

Research on Industrial Policy of Hydrogen Fuel Cell Vehicles in Jinhua City

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Abstract: Through research and analysis of current Hydrogen fuel cell vehicle industry policy status and development basis, combined with Hydrogen fuel cell vehicle technology development direction and industry development trend, after extensive investigation and research, and according to the guidance of Zhejiang Province to accelerate the development of hydrogen energy industry, this paper conducts detailed and in-depth analysis from four aspects: overall requirements, development goals, key tasks and measures, to provide theoretical support for the government to formulate industrial policies and guide the sound and rapid development of Jinhua Hydrogen fuel cell vehicle industry.

Keywords: Hydrogen fuel cell vehicle, industry policy, industry development

1. Introduction

Hydrogen energy is a rich, green, low-carbon, and widely used secondary energy source, gradually becoming one of the important carriers of global energy transformation and development. Hydrogen energy is an important component of the future national energy system. In order to promote the standardized, orderly and high-quality development of the hydrogen energy industry, the National Development and Reform Commission and the National Energy Administration jointly issued the Medium and Long term Plan for the Development of the Hydrogen Energy Industry (2021-2035), proposed that by 2025, we should basically master the core technology and manufacturing process, about 50000 fuel cell vehicles, deploy and build a number of Hydrogen station, and achieve hydrogen production from renewable energy of 100000 to 200000 tons/year, and achieve carbon dioxide reduction of 1-2 million tons/year. By 2030, a relatively complete technological innovation system for the hydrogen energy industry, as well as a clean energy hydrogen production and supply system, will formed to effectively support the achievement of carbon peak goals. By 2035, a diversified application ecosystem of hydrogen energy will be formed, and the proportion of renewable energy hydrogen production in terminal energy consumption will significantly increase^[1].

Guided by the "dual carbon" goal, China's hydrogen energy industry is entering a fast lane of development. During the 2019 Two Sessions, hydrogen energy and fuel cells were first included in the government work report, and in 2021, hydrogen energy was officially included in the 14th Five Year Plan. In October 2021, the National Development and Reform Commission and other ten departments jointly issued the "14th Five Year Plan for Promoting National Clean Production", supporting the integrated application demonstration of clean production technologies in areas such as clean and utilization of coal and hydrogen metallurgy. On March 22, 2022, the National Development and Commission and the National Energy Administration jointly issued the "14th Five Year Plan for Energy System" to strengthen cutting-edge scientific and technological breakthroughs in energy storage and hydrogen energy. On March 23, 2022, the National Development and Reform Commission and the National Energy Administration jointly issued the "Medium and Long Term Plan for the Development the Hydrogen Energy Industry (2021-2035)". It is China's first medium and long term plan for the hydrogen energy industry, which first clarifies that hydrogen energy is an important component of the future national energy system and an important carrier for energy terminals to achieve green and low-carbon transformation. The hydrogen energy industry is a strategic emerging industry and a key development direction for future industries. On June 1, 2022, 9 departments including the National Development and Reform Commission and the National Energy Administration jointly issued the "14th Five Year Plan for Renewable Energy Development", proposing to promote the large-scale utilization renewable energy for hydrogen production and carry out large-scale demonstration of renewable for hydrogen production.

2. General requirements

Following the forefront of global hydrogen energy industry development, with technological breakthroughs and industrial cultivation as the main line, we will accelerate the development and growth of the hydrogen energy industry by following the path of pilot demonstration to promote facility construction, facility construction to promote promotion and application, and promotion and application to promote industrial development. Enterprise should strengthen the key core technology research and transformation of scientific and technological achievements, actively layout the Hydrogen fuel cell and vehicle industry. Enterprise can expand and extend the hydrogen energy industry chain, and strive to create a hydrogen energy industry highland with collaborative development of innovative research and development, equipment manufacturing, demonstration applications, facility construction, standards and specifications^[2].

2.1 Guiding ideology

The government should implement the new development concept of innovation, coordination, green, openness and sharing, actively respond to the action of "carbon peak, carbon neutrality". Enterprise should focus on the Hydrogen fuel cell and vehicle industry, scientifically layout the hydrogen energy infrastructure, strengthen the construction of innovation platforms and talent team cultivation. The government can support the promotion and application of hydrogen energy terminal products, and build the provincial Hydrogen fuel logistics demonstration line. The government will be made to build a demonstration base for the hydrogen energy industry that leads the province, an important node city for the hydrogen energy industry in the Yangtze River Delta, and a national demonstration application city for fuel cell vehicles.

2.2 Basic principles

The government should strengthen guidance. Through giving full play to the government's guiding role, in order to strengthen departmental collaboration, improve top-level design, strengthen policy support for the hydrogen energy industry, increase investment attraction, optimize the layout of the hydrogen energy industry. The government should build a hydrogen energy industry platform, and guide the high-quality development of the hydrogen energy industry. The government should cultivate market entities and highlight the dominant position of enterprises in the market, leverage the advantages of market resource allocation, mobilize the enthusiasm of enterprises, in order to stimulate the endogenous driving force of independent innovation, The government should promote the healthy development of the hydrogen energy industry. Enterprise should focus on technological innovation and industrial chain construction of the hydrogen energy industry, accelerate the technological research and development and industrialization of Hydrogen fuel cell vehicles. Enterprise should achieve breakthroughs in research and development of relevant basic materials, core components and key technologies of the whole vehicle, and achieve industrialized application, in order to form a perfect industrial chain and accelerate demonstration applications. The government should give full play to the city's transportation hub advantages, increase the promotion of fuel logistics vehicles, orderly promote and layout the application of hydrogen buses, hydrogen sanitation vehicles and large-scale hydrogen logistics vehicles. The government should accelerate the construction of Hydrogen station, and improve the reliability, safety and durability of demonstration operations.

3. Development goals

3.1 Short term goals (2021-2025)

By 2025, the hydrogen energy industry system will continue to improve, independent innovation capabilities will continue to improve, and the industrial development environment will be more favorable. A number of hydrogen energy application demonstration facilities will be promoted, and the comprehensive strength of the city's hydrogen energy industry will continue to strengthen. Build a national innovation base for hydrogen energy technology standards. At the level of industrial chain, industrial clusters such as hydrogen production, hydrogen storage, hydrogen transportation, hydrogenation, fuel cell stacks, key core components, fuel cell vehicles, and distributed energy have taken shape. Focusing on the manufacturing of core equipment such as bipolar plates, fuel cell stacks, and power system integration, and focusing on the upstream and downstream industrial chains, we

strive to introduce and cultivate a group of influential hydrogen energy leading enterprises both domestically and internationally. More than 9 Hydrogen station have been built, and the demonstration operation of buses and logistics vehicles has been promoted. The operation scale of Hydrogen fuel cell vehicles has reached more than 500, and the construction of clean energy hydrogen production, storage and transportation, and hydrogen energy distributed systems has been promoted.

3.2 Long term goals (2026-2030)

By 2030, the scale of the city's hydrogen energy industry will be significantly improved, the core technology of Hydrogen fuel cell stack, key materials, parts and power system integration will reach the domestic advanced level, more than 20 hydrogen energy high-tech enterprises will be introduced and cultivated, and more than 5 leading enterprises will be introduced, realizing an output value of 30 billion yuan. Jinhua Hydrogen Energy Industry Innovation Research Institute was established to break through the key core technology of Hydrogen fuel cell, realize the localization rate of key materials and components of fuel cell more than 50%, and the life of commercial vehicle stack is 20000 hours. More than 2 hydrogen production plants and more than 25 Hydrogen station have been built, and the operation scale of Hydrogen fuel cell vehicles is striving to exceed 2000. The hydrogen energy industry ecosystem with interactive integration of technology, industry and application and mutual support of talents, systems and environment has initially taken shape, becoming a national hydrogen energy industry demonstration zone [3].

4. Key Tasks

4.1 Build and improve the hydrogen energy industry chain

The government should establish a hydrogen source supply system. Fully utilizing the advantages of industrial by-product hydrogen resources within the city and surrounding areas to meet the recent development needs of the hydrogen energy industry, we plan to construct the Lanxi industrial waste hydrogen production project. Combining natural gas, electricity, photovoltaic power generation and other resources, we will actively implement the construction of a hydrogen production and supply plant that combines renewable energy hydrogen production, valley power hydrogen production, and natural gas hydrogen production. The government should actively collaborate with surrounding areas to plan clean energy (wind power, hydropower, nuclear power, etc.) hydrogen production demonstration projects, and gradually build a low-carbon and low-cost hydrogen source supply system that combines external and internal hydrogen supply.

The government should establish an efficient hydrogen storage and transportation system. Through accelerating the construction of quality supervision hydrogen energy storage and transportation equipment inspection stations, improving the efficient hydrogen energy storage and transportation system, in order to strengthen the supervision of hydrogen long-distance trailer transportation, and carry out demonstration applications of hydrogen long-distance trailer pressure lifting transportation and liquid hydrogen transportation. The government should implement a demonstration project for the planning and construction of hydrogen transmission pipelines in the "Jinhua Hydrogen Valley" hydrogen related zone, introduce research and development units for hydrogen storage materials, high-pressure hydrogen storage bottles, solid hydrogen storage, and other technologies, and improve the conditions for promotion and application. Enterprises should carry out research on key technologies such as hydrogen compressor, hydrogen storage vessel of Hydrogen station, 70MPa hydrogen refueling machine, control system of Hydrogen station, and steadily promote the construction of Hydrogen station based on existing gas stations, gas stations, and integrated energy supply service stations. The government should build a management and operation platform for Hydrogen station, strengthen the supervision of Hydrogen station, and build a quality and safety supervision system for Hydrogen station.

Enterprises should breaking through the key technologies of fuel cell core components. Enterprises can accelerate the research and industrialization of fuel cell vehicle technology, and introduce key leading enterprises. Relying on the equipment manufacturing industry foundation of our city, we will carry out the research, development and production of fuel cell core components and fuel cell power systems such as catalysts, membrane electrodes, bipolar plates, and build a national leading supporting base for Hydrogen fuel cell core components.

Enterprises should cultivate Hydrogen fuel cell vehicle industry chain brand. Give full play to the

resource advantages of our city's automobile enterprises, carry out the design and manufacturing of Hydrogen fuel cell commercial vehicles (including transport and logistics vehicles, public transportation, special vehicles, etc), Enterprises should build an important Hydrogen fuel cell vehicle manufacturing base in Zhejiang Province.

4.2 Cultivate and introduce hydrogen energy enterprises

The government should cultivate industry leading enterprises. Guide hydrogen energy industry enterprises to establish their own advantages, accelerate innovative development, increase the research and development and production of hydrogen fuel cell system products and core components, as well as hydrogen manufacturing and storage equipment. The government can cultivate a group of innovative advantageous enterprises with technology patents and market competitiveness in the industry. Enterprises should attracting industry leading projects. Focusing on key links in the hydrogen energy industry chain, we will increase investment attraction, strengthen industry docking, and actively introduce hydrogen energy industry projects with strong influence and driving force both domestically and internationally. Cultivate and develop supporting enterprises. Focusing on the market demand of hydrogen energy industry, we will strive to build a number of "three high" enterprises with high research and development level, high manufacturing level and high product quality, cultivate a number of Hidden champions in the field of supporting equipment for hydrogen energy industry, and cultivate and form industrial chain demonstration and leading enterprises.

4.3 Build a hydrogen energy industry platform

Enterprises should build an innovative research institute for hydrogen energy and fuel cell engineering. Enterprises can carry out technological innovation research on key materials and components of fuel cells, such as fuel cell stacks, bipolar plates, membrane electrodes, catalysts, high-speed precision motors and drive controllers, materials and surface processes. Enterprises should actively break through key technologies of fuel cells, increase technology transfer and achievement transformation, and build an industrial chain of key materials and components of fuel cells with independent intellectual property rights.

The government should build a hydrogen energy industrial park. Focusing on the four core areas of Hydrogen energy infrastructure, Hydrogen fuel cell and core components, Hydrogen fuel cell vehicle design and manufacturing, and hydrogen energy testing, we will build a Hydrogen fuel cell core components supporting base, a high-performance Hydrogen fuel cell and system assembly R&D and production base, and an important Hydrogen fuel cell vehicle manufacturing base in East China.

The government should build a national hydrogen energy technology standard innovation base. The government should promote the construction opportunity of the national hydrogen energy technology standard innovation base, focus on the development needs of the hydrogen energy industry, focus on the research, formulation and revision of standards for hydrogen sources, Hydrogen station, hydrogen storage and transportation, Hydrogen fuel cell applications and their safe operation, supervision, etc., The government can strive to build a hydrogen energy technology standard system covering national standards, industrial standards, local standards, group standards and enterprise standards. Benchmark international standards and timely introduce and transform international standards, improve the level of hydrogen energy technology with high standards, and lead the standardized and healthy development of Jinhua's hydrogen energy industry. The government should build Jinhua Hydrogen Energy International Science and Technology Innovation Park. Focusing on key core technologies in the hydrogen energy industry, we will introduce innovative and entrepreneurial talents in the fields of hydrogen and fuel cells to enter the Science and Technology Innovation Park for entrepreneurship incubation, accelerate the growth of related projects and innovative enterprises, and make the Science and Technology Innovation Park a gathering platform for talents, technological achievements, and industries in the hydrogen energy industry.

4.4 Expand the market for hydrogen energy applications

The government should promote application of Hydrogen fuel cell vehicles. On the basis of vigorously promoting Hydrogen fuel cell vehicles in public service fields such as public transportation, logistics distribution, muck transportation, landscape and environmental protection, The government should encourage social capital to participate in the application and promotion of Hydrogen fuel cell vehicles, build Hydrogen fuel logistics demonstration lines in the province, plan hydrogen fuel cell

logistics distribution routes as a whole, and ensure the continuous operation of hydrogen fuel cell logistics vehicles. The purchase, operation subsidy and exit mechanism of fuel cell vehicles shall be formulated as a whole to realize the use efficiency of Hydrogen fuel cell vehicles. The government should encourage and support the expansion and application of Hydrogen fuel cell technology in sightseeing vehicles, bicycles, electric vehicles, unmanned aerial vehicles, ships and other fields, The government can actively promote the docking of hydrogen energy enterprises with Relevant market, and carry out demonstration applications.

The government should demonstrate application of Hydrogen fuel cell distributed power generation and standby power supply. The government should connect the production and planning of Jinhua photovoltaic power generation devices, actively seek support from superiors, promote the construction of demonstration projects such as photovoltaic power generation hydrogen production, Hydrogen fuel cell distributed power generation, and energy storage systems,.The government should encourage and support relevant enterprises to connect with communication base station operators and industrial enterprises, expand the scale application of hydrogen energy backup power in Jinhua communication base stations and industrial enterprises, and increase the promotion and application of Jinhua and other cities outside the city.

4.5 Strengthen support for element resources

Gathering talents in the hydrogen energy industry. Further implement talent policies such as the 20 new policies of "Double Dragons Attracting Talents", and recruit talent teams globally through activities such as unveiling and leading. The government should Strengthen the cooperation between industry, university and research, accelerate the construction of seven hydrogen energy industry, university and research platforms, such as the hydrogen energy national technology standard innovation base, rely on colleges and universities such as Zhejiang University, Zhejiang University of Technology, Zhejiang Normal University, Jinhua Polytechnic Institute, Jinhua Institute of Technology, Jinhua Institute of Technology, and the International Hydrogen Standards Committee and other institutions to carry out research on key technologies of hydrogen energy. The government should strengthen the academic education and skills training of hydrogen energy technology talents, and cultivate localized "high precision and specialized" technical talents, Build Jinhua Hydrogen Energy Talent Pool.

The government should ensure the construction of hydrogen energy projects. In terms of space planning, project site selection and land indicators, the construction needs of hydrogen energy infrastructure such as hydrogen plants, Hydrogen station, vehicle operation sites, and hydrogen energy industrial parks are guaranteed. Government procurement focuses on supporting the demonstration operation of Hydrogen fuel cell vehicles. When purchasing and updating new vehicles in the fields of buses, sanitation vehicles, municipal vehicles, etc., the purchase of Hydrogen fuel cell vehicles will be given priority to, providing a good application scenario for the demonstration operation of Hydrogen fuel cell vehicles.

The government should Give full play to the role of industrial funds. We will increase financial support, explore the establishment of a special fund for the development of the hydrogen energy industry, use financial funds as the Seed money, and absorb social capital to participate in the investment in the hydrogen energy industry. The fund mainly supports innovation and transformation of core and key technologies, product promotion and application, construction of industrial development platforms, and support for the growth of key enterprises.

The government should accelerate the construction of hydrogen energy infrastructure. By 2021, Wucheng District, Wuyi County and Jinhua Development Zone will be the first to build three Hydrogen station; By 2022, Dongyang City and Yiwu City should complete at least one Hydrogen station; By 2025, each county (city, district) shall complete the construction of at least one Hydrogen station.

5. Safeguard measures

5.1 Strengthen organizational leadership

The government should give play to the overall leadership role of Jinhua New Energy Vehicle Promotion and Application Leading Group and Jinhua Hydrogen Energy Industry Development

Leading Group, and strive to become a national Hydrogen fuel cell vehicle demonstration city. The government should strengthen coordination and linkage between cities and counties, departments, and hold regular work meetings to study and solve problems in the promotion and application of fuel cell vehicles and the development of the hydrogen energy industry. The government should plan to establish Jinhua Hydrogen Energy Industry Alliance to jointly promote the high-quality development of the city's hydrogen energy industry.

5.2 Strengthen policy guidance

The government should implement national and provincial hydrogen energy industry plans, formulate supporting policies for the development of hydrogen energy industry based on the actual situation of our city. The government can give local subsidies or rewards to hydrogen energy enterprises in terms of scientific research and development, construction of major hydrogen energy projects, promotion of Hydrogen fuel cell vehicles, construction and operation of Hydrogen station, etc.

5.3 Strengthen safety supervision

The government should establish and improve the safety assurance system for the hydrogen energy industry, standardize the approval and supervision procedures for Hydrogen station. Enterprises must implement the main responsibility of enterprise safety production, establish an online detection system for hydrogen production, hydrogen storage, hydrogen transportation, hydrogen refueling and application, and realize real-time tracking and monitoring. Enterprises must develop a safety production management assessment system and ensure the prevention and resolution of safety risks.

5.4 Strengthen publicity and guidance

The government should build platforms such as hydrogen energy exhibition centers, hydrogen science popularization bases, hydrogen parks, hydrogen experience areas, and enterprise exhibition halls. The government can hold hydrogen energy forums to showcase hydrogen energy products and application scenarios, popularize hydrogen science knowledge, carry out hydrogen safety knowledge education, improve hydrogen energy safety awareness and risk prevention awareness, in order to enhance social recognition for the development of the hydrogen energy industry.

6. Conclusion

China's hydrogen energy industry policy requires top-level design at the national level, research and development of a special plan for the development of the hydrogen energy industry, with the active participation of local governments, presenting a trend of top-down promotion. According to the development status of Hydrogen fuel cell vehicle industry in Jinhua, the author of this paper proposes a Hydrogen fuel cell vehicle policy that is in line with local reality and has strong operability, which can promote the high-quality development of Hydrogen fuel cell vehicle industry in Jinhua.

References

- [1] Shen Y(2022).*Summary and Analysis of Policies Related to Hydrogen Energy and Fuel Cell Vehicles in China* .pp.1-2.
- [2] Qi H(2019).*Guiding Opinions on Accelerating the Development of Hydrogen Energy Industry in Zhejiang Province*. pp.5-6.
- [3] Fang M(2021).*Notice on Printing and Distributing the Implementation Opinions of Jinhua on Accelerating the Development of Hydrogen Energy Industry*. pp.8-10.