Hydrogen Power
– the Blueprint of Our Future

Troowin | Expert of Fuel Cells

 Revised in November

CONTENTS

Contents

I. Company Profile

II. Key Advantages

III. Technologies & Products

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- Established in Wuhan in 2011, Troowin engages in the R&D and manufacturing of fuel cell stacks , systems and their key components.
- Troowin,being an expert in the fuel cell industry, has expertise that covers all key technologies for hydrogen fuel cells.
- Troowin' s core competency is to design and develop fuel cells tailored to our customers' specific requirements. Through collaboration with terminal OEMs, Troowin supplies either stack modules or fuel cell systems.

National Hi-tech Enterprise

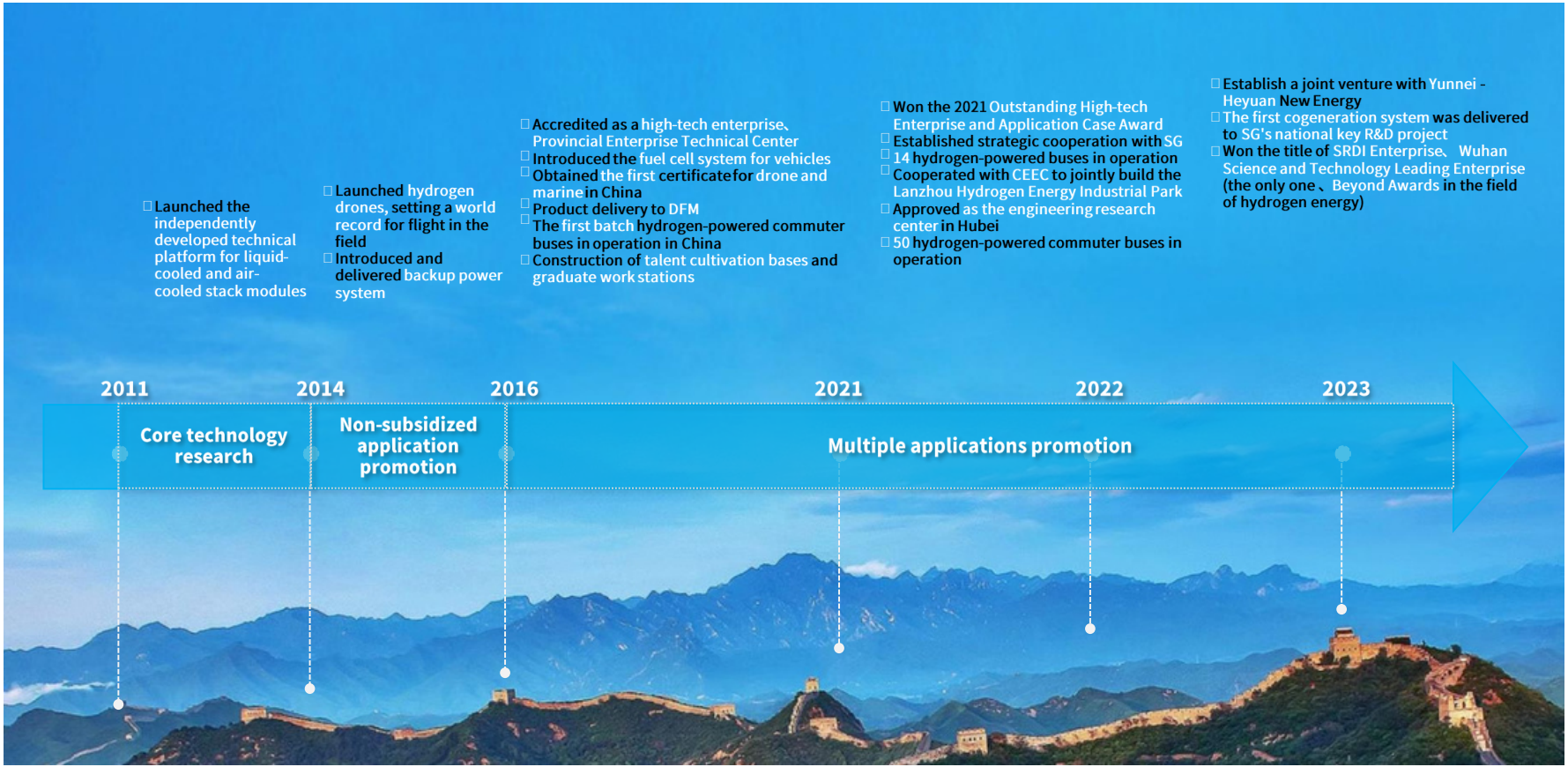
SRDI Enterprise

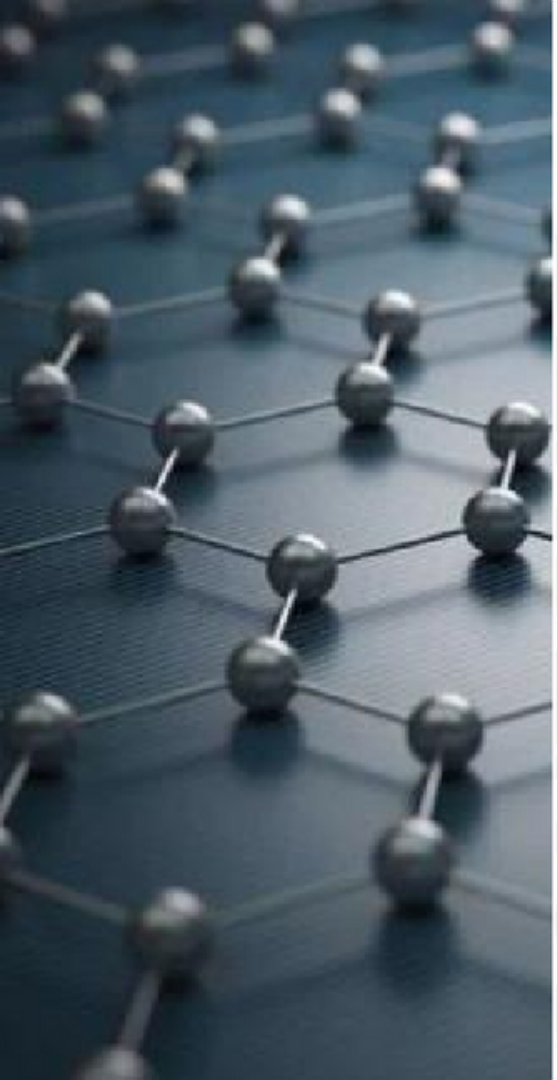
Hubei Provincial Engineering Research Center

Hubei Provincial Enterprise Technical Center

Hubei Hydrogen Energy Talent Cultivation Base

History of Development





CONTENTS

Contents

I. Company Profile

II. Key Advantages

III. Technologies & Products

empower

A core management team of experts

Liu Yingping President

- Master of HIT, expert in gas field
- Founder of several gas companies, worked for WISCO
- Nearly 30 years of experience in gas produc-tion and sales and enterprise management and abund ant resources in the industry

Dr. Li Xiao Founder and General Manager

- Doctor of fuel cells, MU, senior engineer, an expert under the 100 Talent Plan of Hubei and the Huanghe Talents Program of Wuhan
- Deputy to Hubei Provincial People's Congress, Wuhan CPPCC member
- Visiting researcher of Chinese Academy of Sciences, visiting professor of Wuhan Unive -rsity of Technology, Hubei University of Technology, Jianghan University
- Member of National Fuel Cell and Flow Battery Standardization Committee, expert of IEC TC105 International Standard Working Group
- Over 20 years of experience in fuel cell development

Li Jiuding Vice General Manager

- Bachelor of Zhongnan University of Economics and Law
- Worked as the sales general man -ager/director of Hubei Tri-Ring and Guodian Siwei
- More than 10 years of sales experi -ence in the new energy industry with rich resources

Wu Wengang Production Director

- Bachelor of Wuhan University of Tec-hnology
- Worked as the director of Dongfeng Honda's manufacturing department, the head of Wescast, and the vice president of Nissei Display System
- Nearly 30 years of experience in aut -omobile and parts production and quality management

Jie Yarong Financial Director

- Bachelor of Zhongnan University of Economics and Law, CPA, CTA
- Worked as the project manager of PEKING and the financial direc -tor of Wuhan Hengfeng Yuhua
- Has extensive experience in listin -g and stock operation

A first-class R&D team in the sector

Employees 140+	10+ Professional fields	R&D team 60%+	
Employees with master's degree or higher degree 30%+	Doctorate and intermediate & senior titles 20+	Employees with bachelor's degree or higher degree 80%+	

Research institute advisory group

Troowin has established an enterprises-universities-research institutions cooperation mechanism and laboratories or centers with famous research institutes, universities and enterprises both at home and abroad.

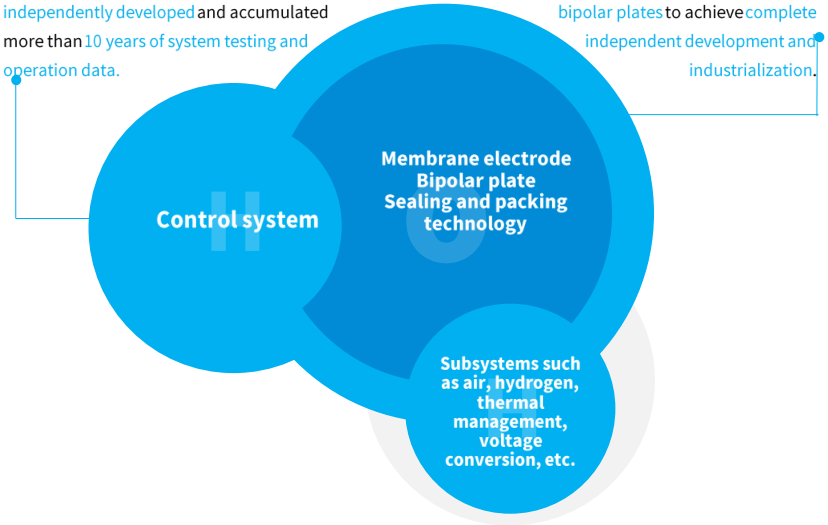
Focus on core technology development and production, core components are 100% independently developed

System’ s "brain": controller

The system control strategy design determines the stability, durability and safety of the system. Troowin has 100% independently developed and accumulated more than 10 years of system testing and operation data.

System’ s "heart": stack

Troowin is committed to the research, development and design of membrane electrodes and bipolar plates to achieve complete independent development and industrialization.



220 patents applied, 156 patents granted

5 Top 5 in the industry 5 patents for invention in the USA, Japan and the EU

21 Led or participated in the formulation of 21 standards

Comprehensive, professional and experienced technical and product services

Fuel cell systems for 3 industries (vehicle, marine and power supply), FCCU solutions, and system testing solutions.

Obtained various authoritative certifications and listed in more than 10 catalogues.

Launched commercial operation in many fields to help carbon neutrality and carbon peaking.

- Troowin is engaged in the entire fuel cell industrial chain and has professional and experienced R&D, design, verification, inspection, production and service capabilities.

- Troowin is also engaged in upstream hydrogen production technology, covering upstream and midstream industrial chains.

CONTENTS

Contents

I. Company Profile

II. Key Advantages

III. Technologies & Products

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Troowin Technologies and Product Line

Technologies -
Fuel cell stack modules and core components

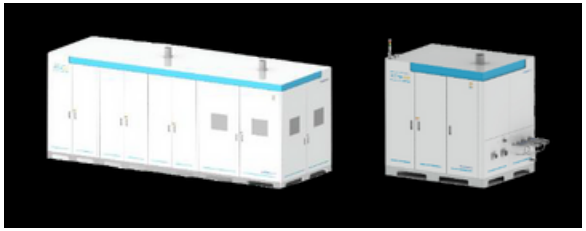
- MEA (mass production)
- Molded graphite BPP (mass production)
- Air-cooled stack
- Liquid-cooled graphite/metallic stack

Products -
Fuel cell systems

- Vehicle fuel cell system
- Fuel cell power plant
- Marine fuel cell system
- C series fuel cell system

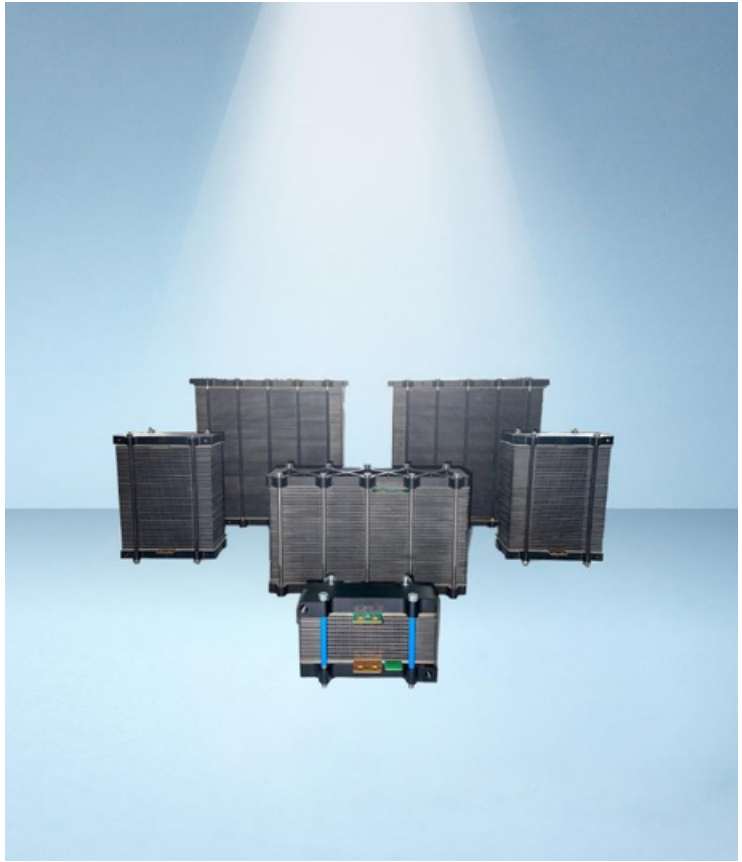
Products -
Technical and engineering services

- FCCU solution
- Fuel cell testing solution
- Fuel cell laboratory design



G4 is a Troowin designed, new generation, graphite liquid-cooled stack with power output of 20-180kW. It can be used in applications such as commercial vehicles, shipping, cogeneration, distributed microgrid, etc.

Product parameters	
Rated power（kW）	174
Volumetric Power Density（kW/L）	4.6
L*W*H（mm^3）	736*510*265
Weight（Including shell, kg）	68.1
Minimum start temperature（℃）	-30
Storage temperature（long term, ℃）	-40~60



C1 is a Troowin designed, commercially available, closed-cathode type air-cooled stack with power output covering 400W-4kW. It has been widely used in backup power supply, portable power source, forklift, two-wheeled vehicles, etc.

Product parameters	
Rated power（W）	3500
Rated current（A）	65
L*W*H（mm^3）	324*74*271
Weight（kg）	4.5
Minimum start temperature（°C）	-20
Storage temperature（long-term, °C）	5~70

The TWLQ series is developed based on the liquid-cooled, graphite stack platform with power output between 30-240 kW, and is applicable to buses/cars, light/medium/heavy-duty trucks/logistic lorries, tractors, etc.

Environmentally-friendly
"Negative" emission
Low noise level

Highly adaptive
Independently developed
Modular integration

Highly efficient
High usage of energy
High energy density

Super safe
IP67
Remote control

Super reliable
Excellent endurance
Free of mechanical parts
Sub-zero temperature startup

	TWLQ-95	TWLQ-120	TWLQ-200
Rated power（kW）	95	120	200
L*W*H（mm^3）	950*800*660	1000*800*690	980*760*980
Weight（kg）	215	194	285
Minimum start temperature（°C）	-30	-30	-30
Max. efficiency		60%	

Catalogue of New Energy Vehicles of MIIT - 14 models


Troowin & DFM


Troowin & DFM


Troowin & Sunlong


Troowin & Geely


Troowin & WHBC


Troowin & Golden Dragon（2）


Troowin & KingLong（2）


Troowin & Skywell


Troowin & Skywell (2)


Troowin & Skywell

Troowin has developed nearly 20 hydrogen energy models with many domestic mainstream automobile manufacturers, and 14 models of them have been included into the Catalogue of Recommended Models for the Promotion and Application of New Energy Vehicles issued by MIIT.

Batch delivery and commercial operation

In January 2020, **China's first batch (10 units)** of hydrogen energy commuter vehicles were put into commercial operation and have operated continuously for **over 1,500,000km**

In December 2021, **14** hydrogen energy buses were put into operation in Wuhan, and have operated continuously for **over 1,000,000 km**

Batch delivery and commercial operation

In 2022, **the first batch** of hydrogen energy sanitation trucks were put into trial operation in Wuhan, which are used for cleaning urban squares, roads and other places

In December 2022, **50** hydrogen energy commuter vehicles were put into commercial operation , and have operated continuously for **nearly 500,000 km**

The plant independently developed and produced by Troowin and fueled by hydrogen, provides efficient, reliable, stable and environment-friendly power support for the power grid. The system adopts a modular design, including six 420kW fuel cell power generation modules. It has the functions of automatic data acquisition, multi-channel cell detection, active safety protection and intelligent temperature/pressure/flow control.

Environmentally-friendly	Highly adaptive	Highly efficient	Super safe	Super reliable
"Negative" emission Low noise level	Independently developed Modular integration	High usage of energy High energy density	Automatic warning and protection IP54	Small attenuation and long service life Resistant to high and low temperature Convenient maintenance

	2.5MW power plant
Rated power（MW）	2.5
L*W*H（m3）	12.19*2.44*2.59（40-foot ISO standard container）
Weight（t）	~30
Output voltage（VDC）	500-850, adjustable
IP rating	IP54
Maximum efficiency	60%

In January 2023, Troowin assists State Grid's first national key hydrogen energy R&D plan - Ningbo Cixi / Hangzhou hydrogen electric coupling DC microgrid demonstration project put into operation

Troowin has independently designed, developed and manufactured a fuel cell system that is applicable to ships navigating offshore and on inland rivers, lakes, etc., and the system has been certified by an authoritative certification agency-CCS.

CCS	Environmentally-friendly	Highly adaptive	Highly efficient	Super safe	Super reliable
First certified in China	"Negative" emission Low noise level	Independently developed Modular design	High energy density Short charging time	Real-time monitoring Forced ventilation	Free of mechanical parts Storage at -40-60℃

	TWZFCSZ-60	TWZFCSZ-80
Rated power（kW）	60	80
L×W×H（mm^3）	1600*827*1235	1600*950*1050
Weight（kg）	338	450
Minimum start temperature（℃）	-30	
System efficiency	＞50%	

CCS certification

In January 2021, Troowin obtained the type approval certificate for the marine fuel cell system from CCS, **the first one in China**

Industrial recognition

In January 2022, Troowin won **the annual industry application case award**

Commercial operation

In December 2021, Troowin & Zhongjiang developed the commercial hydrogen fuel ship, **the first one in China**

Troowin has independently designed, developed and manufactured an air-cooled fuel cell system with power within 0.3-30 kW, and the system is applicable to such fields as power of motor cycles, sightseeing buses and forklifts, power supply, microgrid, power generation, etc. and can be customized.

Environmentally-friendly
"Negative" emission
Low noise level

Highly adaptive
Independently developed
Modular expansion

Highly efficient
Compact and light weight
High energy density

Super safe
Automatic warning and protection

Super reliable
Highly adaptive to environment
Small attenuation and long service life
Maintenance-free

	C-800	C-2400	C-6200
Rated power（W）	650	2000	5000
L×W×H（mm^3）	315*205*200	315*205*330	630*520*430
Weight（kg）	6.5	8.5	23.5
Ambient temperature（℃）	-20~55		

Application in power supply

Backup power source for telecom services Demonstration unit in Mangzhou Island--5G Hydrogen Energy Smart Island

Backup power source for telecom services Demonstration unit in Doushan Base Station in Jiangmen, Guangdong

Backup power supply for server room Demonstration unit in Server Room of Guangdong Gaotang Software Park Administrative Committee

Application in power supply

Backup power source for communication

Smart Base Station Operation in SEA

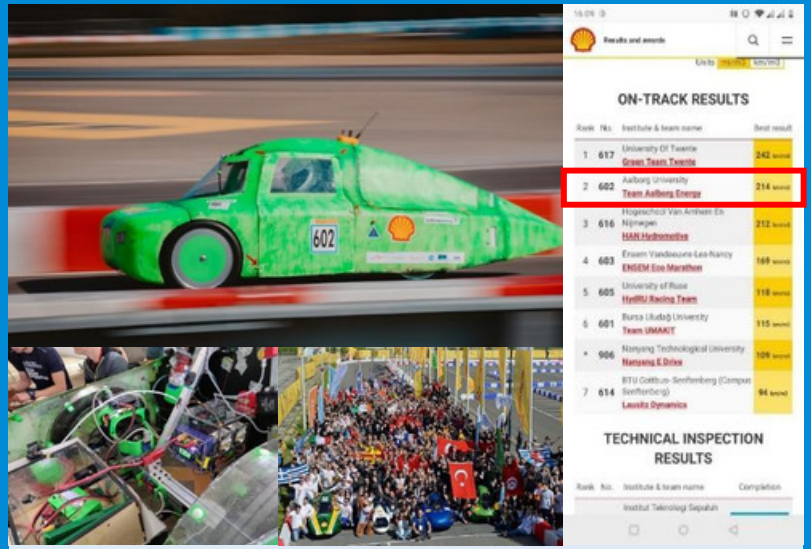
Backup power source for communication

China Mobile Base Station Operation in Dazhou，Sichuan

Application in drone

Hydrogen drones equipped with Troowin's C series created an endurance **world record of 273 mins** in the field, and have been used in **search and rescue over rivers and for patrols at PV power plants**

Application in small powertrain



Hydrogen cars of Team Aalborg Energy equipped with Troowin's C series won **the second place in the Shell Eco-marathon Europe**

THANK YOU

TROOWIN 众宇
燃料电池专家

Empower

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