans for the hydrogen industry that are based on China's current science and technology capabilities will drive innovation across the entire hydrogen value chain, and allow China to become a hydrogen technology innovation center and a global leader in the industry. Ownership of core technologies and the completeness level of the industry chain will determine each country's influence on the development of international standards.

In China, various local governments have introduced supportive policies for the hydrogen industry. However, challenges such as insufficient core technologies, low industrial levels, high costs, limited sources of hydrogen, and poor environmental standards remain. To address these concerns, this study makes the following suggestions:

1. In line with China's energy development and emission reduction plans, the country should define the position and role of hydrogen in the energy system in a scientific way, and develop overall plans for the hydrogen industry to ensure its efficient, reasonable, and orderly development.

2. China should strengthen and coordinate the development of upstream and downstream businesses along the hydrogen value chain. China should encourage downstream users to adopt hydrogen energy, and support the upstream sector in R&D and scaling, thus driving balanced development of all links in the hydrogen industry.

3. China should participate in the development of international standards and engage in the future international hydrogen trade. Global exchange and cooperation will further facilitate the development of core technologies.

4. In addition to supply-side efforts, China should cultivate hydrogen demand and boost the hydrogen utilization rate, which will foster key growth engines and unlock the value and potential of hydrogen.

5. China should harmonize policy guidance and market rules, attach importance and give full play to the role of the market in resources allocation, and prevent disorderly competition and overcapacity.

6. China should leverage bilateral and multilateral platforms to tell a compelling "China story" about developing and deploying hydrogen energy, and enhance the country's influence and voice in the international energy governance system.

Siemens has long been committed to providing clean energy for future generations, driving the energy transition, and promoting sustainable development. Working with hydrogen industry players from different countries to develop and share research results, Siemens has accumulated technologies across the entire value chain, including hydrogen production, storage, transportation, and applications. Siemens has also successfully implemented an array of hydrogen application projects to promote the development of local hydrogen industries.

In September 2019, Siemens officially launched a hydrogen partnership with its Chinese partner, with the support of the Chinese Premier and the German Chancellor. Going forward, Siemens is ready to join hands with the Chinese government and its partners to promote the shift to clean hydrogen and make the world a better place.

## 1. Hydrogen is an internationally recognized clean energy medium, and many countries are promoting widespread use of hydrogen across different sectors

### 1.1 The response to climate change requires promoting clean energy alternatives, and green hydrogen will accelerate the decarbonization process

In 2020, the climate change challenge facing residents of our "global village" is grimmer than when the Paris Agreement was signed. The past decade saw the warmest average temperatures on record, and global GHG emissions continued growing after a short-lived plateau, repeatedly hitting record highs. And there is no indication that emissions have peaked or will peak in the coming years. According to the Emissions Gap Report released by the United Nations Environment Program (UNEP), by 2030, even if all Paris Agreement NDCs are achieved, the global temperature may still rise by 3.2°C[1]. To achieve the Paris Agreement target of a global temperature increase below 2°C, all countries need to increase their NDCs threefold. To limit the temperature rise to below 1.5°C, all countries need to increase their NDCs fivefold.

To significantly reduce the impacts of GHG emissions on the environment and achieve global decarbonization, it is imperative to promote and transition to clean energy alternatives, in addition to boosting energy utilization efficiency and reducing consumption of fossil fuels. Hydrogen is seen as the green energy source with the highest potential in the 21st century. As a clean, efficient, and sustainable energy medium, hydrogen promises to become a key tool in the fight against climate change.

### 1.2 Currently, there are many hydrogen production technologies, but green hydrogen represents the future for global decarbonization

Generally, hydrogen is divided into gray hydrogen, blue hydrogen, and green hydrogen, depending on different production procedures and their environmental effects. Gray hydrogen is mainly produced by coal gasification, natural gas cracking, and methanol reforming technologies, in which substantial levels of $CO_2$ are emitted. For example, when natural gas is used as the source material, 10 tons of $CO_2$ are emitted per ton of

[1] Emissions Gap Report. UNEP. Cited from www.news.cn: http://www.xinhuanet.com/2019-11/27/c_1125280403.htm.

hydrogen produced; when coal is used as the source material, 19 tons of $CO_2$ are emitted per ton of hydrogen produced.[2]

Blue hydrogen has a similar production process to gray hydrogen, except its carbon emissions are captured and stored, or reused. The production process for blue hydrogen is environmentally friendly because it prevents $CO_2$ from directly being emitted into the atmosphere.

Green hydrogen refers to the hydrogen produced by renewable energy-based water electrolysis technology, where only water and clean electricity like wind power, hydro power, or solar power are used, and the resulting oxygen output can also be used by various industries, such as healthcare. The production process of green hydrogen is truly free of $CO_2$ emissions.

### 1.3 Hydrogen has extensive application potential in fields such as steel, transportation, and construction, in addition to petroleum refining and chemicals

Hydrogen is an important industrial material. Currently, the main applications of hydrogen include petroleum refining (accounting for 33% of total hydrogen consumption), ammonia synthesis (27%) and methanol synthesis (11%).[3] In fact, hydrogen can be used extensively to help decarbonize many industries.

The steel industry is one of the sectors with the highest level of carbon emissions. Direct $CO_2$ emissions from the production of one ton of crude steel resister 1.4 tons[4], and carbon emissions from the steel industry account for 7% of the global emissions total. By using hydrogen as an energy source and reducing agent in the smelting process, the majority of carbon emissions from steel production can be avoided.

[2] The Future of Hydrogen – Seizing today's opportunities. IEA. p21-22.
[3] The Future of Hydrogen – Seizing today's opportunities. IEA. p63.
[4] The Future of Hydrogen – Seizing today's opportunities. IEA. p80.

In transportation, hydrogen fuel cells can be used to power cars, buses, and trucks, and even trains and freighters after the technologies mature.

For heating and cooling buildings, hydrogen can be used in the form of HCNG (hydrogen enriched with compressed natural gas). The use of pure hydrogen in building heating is also technologically workable.

### 1.4 The European Union, the United States, and Japan recognize and value the potential for hydrogen, and are increasing efforts to develop strategies and plans for the industry

To promote the clean energy transition, the European Union reiterated a directive on the promotion of the use of energy from renewable sources in 2018, and included green hydrogen in the 2030 EU renewable energy goal. Moreover, 28 European countries signed the Hydrogen Initiative and pledged to increase support for the R&D and large-scale deployment of hydrogen technologies, so as to reduce carbon emissions in Europe. Germany has twice approved the National Innovation Program for Hydrogen and Fuel Cell Technologies, which includes EUR 1.4 billion of funding for 10 years, in 2006 and 2016. The program aims to promote Germany's hydrogen technology development and batch deployment efforts, and ensure its leadership in the hydrogen and fuel cell fields.

The United States introduced the Hydrogen Research, Development, and Demonstration Act in 1990, and has supported policies for hydrogen research and utilization in the following decades. Currently, the United States is second only to Japan in the number of patents in the hydrogen and fuel cell fields, and ranks first in terms of production capacity of liquid hydrogen and the ownership of fuel cell passenger vehicles.[5]

[5] White Paper on China's Hydrogen Energy and Fuel Cell Industry. p6.

In 2017, Japan released the Basic Hydrogen Strategy, which aims to achieve widespread adoption of hydrogen fuel cell vehicles (HFCVs) and establishment of a zero-carbon hydrogen fuel supply system by 2050. Japan's Ministry of Economy, Trade and Industry (METI) set up an agency for the comprehensive development of the new energy industry, which supports hydrogen R&D projects.[6]

### 1.5 The substitution of green hydrogen for fossil fuels is technologically workable, but its success depends on economic feasibility and regulatory support

As R&D investments in fields such as hydrogen energy and fuel cells steadily increase, many technological barriers to hydrogen development and deployment have been broken. For example, on the hydrogen production side, the proton exchange membrane (PEM) electrolysis system can output high-quality hydrogen with high energy density and operating efficiency. On the hydrogen storage and transportation side, technologies such as geological storage, storage tanks, HCNG transportation via natural gas pipelines, and liquid-state organic carriers continue to make progress.[7] In addition, as the combustion chamber design is upgraded, gas turbines can use a higher proportion of hydrogen as fuel, lowering the demand for fossil fuels.

Currently, the biggest impediment to the widespread use of hydrogen is high costs, and the financial barrier needs to be overcome urgently. On one hand, the costs of producing hydrogen from low-carbon energy remain high, and slowly-developing hydrogen infrastructure contributes to the high cost for hydrogen storage, transportation, and usability. As such, hydrogen production needs to be scaled up, so as to reduce costs through economies of scale. On the other hand, the high R&D costs of hydrogen-related technologies hinder technological progress. Therefore, public funding is required to

[6] Jing Chunmei et al. A Study on China's Hydrogen Development by Reviewing the Hydrogen Industry Developments of Japan and South Korea. Energy. 2019.
[7] The Future of Hydrogen – Seizing today's opportunities. IEA. p46-52.

support hydrogen technology R&D. Government efforts in providing strategic guidelines, reducing unnecessary regulatory barriers, and facilitating the development of industry standards are also critical.

## 2. The hydrogen industry is significant to China and needs further development

### 2.1 Hydrogen can be a key tool for China to fulfill its Paris NDC goal and lead global climate governance

At the Paris Conference in 2015, President Xi Jinping announced China's pledge to hit peak $CO_2$ emissions around 2030, and by that year, to reduce carbon intensity by 60 to 65% of the 2005 level. Thereafter, the Chinese government made comprehensive efforts to promote climate change mitigation, and as a result, China's carbon emission intensity in 2018 declined by 45.8% from 2005, meeting the target of a 40 to 45% reduction by 2020 ahead of schedule.[8]

Despite China's impressive achievements in improving energy utilization efficiency, addressing excess capacity, and increasing carbon sinks, it remains the world's largest carbon emitter and faces intense pressure to reduce emissions. Substituting green hydrogen for fossil fuels can help fulfill China's NDC goal under the Paris Agreement and reinforce its leadership in global climate governance.

### 2.2 Hydrogen development will help optimize China's energy structure and safeguard and enhance the country's strategic energy security

In China, coal accounts for 59% of total energy consumption, followed by oil and gas (with a combined share of 27%). The proportion of renewable energy, including hydro power, has increased by 6 percentage points since 2010, but remains low at 13%. China is

[8] The Release of the 2019 Report on China's Policies and Actions to Combat Climate Change. http://www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/39595/42117/index.htm

taking steady actions to reduce coal use, but the country's dependence on imported oil and gas remains excessively high at 72% and 46%, respectively, creating risks from an energy security perspective.

Clearly defining the position of renewable energy, optimizing the energy mix, and safeguarding strategic energy security were key issues in the legislative process of China's Energy Law. Efforts to promote the development of the hydrogen industry (including green hydrogen and blue hydrogen), can help reduce carbon emissions and dependence on imported oil and gas resources, and safeguard China's strategic energy security.

### 2.3 Hydrogen as an energy storage medium can help address mismatches in renewable energy supply and demand, and reduce resources waste

In recent years, China's renewable energy generation has maintained strong growth momentum. In 2018, China's installed capacity of renewable energy registered 730 GW, accounting for 38.3% of the total installed energy capacity, and the output of renewable energy reached 1,900TWh, making up 26.7% of the country's total.[9] However, there is a large spatial and temporal mismatch between renewable energy production and demand in China, resulting in wind and solar curtailments. In 2019, China's wind and solar curtailments registered 16.9TWh and 4.6TWh respectively[10], a significant waste of resources.

As an electricity medium that can be stored in large volumes and for long periods of time, and also can be transported long distances, hydrogen can serve as a storage carrier for curtailed renewable energy. In this way, hydrogen will help overcome challenges like imbalances in regional supply and demand for renewable energy, and periodic

[9] The 2019 Report on China's Policies and Actions to Combat Climate Change. p13.
[10] Q1 Online Press Conference of National Energy Administration 2020. http://www.nea.gov.cn/2020-03/06/c_138850234.htm

fluctuations of electricity demand, thus boosting efficiency of the entire energy system and avoiding the waste of wind and solar curtailment.

### 2.4 The hydrogen industry will benefit China's innovation capacity and enlarge the country's voice in the development of international standards

High-quality development is no longer driven by untargeted resource investments, but relies on improved productivity enabled by new innovation-driven growth engines. In recent years, China has seen rapid improvement of its innovation capacity, but still needs to improve the national innovation system and drive all-round innovation in basic sciences and applied sciences. Proactive plans for the hydrogen industry based on China's current science and technology capabilities, will undoubtedly drive technological innovation across the entire hydrogen value chain, spanning hydrogen production, storage, transportation, and applications. Moreover, as technological innovation achievements along the hydrogen value chain benefit other industries, China will emerge as a global hydrogen technology innovation center and a global leader in the industry's development.

Due to the relative immaturity of the hydrogen industry and a lack of international cooperation, hydrogen-related international standards are still in great need. As hydrogen costs further decrease and the industry grows, international hydrogen trade will become common like the trade of oil and gas, and countries will need to coordinate and develop consistent hydrogen-related international standards. The countries with more core technologies and a complete hydrogen value chain will enjoy more influence in the development of international standards.

### 2.5 The Chinese government should introduce hydrogen industry policies to support the implementation of pilot hydrogen projects

In 2019, "facilitating the construction of charging and hydrogen refueling facilities" was mentioned in a government work report for the first time, and the National Energy Commission proposed exploring pathways for hydrogen energy commercialization. As of the end of 2019, 36 local governments have introduced policies to support the hydrogen and fuel cell industry.[11] For the upstream side, local governments, including in Sichuan and Hebei, released policies for water electrolysis-based hydrogen production, and implemented preferential electricity prices for renewable energy-based hydrogen generation. For example, Sichuan included electrolysis-based hydrogen production technology in the scope of electricity price support. For the downstream side, Wuhan announced it is building a pilot for a "hydrogen-powered city", and plans to set up 300 hydrogen refueling stations and 100 fuel cell related factories by 2025.

Government support has attracted capital inflows into the hydrogen industry, and hydrogen application pilot projects have been gradually implemented in the Yangtze River Delta, the Pearl River Delta, and the Beijing-Tianjin-Hebei Region. Enterprises and scientific research institutions have worked together to develop standards for upstream and downstream sectors of the hydrogen industry.

## 2.6 China's rapidly growing hydrogen market has both opportunities and challenges

Hydrogen has broad application prospects in industry, transportation, and energy, and is making continuous progress. Currently, the size of China's hydrogen market is about 21 million tons, and is expected to reach 43 million tons by 2030. However, the hydrogen industry in China is also faced with several challenges, and the government must strengthen top-level design and supportive policies to drive stable and sound development of the hydrogen industry.

[11] 36 Local Governments Across China Have Introduced Supportive Policies for Hydrogen Industry. QQ.COM. https://new.qq.com/omn/20191115/20191115A0CLI100

On one hand, insufficient core technologies and low industrial level give rise to high costs and constrain the development of the hydrogen industry. On the other hand, China still heavily relies on coal-to-hydrogen technology with high $CO_2$ emissions, which goes against the country's emissions reduction target. The use of carbon capture, storage, or reuse technologies will further drive up the costs. Therefore, financially viable approaches are required to use and promote low-carbon hydrogen produced from renewable energy.

## 3. Suggestions on policies for hydrogen industry development based on China's conditions and international experience

### 3.1 Define the position and role of hydrogen in the energy system in a scientific and reasonable way, and develop overall plans for the development of the industry

National policies—including the development of hydrogen infrastructure mentioned in the government work report, the exploration of pathways for hydrogen energy commercialization put forward at a meeting of the National Energy Commission, and the requirements of giving priority to the development of renewable energy underlined in the Energy Law (exposure draft)—can provide a clear boost to the hydrogen industry. If the role of hydrogen in building a clean, low-carbon, secure, and efficient national energy system is more clearly defined, and long-term stable policy signals are sent to the market, businesses, investors and consumers will be more confident about the long-term prospect of hydrogen, thus contributing to the development of China's hydrogen industry.

In line with China's energy development and emissions reduction plans, the central government should develop national hydrogen strategies, plans, and development goals; analyze and determine how hydrogen development can be combined with local resource

endowment; and identify the priority links of the hydrogen value chain for local governments. In this way, the central government can have more proactive plans for the hydrogen industry chain than local governments, allowing more efficient, reasonable, and orderly development of the hydrogen industry.

### 3.2 Strengthen the coordinated development of upstream and downstream businesses and drive balanced development of all links along the hydrogen value chain

Currently, local governments have formulated policies for the hydrogen industry that match local conditions. On the hydrogen use side in particular, incentive policies for hydrogen vehicle and fuel cell sectors have seen rapid development. At the next stage, in addition to continuous encouragement for the downstream market, China should increase support to the R&D and application efforts on the upstream side, including renewable energy electrolysis-based green hydrogen production, HCNG, power-to-ammonia, and power-to-methanol. Accelerating coordinated upstream and downstream development of the hydrogen industry, not only creates economies of scale and a complete value chain, but also allows strengthens China's energy security and the international competitiveness of its hydrogen industry.

### 3.3 Enlarge international cooperation and expedite development of core technologies

Further expanding international exchange and cooperation on hydrogen is significant in the following three aspects. First, it can help China play a leading role in the development of international hydrogen standards. Second, it prepares China for the future international hydrogen trade. Third, international exchange and cooperation can facilitate the development of core technologies. In recent years, independent R&D and awareness of Chinese companies is gradually improving, and all parts of the hydrogen value chain have seen technological breakthroughs. On the whole, China still has a gap to bridge with

advanced hydrogen technologies around the world. The absence of international exchange and collaboration between enterprises, and between enterprises and universities and research institutes, represents one of the constraints for China to overcome difficulties in ownership of core technologies.

### 3.4 Foster new growth engines for hydrogen industry development on the demand side

Hydrogen has a wide range of applications. In addition to supply-side support, China should also prioritize cultivating hydrogen demand, including by unlocking the value and potential of hydrogen, boosting the hydrogen utilization rate, and fostering new growth engines. The policies for growing hydrogen demand should not be limited to common steps like providing subsidies for HFCVs. Other feasible measures include incentivizing industries to use more clean energy, including hydrogen, by increasing the costs of carbon emissions, stipulating the use of renewable fuels, and introducing stricter exhaust emission standards to make hydrogen-powered vehicles more competitive.

### 3.5 Attach importance to the role of the market in resources allocation and prevent disordered competition and overcapacity

Governments should develop effective industry policy packages, comprising incentives for scientific research innovation, investment promotion, and fiscal subsidies, to guide capital and technologies into the hydrogen industry—which does not conflict with the idea of allowing the market to play a decisive role in resources allocation. However, under policy guidance, research innovations must drive down costs, and upfront capital investments must generate scale effects later on so that continuous policy-incentivized investments are not required. In this way, subsequent industry development will be driven by optimizing resource allocation. To give full play to the market, China also needs to

prevent excessively preferential policies that can lead capital and businesses to swarm into the hydrogen industry and cause disordered competition and overcapacity.

### 3.6 Tell a good "China story" about hydrogen and enhance China's influence and voice in the international energy governance system

In addition to providing full guidance on sound development of China's hydrogen industry, China should develop key enterprise pilot projects, hydrogen industrial parks, or Sino-foreign cooperation benchmark projects, and leverage bilateral and multilateral platforms to tell a good "China story" about developing and deploying hydrogen energy. This can better demonstrate that China shoulders its great power responsibilities, thus enhancing China's influence in the international energy governance system.

## 4. Case study

### 4.1 Siemens' hydrogen applications and R&D cases

Siemens works to create one-stop hydrogen solutions, including hydrogen electrolysis, compression, storage, carbon capture, hydrogen-containing synthetic fuels, hydrogen-driven gas turbines, and fuel cells. Siemens has worked with hydrogen industry players from different countries to develop and share research results, and has successfully implemented an array of hydrogen application projects to promote the development of local hydrogen industries.

On the hydrogen production side, under the coordination of VERBUND, an Austria-based electric utility, the PEM hydrogen electrolyzer system developed by Siemens is under construction and will be delivered to Voestalpine Group's largest steel production base. This solution is part of the EU flagship project "H2 FUTURE – Hydrogen meets the

future demand of low-carbon manufacturing value chains". With a total capacity of 6MW, this project can use renewable energy to produce green hydrogen at 1,200 $m^3$ per hour, and represents the world's largest and most advanced hydrogen test facility up to now.

On the hydrogen transportation and storage sides, in July 2019, Siemens, the Free State of Saxony, and the research organization Fraunhofer-Gesellschaft signed a memorandum of understanding, under which an innovation park and startup accelerator would be built in the Siemens factory in Gorlitz, Germany. One component of the innovation park is a hydrogen research laboratory for studying hydrogen production, storage ,and use.

On the hydrogen use side, Siemens partnered with Ballard, a Canada-based fuel cell manufacturer, and RWTH Aachen University to develop a next-generation hydrogen fuel cell that features a longer lifespan, higher energy density and efficiency, and which can be deployed in trains. With support from the Federal Ministry of Transportation and Digital Infrastructure of Germany, this R&D project is expected to make major breakthroughs in 2021.

Siemens is also further expanding its R&D efforts in decarbonizing the industrial flow of its Gorlitz factory. Siemens researchers will explore how to utilize hydrogen technology to reduce $CO_2$ emissions from energy-intensive industries, and work to develop new climate-friendly solutions.

In the hydrogen and power-to-fuel field, Siemens cooperated with a British research institute to develop, construct, and operate a small-sized but complete power-to-ammonia plant, which will explore how to re-electrify hydrogen-containing synthetic fuels through reciprocating engine. Siemens also worked with Stadtwerk Hassfurt, a Germany-based utility, the Technical University Munich, and the University of Erlangen-Nuremberg to use a new synthesis process for power-to-methanol.

### 4.2 Siemens' hydrogen application projects in China and cases of win-win cooperation with Chinese partners

In September 2019, Siemens and the State Power Investment Corporation (SPIC) of China signed a Memorandum of Understanding for cooperation on the development and comprehensive use of green hydrogen in Beijing, in the presence of the Chinese Premier and the German Chancellor. Under the partnership, the two parties are focusing on joint development and deployment of key technologies on both the supply and demand sides, and collaborating on various innovation projects, including green hydrogen production projects for the Beijing Winter Olympics in 2022. The two parties are also jointly developing hydrogen industry capacity and standards, cultivating third-party market cooperation, and striving to build China-Germany green hydrogen pilot projects.

In October 2019, following an agreement between Siemens and the Chengdu Economic Development Zone on intelligent and new energy vehicles, the two parties reached an another agreement to implement hydrogen R&D projects, including an electrolysis-based green hydrogen production plant, the Siemens Hydrogen Innovation and Technology Center, and a hydrogen test center.

Siemens has long been committed to providing clean energy for future generations, driving the energy transition, and promoting sustainable development. Going forward, Siemens is ready to join hands with the Chinese government and its partners to promote the shift to clean hydrogen and make the world a better place.