



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION



UNIDO GLOBAL CALL 2023 TECHNOLOGY SOLUTIONS

Clean and Smart Energy for Inclusive
and Sustainable Industrial Development

FOREWORD



Excellencies,
Ladies and Gentlemen,

The past years show clearly that climate change is an existential threat to a sustainable future.

Energy is the basis for all development. It is the decisive motor that moves everything else. Access to sustainable energy is even more important than ever as the world recovers from the impacts of the COVID pandemic. Affordable and Clean Energy – SDG 7 – is absolutely key, it is where we need great investments in our shared future.

We need a green energy transition at the global level, using the possibilities of innovative digital technologies. Therefore, the UNIDO Global Call 2023 has the theme of "Clean and Smart Energy for Inclusive and Sustainable Industrial Development".

As a flagship programme, the UNIDO Global Call has been focusing on innovative technologies for the past three years. We have received over 2,000 applications from 108 countries. This year, UNIDO ITPO Beijing is taking the lead. ITPO Beijing will work with the entire UNIDO Investment and Technology Promotion network, as well as other international organizations within the UN system, to increase the global reach of our Global Call. I am very glad that we are also being actively supported by policy, industry, and knowledge partners from around the world.

Global Call 2023 focuses on three strategic categories, with Green Hydrogen at the core, and Energy Efficiency and Clean Energy Innovation alongside it.

Hydrogen is one of the most abundant elements on Earth. It gives us a unique opportunity for a clean energy transition. Green hydrogen can play a vital role in industrial decarbonization, especially in the critical but high emissions steel, cement, and chemical industries. Green hydrogen is an immense opportunity, especially for developing countries and emerging economies. It can help them achieve energy transition, enhance their national energy security, and achieve climate goals. This is the chance for low-carbon industrialization and jobs for millions of people.

Excellencies,

Such a global energy transition is not an easy thing to achieve, but despite difficulties, it is a great opportunity for us all. Under our motto, "Progress by innovation", UNIDO looks forward to working with innovators and partners from all around the world, finding novel solutions for a sustainable future.

Thank you so much.



Scan for Video

Gerd Müller
Director General of UNIDO



BACKGROUND INFORMATION

In response to global challenges like climate change, post-pandemic economic reconstruction, green recovery, and the Decade of Action to deliver the Sustainable Development Goals (SDGs) by 2030, the United Nations Industrial Development Organization (UNIDO) Investment and Technology Promotion Network (ITP Network) has issued Global Call since 2020, with more than 2,000 participants from 108 countries taking part over these three years. As UNIDO's flagship event, this initiative aims to drive a green economic rebound and sustainable industrial growth after the pandemic through global technological innovation and collaboration.

This year, UNIDO Global Call 2023, initiated by UNIDO ITPO Beijing, focuses on clean and smart energy. With the escalating impact of climate change, the urgency for renewable energy and efficiency grows to meet rising energy demands while mitigating irreversible planetary damage. The initiative aims at inclusive and sustainable industrial development by identifying replicable, scalable technological solutions in green hydrogen, energy efficiency and clean energy innovation.

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STRATEGIC CATEGORIES

In the context of the post-COVID green recovery and global challenges, the Global Call 2023 is looking for clean technologies and solutions in the following strategic categories:



Green Hydrogen

- Green hydrogen production (including "super green" hydrogen production)
- Green hydrogen in manufacturing
- Green hydrogen in transportation
- Green hydrogen storage and integration into energy networks



Energy Efficiency

- Digital solutions for energy efficiency
- Secure and efficient energy network (including decentralized energy systems)
- Energy efficiency improvement in industry, construction, and homes
- Industrial design and commercialization of energy efficient products



Clean Energy Innovation

- Renewable energy development and application
- Fuel cell innovation
- Clean energy storage, transportation, and load shifting
- Climate resilience of energy systems



Global Call 2023 Sparks Developing World Engagement

Global Call 2023 attracted 315 clean energy solutions from 60 countries across Asia, Europe, North America, South America, and Africa. These solutions are distributed among three major categories: green hydrogen, energy efficiency and clean energy innovation. Notably, developing countries emerged as significant contributors, claiming 88% of the proposals within these major categories.



2023 GLOBAL CALL Highlights Overview

Number of Applications in Categories

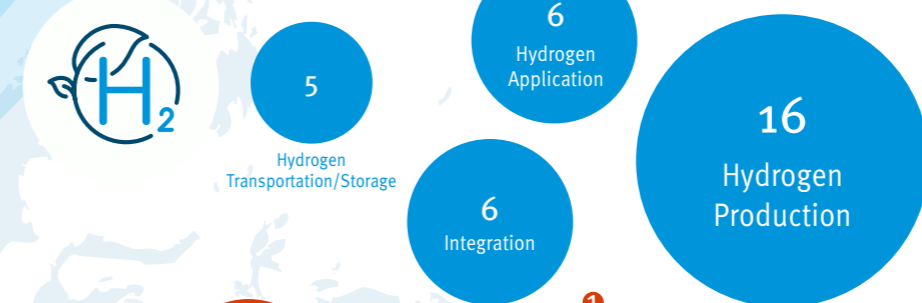
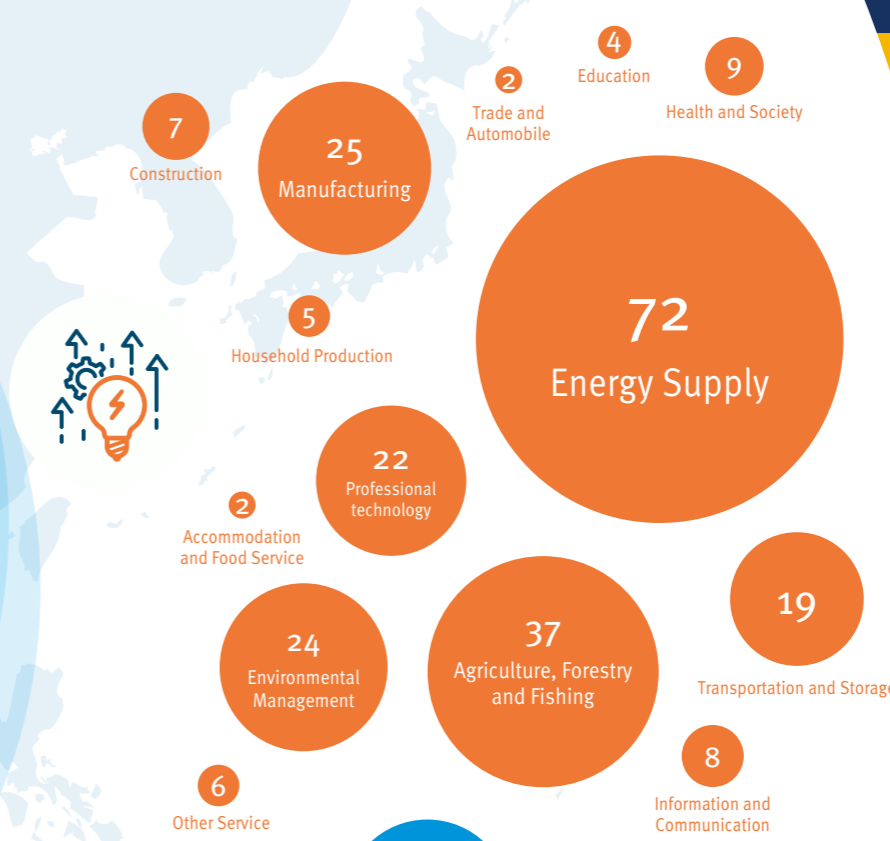
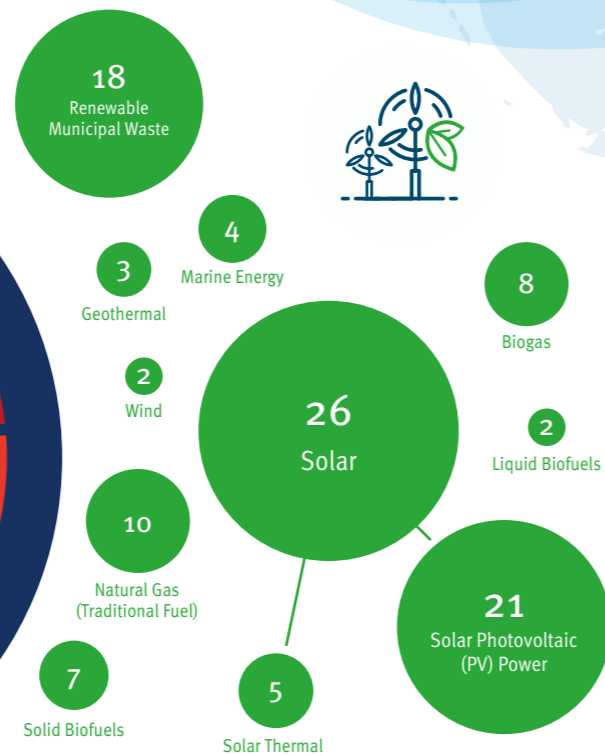


Technical Stage of Solutions



Female/Teenagers Friendly

172



Highlights

Energy Efficiency Covers Different Fields

Energy Efficiency 2023, published by IEA, released during COP28, emphasized the global expansion of measures to improve energy efficiency in 2023, as well as the need to double energy efficiency within a decade to achieve the 1.5° C temperature control goal and ensure energy security. UNIDO Global Call 2023's solutions innovate in areas like data center building, digital energy management, transportation production, and wider solar energy use.

Green Hydrogen Leads Sustainable Development

Hydrogen energy, as the most promising secondary clean energy source of the 21st century, plays a crucial role in achieving deep decarbonization and global energy technology transition. Winning projects in Global Call 2023 offer solutions spanning hydrogen production, transportation, storage, and utilization, fostering innovation and sustainable development. Among this category, six solutions are in startup (50%), four in development (33.3%), and two in the mature stage (16.7%).

Digital Transformation Facilitates Energy Efficiency

Global Call 2023 spotlights the application of digital technology in energy efficiency enhancement and innovation. Through data mining, empowering traditional industries with digital technology, and integrating resources through digital platforms, it creates new business models and services in fields such as decarbonization, energy efficiency optimization, and digital integration, generating diverse value.

Explore Innovative Clean Energy Solutions

Clean energy innovation stands as a pivotal measure to address the global challenges of climate change and energy security. Solutions showcased in Global Call 2023 cover diverse technologies for utilizing water, solar, photovoltaics, biogas, wind, storage, timber, biomass, and related technologies for clean energy integrated utilization.

TARGET GROUPS & EVALUATION

Target Groups

The call for proposals targets private sector entities to submit proposals for each category according to the following sub-categories:

- Technological solutions in the early stage: These are technologies that are at an advanced stage of research and development and ready for implementation, with verified data from testing.
- Technological solutions in the growth stage: These solutions have already been piloted with verified data at a replicable scale and have demonstrated proof of concept (POC).
- Mature technological solutions: These are established technologies on the market that are aiming to expand to new markets.

Evaluation



HIGHLIGHTS

Global and Regional Outreach and Partnership

Global Call 2023 facilitates global and regional collaboration by launching international events and strategically forging global partnerships. Promotional events have been conducted in various locations, spanning the Middle East (United Arab Emirates), Europe (Austria, Germany), and China.



Green and Sustainable Global Call

The Global Call 2023 event focuses specifically on the theme of green energy in its agenda, advocating for the development of green technologies and promoting green innovation. Besides, in pursuit of advancing sustainable development practices, the event has engaged a third-party professional organization to conduct a comprehensive assessment of the total carbon emissions produced during the proceedings. Subsequently, an equivalent volume of carbon credits will be procured to effectively neutralize the event's carbon footprint, thereby attaining full carbon neutrality for Global Call 2023.



HIGHLIGHTS

Targeted Support and Empowerment

The event empowers the growth of enterprises as shortlisted teams receive capacity-building training opportunities from experienced scholars, corporate executives, and international organization experts.



Capacity Building Serial Lectures	
Tie DAI , Professor of Institute of Atmospheric Physics, Chinese Academy of Sciences	Climate Change, Carbon Peaking, Carbon Neutrality, and Their Impact on Energy Enterprises
Hongbo HUANG , Schneider Electric Energy Efficiency Carbon Peaking and Carbon Neutrality Consultant	Facilitating the Carbon Peaking and Carbon Neutrality Plans to Achieve Sustainable Development
Hao JIANG , African Regional Coordination Expert of UNIDO ITPO Beijing	Aid Is Not the Solution to Poverty, Only the Closed-Loop Economy Can Drive Social Development
Xiangyu MENG , Tsinghua University	Tailoring Hydrogen Development to Local Conditions and Market Demands
Wei TIAN , Deputy Director of Member and Institutional Cooperation Department, China Beijing Green Exchange	Active Participation from All Parties Promotes the Development of China's Carbon Market
Zidan ZHU , Assistant General Manager of Strategic Development Department of China Water Environment Group	Distributed Underground Reclaimed Water Ecosystem Contributes to Achieving Sustainable Development Goals
Tao BIAN , Secretary General of the Organization of 50 People for the Transformation of Scientific and Technological Achievements	Carbon Peaking and Carbon Neutrality Goals and the New Power System



Scan for Lecture Videos



Scan for Booth Video

HIGHLIGHTS

Sustained Impact through Promotion and Piloting

The winners of Global Call 2023 showcased their innovations at esteemed international events such as the China International Import Expo (CIIE) and the China International Fair for Investment & Trade (CIFIT). Additionally, they will have the opportunity to set up enduring exhibitions for promotion and matchmaking, including platform like the UNIDO Fourth Industrial Revolution Accelerator (Hangzhou) and collaborations with local industrial parks.



HIGHLIGHTS

Roadshow Booth at the 6th CIIE

At the 6th China International Import Expo (CIIE), the UNIDO ITPO Beijing set up a "Global Call 2023" booth, focusing on showcasing awards winners' advanced technologies in the fields of green hydrogen, energy efficiency, and clean energy innovation. The booth hosted multiple roadshow events, delving into the promotion of innovative technologies and advanced solutions in the energy sector.



JURY MEMBERS

Experts Groups



Supee
TERAVANINTHORN

Special Advisor to the Vice President, Office of the Vice President, Investment Operations Region 2, Asian Infrastructure Investment Bank (AIIB)

Ms. Supee TERAVANINTHORN is Special Advisor to the Vice President of Investment Operations Region 2. Apart from advising the Vice President on some complex operation issues, her focus is on the AIIB planned operations in Non-regional Members, i.e., African and Latin American members. Prior to this position, she leads the Infrastructure Investment Department (Region 2) as Director General. When she was Director General, she was responsible for building up the institutional capacity in investment operations and ensuring the strength and sustainability of overall investment operations. This work ranges from business development to building a well-balanced and diversified investment portfolio, in terms of both quantity and quality. She also managed the effective utilization of investment operations resources in line with the mission and vision of AIIB.



Alois Posekufa
MHLANGA

Chief of Climate Technologies Innovation Unit in the Division of Decarbonization and Sustainable Energy at UNIDO

Mr. Alois Posekufa MHLANGA is the Chief of Climate Technology Innovation Division in the Department of Energy at the United Nations Industrial Development Organization (UNIDO). He has over 20 years of experience in the sustainable energy and climate change field and is passionate about the role of innovation and entrepreneurship in climate action and the energy transition. He was responsible for flagship programs in UNIDO such as the establishment of the regional centers for renewable energy and energy efficiency in the ECOWAS and SADC regions and the Global Cleantech Innovation Program. Before joining UNIDO, Alois was a Renewable Energy Expert at the African Development Bank managing investments in sustainable energy across Africa. Before that, he was the Principal Sustainable Energy Expert at the Southern Centre for Energy and Environment and a Lecturer at the University of Zimbabwe.



Juan Pablo
DAVILA

Senior Industrial Development Officer, Division of Climate and Technology Partnerships, UNIDO

Mr. Juan Pablo DAVILA is an experienced Industrial Development Officer at UNIDO since 2008, where he leads technical assistance projects related to green hydrogen in developing countries. With over 18 years of experience in designing, implementing, and monitoring national, regional, and international technical assistance programs and partnerships, he has expertise in quality infrastructure, skills development, competitiveness, innovation, and climate technologies. Mr. Juan Pablo holds a degree in mechanical engineering from ITESM (Mexico, 1997), a Master's Degree in Technological Innovation from CentraleSupélec (France, 2001), and has completed executive courses on Blockchain Technologies Business Innovations and Clean Energy Solutions from MIT. He is also a lead auditor for ISO 9001.



Ayfer
VEZIROGLU

CFO and Executive Vice President of International Association for Hydrogen Energy

Ayfer VEZIROGLU has graduated from the Marmara University, Istanbul, Turkey, with a B.S. Degree in International Business in 1999. Subsequently, she enrolled at the Industrial Engineering Department of the University of Miami, U.S.A., and graduated with an M.S. Degree in Management of Technology in 2004. She pursued her Doctorate in Hydrogen Powered Transportation Systems and received her Ph.D. from the Instituto Superior Técnico, Lisbon, Portugal, in 2013. Dr. Ayfer VEZIROGLU has authored and/or co-authored forty-eight publications. She has also given several invited talks at conferences and universities. For the last fifteen years, Dr. Ayfer VEZIROGLU has been contributing to the International Association for Hydrogen Energy (IAHE) in various capacities, as the IAHE Comptroller since 2002, as the Trustee and Financial Officer for the IAHE-TNV-Trust since 2007 and as the IAHE Board Director (USA) since 2009, also Executive Vice President and assisting Dr. V with his Presidential Duties for the last few years.



Yabin
WU

Head of UNIDO ITPO Beijing

Prof. Yabin WU is Executive Director of China Association of International Trade, Member of China Info100, Chief Economist of China Venture Capital and Private Equity Association, and Visiting Professor at the University of Sofia. Prof. Wu worked in MOFCOM. He has been engaged in macroeconomic research, formulation of trade and industrial policies and international trade negotiation for a long time. Prof. Wu served as deputy mayor of Yiwu, Zhejiang Province. He was also an independent director of many listed companies. Postdoctoral Fellow in Applied Economics at Peking University, PhD in Management Science and Engineering at Chinese Academy of Sciences, Visiting Scholar of Asia-Pacific institute at Duke University in the United States, Master in Public Policy at University College London in United Kingdom, and Master in Laws at Renmin University of China. The editor of Study on China-Africa Development Cooperation in the New Era, author of Import and China's Practice, etc., and translator of Hardness 10 and Twilight of the Titans: Great Power Decline and Retrenchment, etc.



Zongqiang
MAO

Vice President of the International Association for Hydrogen Energy

Prof. Zongqiang MAO serves as Vice President of International Association for Hydrogen Energy (IAHE), Professor of Tsinghua University, deputy editor of both Acta Energetica Sinica and Chinese Journal of Power Sources and expert for International Partnership for Hydrogen Economy (IPHE). Prof. Mao's professional area is in hydrogen energy, including hydrogen energy practices and hydrogen stratagem research; fuel cell, including PEMFC, MCFC, SOFC. Prof. Mao has published more than 150 scientific papers, 4 books and several Patents. He was a Chief Scientist for the first China National key Hydrogen Fundamental Project (973 Program) in the years 2000-2005. Many high-ranking hydrogen scientists in China are from his group.

JURY MEMBERS

Experts Groups



Xiaolong FU

Deputy Director of International Hydrogen Energy Centre, Deputy Director of Beijing Tsinghua Industrial R&D Institute

Xiaolong FU has previously held positions such as Deputy Head of the Registration Center at Tsinghua University, and Head of the Youth Department of the China Higher Education Information Academy. From 2016 to 2018, he served as the Director Assistant of the Office of Technology Transfer, Tsinghua University, responsible for intellectual property and equity investment. Since 2019, he has been serving as Deputy Director of Beijing Tsinghua Industrial &RD Institute, overseeing the industrialization of technological achievements from Tsinghua University in Beijing.



Jie WANG

Vice President of Schneider Electric, Head of Corporate Affairs and Sustainability in China

Jie WANG graduated from Institut National des Sciences Appliquées (INSA) in 1984 and got an MBA in 2003. Since joining Schneider Electric China in 1996, she has held a number of roles cross various functions including Technical Training Manager, Marketing Communications Manager, and then became the Vice President of Schneider Electric China. Before her employment at Schneider Electric, she has spent six years teaching in Beijing University of Science and Technology and then joined Alcatel China in 1991.



Yongping ZHAI

Senior Advisor of Strategic Development Department, Tencent

Mr. Yongping ZHAI was the Chief Energy Specialist at the Asian Development Bank (ADB), with over 30 years of experience in energy and public affairs. In July 2021, he joined Tencent as Senior Advisor supporting the company's researching and implementing its carbon neutrality strategy.

JURY MEMBERS

Institutions



Chinese Academy of Sciences

The Chinese Academy of Sciences (CAS) is the national academy for natural sciences and the highest consultancy for science and technology of the People's Republic of China. It is the world's largest research organization, with 100 research institutes, 3 universities, 69 thousand full-time employees, and 79 thousand graduate students. It has been consistently ranked among the top research organizations around the world.

Institute of Atmospheric Physics, Chinese Academy of Sciences

Established in February of 1928 (then called institute of Meteorology of Academia Sinica), the IAP was the very first research center carrying out meteorological research in modern China. Today, the IAP has become a comprehensive atmospheric research institution, covering all aspects of the atmospheric sciences.

As of 2020, 515 staff work at the IAP, about 80% of whom are researchers, including 129 full research professors, 198 associate professors, 148 intermediate faculty and postdoctoral researchers, as well as 541 postgraduate students.

IAP's mission is to study and explore new laws governing interactions between physical, chemical and biological processes in the atmosphere and how, in the case of Earth, humans are perturbing these. IAP strives to advance theories, methods and provide the technology to facilitate the monitoring and forecasting of weather, climate and environmental conditions.



Shandong University

Shandong University, or SDU – under the direct jurisdiction of the Ministry of Education – is a key comprehensive university with a long and honorable history, a broad variety of disciplines, strong academic strength and distinctive characteristics, which has had a great influence both at home and abroad. In 2017, the SDU was chosen as one of the first group of China's high-level universities to be listed in the double first-class university program released by the central government of China.

School of Energy and Power Engineering, Shandong University

As one of the earliest founding schools with the most complete disciplines and strong faculties in Shandong University, School of Energy and Power Engineering set up two undergraduate majors in 1958: Thermal power engineering and Internal combustion engines. In 1981, it was one of the first to be approved by the State Council to award master degrees in Engineering Thermophysics and Internal Combustion Engines. The School has established a complete teaching system that covers undergraduate, postgraduate, doctoral and post-doctoral education. Under School of Energy and Power Engineering, there are Energy and Power Engineering as State-level Characteristic Discipline, Energy and Environmental Systems Engineering as School-level talent training base. The School owns Master's degree, Ph.D program and post-doctoral station in Power Engineering and Engineering Thermophysics, In addition, Power Engineering and Engineering Thermophysics is one of the key disciplines in Shandong University supported by "Project 211" and "Project 985". Furthermore, the School has three key disciplines of Shandong Province: Power Machine and Engineering, Engineering Thermophysics, Thermal Power Engineering. Power Engineering and Engineering Thermophysics is selected in the first Characteristic Disciplines of Peak Program (Shandong University) and also in the construction plan of First-Class Subject Group.

UNIDO Global Call 2023
Prize Winners



Green Hydrogen Category

Solutions	Institutions	Nations
Grand Prize		
Green Hydrogen Energy in Hand - A New High Density Solid Hydrogen Storage and Transportation Technology	Xi'an 1908 New Energy Technology Co., Ltd.	China
First Prize		
Plasmon Catalytic Water to Hydrogen (W2H) Reactor Technology	Beijing Guanghe New Energy	China
H2umidity@	Water2kW	Spain
Second Prize		
Go for Green Hydrogen Equipment Whole Industry One Stop Solution for Energy Storage, Fuel Cell Vehicles and Hydrogen Refueling Stations	Jiangsu Guofu Hydrogen Energy Equipment Co., Ltd.	China
Cawolo PEM Water Electrolytic Hydrogen Production Equipment Industrialization Project	Guangdong Cawolo Hydrogen Technology Co., Ltd.	China
High Performance and High Durability Metal Bipolar Fuel Cell Stack (System)	Anhui Mingtian Hydrogen Energy Technology Co., Ltd.	China
Third Prize		
LONGi Hydrogen LONGI ALK Hi1 Series-"Green Power+Green Hydrogen" Solutions	Xi'an LONGi Hydrogen Technology Co., Ltd.	China
Pacha K'anchay	H2 Bolivia	Bolivia (Plurinational State of)
Hydrogen Loading - Promoting the Intelligent and Green Transformation of Industrial Parks	State Grid Hangzhou Qiantang Area Power Supply Company	China
Efficient Thermal Management Technology for Hydrogen Fuel Cells Based on Microheat Pipe Arrays	Zibo Boyi New Energy Technology Development Co., Ltd.	China
Hydrogen Dynamics Generator (HDG) Development	Hydrogen Dynamics Inc.	Canada
Best Innovation Award		
Green Power and Fuel Cell Vehicles	Sunhydro, Inc.	China



Green Hydrogen Category

Grand Prize

Xi'an 1908 New Energy Technology Co., Ltd.

Xi'an 1908 New Energy Technology Co., Ltd. is the world's leading high-tech enterprise for hydrogen energy storage and transportation. It has developed a series of metal hydrides @graphene composite solid-state hydrogen storage materials with high hydrogen storage and release density, wide working conditions, non-catalytic hydrogen release, and high air safety. This solution has fundamentally solved the safety and cost problems of hydrogen energy storage, transportation and use. It can meet the needs of large-scale storage and transportation of hydrogen energy, and be widely used in industrial hydrogen production, power energy storage, mobile applications, and other scenes.

Green Hydrogen Energy in Hand - A New High Density Solid Hydrogen Storage and Transportation Technology

The core technology is metal hydride@graphene composite solid-state hydrogen storage material. Using light metals such as sodium, aluminum, calcium, and lithium, and the world's first graphene interface nanovalve technology, reaction control is carried out at the micro-nano level, solving the problem of high hydrogen storage density, wide working conditions, non-catalytic controlled release of hydrogen from highly active light metals, high air safety storage, and successfully developed a new high-density solid-state hydrogen storage material.

Hydrogen energy storage and transportation solutions based on solid-state hydrogen storage technology have reached international leading levels in terms of safety, efficiency, and cost. High security: normal temperature and pressure storage and transportation, no special equipment is required, ordinary truck/rail transportation; high efficiency: more than 10 times higher than traditional high-pressure gas transportation; low cost: using aluminum, sodium, etc. with the widest reserves and lowest cost hydrogen storage materials.



Application Scenario

- 1 Hydrogen storage and transportation field: Provide hydrogen energy storage and transportation system solutions for new energy hydrogen production or industrial by-product hydrogen projects of energy and petrochemical enterprises to achieve ultra-large-scale storage and ultra-long-distance transportation of hydrogen;
- 2 Power energy field: Provide long-term energy storage solutions for new energy power generation projects, in-situ energy storage, and grid-connected power generation;
- 3 Mobile application fields: Solid-state hydrogen power systems with high energy density, long endurance, and high-security can meet the needs of various mobile terminals such as cars and ships.

Technical Parameters

- Material hydrogen storage weight density: 4wt.%~12.5wt.% adjustable
- Material hydrogen release weight density: 8wt.%~25wt.%, the stored hydrogen can be completely released
- Hydrogen release temperature range: -40°C ~+80°C
- Hydrogen release pressure conditions: Hydrogen can be released normally under any pressure
- Hydrogen release purity: >99.99%
- Does it require a catalyst: No
- Whether purification is required: No
- Air safety: 30 days at 60RH%, hydrogen loss is less than 1%

 Green Hydrogen Category

First Prize

Beijing Guanghe New Energy


GUANGHE is committed to the research and application of cutting-edge plasmon technology, continually developing and offering high-efficiency, low-cost, and large-scale carbon neutral clean energy technology products and solutions.

Plasmon Catalytic Water to Hydrogen (W2H) Reactor Technology

The 'Plasmonic technology for Green Hydrogen Production' of Guanghe New Energy is based on the surface plasmon resonance of nano-catalysts, using sunlight or waste heat as the energy source, enhancing the incident energy on the surface of nano-catalysts and thereafter splitting water into hydrogen and oxygen in one step. Since the energy enhancement can be up to 100 times compared with normal nano-catalysts, the whole process can be completed under mild conditions without high temperatures and pressures. The energy input of this technology is low-grade heat (300°C) and the energy cost can be 50% lower than water electrolysis. The heat storage system is not affected by fluctuations in input capacity and supports 24/7 operation. The reaction employs a neutral medium under normal pressure and temperatures below 300°C with little risk of leakage and ensures complete environmental compatibility.

Moreover, low-grade heat can be obtained from a variety of scenarios such as photo-thermal, waste heat, geothermal and nuclear thermal, making it versatile and suitable for a wide range of applications. Plasmonic technology, with broad commercial application prospects, can not only be used for hydrogen production, but also the production of important industrial materials such as the conversion of carbon dioxide and water into paraffins and olefins as well as the amino acids/peptides production from nitrogen and water. Currently, a pilot project has been completed in Qitaihe, Heilongjiang Province, which has opened up the main industrial processes. Also, Guanghe is cooperating with Baowu Iron and Steel Group in various modes including joint laboratories and several demonstration projects.



 Green Hydrogen Category

First Prize

Water2kW

The activity of Water2kW since its inception has been focused on development of disruptive technologies to produce green hydrogen through water electrolysis. It has a team of managers and advisors with more than 25 years of experience in the energy sector, occupying senior management positions in energy multinationals and a stable R&D&I team in constant growth.

Water2kW has made an intense investigation work that has made it possible to get close to many industries, initiatives, and technology clusters, under different collaboration models and framework agreements in different areas, for example, energy and raw materials supply and new core electrolysis components.

H2umidity®

Water2kW disruptive and patented technology is the prominent solution on the market to produce green hydrogen through electrolysis, contributing to the achievement of 12 of the 17 UN Sustainable Development Goals (SDGs).

Its unique process not only produces green hydrogen, but also generates the necessary conditions both for human development and the environment and biodiversity protection, in addition the technology allows the improvement of industrial processes. Water2kW technology takes advantage of the electrolysis byproducts to generate, among others, electricity, drinking water, ecological disinfectants (H_2O_2), as well as, cold and heat for climatization, making it a 100% circular process. All this, without reducing water resources, or discharging polluting byproducts into the environment thanks to H2umidity®.

H2umidity® guarantees three basic things for human development: WATER SUPPLY, ENERGY AND HEALTH SECURITY. These three pillars in a single sustainable system could significantly contribute to the progress of populations that do not have these resources available or have them in an unstable way.

H2umidity® represents a modular, reliable and easily scalable energy solution based on the production of green hydrogen using environmental humidity as water supply. Our technology enables entering green hydrogen market with no location restrictions, requiring only one source of energy, preferably from renewable sources, to be totally sustainable.



 Green Hydrogen Category

Second Prize

Jiangsu Guofu Hydrogen Energy Equipment Co., Ltd.

Jiangsu Guofu Hydrogen Energy Equipment Co., Ltd. is a leading supplier of hydrogen energy equipment in China, specializes in customized development and large-scale manufacturing. The main products include water electrolysis equipment and systems, hydrogen liquefaction units, LH₂ storage and transportation equipment, hydrogen cylinders and vehicle-mounted hydrogen supply system, complete sets of HRSs and IOT security operation supervision platform.

Go for Green Hydrogen Equipment Whole Industry One Stop Solution for Energy Storage, Fuel Cell Vehicles and Hydrogen Refueling Stations

GUOFU has successfully established over 130 hydrogen fueling stations and deployed a fleet of over 7,000 fuel cell vehicles across China. Notably, over 90 percent of these vehicles are buses and heavy trucks. This concerted effort has resulted in an impressive cumulative zero-carbon mileage exceeding 200 million kilometers, contributing to a substantial reduction of over 150,000 tons in carbon emissions. Moreover, green hydrogen liquefaction plants have been built. The equipment has obtained several international certifications, and GUOFU is applying this business model to the Middle East and Southeast Asia, providing solutions for green hydrogen preparation, liquefaction, storage and transportation, hydrogen refueling infrastructure construction and operation of fuel cell vehicles in developing countries rich in renewable energy. GUOFU has obtained more than 400 patents, including 31 invention patents and 27 software Copyrights, obtained ISO9001, ISO 14001, ISO45001, IATF 16949 and other management system certification, most of the products have obtained EU certification or other international certifications, exported to Malaysia, the United Arab Emirates, the United States and other countries. With a total investment of 480 million yuan, the first and second phase of hydrogen energy equipment industrial base has been built, covering an area of about 75 acres, plant and office building area of 70,000 square meters. The third phase of the hydrogen energy industrial base project is under construction with a total investment of 1.8 billion yuan, including an annual output of 80,000 hydrogen bottles and 2GW electrolytic cell intelligent production line. GUOFU has also signed Mous with partners to jointly establish joint ventures and build factories in the Middle East to create more green hydrogen jobs in developing countries. GUOFU employs more than 600 people worldwide, more than 85% of whom are aged 44 and under. Providing women with higher positions and more important jobs, women make up more than 20% of middle and senior management.



70MPa hydrogen refueling station for the 2022 Beijing Winter Olympics



Alkaline water electrolysis hydrogen production system



 Green Hydrogen Category

Second Prize

Guangdong CAWOLO Hydrogen Technology Co., Ltd.

CAWOLO specializes in research, design, manufacturing and sales of Proton Exchange Membrane (PEM) electrolysis water hydrogen production equipment, as well as its core parts and materials. It independently grasps the core technology of PEM stack and membrane electrode, constantly carrying out technology and process innovation to realize a localized, intelligent and large-scale manufacturing of PEM hydrogen production equipment and integrated system. Now, CAWOLO has a full range industrial products of PEM electrolyzers and systems from 0.5Nm³/h to 500Nm³/h, providing unique advantages in matching photovoltaic, wind energy and offshore wind power applications.

Cawolo PEM Water Electrolytic Hydrogen Production Equipment Industrialization Project

The core of the industrialization project of PEM water electrolyzer equipment is the PEM water electrolysis hydrogen production technology. After obtaining electricity from renewable energy generation systems, it needs to be converted into hydrogen energy by water electrolysis. Nafion PEM technology for hydrogen production has excellent electrochemical stability, hydrogen proton transitivity and gas-liquid separability, and greatly improve the safety performance of PEM electrolyzers. The structure of the electrolyzer is mainly composed of PEM, cathode and anode electrochemical catalyst, gas diffusion layer and bipolar plates. The electrochemical catalytic layer and PEM form the Membrane Electrode Assembly (MEA), which is the main place for the medium transmission and electrochemical reaction of the electrolyzer. The characteristics and structure of the MEA can directly affect the performance of the electrolyzer. The gas diffusion layer makes the current more evenly distributed on the surface of the MEA, so that the electrochemical reaction of the MEA is more stable; The cathode and anode plates provide mechanical support for the electrolyzer, while playing the role of transferring electrolyte, gas and current. PEM hydrogen production is mainly divided into four steps: water electrolysis and oxygen precipitation, proton exchange, electron conduction and hydrogen precipitation. PEM electrolysis is recognized as a promising technology in the field of water electrolysis hydrogen production. Its design structure is compact, small size, conducive to rapid load change. It provides high electrolyzer efficiency and gas purity, but requires low energy consumption, safety and reliability are also greatly improved. So it is more suitable for the volatility of renewable energy, providing unique advantages in matching photovoltaic, wind energy and offshore wind power applications.

Cawolo 100Nm³/h technical parameters:

Hydrogen production : 100Nm³/h

Hydrogen output pressure : Max.3.0MPa

DC energy consumption : 4.74kWh/Nm³H₂@ operating current density

Current density : Rated 1 A/cm²@ Running cell voltage

Maximum 1.5A/cm²@ Running cell voltage

Single MEA active area : 4900cm²

Power fluctuation range : 5%~120%

Cold start time : 60s

Design life : 8000h



100Nm³/h PEM electrolyzer



Green Hydrogen Category

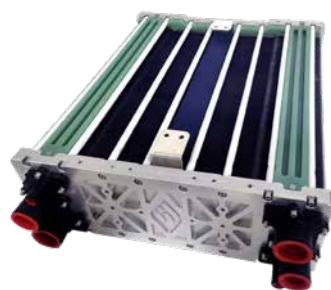
Second Prize

Anhui Mingtian Hydrogen Energy Technology Co., Ltd.

Mingtian Hydrogen Energy Company was established on July 1, 2017. It is a technological innovation company in the hydrogen energy industry. The company has built the only academician workstation in Anhui Province in the field of fuel cells and the first 10,000-unit fuel cell factory in China. It currently has more than 80 researchers, doctoral supervisors, doctors, and masters. The company is committed to the development and application of clean energy, providing products, facilities and solutions for hydrogen energy transportation, hydrogen-electricity coupling, mobile power supplies, energy storage power stations, hydrogen energy industry, military and civilian applications.

High Performance and High Durability Metal Bipolar Fuel Cell Stack (System)

- 1 Breaking through key technologies such as high consistency, long lifespan, and adaptability to high and low temperature environments in high-power stacks, achieving rated power $\geq 200\text{kW}$, power density $\geq 5.5\text{kW/L}$, low-temperature storage startup temperature $\leq -30^\circ\text{C}$, and durability $\geq 15000\text{h}$ (based on the accelerated evaluation method of national standards);
- 2 Breaking through key technologies such as high-performance membrane electrode preparation and anti reverse electrode long life, achieving membrane electrode Pt dosage $\leq 0.25\text{g/kW}$, power density $\geq 1.5\text{W/cm}^2$, non-destructive reverse electrode continuous operation time $\geq 200\text{min}$, and durability $\geq 20000\text{h}$ (based on national standard accelerated evaluation method);
- 3 Breaking through key technologies such as strengthening mass transfer flow field design and conducting corrosion resistant surface treatment for large area metal sheets, achieving bipolar plate thickness $\leq 0.9\text{mm}$, contact resistance $\leq 10\text{m}\Omega \cdot \text{cm}^2$, and corrosion current $\leq 1\mu\text{A/cm}^2$, design durability $\geq 15000\text{h}$.



150kW fuel cell stack



210kW fuel cell stack



The factory of Anhui Mingtian Hydrogen Energy Technology Co., Ltd

Green Hydrogen Category

Third Prize

Xi'an LONGi Hydrogen Technology Co., Ltd.

Founded in March 2021 as a subsidiary of LONGi Green Energy Technology Co., Ltd., Xi'an LONGi Hydrogen Technology Co., Ltd. is committed to becoming the world's leading large-scale electrolyzer and green hydrogen production solution provider. Through continuous technological innovations over the past years, LONGi Hydrogen has developed a spectrum of "Green Power + Green Hydrogen" products and solutions that can effectively support the world's transformation toward zero-carbon development.

LONGi Hydrogen LONGi ALK Hi1 Series-"Green Power+Green Hydrogen" Solutions

Applicability: In February 2023, LONGi Hydrogen launched the ALK Hi1 series, an alkaline electrolysis hydrogen production equipment with remarkable energy efficiency. Achieving a low DC power consumption of 4.1kWh/Nm^3 , 10% below industry averages, it significantly reduces the Levelized Cost of Hydrogen (LCOH). Rigorously tested for 72 hours in Yunnan Province, the electrolyzer demonstrated stability, qualified purity, and a commendable DC power consumption of 4.04, averaging 4.07kWh/Nm^3 —validated by a third party.

Internationally, LONGi Hydrogen secured the world's first 10,000-ton green hydrogen project in May 2022, successfully delivered, and dominated the world's largest green hydrogen synthesis green ammonia project in April 2023, claiming nearly 40% of the winning share. Active projects in India and Australia exemplify LONGi Hydrogen's global commitment to advancing sustainable solutions. **Scalability:** LONGi Hydrogen has the industry's first $4000\text{Nm}^3/\text{h}$ bundled system (4 electrolyzers with 1 gas-liquid separation skid), saving 20% footprint, with a total gas production capacity of up to $4,000\text{Nm}^3/\text{h}$. It can effectively reduce the capital expenditure and footprint, improve the intensification of large-scale hydrogen production plants, and effectively reduce LCOH. This design model has been validated in the 20,000 tpa photovoltaic preparation of green hydrogen in Sinopec's project in Northwest China with high maturity.

Possibility of expansion: The above technical solutions are compatible with the existing conventional electrical design, public utility design, can replace the traditional technical solutions, front-end applicable grid power, wind power, photovoltaic and other types of power forms, lowering its promotion threshold.



Green Hydrogen Category

Third Prize

H2 Bolivia

H2 Bolivia is a project company developing a large scale green ammonia project in the Altiplano Region of Bolivia. The project makes use of the highest solar irradiance on earth to help decarbonize the agriculture, power and maritime markets.

Pacha K'anchay

The company uses PV Solar, CSP Solar and Thermal, Electrolyzers, Energy Storage and Ammonia Loops to produce green hydrogen for the market. The technology being accessed is at various levels of maturity, but the project focus is more on technology selection than technology development.

Pacha K'anchay GREENING THE ENERGY VALUE CHAIN

THE PROJECT

GREEN AMMONIA EXPORT FROM THE SUNNIEST REGION IN THE WORLD

PROJECT & SCOPE	<ul style="list-style-type: none"> 1.5GW solar + 400MW electrolyser⁽¹⁾ Options for around-the-clock production under analysis⁽¹⁾: <ul style="list-style-type: none"> 200 MW hydro (bilateral PPA) 89MW operational hydropower plant available for acquisition with 135MW expansion potential Pumped hydro (greenfield) CSP + molten salt storage
OUTPUT	<ul style="list-style-type: none"> 370ktpa green ammonia Site expandable to 2.5mtpa of production
TRANSPORT	<ul style="list-style-type: none"> Retrofit of 250km existing liquids pipeline to Chilean port of Arica under discussion with government Export terminal JV under discussion
REVENUE STRATEGY	<ul style="list-style-type: none"> Ongoing long term offtake discussions with major market players in Europe and Asia
INVESTMENT OPPORTUNITY	<ul style="list-style-type: none"> Construction cost estimate 1,700 MUSD Seeking c.USD12-16m development capital to reach FID Significant development work complete

⁽¹⁾ Technical configuration under optimisation

H2 BOLIVIA Slide 5

Pacha K'anchay GREENING THE ENERGY VALUE CHAIN

PROJECT HIGHLIGHTS

WHY PACHA K'ANCHAY ?

- Highest solar irradiation in the world:** Site selected has optimized PV yield in the range of **c.3000 kWh/kWp**. Unlike many other solar regions, the cool temperatures of ~10°C at the high altitude increase PV efficiency. DNI is in excess of 3,000 kWh/m².
- Access to hydropower:** Multiple existing and oncoming new hydro plants in region - PPAs under discussion with state utility ENDE. Separately, H2 Bolivia has the opportunity to purchase an operating 89MW hydro plant.
- Massive land & water rights secured:** Exclusive development and land/water rights for 8,800ha signed with government. Further 6,000ha under negotiations with private landowner.
- Access to pipelines and port:** 1904 treaty grants the right of free transit through Chile without encumbrances; port usage at reduced fees; potential location in the bay identified for the construction of terminal, with water depth of 15-20m for new VLGCs.
- Domestic demand:** Bolivia's mining areas offer a high-value diesel substitution use case. Hydrogen bus pilots and injection into gas pipeline grid under discussion with government.
- Strong local, regional and national government support:** Green hydrogen/ammonia development now part of Oruro government strategic plan along with lithium production

⁽¹⁾ very large gas carrier

H2 BOLIVIA Slide 2

Green Hydrogen Category

Third Prize

State Grid Hangzhou Qiantang Area Power Supply Company

State Grid Hangzhou Qiantang Area Power Supply Company is responsible for the construction, operation, maintenance and repair of 10 kV (20 kV) distribution network within the jurisdiction, and provides power services for 35 kV and below power users. The company has carried out the exploration of new regional energy Internet with multiple integration of "wind, light, electricity, hydrogen, oxygen and heat", and built two core parks: zero-carbon multi-energy complementary park and zero-carbon hydrogen-electric coupling park.

Hydrogen Loading - Promoting the Intelligent and Green Transformation of Industrial Parks

State Grid Hangzhou Qiantang Area Power Supply Company explored a new model of hydrogen energy application, combining hydrogen energy with the power grid, and carry out practical applications in the Qiantang District to promote the deep decarbonization and apply energy green and intelligent in the industrial parks.

Qiantang District is located at the entrance of the Qiantang River to the sea. It is rich in wind and solar resources and the installed capacity of photovoltaics and wind turbines reaches 760MW here. By relying on National key research and development program, we have mastered the key technology of soft open point and have built the first medium and low voltage flexible DC distribution network project in China, just like adding an adjustable valve in front of the hydrogen production device, converting unstable wind and solar resources into stable direct current energy, and then realize large-scale production of green hydrogen by green electricity.



The company is landed in Qiantang Green Park and built a hydrogen-electric coupling project integrating hydrogen production, hydrogen storage, hydrogenation, and hydrogen fuel cells. Hydrogen-electric coupling is the use of clean energy and grid electricity during low consumption period to produce and store hydrogen and then generate electricity through hydrogen fuel cells during peak consumption period to achieve grid peak cutting. The company has mastered the key technology of multi-reactor system control and efficient energy management, put into operation the Solid Oxide Fuel Cell (SOFC) with the largest single capacity, and developed the first "Electric-Hydrogen-Oxygen-Heat" integrated energy management system in China. The prepared green hydrogen can not only be transported to the production workshop, but also be filled with hydrogen energy vehicles in the parks and can also generate electricity to fill the electricity gap during peak consumption period. The waste heat generated in the hydrogen process can supply hot water for the parks, and the by-product oxygen is used for welding combustion in the production line.

Outside the industrial parks, the hydrogen energy generating vehicles served as emergency power supplies to provide the guarantee of clean energy for the venues of the Asian Games. The company actively expands the downstream industry market of hydrogen energy at the same time, and promote the application of hydrogen energy in the field of public transportation by cooperating with the transport group of the district, Green Altairnano New Energy, and other enterprises.

Green Hydrogen Category

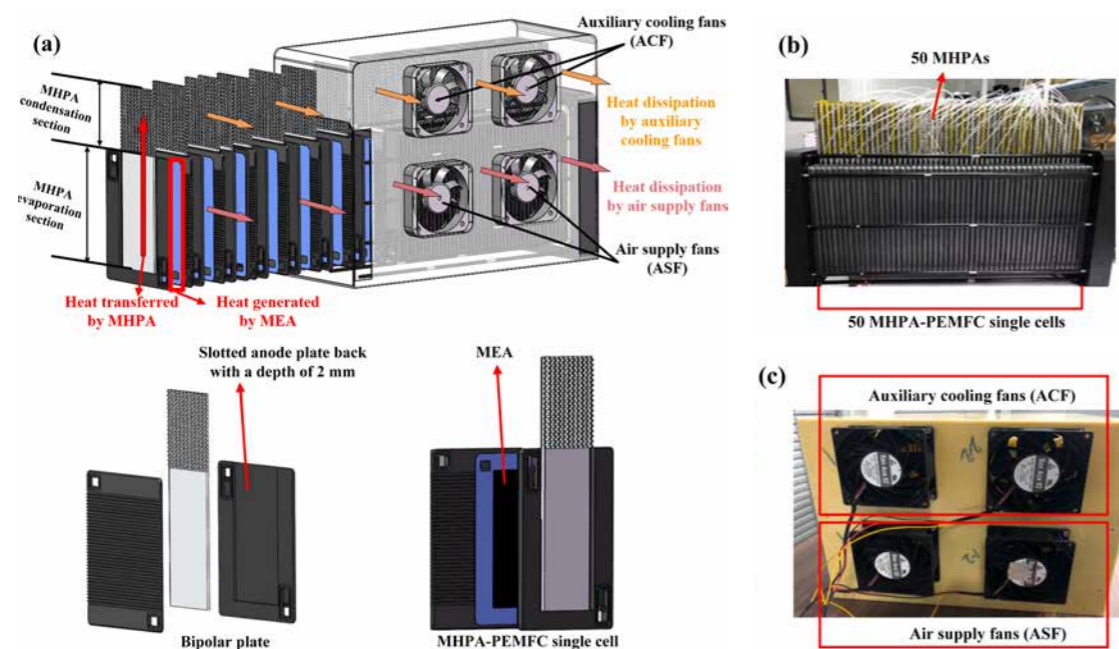
Third Prize

Zibo Boyi New Energy Technology Development Co., Ltd.

Zibo Boyi New Energy Technology Development Co., Ltd. was established by Professor Yaohua ZHAO, an internationally renowned thermal control expert. It is a high-tech enterprise integrating research and development, production, sales and application engineering. All technologies have completely independent intellectual property rights, leading the world. The main industrial fields involve efficient functional thermal conductivity materials, smart clean energy multi-energy complementary energy supply (cold, heat, electricity) triple supply technology, industrial energy saving and residual energy (waste heat, residual cold) comprehensive utilization technology, power lithium battery pack technology.

Efficient Thermal Management Technology for Hydrogen Fuel Cells Based on Microheat Pipe Arrays

The novel air cooled hydrogen fuel cell stack (MHPA-PEMFC) based on micro-heat pipe array has a safe, efficient and portable thermal management system, which can improve the thermoelectric performance of fuel cells. Under the same environment and conditions, the current load level of MHPA-PEMFC reactor is 80% higher than that of ordinary PEMFC reactor of the same size and type, and the safety performance is 100% higher. The thermal performance index is at least 50% higher than that of ordinary reactor. In actual operation, the hydration of proton exchange membrane of MHPA-PEMFC reactor is at least 50% higher than that of ordinary PEMFC reactor, which solves the difficult problem of membrane drying under high air flow rate and high temperature of traditional air cooled open cathode PEMFC reactor, and improves the service life and safety of fuel cell.



Green Hydrogen Category

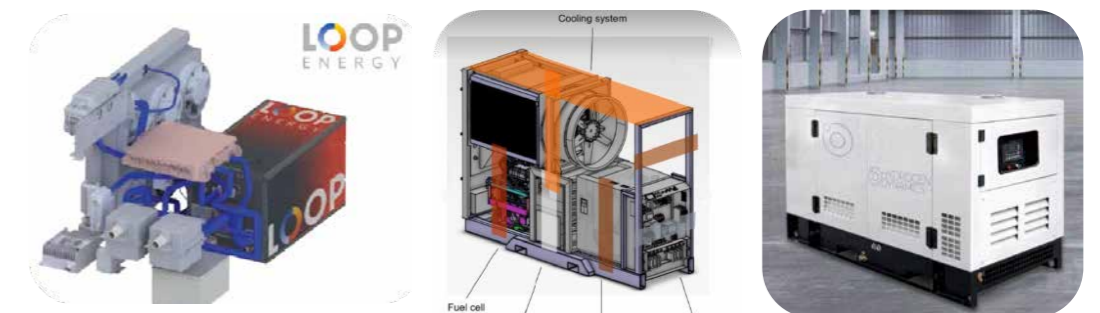
Third Prize

Hydrogen Dynamics Inc.

Hydrogen Dynamics is a leading company in the hydrogen industry, providing cutting-edge solutions for industrial-scale power generation. The company's focus is on the development of innovative hydrogen-based power generation solutions and the integration of a network of hydrogen production and supply stations to support this initiative. The company is committed to revolutionizing the construction industry by leading the transition to hydrogen energy through direct integration and technical solutions. The hydrogen-powered generators are designed to meet the demands of industrial-scale operations while reducing carbon emissions and promoting sustainable practices. At Hydrogen Dynamics, everyone strives to be at the forefront of the hydrogen revolution and is committed to providing the highest quality products and services to the clients.

Hydrogen Dynamics Generator (HDG) Development

Hydrogen Dynamics Inc. (HDI) has designed a renewable hydrogen-fueled power generation device named the "HDG30". This groundbreaking creation offers on-demand, reliable, affordable, and clean power with remarkable noiselessness, ensuring a harmonious coexistence with nature. HDG30 caters to multifarious needs and is adaptable for temporary and long-term installations. HDI recognizes that despite the push for clean energy, industries still struggle with reliance on hydrocarbon-derived fuels and their associated technologies, known for ineffectiveness, noisiness, and adverse environmental impact. This reliance is due to a lack of innovation that addresses the entire problem in the energy space: batteries are slow to charge, struggle with short life span, have sensitive environment requirements and are not suitable for industry use. Fuel cells are slow to respond to power demand changes and are sensitive to membrane degradation. To address these challenges, HDI designed an integration model incorporating state-of-the-art fuel cell systems and battery technologies, reaping their merits while rectifying limitations. HDI has refined this innovation, giving birth to HDG30. Being able to instantaneously respond to any fluctuations in power demand, HDG30 achieves a minimum efficiency exceeding 50%, far surpassing other gensets technologies at 20-30%. The device's energy capacity is highly scalable, only needing more hydrogen to indefinitely increase its total power generation. Furthermore, it is extremely easy to scale up the wattage output by simply replacing one component or by stacking multiple units in parallel. HDG30 finds application in diverse fields, including military & disaster relief, land development & construction, entertainment, EV charging, grid support, agriculture, and remote power. This innovation's proven applicability is evident through demonstration projects and LOIs from enterprises representing agriculture, off-grid living, material R&D, and land development. As HDG30 paves the way for sustainable power generation, its scalability and possibility of expansion become evident, opening doors for wider impacts across various sectors.



Green Hydrogen Category

Best Innovation Prize

Sunhydro, Inc.

Sunhydro is the world's leading provider and operator of methanol-based hydrogen solutions.

Green Power and Fuel Cell Vehicles

Sunhydro new product MHU-600 is a highly integrated modular methanol-hydrogen production system with a daily hydrogen capacity of up to 600kg per unit. Housed in a 20-foot container, it incorporates methanol hydrogenation and purification units. The system boasts a single-step hydrogen production purity exceeding 99.99%, Achieving a methanol-to-hydrogen conversion efficiency exceeding 80%, it offers advantages such as on-demand hydrogen production, compact equipment footprint, low hydrogen production costs, and high-security. It can be seamlessly integrated with pressurized filling systems and finds versatile applications in various scenarios, including comprehensive energy stations for oil, gas, hydrogen, and electricity, mobile stations for mining and industrial zones, and hydrogen filling points for light-duty vehicles. Additionally, it contributes to a 50% reduction in end-use hydrogen costs.

MHPU-100 is the pioneering methanol hydrogen power generation unit developed by SunHydro. It integrates core technologies for methanol hydrogenation and hydrogen power generation, achieving a power output of 100kW in a single cabinet. Compared to diesel generators, it can save fuel costs by 50%, supports modular stacking, and allows flexible expansion from hundreds of kilowatts to megawatts or even hundreds of megawatts, with a comprehensive energy efficiency exceeding 80% in combined heat and power generation. The entire system can provide distributed independent power or efficiently collaborate with wind and solar power to form flexible microgrids. It finds wide applications in scenarios such as base station power supply, construction and mining electricity, facility agriculture energy stations, methanol hydrogen-powered vehicles and ships, cogeneration in industrial and commercial parks, as well as mobile power generation and charging. MHPU-100 caters to diverse electricity needs in industries, construction, transportation, agriculture, and other fields.

SunHydro H1 is a water-cooled hydrogen-powered two-wheeler jointly developed by SunHydro in collaboration with Tailg and SHPT. The vehicle is powered by a low-pressure solid-state metal hydrogen storage tank and a water-cooled fuel cell system. It boasts high safety, zero carbon emissions, and an extended range. Compared to traditional electric vehicles, the energy cost is reduced by 40%, making it suitable for a wide range of applications such as food delivery, instant logistics, and personal transportation.

SunHydro truly achieves a commercial closed loop of "hydrogen production - hydrogen supply - operation".



UNIDO Global Call 2023
Prize Winners



Energy Efficiency Category

Solutions	Institutions	Nations
Grand Prize		
Lenovo Warm Water-Cooling System	Lenovo Group	China
First Prize		
Carbon Neutrality Driven Data Center Job/ Resource Scheduling and Energy Management System	Alibaba Cloud Computing Co., Ltd., North China Electric Power University	China
Data Links of Electricity and Carbon — China's Pilot Energy Big Data Center to Support Carbon Neutrality Strategy in Zhejiang	Zhejiang Energy Big Data Center	China
Second Prize		
Alibaba Cloud Energy Expert	Alibaba Cloud Computing Co., Ltd.	China
DAC- Dynamic Air Cooling	DAC Sp.z o.o.	Poland
Net-Zero-Carbon Targeted Energy Operation and Maintenance System	Shanghai Manabox Intelligent Technology Co., Ltd.	China
Third Prize		
Green and Low-Carbon New-Type Rail Transit Technology	China Construction Fifth Engineering Division Corp., Ltd.	China
Empowering Women through Clean Energy Entrepreneurship	Solar Sister (NGO)	United States of America
JA Solar Innovative Rural Household Power Station Solution	JA Solar	China
Mayr Melnhof Group—Europe's Largest Industrial Solar Cooling Facility	Soliterm Group	Germany
Most Promising Solution Award		
HyperHybrid: The Future of Sustainable Mobility	OBRIST Powertrain GmbH	Austria
FEAD: Inceptio's Proprietary Total Solution for Fuel Saving in Autonomous Driving Heavy-Duty Trucks	Inceptio Technology	China
Best Innovation Award		
Promoting Energy Efficient and Responsible Palm Oil Processing in the Eastern Region (PEER Processing Project)	Plan for Change Ghana	Ghana



Energy Efficiency Category

Grand Prize

Lenovo Group

Lenovo is a global leading company in the digital economy, with a revenue of US\$62 billion. Operating 35 manufacturing facilities in nine markets, including China, Japan, India, the United States, Mexico, Brazil, Argentina, Hungary, and Germany, and employing 77,000 people worldwide, Lenovo serves millions of customers every day across 180 markets. Over the years, Lenovo has built on its success as the world's largest PC company by further expanding into growth areas, including server, storage, mobile, software, solutions, and services. Lenovo continues to invest about US\$1.4 billion yearly in R&D, focusing on New IT technologies (client, edge, cloud, network, and intelligence). Working towards a bold vision to deliver smarter technology for all, Lenovo is committed to building a more sustainable, inclusive, and trustworthy smart future for everyone, everywhere.

Lenovo Warm Water-Cooling System

Lenovo warm water-cooling system is a proprietary liquid cooling solution developed in-house by Lenovo. This industry-first solution uses a highly sophisticated water loop design to absorb heat from data center servers, cooling down the server components. Unlike conventional liquid cooling systems, which usually maintain the inlet cooling water temperature at around 16°C, this system can turn incoming water of up to 50°C into outgoing water at about 58°C, achieving optimal energy-consumption ratio and economic efficiency. The discharged water can be used to meet urban underfloor heating and hot water supply water temperature requirements, thereby better utilizing data centers' waste heat. In addition, the modular design allows for maximum scalability at data centers.

Thanks to strenuous R&D efforts since 1996, the system is now in its six-generation, winning multiple domestic and international patents, has been commercially available for over a decade and tested in various scenarios. To date, this system has empowered more than 70,000 sets of HPC equipment worldwide and has found widespread adoption in universities, research institutes, companies, and government departments across China, Malaysia, India, Philippine, Argentina, South Africa, the United States, Austria, Germany, Sweden, and the Netherlands etc.

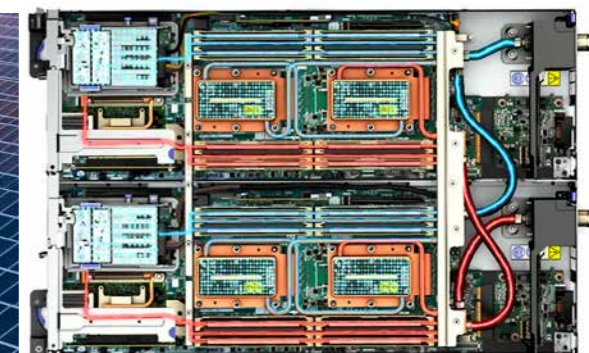
With growing developments in the digital economy, the demand for computing power is growing exponentially, resulting in further issues in energy consumption expansion. The International Energy Agency (IEA) estimates that data centers already account for 1.5% to 2% of the world's total power consumption, roughly equivalent to that of the entire UK economy. By 2030, that number is expected to rise to 4%. With the exponential growth of AI technology, it is imperative to address the issue of high energy consumption of data centers that provide computing power to such technologies.

Application Scenario

Lenovo's warm water-cooling system is suitable for large-scale data centers, high-performance computing, and large-scale cloud computing scenarios, making it an ideal option for universities and research institutes in life science, meteorology, oceanography, petrochemical, engineering, and manufacturing fields applicable in most locations. For example, in China, the system is used for natural cooling year round in Beijing, Inner Mongolia and other northern regions, and parts of the year in Guangzhou, Shenzhen and other southern regions.



Lenovo Water-Cooling System



Internal Structure of Water-Cooling System



Applied in High Performance Computing Center, Barcelona, Spain

Technical Parameters

Lenovo's warm water-cooling system is an amalgamation of multiple technological achievement based on materials science, microbiology, fluid mechanics, heat transfer, and other disciplines. The system's overall heat removal efficiency is as high as 98%, a significant increase from air cooling methods. The technology can reduce data center PUE to less than 1.1, compared with the global average of 1.55 in 2022.

Energy Efficiency Category

First Prize

Alibaba Cloud Computing Co., Ltd., North China Electric Power University

Alibaba Cloud is a globally leading technology company specializing in cloud computing and artificial intelligence. It ranks third in the global cloud computing market and is the market leader in Asia. The company is at the forefront of research in areas such as elastic scheduling of computing jobs/resources and data center energy management, showcasing world-class expertise.

North China Electric Power University (NCEPU) is a key national university which focuses on power and energy. It owns the State Key Laboratory of Alternate Electrical Power System with Renewable Energy Sources and has extensive research experience in fields of renewable energy and electrical engineering.

Carbon Neutrality Driven Data Center Job/Resource Scheduling and Energy Management System

This system optimizes the scheduling of computing tasks in data centers by strategically rescheduling them to periods or regions with lower electricity prices and higher renewable energy availability. The system dynamically manages various energy-consuming devices within the data center to reduce energy costs, promote renewable energy integration, and achieve low-carbon-driven energy and carbon management.

The technology behind the system includes:

1 Carbon Neutrality-Driven Data Center Energy Management Technology:

The system, responsive to fluctuations in cloud computing workloads and renewable energy output, makes adaptive decisions on adjusting the operating status of energy-consuming devices. This lowers carbon emissions of data centers, and provides auxiliary services to the power system.

2 Data Center Computing-Electricity Collaborative Scheduling Technology in Coupled Electricity-Carbon Markets:

This team have developed an energy-and-carbon-aware workload scheduling technology for data centers. It transfers computing jobs to periods or regions with lower electricity prices and higher renewable energy availability, reducing data center energy costs and carbon emissions.

3 Data Center Electricity-Computing-Heat Joint Optimization Scheduling Technology:

In data centers, this technology optimally controls the output of various units, manages the charging and discharging of energy storage systems, and regulates the operational status of thermal storage systems. Coupled with waste heat recovery technology, it recovers the heat emitted by servers and supplies it to surrounding thermal loads, thereby enhancing the overall energy efficiency data center.

4 Geo-Distributed Data Center Joint Optimization Scheduling Management Technology:

Considering variations in renewable energy resources across different regions, the system flexibly transfers workloads between different geo-distributed data centers, harnessing green and low-cost energy in each region.

This system empowers data centers to deliver green and inclusive computing power to customers, offering a solution for the low-carbon and cost-effective operation of data centers.



Energy Efficiency Category

First Prize

Zhejiang Energy Big Data Center

To pursue SDGs and embrace the energy and data revolutions, Zhejiang Energy Big Data Center was formally established in September 2021, facilitating the digital transformation. The center has built a three-level platform for provincial, municipal and enterprise integration, incorporating multi-dimensional data from power plants, large-scale enterprises, key energy-consuming enterprises, macroeconomics, demographics, meteorology, and environmental factors. This enables precise daily monitoring and effective control of energy consumption, energy intensity, carbon emissions, and carbon intensity at the provincial, regional, sectoral and enterprise levels. The Center has developed 65 practical and effective data products by 2023.

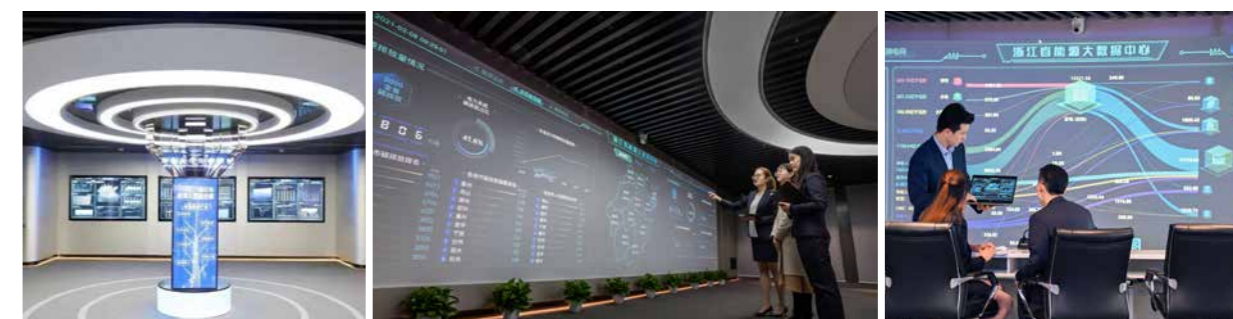
Data Links of Electricity and Carbon — China's Pilot Energy Big Data Center to Support Carbon Neutrality Strategy in Zhejiang

Zhejiang Energy Big Data Center implemented a "government-enterprise linkage" model to leverage timely energy data at scale and deliver an "Electricity Carbon Data Chain" collaborative governance system.

This framework facilitates collaborative data sharing across traditionally siloed sectors. The model enables dynamic energy monitoring like never before by integrating real-time energy insights. It informs strategies with data to support evidence-based policymaking and offer services personalized for businesses. The "linkage" model ultimately connects all interested parties within an integrated energy data ecosystem.

As for the technology, it sets up the first provincial-level energy big data center in China that follows business technology standards, built a three-level platform at the provincial, municipal, and enterprise levels, and built an innovative ecology for carbon reduction services. Based on the electricity carbon data products, it actively extends the business chain, launch energy efficiency services for energy consumption units, help the upstream and downstream industrial chain of power energy to reduce carbon, promote clean carbon reduction of energy supply, and improve energy consumption efficiency and carbon reduction.

In addition, Zhejiang Energy Big Data Center assists in forming precise and intelligent governance of the whole society's energy conservation and carbon reduction pattern and a set of carbon reduction service management systems to fully support the high-quality "dual carbon" work of Zhejiang Province.



Energy Efficiency Category

Second Prize

Alibaba Cloud Computing Co., Ltd.

The Energy Expert team at Alibaba Cloud is at the forefront of dual-carbon solutions for industrial manufacturing, power generation, and other fields, closely following carbon neutrality and carbon peak policies. Leveraging Alibaba Cloud's integrated computing capabilities for big data, and a multidisciplinary team of experts in energy and environmental science, product development, data science, and software engineering, the goal is to develop an innovative SaaS product that can help small and medium enterprises (SMEs) tackle their energy-saving and carbon emission reduction challenges with data intelligence. Building on this foundation, this climate research and innovation team focuses on data science and AI-driven climate change research.

Alibaba Cloud Energy Expert

- 1 Digital technology empowers companies to conduct carbon audits, set carbon neutrality/ESG goals and pathways. Following the ISO-14064 standard, Energy Expert provides online auditing capabilities for Scope 1-3 emissions, helping companies identify the main sources of carbon emissions, scientifically formulate carbon emission/ESG goals, and provide energy-saving and carbon reduction pathways.
- 2 Scientific calculation of carbon footprint to address trade barriers. By obtaining online data on raw material usage, energy consumption, and other resource consumption, Energy Expert completes carbon footprint modeling and accounting for products in the cloud. It also connects with authoritative third-party organizations for online certification. Ultimately, reports, certificates, and labels are generated to help companies cope with cross-border trade carbon tariffs.
- 3 Fine-grained analysis of energy use in enterprises to achieve energy-saving and emission reduction through mechanism and AI algorithms. The above two scientific calculations of corporate carbon emissions are not endpoints but starting points. Companies need guidance on how to reduce carbon emissions. Energy management in the operational processes of companies, including air conditioning, lighting, and factory energy consumption, mainly relies on experience for equipment operation configuration. Energy Expert combines practical operational management experience of enterprises, analyzes different aspects such as production lines, equipment, and management in factories, explores energy-saving potential in buildings and factories, and constructs intelligent controls for heating, ventilation, and air conditioning, lighting strategy optimization, and off-peak energy consumption management. This helps companies achieve energy-saving and emission reduction.
- 4 Promote inclusive carbon initiatives in communities and campuses, advocate for low-carbon lifestyles, and cultivate a green mindset among the public. Energy Expert's community version promotes low-carbon behaviors such as clothing/book recycling, disc action, paperless office/learning, and green transportation. By providing equity rewards, it cultivates a green mindset among the public/students, passes on the concept of sustainable development to the next generation, and encourages active participation in carbon neutrality strategies.



Energy Efficiency Category

Second Prize

DAC Sp.z o.o.

Dynamic Air Cooling is a new ecological way to generate cold for industrial or residential air cooling and refrigeration. The technology decreases temperature by -60°C and has no impact on environment: it uses no synthetic coolants and has neither thermal nor CO₂ emissions. DAC is up to 50% cheaper compared to traditional A/C or refrigeration technology.

DAC-Dynamic Air Cooling

DAC innovation is the creation of a freon-free environment allowing higher flexibility of food storage, reducing food waste throughout the supply chain, and decreasing the global environmental impact of cooling, also by cutting down waste of valuable resources (water, land, labor, and energy).

DAC uses a unique combination of gas-dynamic principles, allowing to recuperate part of the thermal energy of the air and convert it into electricity, benefits include:

- 1 Immediate air cooling by 90°C (potentially up to 172°C) with a Tornado-like jet stream.
- 2 Air as a cooling agent replacing HFCs.
- 3 Low-pressure cooling (0.6-3 bar) = safer and lower-cost devices (by 30%).
- 4 Smaller & more efficient (uses 50% less electricity) compared to conventional HFC systems.
- 5 More affordable (30% less cost) and easy to install.
- 6 Wide application of DAC will cut valuable waste by up to 5% vs conventional cooling

Summary: 30% cost reduction, 50% energy savings, 2x faster cooling, easy install, reliable.



Energy Efficiency Category

Second Prize

Shanghai Manabox Intelligent Technology Co., Ltd.

Shanghai Manabox Intelligent Technology Co., Ltd. is a high-tech enterprise that offers end-to-end services in distributed microgrid energy carbon management, including consulting, construction, operation, and investment. The company utilizes artificial intelligence technology to provide enterprises with comprehensive services in carbon intelligence, encompassing carbon neutrality planning, intelligent upgrading of power Internet of Things, real-time optimization of distribution strategies, and more. It has delivered cutting-edge energy carbon solutions to numerous Fortune 500 companies and publicly listed enterprises, and is committed to becoming a leading enterprise in promoting the intelligent application of energy and carbon.

Net-Zero-Carbon Targeted Energy Operation and Maintenance System

The technical innovations of this project are specifically manifested in the following aspects:

- 1 Addressing issues related to customer energy saving, cost reduction, and regulatory compliance, Manabox proposes the use of IoT smart circuit breakers and branch circuit metering devices to monitor customers' three-level circuits. By observing the endpoints of customer electricity consumption, the technology identifies hidden energy waste points and, through automated rules, controls circuit power supply to eliminate invisible energy wastage.
- 2 To ensure energy efficiency and cost savings, Manabox, from the construction perspective, utilizes a series of independently developed and manufactured low-voltage smart circuit breakers and branch circuit metering products. These products provide data monitoring foundations for energy analysis and carbon emissions, identifying the sources of energy waste. This enables effective control of wasteful behaviors and ensures customer energy and cost savings.
- 3 Through on-site deployment of edge hardware, Manabox controls the scheduling of renewable energy devices and uses neural network algorithms on the platform to predict macro operating conditions. The edge hardware algorithms are continuously adjusted, not only improving the return on investment of renewable energy equipment but also preventing additional costs incurred by customers' renewable energy devices due to demand exceeding limits and power factor reduction during operation.
- 4 To address customers' need to view the reduction in carbon emissions, Manabox presents digital information on the construction of renewable energy equipment and the energy-saving transformations carried out by customers. The carbon emissions measurement on the Manabox platform conforms to international standards and can be directly used as certification data, providing customers with certification services.

By addressing customer pain points, Manabox has been approved as one of the first batch of industrial communication carbon management pilot units in Shanghai for the year 2023. It has assisted project clients in obtaining Net Zero Carbon Building Operation Certification at the outstanding level, co-creating one invention patent and one software copyright.



Energy Efficiency Category

Third Prize

China Construction Fifth Engineering Division Corp., Ltd.

Founded in 1965, China Construction Fifth Engineering Division Co., Ltd. is the wholly owned enterprise of China State Construction Co., Ltd., which ranks 13th among the world's top 500 companies. With housing construction, infrastructure construction, investment, and real estate development as its main business, it has the qualifications for housing construction, municipal administration, and highway. With a cumulative investment of more than 150 billion RMB, it has developed into a modern investment and construction group with high-quality for investors.

Green and Low-Carbon New-Type Rail Transit Technology

The innovative and prefabricated construction of the medium and low-capacity straddle monorail transportation system effectively saves resources and enables rapid construction. It is worth noting that the combination of track beams with full assembly and prefabrication results in fast construction speed, short construction enclosure time, high beam quality, reduced noise and dust, and minimized impact on the surrounding people's production and daily life. This approach generates significant benefits.

As urbanization continues to advance, urban traffic congestion and air pollution have become increasingly serious. The threshold for constructing high-capacity subways is also rising. Due to its advantages of low investment, low threshold, and short construction cycle, medium and low-capacity urban rail transit has gradually gained recognition from the public and has become an inevitable choice for the development of transportation in second and third-tier cities. As a resource-saving and environmental-friendly urban rail transit system, it features slender and lightweight elevated structures that traverse the city without compromising the urban landscape and environment. It can effectively alleviate urban traffic congestion and promote the diversified development of urban public transportation.

The new technology for fully prefabricated construction of low-capacity urban rail transit involves standardized production of components in factories and on-site assembly construction. This significantly reduces the time and workload of on-site operations, ensuring construction quality and enabling rapid construction. It is fundamentally different from traditional construction methods and structural forms. It brings significant improvements in material conservation, environmental protection, waste discharge, and meets the requirements for urban landscape after operation. It is an important direction for the future development of low-capacity urban rail transit.



Three-dimensional traffic



New technology of full prefabrication of medium and low volume urban rail transit



Straddle-type Monorail Intelligent Welding Robot

Energy Efficiency Category

Third Prize

Solar Sister (NGO)

Empowering Women through Clean Energy Entrepreneurship

Solar Sister's mission is to invest in women to improve gender equity, increase clean energy access, and facilitate climate action in last-mile communities across Sub-Saharan Africa (SSA) where more than 597 million people do not have access to energy and 1.9 billion people lack access to clean cooking.

Since 2010, Solar Sister has worked to fight energy poverty across Sub-Saharan Africa by recruiting, training, and supporting women entrepreneurs as they create clean energy distribution businesses. These women, in turn, develop financial resilience, confidence, and community status, by delivering clean energy to their communities. To date, Solar Sister has recruited, trained and supported more than 9,400 entrepreneurs who have gone on to mitigate more than 1.3M CO₂e, providing access to energy to more than 4.3M beneficiaries across Nigeria, Tanzania and Kenya. Solar Sister's theory of change is based on the fundamental knowledge that energy access, climate change, and gender equity are inextricably connected. Solar Sister operates at the nexus of these three focus areas, aiming to economically empower women and eradicate energy poverty through entrepreneurship. Solar Sister achieves impact in all three focus areas through three primary activity channels: recruiting women to deliver clean energy products in their last-mile communities, training women to become clean energy entrepreneurs and climate actors, and supporting entrepreneurs to create thriving businesses.

Solar Sister's award-winning innovation brings a unique gender lens to energy poverty through a women-powered, last-mile distribution model, delivering clean energy to underserved communities, who are often the only local sources for clean energy products.

The Solar Sister model has been implemented in war-torn regions and has supported women from all backgrounds, from people with disabilities, to internally displaced persons and refugees. By 2030, Solar Sister's ambition is to eradicate energy poverty across Sub-Saharan Africa by continuing to scale the model to empower 30,000 women and provide more than 20 million people with clean energy solutions.



Energy Efficiency Category

Third Prize

JA Solar

JA Solar was founded in 2005, after nearly 20 years of development ever since, has become one of the world's largest photovoltaic module enterprise and renewable energy solution provider. JA Solar is publicly traded on the Shenzhen Stock Exchange under the ticker symbol NO.002459. With continuous technological innovation, stable financial strengths, and a well-developed global sales and service network, JA Solar has been widely recognized by domestic and international customers and has been listed in the "Fortune China 500" and "Global Top 500 New Energy Enterprises" for multiple consecutive years.

JA Solar Innovative Rural Household Power Station Solution

In many cases, traditional rooftop distributed photovoltaic power stations find it hard to adapt to diverse and complex roof environments. To solve these obstacles, JA Solar proposes four layers of innovative solutions, including sunlight shed, flat-to-slope revamp, truss solution, and courtyard solution, tailored for different latitudes, climatic environments, and building structures. Through these customizable solutions, JA Solar aims to resolve the installation difficulties and helping more rural households to enjoy the convenience of photovoltaic power.

- Sunlight Shed Solution:** Designed according to the specific situation of household roofs, the overall structure of the power station has undergone strict professional calculations and tests, taking into account factors such as load bearing, wind resistance, and shake resistance, achieving all-round protection. Meanwhile, it has a multi-layer waterproof function in its structural design that can effectively prevent leakage. The photovoltaic sunlight shed can not only produce green energy for the rural houses, but also protect fragile roofs from direct exposure to rainfall and sunlight, enhancing temperature control of the house, making it warmer in winter and cooler in summer to achieve better energy efficiency.
- Flat-to-Slope Solution:** Tailored for the building structure of rural houses, the flat-to-slope solution transforms the flat roof of the rural house into a sloped one without demolishing the original roof. By installing the photovoltaic power station and adding color steel protection around the roof, this solution aids in improving temperature control, delaying house aging, bringing better energy efficiency and improved building lifespan.
- Truss Solution:** The application of truss structure realizes the installation of large-span photovoltaic array, suitable for houses with complex structures and artistic modeling. The truss solution not only solves the installation problem but also protects the house without damaging the original structure, achieving a perfect combination of architectural aesthetics and green energy generation, while improving the living quality of rural residents in remote areas.
- Courtyard Photovoltaic Solution:** The courtyard solution is very broadly applicable, suitable for small-sized houses or those unfit for rooftop photovoltaic installation but have large courtyards, especially for many regions across the world where peaked roof designs are common. In the courtyard of those rural farmhouse, elevated courtyard photovoltaics are built that do not affect the normal use of the courtyard and can realize organized drainage, reducing muddiness during the rainy season.



Energy Efficiency Category

Third Prize

Soliterm Group

Mayr Melnhof Group—Europe's Largest Industrial Solar Cooling Facility

The project at hand is an industrial application for Mayr-Melnhof Graphia (MMG), a multi-national company and one of the world leading manufactures of carton board, fine and kraft paper and with MM Packaging also of folding cartons. Based in Vienna, Austria the MM Karton AG runs 52 production sites in 22 countries and employs over 10,000 persons. The company not only sets high economical standards but also aims for a sustainable and efficient production with recyclable and biodegradable carton board packaging to commit to net zero emissions as part of the Business Ambition for 1.5°C. MM Graphia production facility in Izmir is specialized on packaging in gravure and offset printing as well as on manufacturing innovative and high finish folding cartons. The company was facing high energy costs and dependency on conventional energy supply for their production processes and the air conditioning at one of their production facilities in Turkey. The company has a tremendous demand for cooling, heating, and warm water. Since the energy consumption for the production processes and the air conditioning of the facilities increased and with that CO₂ emissions, an environment friendly and sustainable solution had to be found. Henceforth, the company decided to switch from fossil energy sources to a renewable source that is based on solar energy. The SOLITERM Group has now built a 3.5 MW solar based thermal cooling system at their facilities, which supplies the production units and offices with process cooling, air conditioning and warm water.

This system at hand is the largest industrial solar based cooling facility in whole Europe with a capacity of 3,500 kW.

The solar thermal system is a smart, renewable and sustainable energy supply resource that utilizes the natural energy of the sun to ensure the reduction of emissions, high energy and monetary savings in form of a highly automated and sophisticated energy supply system. This system represents an essential step towards carbon neutrality and towards reversing the effects of climate change in the long-term, since the most energy is consumed within production processes of different industries. The project is based on an international cooperation of various parties that contributed towards the execution and the later success of the project.



Energy Efficiency Category

Most Promising Solution Prize

OBRIST Powertrain GmbH

The OBRIST Group pioneers in heat pump compressors and systems, advanced hybrid powertrains, and carbon-negative fuel technologies, holding over 500 patents. Based in Austria, the company focuses on R744 refrigerant and the world's first CO₂ compressor development. In the hybrid and electric vehicle sectors, OBRIST develops Zero-Vibration engines and patented batteries. The HyperHybrid powertrain employs eMethanol/aFuel® to achieve carbon-negative emissions. aFuel® utilizes solar energy and carbon sink processes for carbon-negative output. The company also innovates in direct air capture technology, contributing to carbon reduction.

HyperHybrid: The Future of Sustainable Mobility

The HyperHybrid powertrain redefines automotive efficiency and comfort with advanced components and eco-friendly energy solutions. Its core is the ultra-compact combustion engine designed for incomparable efficiency in a small package, maximizing performance and space-efficiency. Additionally, the innovative Zero Vibration Generator offers noise, vibration, and harshness (NVH) levels comparable to battery electric vehicles (BEVs), enhancing passenger comfort.

The powertrain also boasts a high-power, cost-effective battery using 18650 cells, known for their robust output and cost efficiency, ensuring the HyperHybrid is both powerful and economically viable.

One of the most revolutionary aspects of the HyperHybrid is its utilization of aFuel®, the world's first climate-positive energy carrier, enabling the system to achieve negative CO₂ emissions and surpassing previous environmental benchmarks.

Additional advantages of the HyperHybrid include its cost-effectiveness, with pricing on par with conventional gas or diesel drivetrains. It is significantly lighter than BEVs, contributing to enhanced efficiency and performance. The charging flexibility addresses range anxiety, as the powertrain is plug-in chargeable but not reliant on this feature. Lastly, its battery range qualifies for government subsidies, making it an economically attractive choice for eco-aware consumers.





Energy Efficiency Category

Most Promising Solution Prize

Inceptio Technology

As a leader in freight autonomous driving, Inceptio Technology focuses on trunk logistics autonomous driving and adheres to the core strategy of "full stack self-developed+mass production driven+deep operation". It independently develops full stack L3 and L4 level autonomous driving technology, and closely cooperates with the automotive industry, aiming to provide logistics customers with safer, more efficient, and more environmentally friendly autonomous driving technology as well as a new generation TaaS freight network. Since the end of 2021, Inceptio Technology and its OEM partners have successfully mass-produced intelligent heavy-duty trucks. Since then, Inceptio Truck NOA (Navigation Assisted Driving) has been safely operating for over 80 million kilometers and has successfully covered national high-speed trunk lines. Its safe, time-saving, labor-saving, and fuel-efficient value has been widely recognized by top logistics customers, achieving large-scale commercial operation of intelligent truck driving and continuing to grow.

FEAD: Inceptio's Proprietary Total Solution for Fuel Saving in Autonomous Driving Heavy-Duty Trucks

Inceptio Technology's autonomous driving technology, with a core technology strategy of "full stack self-developed and mass production oriented", has the world's most mature full stack self-developed core technology for truck autonomous driving.

- At the algorithm level:** Inceptio's core algorithm of auto drive system has solved technical difficulties such as long-distance perception, adaptive robust control, and fuel saving. The fuel saving algorithm learns the optimal driving strategy through massive driving behavior data, including long-term accurate prediction, intelligent decision-making, and engine in the environment planner, to maximize the engine's operation in the optimal fuel economy zone and achieve better overall fuel consumption than older drivers.
- At the software level:** The redundant design of the computing platform and vehicle is fully utilized to achieve software availability and intelligent switching between the main and backup systems, ensuring the safety and reliability of software and data on the vehicle.
- At the level of computing platform:** The computing platform has the characteristics of high computing power, high energy efficiency, and high safety. The architecture is independently developed by Inceptio Technology and can be compatible with various autonomous driving chips, flexibly realizing various configurations from L2 to L4.
- At the level of wire controlled chassis:** Directly oriented towards truck mass production, fully considering the needs of vehicle integration and control, a wire controlled chassis interface has been designed for L4, covering four major systems: steering, braking, power, and power supply.



Energy Efficiency Category

Best Innovation Prize

Plan for Change Ghana

Plan for Change (P4C) Ghana is a youth led non-governmental organization promoting the rights and dignity of vulnerable people and communities especially women, youth and People with Disability (PWDs) in Ghana. P4C Ghana started operating in 2017 but officially registered with the Registrar General Department of Ghana in 2019 with the office located in Tamale, Northern Region of Ghana. It is an ambassador for fighting poverty, climate change, hunger, disease, and illiteracy. It is mainly into the fields of women empowerment, livelihoods, girl child education, reproductive health, enterprise development, poverty alleviation, policy advocacy, sustainable agriculture, and climate change. The Vision: A world in which the rights and dignity of vulnerable people are respected Mission: To promote the socioeconomic well-being of vulnerable people and communities especially women, youth and PWDs through innovative development interventions. Mission: To promote the socioeconomic well-being of vulnerable people and communities especially women, youth and PWDs through innovative development interventions.

Promoting Energy Efficient and Responsible Palm Oil Processing in the Eastern Region (PEER Processing Project)

Plan for Change Ghana through grants from the UNDP in Ghana Implemented the PEER Processing Project in Eastern region of Ghana which was aimed at improving energy efficiency and responsible palm oil processing through equipment upgrade, replacement, new installation and training, which in turn is positively impacting productivity, time, labour, health and safety, energy consumption, and the environment including reducing harmful emissions into the atmosphere. The Project has a good number of innovations that enhanced the achievement of the project objectives and goal. These innovations among others will be adopted in subsequent projects. They include:

- Threshing and milling efficiency:** The threshers and expellers installed in the project communities have the capacity of threshing over 50 tons of Fresh Fruit Bunches (FFB) and milling over 20 tons palm fruit a day as compared to the traditional system, the output of which was 2-3 tons a day, thereby increasing the productivity levels by 150%.
 - Improved cooking system:** The adapted ovens/stoves are designed and constructed with clay bricks, requires less biomass, and reduce workers' exposure to open fire and hazardous smoke at the palm oil processing centers. The steamers fitted as part of the construction of the ovens uses minimal water in cooking of the palm fruits. This reduces energy and time required to search for water for palm oil processing activities. Another important feature of a cook stove is its ability to effectively transfer heat to the points within the stove where most of it can be utilized and this makes cooking 200% faster than the traditional method.
 - Provision of childcare facility:** With most beneficiaries being women, there are therefore some workers who bring their babies and toddlers not yet of school going age to the processing centers. To advance gender equality, decent work, and good health and wellbeing, P4CGH through the UNDP grant has constructed a sheltered childcare space in all intervention sites.
 - Provision mechanized borehole:** P4CGH under this project also drilled and mechanized a borehole fitted with 3,000 liter water tank to promote access to potable water at the Tweapease Processing Centre.
 - Washroom facility:** Good sanitation and proper hygiene help reduce the potential for contaminating food products and helps protect workers and consumers from foodborne diseases.
- P4C is up-scaling this project in the Achiase District of the Eastern of Ghana. The project benefits over 200 additional beneficiaries engaged in artisanal palm oil milling and processing activities.



UNIDO Global Call 2023
Prize Winners



Clean Energy Innovation Category

Solutions	Institutions	Nations
Grand Prize		
Portable DC Atmospheric Water Generator/ Large Scale Distributed Atmospheric Water Supply Station	Mayu (Beijing) New Energy Tech Co., Ltd.	China
First Prize		
Tongwei: Play the Song of the Fishermen in the New Age	Tongwei Co., Ltd.	China
Lucky Elephant Decentralized Solar-Water Solution	Ningbo Weland Renewable Energy Co., Ltd.	China
Second Prize		
Solar-Powered Mobile Cold Storage Technology	MVUTU GreenBox™	Congo
Gilsun Biogas	Gilsun Technologies	United Republic of Tanzania
GIVO Africa	GIVO Africa	Nigeria
Third Prize		
Clean Energy Solution Based on Vanadium Flow Battery Energy Storage System	Chengde Xinxin Vanadium & Titanium Energy Storage Technology Co., Ltd.	China
Vertical Axis Wind Turbine (VAWT)	Dawood University of Engineering and Technology	Pakistan
Underground Wood Project: Geo-Engineering Based on Wood Vaults	Institute of Atmospheric Physics, Chinese Academy of Sciences	China
A New Technology for Near Real-Time Monitoring and Short-Term Forecasting of Large-Scale Photovoltaic Power Generation	Aerospace Information Research Institute, Chinese Academy of Sciences	China
Most Promising Solution Award		
Solar DC Fridge System	Shenzhen Solar Run Energy Co., Ltd.	China
Best Innovation Award		
Biomass Briquettes	Eco Charge Ltd.	Kenya



Clean Energy Innovation Category

Grand Prize

Mayu (Beijing) New Energy Tech Co., Ltd.

Founded in 2017, Mayu is committed to helping solve the problem of water shortage and water pollution around the world through the artificial manufacture of the third water source. The founder is a postdoctoral fellow in Cambridge, UK, and she holds 7 patents. The company has a complete R&D and engineering team, and has long-term cooperation with the university doctoral supervisor team, and the patent rights belong to the company. The management team includes professional CEO who have served in well-known multinational companies.

Mayu is a national high-tech enterprise and Zhongguancun high-tech enterprise, which has obtained 11 patents (another 9 are under application), 14 software copyrights, and has obtained ISO9001 artificial water source R&D and production certification. And obtained the product test certification of the provincial emergency department.

Portable DC Atmospheric Water Generator/ Large Scale Distributed Atmospheric Water Supply Station

Mayu develops, designs and produces artificial water source equipment and systems, that is, in areas where there is a lack of clean fresh water, uses natural resources such as air and sunlight to realize the "artificial manufacturing" of fresh water sources through high-tech physical means. Mayu offers fresh water systems ranging from 20 liters per day (DC portable) to up to 10 tonnes per day from a single site. The water quality has been inspected by a number of professional testing institutions, and all of them have reached and exceeded the national drinking water standards. After five years of research and development, the company has broken through the industry and traditional physical technology, and the water production efficiency is no longer limited by the environmental requirements of temperature (15°C-40°C), relative humidity > 30%RH, that is, the water output can still be guaranteed in the environment of -30°C to 50°C and the relative humidity < 20%RH. Mayu New Energy has the world's only core technology for artificially created water sources.

Application Scenario

Mayu Artificial Water includes a variety of application modules, which can be customized according to the needs of the actual region and scenario. Application scenarios can include, but are not limited to: drinking water sources, animal husbandry, agricultural irrigation, island drinking and domestic water, desert treatment, soil treatment, and emergency rescue. Water sources can be artificially created far from natural water sources, or even without a power grid. Product forms include walk-anywhere DC portable water production equipment or large-scale distributed water stations in crowded areas.

Core Technology Introduction
System Component

AtmosQua® System

Simulating the natural ecological water cycle through physical means, realized the physical change from air to water.

Case: Sand Control and Planting project at a Solar Base

5000m² System Space
20 ton AWG

- Sand control and Ecological Restoration
- Vegetable and Grass Planting
- Drinking for People and livestock
- Drip Irrigation for the crops near the Base

CASE: RV CLUB

20L/Day (Mobility)

Application Scenarios - Inner Mongolia Pasturing Area

Technical Parameters

20L Portable DC Atmospheric Water Generator:	1000L Atmospheric Water Generator:
Water production: 20L/day	Water production: 1000L/day
Power: 0.5kw	Power: 25.4kw
Size: 500*380*420mm	Size: 2165*1550*2076mm
Net weight: 30kg	Net weight: 1070kg
Power supply: AC & DC (DC: 12V, 24V, 48V)	Power supply: 380V



Clean Energy Innovation Category

First Prize

Tongwei Co., Ltd.

Tongwei Co., Ltd., controlled by Tongwei Group, is a large-scale private technology-based listed company with the dual main businesses of agriculture and new energy as its core. The company now has more than 200 branches and subsidiaries all over the country and overseas, with more than 50,000 employees. It boasts an annual feed production capacity of more than 10 million tons, an annual production capacity of high-purity crystalline silicon of 420,000 tons, an annual production capacity of solar cells of more than 90GW, an annual module production capacity of 55GW, and a cumulative installed and grid-connected capacity of PV power stations based on "PV+fishery" of 3.7GW. Tongwei plans that the cumulative production capacity of high-purity crystalline silicon and solar cells will respectively reach 800,000-1,000,000 tons and 130-150GW from 2024 to 2026.

Tongwei: Play the Song of the Fishermen in the New Age

In China, Tongwei vigorously promotes the "Fishery and Photovoltaic Integration" mode, constantly boosts the development of large scale, automatic and intelligent aquaculture, and realizes the production of green and safe aquatic products underwater and clean energy on water surfaces, thus achieving a triple win in fishing, power generation and environmental protection.

Producing clean energy on water surfaces: By the June 2023, Tongwei has put into operation 52 power stations based on fishery and photovoltaic integration in 20 provinces and cities in China, with a cumulative grid-connected scale of 3.7 GW. The incremental on-grid electricity of Fishery and Photovoltaic Integration projects have reached 9.163 billion kWh, saving 2.7626 million tons of standard coal, reducing carbon dioxide emissions by 7.032 million tons, and reducing sulfur dioxide emissions by 0.09 million tons, which is equivalent to planting 38,507.27 hectares of forest.

Producing green and safe food under water: Tongwei Fish has achieved food safely management throughout the industry chain. We have many high-quality fish farming bases nationwide, and several deep processing bases for products in Chengdu, Hainan, etc. Tongwei's processing process fully conforms to ISO and HACCP management systems, as well as EU and FDA certification standards. Each production step is subject to strict test and control, and one code is assigned to one fish for digital ID management, so as to deliver healthy, safe and high quality products.



Clean Energy Innovation Category

First Prize

Ningbo Weland Renewable Energy Co., Ltd.

As a world leading Decentralized Solar-Water Solution manufacturer, Lucky Elephant Solar is made for energy-poverty rural communities to empower their energy-independent and self-sufficient. In more than 80 countries, Lucky Elephant Solar is widely applicable at solar irrigation, solar fertigation, solar aeration, saline-alkali soil treatment, e-fishboat & dairy value-chain, etc. Lucky Elephant Solar is also the First Prize Winner of clean energy innovation of Low-Carbon Agriculture organized by FAO & CAAS.

Lucky Elephant Decentralized Solar-Water Solution

Ningbo Weland (Brand: Lucky Elephant) in house develops & builds equipment for various applications based on high-efficiency PMSM/BLDC engines, controlling system and IOT platform. Decentralized solar PV clean energy drives engines, and the controlling systems make sure they are running at the best performance. IoT supports remote control and data cloud storage which support Carbon Credit and traceability.



Clean Energy Innovation Category

Second Prize

MVUTU GreenBox™

Mvutu is a social enterprise based in Congo, that designs, installs, commissions and operates 100% solar-powered walk-in cold rooms under the GreenBox™ brand, in outdoor markets and farm clusters. GreenBox™ products are used by smallholder farmers, retailers and wholesalers to store and keep fruits, vegetables and other perishable foods fresh 24/7, extending their shelf life from 2 days to 21 days.

Solar-Powered Mobile Cold Storage Technology

The solar-powered walk-in cold room comprises 120mm insulation panels designed to effectively preserve a low-temperature environment. Solar panels affixed to the cold room's roof harness energy, which is subsequently stored in high-capacity batteries. These batteries power an inverter, facilitating the operation of the refrigeration unit. Incorporating advanced ice battery technology, the cold room employs a process of freezing water to create ice. This innovative approach involves the use of a chiller equipped with eight cooling units, each dedicated to lowering the temperature of water until it transforms into ice.

The cold water, surrounding the ice, is then pumped into the cold room, where an exchanger circulates the water and emits cold air to cool the stored food items. Notably, the Ice Battery Technology stands out for its commendable energy efficiency. Even during nighttime operations, the system utilizes a mere 5% of its energy capacity for cooling, leveraging the ice generated during daylight hours. This sustainable feature enhances the overall efficiency and environmental impact of the cold room.



Clean Energy Innovation Category

Second Prize

Gilsun Technologies

Gilsun Technologies specializes in the development, implementation, and maintenance of cutting-edge technology solutions in the field of renewable energy. A comprehensive range of services are offered, including:

- 1 **Biogas Solutions:** Gilsun Technologies provides customized biogas solutions that convert organic waste into valuable energy sources. Through advanced anaerobic digestion technology, the systems of Gilsun Technologies promote a circular economy while reducing greenhouse gas emissions.
- 2 **Biotech Innovations:** The team of experts leverages biotechnology to develop sustainable and cost-effective solutions for various industries. From microbial engineering to enzymatic processes, Gilsun Technologies aims to optimize efficiency and ecological sustainability.
- 3 **Engineering and Design:** Gilsun Technologies offers engineering and design services tailored to the specific requirements of each project. The experienced team collaborates closely with clients to create practical and efficient solutions that maximize performance and minimize environmental impact.
- 4 **Project Implementation:** Gilsun Technologies manages all aspects of project implementation, from feasibility studies and permitting to construction and commissioning. The focus on quality control and adherence to industry standards ensures the successful completion of every project.

Gilsun Biogas

Gilsun Technologies' biogas project presents a robust and sustainable solution for organic waste management and renewable energy production. With proven applicability across diverse sectors, the project efficiently converts organic waste into valuable biogas through anaerobic digestion. This process not only mitigates environmental pollution but also harnesses biogas as a clean energy source.

The project's scalability is a key highlight, as it can be tailored to meet the waste disposal needs of various industries, including agriculture, food processing, and municipal waste management. Its modular design allows for easy replication and expansion, ensuring adaptability to changing waste volumes and energy demands. By utilizing locally available organic materials, the biogas project reduces dependency on fossil fuels and contributes to a more sustainable energy mix.

Furthermore, the possibility of expansion sets Gilsun Technologies' biogas project apart. As the demand for renewable energy sources continues to grow, the project can be seamlessly extended to

accommodate larger waste streams and generate higher biogas yields. The technology's efficiency and reliability provide a solid foundation for future growth, making it an attractive option for investors and stakeholders seeking long-term, scalable solutions.

In conclusion, Gilsun Technologies' biogas project not only addresses pressing environmental concerns through organic waste management but also offers a viable pathway to renewable energy generation. Its proven applicability across diverse sectors, combined with its inherent scalability and potential for expansion, positions the project as a strategic and sustainable investment for a greener future.





Clean Energy Innovation Category

Second Prize

GIVO Africa

GIVO (Garbage In Value Out) is a circular economy company that offers an end-to-end recycling solution. GIVO uses IoT-enabled devices to collect recyclable material directly from individuals, families, and businesses and process these materials into consumer and industrial goods. GIVO also partners with mobile money service providers like Paga to improve the overall economic welfare of the waste generators (those who participate in GIVO's collection exercises) and drive financial inclusion through incentives, cashless transactions, and credit history.

GIVO began making international standard PPE from recycled materials, but GIVO has grown beyond making PPEs and has begun producing other sustainable and aesthetically pleasing products from the recycled materials collected during the recycling activities. Some of these products include flower vases, tables, toys, face masks etc. The latest innovation is the plastic panel, made from 100% recycled plastics.

GIVO, a climate tech startup, champions circularity in Africa through tech-enabled community solutions. Two synergistic products drive GIVO's mission:

GIVO Technology Platform (GTP): This digital powerhouse leverages frontier technologies to enhance waste management transparency, emissions tracking, and compliance metrics. By linking plastic management's intricate supply chain, GTP fosters data-driven decisions, fostering a circular economy.

GIVO Center: Empowered by solar tech, youth, and women, these community hubs aggregate, process local recyclables, averting 2000 MT of CO₂ annually. Each center employs up to 15 full-time youth and women, with a capacity to process 90 MT annually. Currently active in two Nigerian cities, GIVO is expanding to Liberia in Q4 2023.

GIVO's impact aligns with Sustainable Development Goals (SDGs):

SDG 5: Empowering, GIVO has 55% women in the workforce.

SDG 8: GIVO has added value, generating \$500k+.

SDG 11: An average of 22kg of recyclables collected per user, contributing to sustainable cities.

SDG 12: Sustainability shines as GIVO has collected & processed 849,762.4kg of recyclables.

SDG 14: By diverting 495,678.2kg from landfills and water bodies, GIVO protects life below water. GIVO's ecosystem thrives on innovation, empowerment, and tangible contributions to Africa's circular vision.



Clean Energy Innovation Category

Third Prize

Chengde Xinxin Vanadium & Titanium Energy Storage Technology Co., Ltd.

Based on the extensive vanadium and titanium resources in Chengde, the company has been collaborating with Dr. Maria, the inventor of Vanadium Flow Battery (VFB), and Tsinghua University since 2006 to develop key materials for VFB. Having a production capacity of 500MWh and 33,000m³ electrolyte production line, bipolar plate, proton exchange membrane production line, stack assembly, system integration, energy storage and power generation technology, with 15 patents and 12 invention patents, participating in the formulation of 7 national and industry standards for liquid flow batteries, undertaking 863 projects, National Scientific and Technological Support Project and other implementations.

Clean Energy Solution Based on Vanadium Flow Battery Energy Storage System

In three typical renewable energy scenarios (new energy plant, power grid, and user-end microgrids) vanadium flow battery (VFB) energy storage system served a crucial and irreplaceable role to change the unpredictable renewable energy into stable electricity supply.

In wind and PV plant, VFB energy storage system can collect energy abandonment and reduce curtailment. In power grid, the system can not only shift peak-load but also ease the electricity price differences. In remote areas isolated clean energy microgrid, VFB can store instantaneous daylight PV energy and provide power at night.

VFB energy storage system has the following benefits among other technologies. Safety: its aqueous electrolyte defines it as an inherently safe technology, avoiding risks such as fire and explosion in Lithium battery. Its long lifetime usage can last to 25 years or over 20000 circulations, with a fast grid-friendly response time. Also, VFB has a lifetime energy efficiency of 75%, which will not decline over time. Due to its safety and stackable nature, large-scale energy storage system, especially for scale from 100MW to 1GW, is most economically preferred to use VFB. Most importantly, the current lifetime Leveraged Cost of Storage energy (LCOS) of VFB is only 1.5 cents/KWh in USD, and will lower to 0.7 cent/KWh by the end of 2025. This low cost of storing energy allows the energy storage stations to have sufficient profit to operate and sustain a renewable power solution.

VFB also solve the problem of wasting vanadium resources in steel consumption for the past century which cannot be recycled. In VFB, vanadium electrolyte is a non-loss material functioning throughout its lifetime and can be recycled after battery termination.



Clean Energy Innovation Category

Third Prize

Dawood University of Engineering and Technology

Dawood University of Engineering & Technology (DUET) is a leading engineering institution dedicated to advancing engineering knowledge and practices. With a focus on groundbreaking R&D, DUET strives for a knowledge-driven economy and a brighter future. DUET take pride in the team's commitment to inclusivity and innovation. The university's visionary goal is to lead in techno-entrepreneurial excellence. The DUET has been a steadfast supporter, fostering innovation and contributing to the team's success.

Vertical Axis Wind Turbine (VAWT)

The groundbreaking technology involves the indigenous development of a Vertical Axis Wind Turbine (VAWT) solution designed for affordable and clean energy production. This innovative VAWT system is specifically tailored for installation in diverse settings, including urban, residential, commercial areas, and remote rural regions, regardless of their specific wind conditions.

The distinguishing feature of the model lies in its incorporation of an auxiliary system to maintain a constant wind speed. This expands the system's capabilities by harnessing both natural and artificial wind, ensuring a continuous and reliable wind energy supply. With a capacity ranging from 300 to 1,000 watts, the VAWT system has demonstrated its efficacy through a successful prototype deployed in Karachi, Pakistan, within a residential building.

Key features of the VAWT model include:

- Local Manufacturing:** 75% of VAWT components are locally manufactured, contributing to the regional economy.
- Long Operational Life:** The VAWT system boasts an operational life of up to 10 years, providing sustained performance.
- Local Repair and Maintenance:** The model emphasizes local repair and maintenance, reducing downtime and ensuring longevity.
- Workforce Training:** It prioritizes workforce training for VAWT development, maintenance, troubleshooting, and installation, creating skilled opportunities, especially for youth and women.
- Scalability:** The working prototype, a 300W turbine installed in Karachi, demonstrates promising results and the potential to effortlessly scale up to 1000W.
- Community Impact:** With plans to deploy in rural areas lacking electricity, this technology aims to benefit underserved communities by reducing carbon footprint and offering low energy costs, making it a cost-effective solution compared to other energy alternatives.
- Low Noise and Vibration:** Operating smoothly with minimal noise. The VAWT model respects the tranquility of its surroundings, ensuring both its longevity and the comfort of the local environment and structure.

In essence, the VAWT model is more than just a turbine; it represents a promise of sustainable energy for everyone, anywhere, and anytime, regardless of wind conditions. Its commitment extends to bringing clean energy to underserved communities, contributing to a more sustainable and inclusive future.



Clean Energy Innovation Category

Third Prize

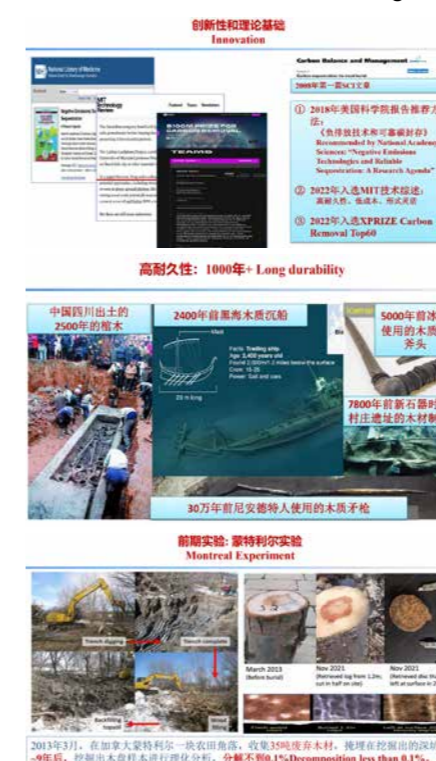
Institute of Atmospheric Physics, Chinese Academy of Sciences

The carbon monitoring and carbon removal team from the Institute of Atmospheric Physics, Chinese Academy of Sciences has undertaken several major national projects. This team focuses on the research, development, and application of technologies on carbon monitoring, inversion, emissions reduction, and sink enhancement. It is committed to provide multi-scale carbon monitoring and carbon removal solutions from enterprise, industrial park, to city, provincial and regional scales.

Underground Wood Project: Geo-Engineering Based on Wood Vaults

The climate catastrophe caused by climate change is imminent, and the climate urgency requires a large amount of highly durable (>100 years) carbon removal (CDR) of 10 billion tons of CO₂/year. Current engineering methods, such as direct air capture (DAC), are too expensive and energy-intensive, and are only used on a small scale, while nature-based solutions (NbS), such as afforestation, are at risk of re-release of carbon sinks (fires, droughts, pests and diseases, etc.), and are becoming carbon neutral as forests aging. The wood vault method, achieves low cost through the photosynthesis of natural vegetation (forestry, agriculture, etc.), which is free, and it is further combined with artificial engineering methods. That is the sustainable source of biomass (waste wood and straw, etc.) is collected and deeply buried. The biomass is isolated from oxygen and microorganisms decompositions, which can be maintained at the millennium scale with low cost. The technology has been carried out in Europe and the United States and other countries, and entered into the carbon trading market. This technique is selected as one of the "Top Ten Global Breakthrough Technologies" in 2022 by MIT Technology Review. And it is selected as one of the

top 60 techniques in the \$100M XPRIZE FOR CARBON REMOVAL established by Elon MUSK. This method is also recommended by the National Academy of Sciences: "Negative Emission Technologies and Reliable Carbon Sequestration: A Research Proposal". It entered the NASDAQ carbon market trading sector, and it provides historical and current product carbon neutral services for some well-known enterprises. The marketization of this technology will increase income and create green jobs for the developing countries, and at the same time has multiple benefits such as industry feeding agriculture, increasing green employment and tailings restoration, and providing important technical support for China to achieve the dual carbon goals.



Clean Energy Innovation Category

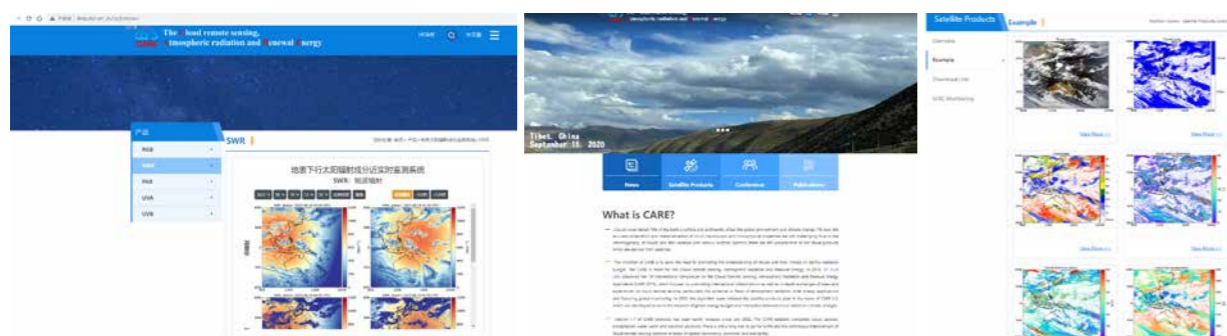
Third Prize

Aerospace Information Research Institute, Chinese Academy of Sciences

Dr. Husi Letu convened the 1st International symposium on the Cloud Remote Sensing, Atmospheric Radiation and Renewal Energy Application (CARE 2018), which focused on promoting international collaborations as well as in-depth exchanges of ideas and experiences on cloud remote sensing, particularly the advances in fields of atmospheric radiation, solar energy applications and featuring global monitoring. In 2020, the algorithm team initiated the satellite products plan in the name of CARE 1.0, which was developed to serve the research of global energy budget and interaction between cloud-radiation-climate changes.

A New Technology for Near Real-Time Monitoring and Short-Term Forecasting of Large-Scale Photovoltaic Power Generation

In order to support the realization of energy security and the innovation of clean energy, this project has developed a large-scale near real-time monitoring and short-term forecasting system for photovoltaic (PV) power generation, based on satellite remote sensing and numerical assimilation technologies. This system achieves higher accurate estimation and short-term forecast of solar radiation over the East Asia-Pacific region, by constructing cloud and aerosol remote sensing algorithms and data assimilation schemes, in comparison to international state-of-the-art products, such as the Clouds and the Earth's Radiant Energy System products from NASA, the next-generation reanalysis products from European Centre for Medium-Range Weather Forecasts, etc. Particularly, the system shows obvious advantages in solar radiation monitoring under cloudy and air pollution conditions. The core algorithms in the system are highly versatile and have been widely adopted by international satellite programs, such as the European Space Agency and the Japan Aerospace Exploration Agency, as well as being applied in the real-time solar energy monitoring application system of the China Meteorological Administration. The system's high portability enables its rapid deployment for large-scale PV power generation monitoring and forecasting in other countries. Therefore, this system holds strong application prospects and market potential in the field of new energy utilization, effectively promoting the sustainable and healthy development of PV power generation with significant economic benefits. With reference to penalties imposed abroad, a 10% improvement in solar energy forecasting accuracy in 2023 could lead to a profit increase of 400 million RMB, and by 2060, the profits could increase to 6.4 billion RMB.



Clean Energy Innovation Category

Most Promising Innovation Prize

Shenzhen Solar Run Energy Co., Ltd.

Founded in 2016, Solar Run Energy is committed to providing reliable, affordable and sustainable one-stop solar solutions for off-grid areas.

Solar Run Energy serves 5.4 million people in 63 countries, sustainably reducing carbon by 1.6 million tonnes. It spends over \$1.8 million on R&D and nearly \$1.2 million on various quality certifications.

Solar Run Energy currently holds the world record for the largest number of companies to achieve World Bank Verasol certification, with 59 products certified. Additionally, Solar Run is ISO 9001 and ISO 14001 certified for Quality Management System, has actively participated in more than 13 World Bank-funded electrification projects, and became a member of the UN GLOBAL COMPACT in 2021.

Solar DC Fridge System

- Project Background:** In the face of food and climate crises, a sustainable food cold chain is crucial. The core team of Solar Run Energy visits developing countries annually, such as India, Africa, Myanmar, Pakistan, Yemen, etc. Witnessing impoverished people on the streets going hungry and the rotting food in dumpsters, it is determined to do something for these populations. According to FAO data, over 3 billion people cannot afford a healthy diet; the lack of effective refrigeration directly leads to a loss of 526 million tons of food production, accounting for 12% of the global total; if the food cold chain infrastructure in developing countries reaches the level of developed countries, they could save 144 million tons of food annually.
- Project Implementation:** To address these issues, Solar Run Energy aims to solve the problems of electricity and food waste in areas without or with insufficient power. Therefore, it is designed and developed a solar DC refrigeration system to reduce food waste in regions with power shortages, lower electricity costs, solve electricity problems for people's daily lives, and extend food storage time. Additionally, it increases income for local small farmers and merchants by selling cold drinks, creates job opportunities, improves living standards, and promotes sustainable development in the local economy, society, and environment.
- Project Achievements:** As a social enterprise, Solar Run Energy actively addresses social issues while ensuring sustainable operations. The company emphasizes innovation and research and has invested significant human and material resources to develop an innovative solution — the solar-powered DC refrigeration system — suitable for low-income groups, meeting daily refrigeration needs.



The solar DC refrigeration system has received certification from the World Bank's Verasol. As a leader in the solar energy industry and a participant in standard-setting, Solar Run Energy actively promote DC appliances to cover rural areas in Africa. Ricky LU, the Product Director of Solar Run Energy, is an invited advisor to CLASP's China Solar Refrigerator Technical Group and is involved in the formulation of standards for solar refrigeration systems in off-grid areas.

Since the official launch of the solar DC refrigeration system in 2022, it has been sold internationally, with main sales countries including Papua New Guinea, Vanuatu, Ethiopia, etc. By the end of 2022, nearly 3,000 refrigerators had been sold, reducing carbon emissions by 600 tons annually through the use of clean solar energy, and decreasing food waste by 15,000 tons, indirectly impacting 24,000 people.



Eco Charge Ltd.

Biomass Briquettes

Eco Charge Ltd. is spearheading an impactful initiative by converting agricultural waste into practical briquettes, offering a green alternative to traditional fossil fuels. These briquettes not only reduce greenhouse gas emissions but also enhance waste management practices.

With a keen focus on scalability, the project targets key sectors like power generation, steam production, heating, and cooking. Manufacturers, schools, and the HORECA sector are primary beneficiaries, positioning the biomass briquettes as a pragmatic solution to energy consumption. In regions where firewood dominates, such as Africa, the environmental consequences are evident—deforestation, increased carbon footprint, and health issues. Eco Charge Ltd. addresses these challenges with a sustainable approach to energy production.

The company has a well-planned roadmap for expanding production into new regions like the DRC Congo, Rwanda, Burundi, and Zambia. Thorough research ensures an understanding of raw material availability and the target market in each location.

Beyond environmental benefits, Eco Charge Ltd. contributes to social development by creating jobs for women and youth. Organized groups collect biomass waste, supplying it to Eco Charge Ltd., and participating in the drying process. Replicating this model has the potential to create over 1,000 jobs per project, making it a concrete and logical solution for both environmental and economic progress.

Eco Charge

Eco charge KUNI BORA

Habari Karibu
ECO CHARGE LIMITED
Tunatoa huduma ya nishati mbadala kwa gharama nafuu sana na kupunguza ukataji wa miti ovyo kwa kutengeneza kuni kwa kutumia masalia mbalimbali ya manzao

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- Zinawaka mara nne Zaidi ya kuni za kawaida
- zinabana matumizi kutokana na kuwaka muda mrefu kuliko kuni za kawaida
- Hazina moshi
- Hazina kernikali yoyote
- Rahisi kuhifadhi
- Halli ya mvuke ipo chini
- Hazilitaji vibarua wengi

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AWARD CEREMONY

On November 6, 2023, UNIDO Global Call 2023 Award Ceremony was held during the 6th China International Import Expo (CIIE) in Shanghai. The award ceremony invited experts from the International Association for Hydrogen Energy, International Hydrogen Energy Center, Beijing Tsinghua Industrial R&D Institute, Tencent Group, Schneider Electric, and other authoritative organizations in the industry to carry out the evaluation.



Scan for Ceremony Video

Through the roadshow presentations of the first-prize shortlisted projects, a grand prize was decided for each category. Fatou HAIDARA, Deputy to the Director General and the Managing Director of the Directorate of Global Partnerships and External Relations of UNIDO; and Siddharth CHATTERJEE, UN Resident Coordinator in China, presented awards to the grand prize winners in recognition of the projects' ground-breaking contributions. The winning teams for special awards, as well as the first, second, and third prizes in each category, were successively unveiled.

In addition, GC2023 featured the Excellent Organization Award, designed to honor entities demonstrating exceptional capabilities and contributions in clear and smart energy sector. The award-winning entities are as follows: International Association for Hydrogen Energy, Lu'an Municipal People's Government, and China Construction Fifth Engineering Division Corp., Ltd.

WAY FORWARD

UNIDO Fourth Industrial Revolution Accelerator (Hangzhou)

The award winners of Global Call 2023 will have the opportunity to join the 4IR Accelerator, gaining access to project roadshows, empowerment training, and long-term showcasing opportunities, thereby enhancing their connections with high-quality resources and deepening international cooperation.

Introduction to the Accelerator:

- Amidst the backdrop of the Fourth Industrial Revolution, leverage UNIDO's global network to explore, identify, and assess practical new technologies, considering both market viability and technical feasibility.
- Organize or Co-host forums, seminars, and matchmaking events to enhance capacity, facilitate investment and technology alignment, provide consultancy, and foster knowledge exchange.
- Advocate for the development of resilient ecosystems aimed at bolstering capabilities, expediting investments, and nurturing growth in both China and worldwide, particularly in developing countries.

Global Showroom + One-stop Procurement Hub + Everlasting Investment Promotion Platform



Scan for Accelerator Video

Hydrogen Energy Technology and Investment Forum for Sustainable Development

The winners of the Global Call 2023 will be given the opportunity to actively participate in the Hydrogen Energy Technology and Investment Forum for Sustainable Development and showcase their cutting-edge technologies.



UNIDO Global Call 2023 Winner Delegation China Mission

A visit by the Global Call 2023 winners' delegation to China is planned. The winners will have the opportunity to explore the four Regional Coordination Centers of UNIDO ITPO Beijing and engage in matchmaking events with investment institutions, industrial parks, and local governments.



UNIDO ITP NETWORK

Under the supervision of the Managing Director of GLO, the Division of ITPOs and Institutional Partnerships (GLO/ITP) is responsible to link all UNIDO's Investment and Technology Promotion Offices (ITPOs) with international corporate partners through the Investment and Technology Promotion Network (ITP Network), thus promoting sustainable industrial development.

UNIDO ITP Network strategically located in both hemispheres, is an umbrella-structured network administrated by GLO/ITP at UNIDO Headquarters. The ITP Network is committed to promoting investment and technology between host countries investors and technology suppliers with potential partners in developing countries. Currently, UNIDO has established 10 ITPOs in 8 countries, including Bahrain, China, Germany, Italy, Japan, South Korea, Nigeria, and Russia.



ACKNOWLEDGEMENT



Prof. Yabin WU
Head of UNIDO ITPO Beijing

The Global Call 2023 is coming to an end, we recognize that the competition and awards ceremony mark not the finish point but a starting point.

We extend heartfelt thanks to all supporting units. Your support has been invaluable, providing the resources and environment for the success of this event.

A special acknowledgment goes to the participants for their passion, creativity, and contributions, making this event vibrant and memorable.

My gratitude extends to the hardworking staff whose dedication ensured the smooth execution of the event. Your efforts and professionalism are the backbone of our collaborative success.

Looking ahead, we commit to leveraging the ITPO platform wisely, making informed investment decisions, and driving further initiatives. Thank you all for your support and participation. Together, let's embrace the inclusive and sustainable industrial development.



ACKNOWLEDGEMENT

Partnerships



The Team

UNIDO ITPO Beijing

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Volunteers

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 Sihan CHENG
 Fuyu DU
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 Xingjian GAO
 Shiqian GUAN
 Yifan HE
 Can HU
 Dangyue JI
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