



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

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Government Co-ordinating agency & Executing agency/cooperating agency:	China International Center for Economic and Technical Exchanges (CICETE), Ministry of Commerce (MOFCOM) of the Government of China
Counterpart:	Beijing Municipal Bureau of Economy and Information Technology (BEIT) Beijing Tsinghua Industrial Development Research Institute (TIDRI) Beijing Yitong Hydrogen Energy and Fuel Cell Technology Innovation Research Institute (BJYT Hydrogen Institute)
Budget:	
Project input :	442,478 USD
Support cost (13%) :	57,522 USD
Grant total (for five years) :	500,000 USD (IDF-China)
Project input :	22,045,455 CNY
Support cost (10%) :	2,204,545 CNY
Grant total (for five years) :	24,250,000 CNY (Apportioned fund through CICETE, excl. CICETE support cost)

Brief description:

Hydrogen, the most abundant chemical element in the universe, offers a way to decarbonize energy, especially for industries, as well as to diversify the economy. The current advancements in its production through electrolysis and related technologies including fuel cells as well as its versatile characteristics offer holistic solutions to reduce global GHG emissions. Hydrogen supports a true paradigm shift in the area of more efficient energy storage, especially for renewable energy at industrial scale. While the technology is maturing, the policy and regulatory framework, safety codes and standards harmonization remains insufficient throughout the world. Therefore, partnerships between the public and private sector as well as academia is crucial.

The establishment of the International Hydrogen Energy Centre (IHEC) in China can play a strategic role to help the development of the hydrogen energy industry not only in China but also globally by attracting international R&D funding and promoting south- south, triangular and regional cooperation, with the involvement of developing countries, i.e. Asia Pacific, Africa and Latin America where UNIDO has a well ramified network of regional offices, centers and industrial projects. The IHEC establishment and development aims to build capacity, disseminate knowledge and advance research in the area of hydrogen. This project will develop a hydrogen economy roadmap as well as strengthen international cooperation with international organizations, such as the IEA.

Approved:

Signature:

Date:

Name and title:

*On behalf of
MOFCOM/CICETE*

*On behalf of
UNIDO:*

*On behalf of
BJYT-Hydrogen Institute*

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A. CONTEXT

A 1. Project Purpose

The establishment of the International Hydrogen Energy Centre (IHEC) can play a strategic role to help the development of a hydrogen energy industry in China by attracting international R&D and promoting south-south, triangular and regional cooperation with key regions, including developing countries, i.e. Asia Pacific, Africa and Latin America where UNIDO has a well ramified network of regional offices, centers and projects. The IHEC will build capacity, disseminate knowledge and advance research in the area of hydrogen, develop a hydrogen roadmap as well as strengthen international cooperation with international organizations, such as the IEA.

This project aims to establish IHEC to achieve technological breakthroughs, demonstrate and application of hydrogen energy products for readiness of the future establishment of hydrogen energy technology and industrial innovation system, the large-scale application of hydrogen energy and international development.

A 2. Baseline Scenario

A 2.1 Global Hydrogen Development

Climate warming has become a global challenge. Commitments under the Paris Agreement emphasize the imperative for zero-carbon energy. This requires strategic decisions on energy infrastructure and the use of available energy resources. Alternatives to carbon-based fuels are required across the energy system. Hydrogen offers ways to decarbonize a range of sectors, including long-haul transport, chemicals, as well as iron and steel, where it is proving difficult to meaningfully reduce emissions so far. Hydrogen can also help improve air quality and strengthen energy security. Despite very ambitious international climate goals, global energy-related CO₂ emissions reached an all-time high in 2018. Both outdoor and indoor air pollution remain a persistent problem, with millions of people dying prematurely each year, most of those affected by indoor air pollution are women and children.

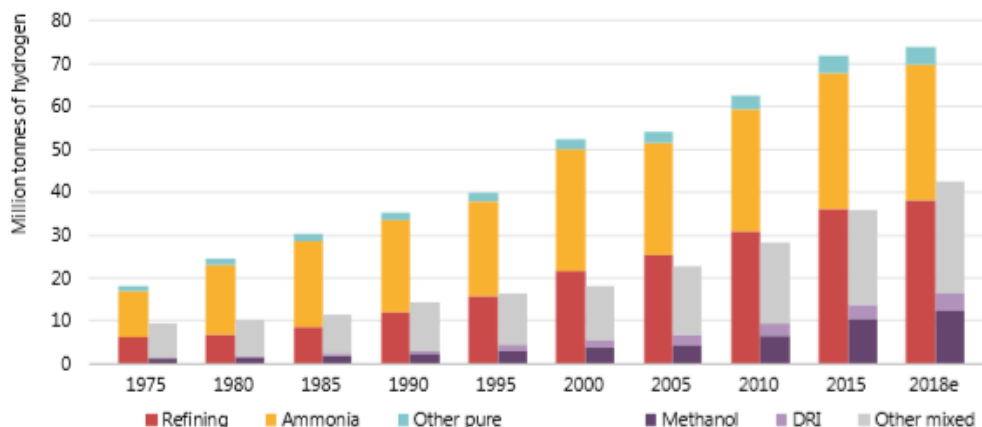
Hydrogen, the most abundant chemical substance in the universe, offers a way to decarbonize energy. It provides possibilities especially for industries, as well as to diversify economies. The current advancements in its production through electrolysis and related technologies, including fuel cells, as well as its versatile characteristics offer holistic solutions to reduce global GHG emissions. Hydrogen has the potential to support a paradigm shift in the area of more efficient energy storage, which is crucial to enhance renewable energies on an industrial scale. While the technology is maturing, the policy and regulatory framework, safety codes and standards remain insufficient

throughout the world. Therefore, partnership between the government, industry and academia is crucial to create an enabling environment to promote hydrogen production and utilization in a sustainable and inclusive manner.

Hydrogen can be used in its pure form, or converted to hydrogen-based fuels, including synthetic methane, synthetic liquid fuels, ammonia and methanol. Hydrogen can be extracted from fossil fuels and biomass, or from water, or from a mix of both. A wide variety of fuels are able to produce hydrogen, including renewables, nuclear, natural gas, coal and oil. It contains more energy per unit of mass than natural gas or gasoline, making it attractive as a transport fuel. On the other hand, hydrogen has low energy density, which makes it more challenging to store and transport than fossil fuels. However, it can be converted into hydrogen-based fuels and feedstocks, such as synthetic methane, synthetic liquid fuels and ammonia, which can make use of existing infrastructure for their transport, storage and distribution. This can reduce the costs of reaching final users.

The global demand for hydrogen has constantly increased since 1975 (Figure 1). Today, hydrogen is mainly used in oil refining and for the production of fertilizers. Natural gas is currently the primary source of hydrogen production, with coal coming next. Due to the dominant role of coal in China (80% of hydrogen is produced from coal): coal accounts for an estimated 23% of global dedicated hydrogen production and uses 107 Mt of coal (2% of global coal use). Nevertheless, China is determined to increase the production of green hydrogen using renewable energy. The dependence of hydrogen production in China on natural gas and coal means that hydrogen production today generates significant CO₂ emissions: 10 tonnes of carbon dioxide per tonne of hydrogen (tCO₂/tH₂) from natural gas, 12 tCO₂/tH₂ from oil products, and 19 tCO₂/tH₂ from coal.

Figure 1. Global annual demand for hydrogen since 1975



Source: IEA (2019). The Future of Hydrogen. Seizing today’s opportunities.

Dedicated electricity generation from renewables or nuclear power offers an alternative to the use of grid electricity for hydrogen production. With declining costs for solar PV and wind turbines,

building electrolysers at locations with excellent renewable energy resource conditions could become a low-cost supply option for producing green hydrogen, even after taking into account the transmission and distribution costs of transporting hydrogen from (often remote) locations to the end users. If hydrogen shall make a significant contribution to the clean energy transition, hydrogen also needs to be adopted in new sectors, such as transport, buildings and electricity generation.

To summarize, hydrogen has many advantages such as higher energy storage density, it is suitable for distributed energy applications, and it can reduce dependence on fossil fuels and solve energy security problems. After hydrogen energy reaction, the by-product is water, with no other harmful substances. It can help to achieve de-carbonization, reduce CO₂ emissions and help to protect the environment. Overall, seven roles of hydrogen in energy transition can be formulated:

1. integration of renewables in power generation,
2. distribution of energy,
3. stabilization of the energy sector,
4. decarbonization of transportation,
5. decarbonization of industry,
6. decarbonization of heating and power supply for buildings, and
7. use of hydrogen as feedstock and substrate in various processes.

It is urgent and necessary to set-up an entity that promotes the development of hydrogen in the energy industry by attracting international R&D and promoting south-south, triangular and regional cooperation to achieve UN SDGs.

A 2.2 China's Hydrogen Development

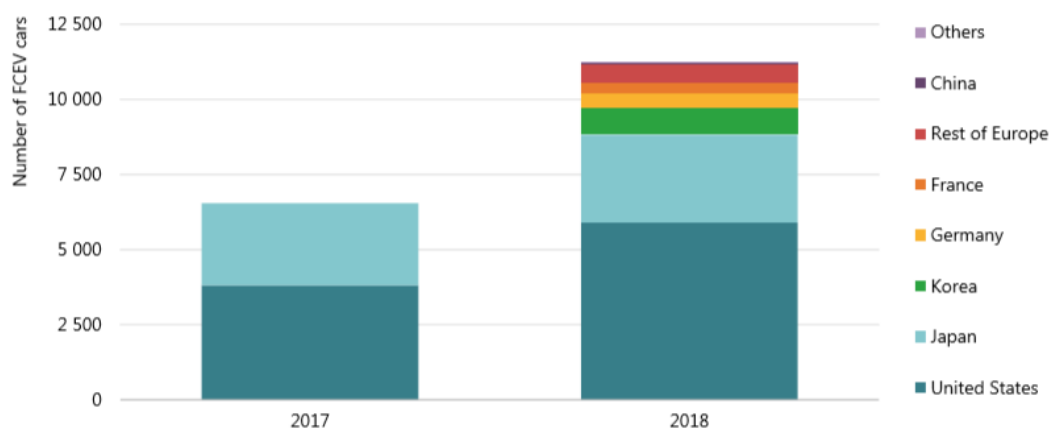
From signing the "The United Nations Framework Convention on Climate Change (UNFCCC)" to supporting the "Paris Agreement", China has demonstrated its positive attitude in dealing with climate change. An important measure for China to deal with climate change is to improve its energy structure. In recent years, the National "The Action Plan Energy for Technology Revolution Innovation (2016-2030)", "Thirteenth Five-Year National Strategic Emerging Industries Development Plan" and "Thirteenth Five-Year National Science and Technology Innovation Plan" have upgraded battery technology innovation to the national level and listed it as a key development direction. Hydrogen energy has become an important means of energy structure transformation. Beijing, Shanghai, Guangdong provinces and cities have successively issued relevant policies to support development of the hydrogen energy industry and begin to form hydrogen energy industry clusters such as Beijing-Tianjin-Hebei, Pearl River Delta and Yangtze River Delta.

The Beijing hydrogen energy and fuel cell industry started the *10th Five-Year* period with the project *hydrogen fuel cell vehicle development*. Already in 2006, in Haidian district of Beijing city domestic hydrogen refuelling station was built. The demonstration project of hydrogen fuel cell vehicles was carried out during the Beijing Olympic Games in 2008. However, so far, there is no finalized national-level hydrogen energy strategy, development roadmap nor industrial policy. Moreover, also the regulations, testing system and infrastructure that promote hydrogen energy development still need to improve.

China has made impressive progress in the field of hydrogen energy, and it is expected to become a leading country in hydrogen energy technology and application in the near future. Beijing, the capital of China, has issued a strategy to increase the use of renewable energy, including hydrogen energy, for creating more sustainable and inclusive communities and enhance resilience to environmental issues. Hydrogen fuel cell electric vehicles (FCEVs) have the potential to reduce local air pollution because – like battery electric vehicles (BEVs) – they have zero tailpipe emissions. China has reported the largest deployment of fuel cell busses, with more than 400 registered by the end of 2018 for demonstration projects. Thousands of fuel cell electric buses are lined up for production and are on pre-order for the coming five years, mostly in China. As regards to trucks, China also leads the global deployment of fuel cell electric trucks and accounts for the majority of demonstration projects.

Country-level statistics in 2018 refer to 412 units registered in China, supplemented by 100 vans. Other countries also are following the same trait. For example, in Korea a public private partnership aims to deploy 1,000 fuel cell electric buses by 2022 on the way to Korea’s stated target of 40,000 by 2040. Japan aims to have 100 fuel cell electric buses operating for the Tokyo 2021 Summer Olympics. Globally, the total amount of fuel cell electric cars are rapidly increasing (Figure 2).

Figure 2. Total fuel cell electric cars in circulation (2017–2018)



Source: IEA (2019). *The Future of Hydrogen. Seizing today’s opportunities.*

China has expressed strong commitment to continue investment in the hydrogen. It announced that the *Ten Cities Programme* that launched battery electric vehicles would be replicated for hydrogen transport in Beijing, Shanghai and Chengdu, among others. China also announced that Wuhan will become the first Chinese Hydrogen City, with up to 100 fuel cell automakers and related enterprises and up to 300 filling stations by 2025. China aims for 5,000 fuel cell electric vehicles (FCEVs) by 2020 and recommitted to the 2015 target of 1 million FCEVs by 2030, plus 1,000 refuelling stations. It has also exempted FCEVs (and battery electric vehicles) from vehicle and vessel tax.

Beijing is also planning to establish an "*Energy Valley*". It will be located in the Eastern District of the *Future Science City* in Beijing. By integrating energy technology and industrial resources, it will form a strong capacity of the energy industry and will become an international science and technology platform. The 10 square kilometres of the first phase of the East District is the core area of the "*Energy Valley*". The "*Energy Valley*" will have three main characteristics: a) solid industrial foundation, b) innovation elements and c) manifested leading role.

Taking into account the above-mentioned attainments, the Government of China expressed to establish an International Hydrogen Energy Center (IHEC) to be a part of the "Energy Valley" in Beijing. The center will support, demonstrate and promote viable implementations of hydrogen energy technologies with the aim of enhancing future economic development worldwide. The IHEC will provide the platform for Governments and industry to work together to scale up hydrogen in a coordinated, sustainable and inclusive manner.

A 2.3 UNIDO's Hydrogen and Center Establishment Experience

The United Nations Industrial Development Organization (UNIDO) aims to promote development and application of renewable energy for productive use worldwide, establishing regional sustainable energy centers, national centres to promote specific technologies (e.g. SHP, biomass, biogas) and a hydrogen research institute. As early as 2003, UNIDO together with the Turkish Government initiated the establishment of an International Centre for Hydrogen Energy Technologies (ICHET) in Turkey to demonstrate and promote hydrogen energy technology for economic development. ICHET was launched in 2004, carried out a series of research, demonstration and education activities in developing countries for the development of hydrogen energy.

UNIDO, within the UN system is leading efforts to foster knowledge exchange and facilitation of hydrogen energy technology development, in the context of its broad programmatic approach to industry decarbonisation. UNIDO is also building on its global network of regional sustainable energy centres and actively engaged with the International Energy Association (IEA) Technology

Collaboration Programme (TCP) on Hydrogen.. The IEA involvement entails cooperation on R&D topics among member states in the hydrogen field. UNIDO is further co-hosting with the United Nations Environment Programme (UNEP) the Climate Technology Centre and Network (CTCN) as a climate technology facilitation mechanism under the Framework Convention on Climate Change (UNFCCC). Building on UNIDO's networks and partnerships, the project would strengthen IHEC capabilities to play an international role in the development and dissemination of knowledge and capacities for the utilization of Hydrogen potential in the clean energy transition.

UNIDO has a close working relationship with China. In 1994, UNIDO and the Chinese Government jointly initiated the establishment of the International Center on Small Hydro Power (ICSHP) with more than 200 members from more than 60 countries. In 1999, with the headquarters of ICSHP in Hangzhou, China had become the host country of the center. ICSHP is also the first international organization based in China after 1949. Over the twenty years of its existence, five bases were established under ICSHP framework, including Hunan's Chenzhou Base, Gansu Zhangye Base, Zhejiang Jinhua Turbine Manufacturing Base, Hunan Changsha Hydropower Automation Control System Base and Nanjing NARI Innovation Base. ICSHP created a new model of tripartite South-South cooperation between developing, developed countries and international organizations based on sharing China's experience in the development of small hydropower worldwide.

A 2.4 UNIDO's Support for the IHEC Establishment and Development

UNIDO together with the Government of China is recognizing the crucial role that hydrogen can play in the future energy system and understands the urgent need to promote this technology to make it more scalable, inclusive and affordable globally.

Under the framework of this project UNIDO will support China to establish and develop the IHEC, to promote hydrogen energy technology development and application, the development of a hydrogen energy economy roadmap and to enhance international hydrogen energy cooperation for achieving clean and renewable energy goals in line with SDGs 7, 9, and 13.

The IHEC will be based in the Beijing Yitong Hydrogen and Fuel Cell Technology Innovation Institute that has been established in China end of 2017.

UNIDO working with strategic knowledge partners such as Tsinghua University will work toward facilitating a robust and sustainable institutional and organizational framework for the operational of IHEC with an international outlook. At the same time the partnership would also facilitate a work programme that tackles key systemic barriers to the scale-up of Hydrogen technology deployment

in domestic markets such as i) demand conditions and end use applications, ii) local industrial capabilities across hydrogen value chains, and an inductive eco-system for commercialization of early stage innovations across the hydrogen technology system. A final pillar of UNIDO's role and engagement in the project is to facilitate broader international cooperation and outreach further building capabilities within IHEC as a platform for international cooperation on Hydrogen technology and its role in the clean energy transition.

A 2.5 The IHEC Role Globally

Taking into account the urgency of climate change and manifold promising opportunities for hydrogen use, the establishment of the IHEC is rational and a much-needed next step for the global community. The IHEC will provide the platform for Governments, industry and the society to work together to scale up hydrogen in a coordinated way. It can help to spur investments in factories and infrastructure that will bring down costs and enable the sharing of knowledge and best practices and promoting south-south, triangular and regional cooperation with key regions, including developing countries, i.e. Asia Pacific, Africa and Latin America where UNIDO has a well ramified network of regional offices, centres and projects.

Global economy will benefit from common international standards for the safety of transporting and storing large volumes of hydrogen and for tracing the environmental and social impacts of different hydrogen supplies. Alongside cost reductions from economies of scale, R&D is crucial to lower costs and improve performance, including for fuel cells, hydrogen-based fuels and electrolyzers (currently only 2% of global hydrogen production). The IHEC will be established in cooperation with the Chinese Government, research institutions and the Beijing Yitong Hydrogen and Fuel Cell Technology Innovation Institute.

The Beijing Yitong Hydrogen and Fuel Cell Technology Innovation Institute, a private non-enterprise unit was jointly established by the Beijing Municipal Bureau of Economy and Information Technology (BEIT), Beijing Tsinghua Industrial Development Research Institute (TIDRI) and Beijing Yihuatong Technology Co., Ltd. in 2017. It will be a great contribution towards hydrogen energy technology research and hydrogen industry development in the country. With the help of UNIDO this initiative will be promoted and transformed into the IHEC to reach international level and application.

The capacity of the IHEC will begin to be built in terms of hydrogen (H₂) networking in the energy and climate sectors: South-South, triangular and regional cooperation options for Chinese institutions and organizations. In particular the development of hydrogen road maps and applications for industrial decarbonization are seen as two promising topics.

The IHEC activities will be advertised within the IEA H₂. The IHEC experts will be deployed to contribute to the work of IEA H₂ Tasks and increase their knowledge through an exchange with other international experts from member states. For this purpose, H₂ Expert Group Meetings (EGMs) will be organised in Vienna within the project timeline. International hydrogen experts from the EU, Japan, USA and South Korea, among others, belonging to both public and private sector, will be invited to contribute to the IHEC roadmap and future development of hydrogen. This will be a relevant opportunity to share the results of the Theory of Change (TOC) and main findings of this project and get experts feedback and take corrective measures as needed.

The Winter Olympics in 2022 and the Winter Paralympic Games represent a first show-case opportunity for the IHEC to gain international visibility and attract resources and new partners. Specific communication actions will be planned for this important event.

A 2.6 The IHEC Tasks

Once established, it is expected that IHEC will carry out research and development in the key fields related to hydrogen production, hydrogen storage, hydrogen transport, hydrogen refuelling, fuel cell and energy storage. The more specific tasks envisioned for IHEC include, facilitation of technology cooperation and knowledge exchange on: .

1. Hydrogen production: development of high-efficiency electrolyzers, mastering core equipment and key technologies, improve the efficiency of electrolytic conversion and increase the production capacity of high purity hydrogen, solving or improving the process for solar energy photocatalysis hydrogen production and thermal decomposition hydrogen production technology, using biomass materials and organisms technology to produce hydrogen in order to achieve diversified hydrogen production and reduce hydrogen production cost
2. Hydrogen storage: Breaking through the research and development of materials and equipment, such as 70 MPa or above, high pressure, liquid hydrogen storage, light gas storage materials, research on materials, technologies and equipment of liquid compound hydrogen storage and hydrogen storage alloys, Nano, as well as related to hydrogen storage technology and equipment development research such as long-term, large-scale hydrogen storage.
3. Transportation: Understanding the development and application of hydrogen transmission technology and equipment for medium and long-distance high-pressure pipelines, develop large-scale hydrogen transportation technology and equipment, and study large-scale low-cost integrated technology for hydrogen transportation networks.
4. Hydrogen refuel station: research and development of key equipment and core components of hydrogen refuel stations, localized production of key components and equipment such as

compressors and filling machines, reduce the equipment cost of the hydrogen refuelling station, and study the hydrogen energy supply network operation mode to ensure the use of hydrogen.

5. Fuel cell: Improving the key technologies of the reactor and carry out the research on membrane electrode technology, promote research on core materials and products such as catalysts, proton exchange membranes, and bipolar plates to improve product performance and significantly reduce costs. Optimized hydrogen fuel cell system set and control technology, study high specific power hydrogen fuel cells to achieve performance improvement for reliability, durability and low operating temperature. Break through key component technologies such as air compressors and hydrogen ring pumps, humidifiers, DC/DC converters.
6. Energy storage for power generation: Research on distributed hydrogen fuel cell for power generation, cooling and heat joint supply technology, develop core technologies for high-efficiency conversion, low-cost and large-scale storage and comprehensive high-efficiency utilization between electricity and hydrogen energy carriers. Break through key technologies such as the volatility of new energy for hydrogen production, grid-coordinated control; research and development core components and logic control of fuel cell thermal-electricity supply systems to improve conversion efficiency of hydrogen fuel cells for thermal-electricity supply systems, and achieve large-scale energy network application with hydrogen storage.

A 3. Main Target Groups

The target groups and potential beneficiaries are from the public and private sector, including representatives from industry, academia and the government as well as the society (e.g. associations that promote gender equality and women's empowerment, or environmental protection) involved in enhancing sustainable productivity growth, thereby contributing to inclusive and sustainable industrial development globally and especially in developing countries. The benefits are expected to accrue to all partners involved, including governments, private sector and SMEs, R&D institutions and organizations, business and industry associations, Beijing municipality and China as well as other developing countries.

The target beneficiaries of this project will be both women and men since UNIDO recognizes that gender equality and the empowerment of women have a significant positive impact on sustained economic growth and inclusive industrial development, which are key drivers for poverty alleviation and social progress. Both women and men will equally lead, participate in and benefit from project interventions.

A 4. Stakeholders

The main stakeholders of this project include the Ministry of Commerce (MOFCOM) represented by the China International Center For Economic and Technical Exchanges (CICETE) as well as the Beijing Municipal Bureau of Economy and Information Technology (BEIT), the Beijing Tsinghua Industrial Development Research Institute (TIDRI) and the Beijing Yitong Hydrogen Energy and Fuel Cell Technology Innovation Research Institute. Other potential partners include: UNIDO Member States, research institutions, and government ministries, national centres of excellence, civil society organisations and other development partners in developing and developed countries, as well as UNIDO's teams and relevant technical departments.

The IHEC will initiate a portfolio of technically and economically viable, sustainable and inclusive projects, establishing itself as a potential partner for academic, public and private organizations willing to work in the hydrogen energy technology field. Besides government officials the project will include representatives from the private sector and from civil society, as well as experts who work in hydrogen research and science applications.

Government Co-coordinating agency: CICETE

CICETE, as a specialized executing agency for international cooperation and assistance projects under the Ministry of Commerce. It is responsible for:

- Coordinating technical cooperation projects of UNIDO in China funded through the Industrial Development Fund (IDF) of CICETE,
- Monitoring such projects at the macro level, and
- Participating in selected activities of such projects as deemed necessary.

Beijing Yitong Hydrogen Energy and Fuel Cell Technology Innovation Research Institute was established by the Beijing Municipal Civil Affairs Bureau in 2017, based on Beijing Tsinghua Industrial Development Research Institute ("Tsinghua Industrial Research Institute") and Beijing Yihuatong Technology Co., Ltd. ("Yihuatong"). Based on the Yihuatong, IHEC will be established.

BEIT is an Agency of the Beijing City Government. The responsibilities of BEIT include but are not limited to:

- Formulate and implement the development plan and industrial policies of the city's

industry, software and information services, and promote the adjustment of industrial layout and the optimization and upgrading of industrial structure.

- Formulate and organize the implementation of the city's industrial, software and information services, information technology, energy conservation and comprehensive utilization of resources, clean production promotion policies.
- Participate in the formulation of energy conservation and comprehensive utilization of resources, and cleaner production promotion planning, organize and coordinate the promotion and application of relevant major demonstration projects and new products, new technologies, new equipment and new materials,

TIDRI is a research institution affiliated to the Tsinghua University, China's top prestigious university known as “Massachusetts Institute of Technology, China”. TIDRI was established in 1998 by the Beijing City Government and Tsinghua University for developing innovative technologies and promoting high-tech industrialization with extensive influence in many fields such as Chinese government, academia, and industry. Shuimu Yide Investment (SYI/TIDRI), established in 2014 under TIDRI, has a deep distribution of hydrogen energy industry chain, tracking global hydrogen energy industry technology, and deep investment capacity and abundant industrial resources in China's hydrogen energy field. Up to now, SYI/TIDRI has invested in a series of leading companies including hydrogen fuel production, storage and transportation, fuel cell stacks and power system development, and has gradually established a strong partnership in the global hydrogen energy industry ecological chain.

A 5. Synergy

The project elaborated herein will create synergies with pre-existing interventions (i.e. projects, Programmes for Country Partnership and/or Country Programmes) in particular in terms of the facilitation of partnerships, networks, knowledge building and raising awareness on the IHEC. In its implementation, the project will also help create synergies among UNIDO’s technical departments including the Department of Agri-Business, Department of Digitalization, Technology and Innovation, and the Department of Environment.

Main examples of synergies with projects includes:

- Project 190272 (“Supporting the UNIDO Centre for South-South Industrial Cooperation (UCSSIC) in China (3rd Phase)”)
- Project 190330 (“Development of a Knowledge Product and a Series of Expert Group Meetings (EGMs) on Best Practices and Pathways for Decarbonization of Industry and Utilization of Hydrogen Technology in Cooperation with KEA and KEEI”)

- Project 190096 (“Vienna Energy Forum 2020”) to be postponed to 2021
- Project 180034 (“Preparatory Phase for the Clean Energy Centre of the Economic Cooperation Organization”)

A 6. Strategies and links with development objectives

At the UN-system level, the project aims to address the Sustainable Development Goal 7, and is closely linked to SDGs 5, 9, 13 and 17. Thereby the IHEC addresses challenges of:

- **SDG 5: Achieve gender equality and empower all women and girls**

Target 5.b: Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women

- **SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all.**

Target 7.a: Enhance international cooperation among UNIDO, China and selected countries and facilitate access to clean energy research and technology.

- **SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.**

Target 9.3: Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

- **SDG 13: Take urgent action to combat climate change and its impacts**

Target 13.2: Integrate climate change measures, especially renewable energy application, into national policies, strategies and planning. GHG emission from the renewable energy will be calculated based on the installation and electricity generation.

- **SDG 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.**

Target 17.7: Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

At the UNIDO-level and in-line with the ISID mandate, the project will assist developing countries to:

- Introduce standards and promote regulations that ensure company projects and initiatives are sustainably managed.
- Increase economic competitiveness and jobs creation through upscaling hydrogen development.
- Increase access to electricity for productive uses through an environmentally sustainable framework.
- Disseminate knowledge and technology through the harmonization of standards.

The strategy envisioned is to address the identified challenges and link them with global objectives as well as developmental priorities of DCs through the use of tried and tested Chinese and international expertise, exchange of information on best practices and institutional training.

Promoting the global objective of South-South cooperation, the project will contribute towards knowledge transfer between China, relevant countries and developing ones. China has extensively used decentralized renewable energy systems for a variety of productive applications such as industrial, agricultural, etc.

B. UNIDO APPROACH

B 1. Rationale

The IHEC has the potential to develop and share knowledge and promote technology transfer between China and other developing countries. China's and UNIDO's cooperation potential has been fully demonstrated through the results of other projects, such as International Center on Small Hydropower (ICSHP) and Centre for South-South Industrial Cooperation (UCSSIC). The IHEC would enhance hydrogen development through improved and more efficient collaboration between research institution from China and other UNIDO Member States.

The centre's establishment is in line with UNIDO's mandate of Inclusive and Sustainable Industrial Development (ISID). The centre is intended to further enhance UNIDO's visibility as innovative leader of state-of-the-art technologies in cooperation with China. It will serve as an important platform for UNIDO to explore hydrogen technology transfer projects between China and other developing countries, which can be contribute to the PCPs.

B 2. Comparative Advantage

UNIDO, as a specialized UN agency has the mandate to foster ISID and international industrial

cooperation. As such UNIDO plays a pivotal role in providing a stimulus to technology transfer by bringing forward its expertise and field experience in support of industrial development in developing countries. UNIDO has been working with Governments, business associations and companies to solve industrial problems for more than 50 years, earning a reputation as the world's most experienced industrial problem solver, as well as a neutral and honest broker in promoting cooperation and coordination among countries around the world. UNIDO is fully committed to contributing to the achievement of the SDGs, particularly Goal 9 focusing on Infrastructure, Industry and Innovation, while delivering on its mandate to support the Member States in achieving ISID.

Through cooperation with the Turkish government, UNIDO accumulated experiences on hydrogen development. ICHET was initially a USD 40 Million project, funded through a Trust Fund Agreement signed between UNIDO and the Turkish Ministry of Energy and Natural Resources. It ran until 2012 when the project was terminated by the Turkish Government. From the ICHET experience some lessons have been learned for planning and implementing the IHEC:

1. New organizations need a clear institutional perspective;
2. Demonstrations must solve real development problems;
3. New technologies start in “killer” niche applications;
4. New technologies do not develop in a vacuum - they compete with other developing technologies.

UNIDO, as the leading agency of hydrogen energy technology development in the UN system, with a global hydrogen energy network, is leading in the transfer of hydrogen technology to developing countries. UNIDO is the only member of the International Energy Association (IEA) Hydrogen Technology Collaboration Programme (TCP) from the UN system. The IEA involvement entails cooperation on R&D topics among member states in the hydrogen field.

UNIDO's support and promotion of the IHEC can be highlighted in the following areas:

- Facilitating matchmaking through specialized networks, centres and workshops;
- Convening platforms and dialogues among various stakeholders focused on knowledge/experience sharing;
- Engaging in the IHEC modalities throughout technical cooperation programmes and projects;
- Enhancing the visibility of the IHEC services and the Organization's contributions to

global initiatives.

B 3. Inception Phase

The proposed project will be implemented based on the achievements previously made by the Chinese Government. The IHEC will be developed based on an existing national level hydrogen centre. The inception phase will focus on describing initial requirements for creating an international entity. It will also focus on developing and justifying that IHEC will be a self-sufficient business unit by attracting international partners. Project operations, activities and programmes will be carried out under the guidance of UNIDO as per its rules and regulations and in consultation with the Chinese Government. Activities during the inception phase will include, but not be limited to the following:

- Develop a report that analyses the existing hydrogen technology practices in China, existing national and international needs and academic achievements;
- Develop a stakeholder mapping of eco-systems players in China and internationally that are influential in the development of hydrogen energy and its applications; including gender focal points and stakeholders that promote gender equality and the empowerment of women in the hydrogen sector.
- Develop an explorative study of potential application scenarios in energy and industry markets and their gender dimensions;
- Invite international hydrogen experts to establish an Expert Working Group (EWG) to support the IHEC establishment and a technical steering committee for monitoring and supervision of the process. Organize 2-3 international Expert Group Meetings (EGMs) in cooperation with other countries (potentially including Japan, USA, Austria, Germany, S. Korea);
- Promote the IHEC at the Vienna Energy Forum 2021 and onwards, for instance through organizing a side event.

B 4. Sustainability Strategy

This project will adhere to UNIDO's sustainability strategy by promoting the advancement of economic, social and environmental sustainability in all of its undertakings. Concrete plans of project activities, which are designed to achieve inclusive and sustainable industrial development within the three aforementioned pillars will be developed on a case-by-case basis.

The Government of China has expressed strong support for the IHEC establishment. China views sustainable industrial development as an important element and entry point for the IHEC. The

sustainability of the Centre will be achieved through continued support from the Chinese Government that will also continue after this project has finished. China aims to position itself as a leading country in the hydrogen sector while enhancing its international cooperation. The Government of China believes that it has a lot to contribute and share with other developing countries by working with UNIDO for the years to come.

It is expected to have a second phase after establishment of the IHEC for its sustainability. If the project goes smoothly and the results meets expectations, Beijing Yitong Hydrogen Energy and Fuel Cell Technology Innovation Institute, or in the name of IHEC, will also apply for the second-phase project to further develop network platform construction, industrialization and international cooperation.

B 5. Gender Mainstreaming Strategy

This project promotes gender equality and the empowerment of women, with particular focus on the economic empowerment of women in the emerging hydrogen sector. The project and all pertaining activities will be undertaken in accordance with the UNIDO Policy on Gender Equality and the Empowerment of Women (DGB/2019/16) and UNIDO Strategy for Gender Equality and Empowerment of Women (2020 - 2023). Guiding principle of the project will be to ensure that both women and men equally lead, participate in, and benefit from the project.

In practical terms,

- This shall include the identification of the differentiated needs and roles of women and men with respect to the capacity building interventions of the project. For this purpose, women's groups, associations or stakeholders concerned with gender and energy will be consulted to verify that the final project logical framework is gender mainstreamed.
- To ensure that gender considerations are taken into account to the largest extent possible, the project will identify the differentiated needs and roles of women and men through conducting a gender analysis, or by including a gender perspective in the baseline study, the training needs assessment (TNA), and other studies conducted in the framework of this project. This will be done through hiring a gender expert and/ or inserting GEEW related tasks into the ToRs of consultants and vendors. Moreover, for this purposes, women's groups and associations, gender experts and/or other stakeholders promoting gender equality and women's empowerment will be consulted.
- Capacity building: Efforts will be made to promote equal participation of women and men in capacity building activities, both at managerial and technical levels, as participants and trainers. All trainings and study tours, as well as awareness workshops and partner meetings taking place

under the project will aim to include a balanced share of female participants, facilitators and organizers, as well as gender-balanced panels, thus complying with UNIDO Director-General's commitment as an International Gender Champion. Furthermore, awareness of project staff and stakeholders will be raised and they will be sensitized to understand the energy-gender nexus.

- In addition, any TC projects derived from the proposed project will ensure the integration of gender perspective to the extent possible.
- The development of training and promotional materials under the project will be gender-responsive, i.e. it will pay adequate attention to gender aspects through, among others, the inclusivity, in particular from a gender perspective, of selected "good practices", the usage of gender-neutral language and gender-balanced media.
- Gender-sensitive recruitment will be practiced at all levels where possible, especially in selection of project staff. Gender responsive TORs will be used to mainstream gender in the activities and tasks of consultants and experts. In cases where the project does not have direct influence, gender-sensitive recruitment will be encouraged.
- All decision-making processes will consider gender dimensions. At project management level, Project Steering Committee meetings will invite observers to ensure that gender dimensions are represented, while also the gender balanced composition in project committees will be emphasized. For this purpose, efforts will be made to consult with stakeholders focusing on gender equality and women's empowerment issues, such as gender experts and organizations, CSOs and NGOs promoting GEEW (providing them with equal voice). This is especially relevant for capacity building activities.
- When data-collection or assessments are conducted, gender dimensions will be considered. The project will collect sex-disaggregated data with the overall aim of constructing a baseline scenario against which forward progress in female participation in all pertaining activities, in particular capacity building activities, can be tracked. UNIDO will join forces with project partners and stakeholders in order to advance internationally agreed-upon development goals related to gender equality, including linking SDG 9 to SDG 5.

In sum, the project design acknowledges the gendered differences of hydrogen energy considering distribution of economic activities and social roles between women and men in the sector.

B 6. Environmental and Social Assessment

As per UNIDO Environmental and Social Safeguards Policies and Procedures (ESSPP), the Environmental and Social screening template has been completed and this project has been categorized as 'B'. Category B projects are likely to have less adverse impacts on human populations or environmentally important areas than those of Category A projects. As a result, an

Environmental and Social Management Plan (ESMP) that outlines the environmental and social risks and the related mitigation measures will be developed during the inception phase.

C. THE PROJECT

C1. Project Logical Framework

Intervention logic	Indicators	Means of Verification	Assumptions
Impact			
Fight against climate change by limiting greenhouse gasses emission globally.	Progress towards the achievement of the SDGs, in particular SDGs 5, 7, 9, 13 and 17.	# Regular monitoring of SDG progress	

Intervention logic	Indicators	Means of Verification	Assumptions
Outcome			
<p>More cost effective, efficient and widespread global use of hydrogen technology promoted by establishment of the International Hydrogen Energy Centre (IHEC) in China:</p> <p><i>-IHEC has contributed towards hydrogen technology development.</i> <i>-Policymakers, academics, students and entrepreneurs have expanded knowledge on the hydrogen technology and its use.</i> <i>- Countries increasingly implement hydrogen technology in domestic markets.</i></p>	<p>ENV.5: Number of new or improved green products made available or used</p> <p>TEC.2: Number of countries showing the adoption of new technologies</p> <p>KASA.2: Number of actors gaining skills on UNIDO knowledge areas</p>	<p># Regular monitoring of center's activities and achievements.</p> <p># Increase of global use of hydrogen energy.</p> <p># Feedback from partners</p>	All partners were actively involved in the center's work

Intervention logic	Indicators	Means of Verification	Assumptions
Output 1			
Support setting up the International Hydrogen Energy Center (IHEC)	CPO.1: Number of global fora, workshops/EGM/side events organized, developed roadmap.	# Gathering information from participants and/or events	Legal status of IHEC is approved by local Government.

	PAO.1: Number of industrial strategies and industrial policy documents drafted / prepared	# International market analysis report is made available	
Activities			
Activity 1.1 Organize international workshops, EGM (gender-responsive).			
Activity 1.2 Draft hydrogen national and/or international market analysis report under consideration of gender-dimensions.			
Activity 1.3 Organize and participate in events and global forums to increase visibility of IHEC. Facilitate good connection and support of the UNIDO network, introduce international technologies and experts, and reflect the value of cooperation with international institutions.			
Activity 1.4 Help to clarify the responsibilities and division of labor and management mechanism of the International Hydrogen Energy Center to Beijing Yitong Hydrogen Energy and Fuel Cell Technology Innovation Research Institute. (Gender balanced).			
Activity 1.5 Support completion of the internal regulations of the IHEC (gender balanced), technical activities, and capacity building.			
Activity 1.6 Support establishment of the Steering Committee (gender balanced), IHEC Council, Strategic Development Committee (SDC) and Scientific Advisory Committee (SAC).			
Activity 1.7 Facilitate public-private communication and demand-and supply-side matchmaking for the updated need assessment.			
Activity 1.8 Organize regular meetings for the Steering Committee and ensure that relevant documents and materials are prepared and distributed in a timely manner.			
Activity 1.9 Support the establishment of the International Hydrogen Energy Center (IHEC) by helping to set up R&D centers and other business departments.			
Activity 1.10 Develop (gender-responsive) roadmap for future IHEC operations. Make recommendations for hydrogen energy strategic planning and research and development directions.			
Activity 1.11 Develop gender awareness of IHEC staff (provide training to IHEC staff on gender dimensions); establish gender focal point at the IHEC			
Output 2			
Facilitate hydrogen energy technology research and development.	TCO.1: Number of capacity building activities provided CPO.3: Number of international networks and platforms for which UNIDO is providing secretariat functions	# The global hydrogen energy development report is made available. # Scientific network is established, including women's chapter	Network is well established and international experts are involved
Activities			
Activity 2.1 Draft annual research work plan with EGM support			
Activity 2.2 Organize and participate in events and global forums to increase visibility of IHEC and its research goals.			

Activity 2.3 Organize regular meetings for the Steering Committee and ensure that relevant documents and materials are prepared and distributed in a timely manner.			
Activity 2.4 Help to strengthen international hydrogen energy technology exchange by holding international hydrogen energy seminars and cooperating in the preparation of a (gender-responsive) global hydrogen energy development report.			
Activity 2.5 Enable communication of the scientific research resources of top scientific research institutions and leading enterprises at home and abroad, and help to build an international hydrogen energy technology research and development network. Establish a women's chapter under the network			
Activity 2.6 Support development of the global hydrogen energy development report.			
Output 3			
Promote demonstration of hydrogen energy application	CPO.1: Number of global fora, workshops/EGM/side events organized	# New hydrogen technology demonstration products are made available or used during the events # Gathering information from participants and/or events	Successful cooperation with partners and local governments and enterprises. New products are invented.
Activities			
Activity 3.1 Organize and participate EGM meetings			
Activity 3.2 Help to strengthen international hydrogen energy technology exchange by organising seminars and workshops (based on a gender-sensitive training needs assessment)			
Activity 3.3 Organize regular meetings for the Steering Committee and ensure that relevant documents and materials are prepared and distributed in a timely manner.			
Activity 3.4 Relying on the layout of the national hydrogen energy industry, combining regional resource endowments and industrial characteristics, support IHEC to carry out demonstration and application of hydrogen energy technology in Beijing, Tianjin and Hebei.			
Activity 3.5 Support IHEC to carry out collaboration with upstream and downstream enterprises in the hydrogen energy industry chain.			
Output 4			
Project Monitoring, reporting and evaluation (MRE).	Number of evaluations conducted	# Reports are made available.	Experts are available for evaluation
Activities			
Activity 4.1 Six-monthly progress reports to Managing Directors office of UNIDO and biannual reports document for Donors (CICETE) are available.			
Activity 4.2 Monitoring, evaluation and coordination including donor participation			

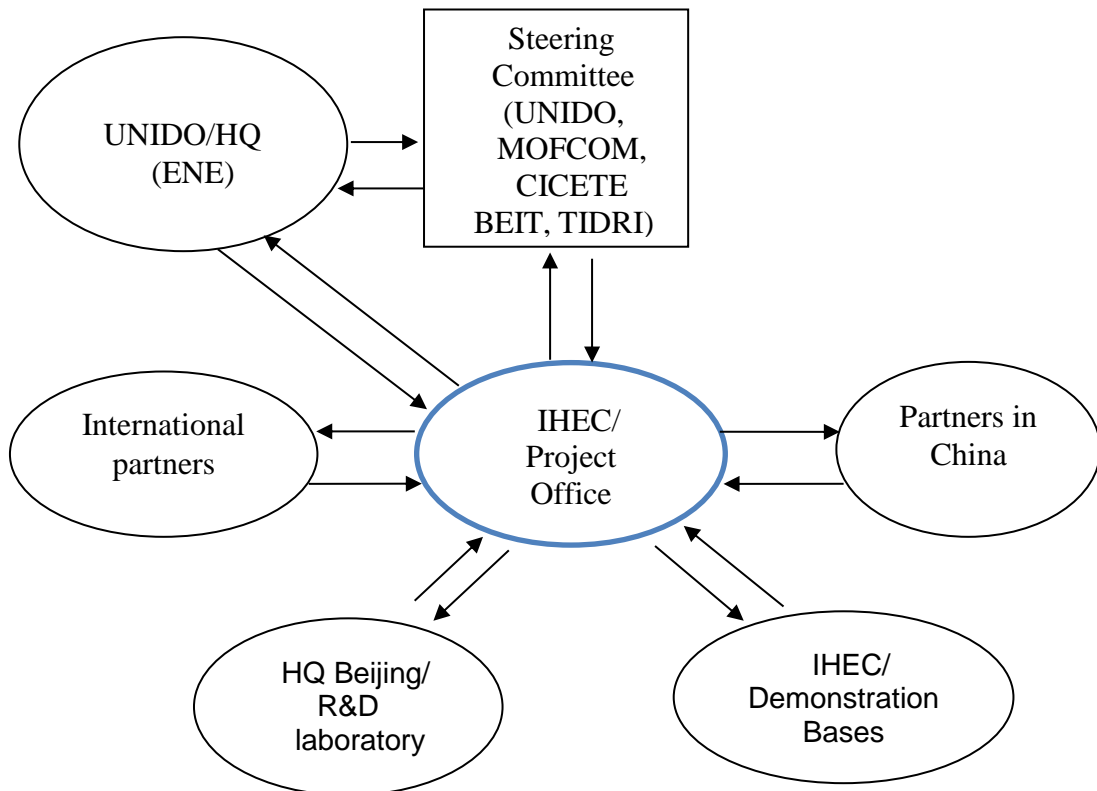
C2. Risks & Mitigation measures

Results	Assumption & Risks				
Project element	Risk Description	Risk Type	Risk Level	Assumptions	Mitigation Measures
IHEC/China	External factors such as unforeseeable changes in macroeconomic and political stability and policy environment may negatively impact the effective participation and engagement of existing and potential partners.	Beneficiaries	Low	Mutually beneficial cooperation will ultimately be conducted among partners in appropriate countries.	Ensure proper sensitization on the importance of IHEC, green hydrogen as key fuel for decarbonization, to reach climate goals and protect the environment and a strong and open channel of communication among stakeholders.
IHEC/China	Institutional capacity and will in key delivery agents and intermediaries / private sector.	Institutional	Medium	Mutually beneficial cooperation will ultimately be conducted among partners in appropriate countries.	Ensure proper sensitization on the importance of IHEC and a strong and open channel of communication among stakeholders.
IHEC/China	Historical relationship between and among intermediaries might impact the willingness to get involved in the project/ share knowledge.	Interrelation	Low	Consensus will be reached based on communication and consultation already conducted between parties.	Ensure proper sensitization on the importance of IHEC and a strong and open channel of communication among stakeholders and potential partners.
IHEC/China	Consensus may not be reached on the management model of the IHEC	Project Management	Medium	Consensus will be reached based on communication and consultation already conducted between UNIDO and MOFCOM/CICETE.	UNIDO and MOFCOM had held several rounds of consultation and have reached preliminary consensus regarding the new management model.
IHEC/China	There could be a risk of resistance against the involvement of women or activities that promote GEEW. Or there could be a lack of interest in, the project activities from stakeholders, especially with regard to the active promotion of gender equality. Low participation rates of suitable female candidates due to lack of interest, inadequate project activity or missing qualified female population within engineering	Social and Gender Risk	Low		To mitigate this risk a gender analysis will be conducted based on which a gender action plan will be developed that defined detailed activities to reach the gender related goals of the project. For instance, the project will pursue thorough and gender responsive communication showing the benefits of gender equality for the country, IHEC and both women and men. The project will ensure stakeholder involvement at all levels, with special regard to involving both women and men, as well as CSOs and NGOs promoting GEEW, and gender experts. This shall mitigate social and gender related risks, promote gender equality, create a culture of mutual acceptance and understanding, and maximize the potential contribution of the project to improving gender equality in the energy field.

	sector.			To attract qualified female candidates to the project, adequate and gender responsive outreach will be carried out involving women's groups and associations, while also making trainings and workshops accessible for women, e.g. by providing safe transport, offering childcare, offering trainings at suitable times for women when children are in school and day-care, etc. If necessary and in the scope of the project additional bridging courses for women will be considered, developed and implemented to empower women.
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C3. Institutional Arrangements and Coordination Mechanism

Under the overall supervision and guidance of the Director of the Department of Programmes, Partnerships and Field Integration (PPF) at UNIDO Headquarters, the project will be coordinated by the Department of Energy (ENE) in cooperation with other relevant PTC departments, regional divisions, field offices and among other UNIDO centres and networks. The project will be governed by a Project Steering Committee (PSC), which will be composed of representatives from UNIDO, MOFCOM, CICETE, BEIT and TIDRI. The Project Steering Committee, which will convene at least once every year. It will provide strategic guidance for planning, implementing and monitoring of the project activities.



The UNIDO strategy within the IHEC will be defined in collaboration with Chinese stakeholders, aiming at finding the best synergies between UNIDO and the main IHEC partners. Responsibilities and accountabilities are described in chapter “C3.2 Funds Mobilization and sustainability”.

Stakeholders will also consider relevant gender focal points and experts, as well as local and international associations and/ or agencies promoting gender equality and women’s empowerment, in particular those focusing on the nexus between gender and hydrogen.

CICETE should be informed and consulted in advance by UNIDO and the project executing agency prior to significant issues related to the important project activities.

C3.1 Project Implementation

As shown in the above chart, the Project Office is the key player for the actual implementation of this project. The project office will undertake two main types of activities:

Operational activities. These assure that the Center is running various awareness-raising events and undertake related promotional activities:

- Liaison with UNIDO/HQ, the government and cooperation partners;
- Undertaking publicity for the IHEC by means of gender-responsive publications and promotional material;
- Organizing workshops, seminars or forums on subjects related to hydrogen technology, also considering relevant gender dimensions;
- Organizing exchange visits between China and other developing countries, etc.

TC programmatic activities. These would assure the management of ongoing and proposed IHEC projects. In line with international established principles, the activities would be:

- Research project identification;
- Research project selection;
- Research project formulation and development;
- Research project implementation;
- Research project reporting and monitoring.

Overall, UNIDO’s rules and regulations will be followed, which includes the above-mentioned activities.

C3.2 Funds Mobilization and sustainability

The initial funding partner of the project will be the Central Government of China. For decades, research in new innovative technologies has been receiving strong government support, both financially and technically. Given the role of industrial development in China's spectacular development success over the last forty years, the Government views sustainable industrial development as an important element and believes that renewable energy should serve as a pillar for sustainable development.

According to initial communication, the Beijing Municipal Bureau of Economy and Information Technology (BEIT) will manage financial support for the establishment of the IHEC. It will coordinate with the relevant district government to provide special support for the establishment of the IHEC in accordance with the relevant management model of Beijing's new R&D guidelines.

The Beijing Tsinghua Industrial Development Research Institute will be responsible for organizing and coordinating the establishment and operation of the IHEC, coordinating the scientific research of Tsinghua University, building a cooperative R&D network for the center, and coordinating the establishment of hydrogen by the Tsinghua Institute of Technology Energy industry chain resources..

The IHEC will be established to support technical hydrogen industrial application. Beijing Yihuatong Technology Co., Ltd., as a leading enterprise and industrial partner of TIDRI will provide financial support for the establishment and operation of the IHEC and provide demonstration and application of hydrogen energy technology research and development organized by the IHEC and support for industrial applications and marketing.

C4. Focus areas and potential cooperating partners

After several rounds of discussions, consultations and expert group meetings, the following potential partners have been identified for undertaking future concrete activities or technical cooperation under the project:

- New Energy & Industrial Technology Development Organization (NEDO).
- Hydrogen Europe: Hydrogen Europe is an umbrella association representing the European Industry, Research, and National and Regional Association in the Hydrogen and Fuel Cell sector (Collection of hydrogen associations from Spain, France, Denmark, Bulgaria, Germany, Hungary, Sweden, Latvia, Norway, Romania, UK and Belgium).

- Hydrogen Council (launched at the World Economic Forum 2017 and a sponsor at COP23) is a global initiative of leading energy, transport and industry companies with a united vision and long-term ambition for hydrogen to foster the energy transition.
- International partnership for Hydrogen and Fuel Cells in the Economy
- Fuel Cells and Hydrogen Joint Undertaking (FCH JU) is a unique public private partnership supporting research, technological development and demonstration (RTD) activities in fuel cell and hydrogen energy technologies in Europe.
- Global Hydrogen Energy Research Unit in the Tokyo Institute of Technology
- International Research Center for Hydrogen Energy, Next-Generation Fuel Cell Research Center in Kyushu University
- Member States, which already expressed interest in hydrogen energy in their respective national energy strategies, include China, India, Brazil, Poland, South Korea, Japan, Australia and South Africa.

C4.1 Renewable and Clean Energy – Hydrogen

By embracing sustainable energy, developing countries will be able to ease the pressures of energy shortages, increase prosperity and reduce the risk of climate-related loss and damage. China today is a leader in hydrogen, solar, small hydropower, biogas and wind energy applications. It has developed many low-cost alternatives such as small hydropower projects, small-scale solar photovoltaic systems and water-heating systems as well as centralized and decentralized biogas systems. The collaborations in hydrogen can be in the form of technology transfer and strengthening capacity of the partners in other developing countries.

C4.2 Training – Capacity-Building

Capacity-building is crucial for the successful promotion of sustainable industrial development. Appropriately designed training programmes, which ensure gender-responsive training in innovative policy formulation will strengthen developing countries' capacities, improve effectiveness and enable them to absorb and adopt new technologies and innovations to meet the specific developmental needs. Thereby, it can assist in the modernization of local industry and enhance the economic impact. China pledged to offer more aid to developing countries, and capacity building is one of the priorities. Many Chinese institutions have accumulated vast experience in developing and implementing capacity-building programmes and tailor-made courses.

The project will closely work with relevant governmental agencies in creating awareness on hydrogen industrial technology and development using training programmes and information

dissemination mechanisms. This will provide benefits for the potential hydrogen users such as government agencies, Non-Government Organization (NGOs), individual companies, etc. who would want to be involved in hydrogen development and application.

The IHEC will be strengthened with sufficient capacity building and resources such as guidebooks, manuals, case studies, training materials to ensure the training activities are sustained after the completion of this project. The proposed project will also link up with the national and international hydrogen associations to share experiences and best practices and conduct joint capacity building. The successful implementation of hydrogen projects in line with proven technical assistance will be good case studies for the hydrogen application in China, as well as other countries and developing nations. A detailed training and capacity building strategy will be developed based on a capacity needs assessment (that considers gender dimensions) and conducted during the establishment period.

C4.3 Trade, Investment and Innovation

It has been widely recognized that trade is an important engine for development. The integration of countries and their business operators in global and/or regional supply and value chains can help accelerate economic development alongside compliance with international standards in production process, product and environmental requirements. In order to succeed in an export-led growth strategy, a country or region must be able to attract investment (foreign or local) and facilitate technology transfer and innovation. A number of middle-income countries, for example China, among others, have demonstrated how to achieve this with remarkable results. Their experiences and lessons learned could be replicated in other developing countries through south-south, triangular and regional cooperation.

D. BUDGET ITEMS

D1. Counterpart inputs

The project intends to apply for the UNIDO Industrial Development Fund to support US \$500,000 (including 13% project supporting cost). Beijing Yitong Hydrogen Energy and Fuel Cell Technology Innovation Institute will apply to the Beijing Municipal Government for CNY 4.85 million per year for a total of CNY 24.25 million (including 10% project support cost and excluding 3% for CICETE support cost) in project allocation over five years.

This input to the project will be comprised of two different sets: (i) the inputs required to undertake the IHEC promotional activities and (ii) the inputs required to run the IHEC project office under the service sub-contract arrangement.

China has shown their interest in hydrogen energy in multiple ways, among them to take part in the establishment of the IHEC as well as adding hydrogen development in national plans. After the IHEC establishment, as the owner of the Center it is expected that the Government of China will continue to support the IHEC for its sustainability. Therefore, it is believed that the second Phase of the project could be supported by the Government of China, where the IHEC scientific strength and application could be enhanced. The future project development funding can also potentially come from other partner countries.

D2. UNIDO inputs

UNIDO will take responsibility through the budget available to support the establishment of the IHEC. Some activities will be through contractual services to be described in TORs and service sub-contracts separately, which include but are not limited to the following,

International and National Experts: To support the day-to-day operations of the IHEC project office, on long-term or ad hoc basis, international and national experts will be recruited with project funding. The job descriptions for international and national experts will be developed separately based on actual needs.

Training: For capacity building of counterpart organizations engaged with the IHEC, workshops and exchange visits will be arranged. In addition, seminars and/or expert group meetings will be held in China on hydrogen technology development and application.

Supplies and Stationery: To maintain normal operations of the office, the project will pay for such expendables as printing cartridges, pens, papers, binders, memory disks, etc.

UNIDO will also provide a wide range of non-financial resources throughout project implementation. These include, but are not limited to, its long-term, field-tested experience in the development of IHEC interventions, in particular in supporting the transfer of industrial technologies and experiences among Southern countries, its existing partnerships and networks with which the project is expected to create synergies and achieve a multiplier effect.

D3. Budget allocation

The detailed budget with yearly allocations is shown as the following: 24,250,000 CNY in the Table 1 below and 500,000 USD in the following Table 2:

Table 1: Budget allocation 24,250,000 CNY *

BLs	Description	2020		2021		2022		2023		2024		Total	
		(CNY)	(USD)	(CNY)	(USD)	(CNY)	(USD)	(CNY)	(USD)	(CNY)	USD	(CNY)	(USD)
Outcome: More cost effective, efficient and widespread global use of hydrogen technology by establishment of the International Hydrogen Energy Centre (IHEC) in China. It will facilitate fight against climate change by limiting greenhouse gasses emission globally.													
Output 1: Support setting up the International Hydrogen Energy Center (IHEC)													
1100	International Consultants	200,000	27,992	200,000	27,992		0		0		0	¥ 400,000	\$55,983
1600	Staff Travel	200,000	27,992	100,000	13,996		0		0		0	¥ 300,000	\$41,987
1700	National Consultant	80,000	11,197	80,000	11,197	80,000	11,197	84,349	11,805	85,000	11,896	¥ 409,349	\$57,292
2100	Contractual Services	300,000	41,987	400,000	55,983		0		0		0	¥ 700,000	\$97,971
3500	International Meetings	100,000	13,996	100,000	13,996		0		0		0	¥ 200,000	\$27,992
5100	Other Direct Costs	100,000	13,996	100,000	13,996		0		0		0	¥ 200,000	\$27,992
Sub-Total Output 1 CNY/USD		¥ 980,000	\$137,159	¥ 980,000	\$137,159	¥ 80,000	\$11,197	¥ 84,349	\$11,805	¥ 85,000	\$11,896	¥ 2,209,349	\$309,216
Output 2: Facilitate hydrogen energy technology research and development.													
1100	International Consultants	500,000	69,979	500,000	69,979	500,000	69,979	500,000	69,979	500,000	69,979	¥ 2,500,000	\$349,895
1600	Staff Travel	200,000	27,992	200,000	27,992	200,000	27,992	200,000	27,992	200,000	27,992	¥ 1,000,000	\$139,958
1700	National Consultant	80,000	11,197	90,000	12,596	180,000	25,192	180,000	25,192	180,000	25,192	¥ 710,000	\$99,370
2100	Contractual Services	900,000	125,962	900,000	125,962	900,000	125,962	900,000	125,962	900,000	125,962	¥ 4,500,000	\$629,811
3000	Train/Fellowship/Study	500,000	69,979	500,000	69,979	500,000	69,979	500,000	69,979	500,000	69,979	¥ 2,500,000	\$349,895

3500	International Meetings	200,000	27,992	200,000	27,992	200,000	27,992	200,000	27,992	200,000	27,992	¥ 1,000,000	\$139,958
5100	Other Direct Costs	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	¥ 500,000	\$69,979
Sub-Total Output 2 CNY/USD		¥ 2,480,000	\$347,096	¥2,490,000	\$348,495	¥ 2,580,000	\$361,092	¥ 2,580,000	\$361,092	¥ 2,580,000	\$361,092	¥ 12,710,000	\$1,778,866
Output 3: Promote demonstration of hydrogen energy application													
1100	International Consultants	100,000	13,996	100,000	13,996	200,000	27,992	200,000	27,992	200,000	27,992	¥ 800,000	\$111,966
1600	Staff Travel	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	¥ 500,000	\$69,979
1700	National Consultant	180,000	25,192	180,000	25,192	180,000	25,192	180,000	25,192	180,000	25,192	¥ 900,000	\$125,962
2100	Contractual Services	100,000	13,996	100,000	13,996	800,000	111,966	800,000	111,966	850,000	118,964	¥ 2,650,000	\$370,889
3000	Train/Fellowship/Study	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	¥ 500,000	\$69,979
3500	International Meetings	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	100,000	13,996	¥ 500,000	\$69,979
5100	Other Direct Costs	100,000	13,996	100,000	13,996	192,035	26,877	192,035	26,877	192,035	26,877	¥ 776,105	\$108,622
Sub-Total Output 3 CNY/USD		¥ 780,000	\$109,167	¥ 780,000	\$109,167	¥ 1,672,035	\$234,015	¥ 1,672,035	\$234,015	¥ 1,722,035	\$241,013	¥ 6,626,105	\$927,376
Monitoring, reporting and evaluation (MRE)													
1100	International Consultants	30,000	4,199	30,000	4,199	30,000	4,199	30,000	4,199	30,000	4,199	¥ 150,000	\$20,994
2100	Contractual Services	30,000	4,199	30,000	4,199	30,000	4,199	30,000	4,199	30,000	4,199	¥ 150,000	\$20,994
3500	International Meetings	30,000	4,199	30,000	4,199	30,000	4,199	30,000	4,199	30,000	4,199	¥ 150,000	\$20,994
5100	Other Direct Costs	10,000	1,400	10,000	1,400	10,000	1,400	10,000	1,400	10,000	1,400	¥ 50,000	\$6,998
Sub-Total MRE CNY/USD		¥ 100,000	\$13,996	¥ 100,000	\$13,996	¥ 100,000	\$13,996	¥ 100,000	\$13,996	¥ 100,000	\$13,996	¥ 500,000	\$69,979
TOTAL CNY/USD		¥ 4,340,000	\$607,418	¥4,350,000	\$608,817	¥ 4,432,035	\$620,299	¥ 4,436,384	\$620,907	¥ 4,487,035	\$627,997	¥ 22,045,454	\$3,085,438
PSC (10%) CNY/USD		¥ 434,000	\$60,742	¥ 435,000	\$60,882	¥ 443,204	\$62,030	¥ 443,638	\$62,091	¥ 448,704	\$62,800	¥ 2,204,545	\$308,544
GRAND TOTAL CNY/USD		¥ 4,774,000	\$668,160	¥4,785,000	\$669,699	¥ 4,875,239	\$682,329	¥ 4,880,022	\$682,998	¥ 4,935,739	\$690,796	¥ 24,249,999	\$3,393,982

* Note: The exchange rate for CNY and USD is based on UN exchange rate (1 USD=7.145 CNY) on 1 June 2020

Table 2: Budget allocation 500,000 USD

BLs	Description	2020	2021	2022	2023	2024	Total
		(USD)	(USD)	(USD)	(USD)	(USD)	(USD)
<p>Outcome: More cost effective, efficient and widespread global use of hydrogen technology by establishment of the International Hydrogen Energy Centre (IHEC) in China. It will facilitate fight against climate change by limiting greenhouse gasses emission globally.</p>							
<p>Output 1: Support setting up the International Hydrogen Energy Center (IHEC)</p>							
1100	International Consultants	10,000	5,000				\$ 15,000
1500	Local Travel	2,000					\$ 2,000
1600	Staff Travel	2,000					\$ 2,000
1700	National Consultants	2,000					\$ 2,000
3500	International Meetings	5,000	5,000				\$ 10,000
4500	Equipment	1,000					\$ 1,000
5100	Other Direct Costs	2,000	2,000				\$ 4,000
Sub-Total Output 1 USD		\$ 24,000	\$ 12,000				\$ 36,000
<p>Output 2: Facilitate hydrogen energy technology research and development.</p>							
1100	International Consultants	10,000	10,000	10,000	10,000	10,000	\$ 50,000
1500	Local Travel	2,000	2,000	2,000	2,000	2,000	\$ 10,000
1600	Staff Travel	5,000	5,000	5,000	5,000	5,000	\$ 25,000
1700	National Consultants	2,000	2,000	2,000	2,000	2,000	\$ 10,000
3000	Train/Fellowship/Study	2,000	2,000	2,000	2,000	2,000	\$ 10,000
3500	International Meetings	10,000	10,000	10,000	10,000	10,000	\$ 50,000

4500	Equipment	1,000	1,000	1,000	1,000	1,000	\$ 5,000
5100	Other Direct Costs	5,000	5,000	5,000	5,000	5,000	\$ 25,000
Sub-Total Output 2 USD		\$ 37,000	\$ 37,000	\$ 37,000	\$ 37,000	\$ 37,000	\$ 185,000
Output 3: Promote demonstration of hydrogen energy application							
1100	International Consultants	10,000	10,000	10,000	10,000	10,000	\$ 50,000
1500	Local Travel	2,000	2,000	2,000	2,000	2,000	\$ 10,000
1600	Staff Travel	5,000	5,000	5,000	5,000	5,000	\$ 25,000
1700	National Consultants	5,000	5,000	5,000	5,000	5,000	\$ 25,000
3000	Train/Fellowship/Study	2,000	2,000	2,000	2,000	2,000	\$ 10,000
3500	International Meetings	5,000	5,000	5,000	5,000	5,000	\$ 25,000
4500	Equipment	1,000	1,000	1,000	1,000	1,000	\$ 5,000
5100	Other Direct Costs	5,000	5,000	5,000	5,000	5,000	\$ 25,000
Sub-Total Output 3 USD		\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 35,000	\$ 175,000
Monitoring, reporting and evaluation (MRE)							
1100	International Consultants	4,000	4,000	4,000	4,000	5,478	\$ 21,478
3500	International Meetings	5,000	5,000	5,000	5,000	5,000	\$ 25,000
Sub-Total MRE USD		\$ 9,000	\$ 9,000	\$ 9,000	\$ 9,000	\$ 10,478	\$ 46,478
TOTAL USD		\$ 105,000	\$ 93,000	\$ 81,000	\$ 81,000	\$ 82,478	\$ 442,478
PSC (13%) USD		\$ 13,650	\$ 12,090	\$ 10,530	\$ 10,530	\$ 10,722	\$ 57,522
GRAND TOTAL USD		\$ 118,650	\$ 105,090	\$ 91,530	\$ 91,530	\$ 93,200	\$ 500,000

E. MONITORING, REPORTING AND EVALUATION

The project will be implemented by the Department of Energy (EAE/ENE) in coordination and cooperation with the local project counterpart, the Beijing Tsinghua Industrial Development Research Institute (TIDRI). All dimensions of the project will be monitored using appropriate business and project management techniques to ensure high fidelity between process and objectives. Reviews of the project's progress will be undertaken by the Project Steering Committee through its regular Project Steering Committee meetings (at least once per year), as well as consultations on an ad-hoc basis. The local project counterpart shall submit to CICETE every six months a financial report regarding its contributions to the project.

The UNIDO project manager will provide CICETE half-yearly project progress report, complemented by uncertified statements. The reports will provide the basis for the Steering Committee's decisions regarding the pertinence of the Centre's annual work plan. In addition, the final report, submitted within six months of the operational completion of the project, will provide a detailed overview of the overall implementation of the project activities as spelled out in this project document.

If UNIDO considers that changes between components and/or additional services, not foreseen in the project document, are required, UNIDO will, after consultation with the local counterpart, submit a revised budget for consultation with CICETE showing the required changes in inputs and/or adjusted financing that will be necessary.

In addition to these reports, UNIDO will provide the Government with the following statements in the format normally followed by UNIDO for accounting and financial reporting:

- An annual financial statement in respect of the project accounts established, showing income and expenditure for the year, and assets and liabilities as of 31 December of each calendar year. The statement shall be supported by a delivery report, in the form of a statement of allotments and expenditures, in respect of the activities of the IHEC/China financed from the project account.
- A final financial statement in respect of the project account within six months of the termination or expiration of this project.

UNIDO and CICETE shall invite each other to participate in any evaluation process to be conducted during or at the time of completion of the programme.

Beside a self-evaluation at the end of the project, the project will also be subject to midterm

evaluation and an independent terminal evaluation in accordance with the established UNIDO procedures, monitored in the same standardized approach as any other UNIDO project, focusing on assessing the project's effectiveness.

All monitoring and evaluation tools and documents, such as the monitoring plan, progress reports, final evaluation report, and thematic evaluations (e.g. training needs assessment), will include gender dimensions, and report with respect to an established baseline for gender related targets.

F. PRIOR OBLIGATIONS AND PREREQUISITES

Start of project activities requires release of the necessary funds from the special purpose contribution of China under the Industrial Development Fund (IDF). In the endorsement letter sent by CICETE to UNIDO on 4th June 2020, it mentioned that the Government of China does agree to UNIDO drawing the required project funds from the IDF-China.

G. LEGAL CONTEXT

The Government of the People's Republic of China agrees to apply to the present project, *mutatis mutandis*, the provisions of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed on 29 June 1979 and entered into force on 24 June 1985.

With respect to TC programmes/projects elaborated under output 3, it is expected that their implementation in the target countries will also be governed by the provisions of the Standard Basic Cooperation Agreements concluded between the Governments of the recipient country concerned and UNIDO or – in the absence of such an agreement – by one of the following: (i) the Standard Basic Assistance Agreement concluded between the recipient country and UNDP, (ii) the Technical Assistance Agreements concluded between the recipient country and the United Nations and specialized agencies, or (iii) the Basic Terms and Conditions Governing UNIDO Project.

ANNEXES



中国国际经济技术交流中心

China International Centre for Economic and Technical Exchange

Mr. Ma Jian
Deputy Representative
UNIDO Regional Office
Beijing, China

June 4, 2020

Subject: Endorsement of Project Proposal - Supporting the International Hydrogen Energy Centre (IHEC) in China

Dear Mr. Ma Jian,

I am pleased to receive the letter regarding the proposed project, which is designed to support the International Hydrogen Energy Centre (IHEC) in its capacity building, R&D, technology application, international exchange and cooperation, etc.

As you mentioned in your letter, the use of hydrogen energy will not only effectively help reduce carbon emissions as an important means of tackling climate change, but also nurture a new growth point for industries and technologies. We are of the view that the project is both in line with UNIDO's main development priorities and China's goals in achieving high quality and sustainable industrial development. Hereby, on behalf of CICETE, I agree to provide the project with USD500,000 from China's special purpose contribution to IDF, in addition to RMB25,000,000 as cost-sharing committed by project counterparts. The above funds shall include the support costs.

It will be very much appreciated if UNIDO could further develop the project document at an early date.

With best regards,

Yours sincerely,

Zhang Yi

Deputy Director-General
China International Center for Economic
& Technical Exchanges