

# HEPS

Hydrogen Electricity Power System



heps@hepshappy.com  
26-23, Suchuldaero 9-gil, Gumi-si,  
Gyeongsangbuk-do, Republic of Korea  
82-54-461-5348



# Fuel Cell Stack / Powerpack Specialist Company



## Hydrogen Fuelcell Stack Platform

- Stack Sale
- Stack maintenance
- OEM, ODM Production

## Hydrogen Fuelcell Powerpack & System

- Micro mobility
- Special purpose mobility
- Distributed power generation system

## Fuel cell engineering for power generation

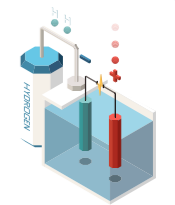
- MW power plant engineering design
- Power plant EPC
- Power plant LTSA

## Stack Reuse & Recycling

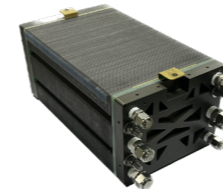
- Stack reuse service
- Stack recycling business



# Fuel Cell Power Products Summary

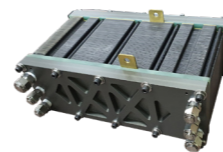


## Stack Platform



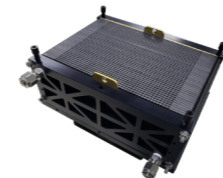
### Liquid-Cooled

- Model Name : H-WCS-SP
- Usage : Distributed power generation
- Application : Building fuelcell
- Rated Power : 1 ~ 10kW



### Liquid-Cooled

- Model Name : H-WCS-HM
- Usage : Mobility, Distributed power generation
- Application : Forklift, Excavator, Distributed power generation, Power plant, Emergency generator
- Rated Power : 10 ~ 100kW

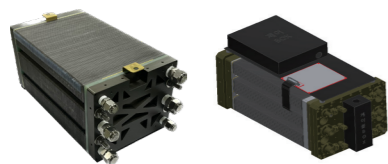


### Air-Cooled

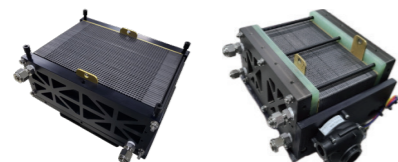
- Model Name : H-ACS-M
- Usage : Micro mobility
- Application : Bicycle, Cargo bike, Scooter
- Rated Power : 0.25 ~ 2.5kW

## Stack Platform

### Liquid-Cooled



### Air-Cooled

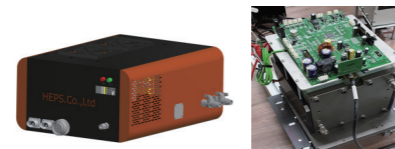


## Mobility Powerpack

### Forklift Fuelcell Powerpack



### Scooter Fuelcell Powertrain



## Stationary System

### Buildings Fuelcell System



### Power Generation Fuelcell System



## Mobility Powerpack



### Liquid-Cooled

- Model Name : H-FC-M
- Usage : Mobility
- Application : Forklift excavator
- Rated Power : 10, 30, 50kW



### Air-Cooled

- Model Name : H-FC-MM
- Usage : Micro mobility
- Application : Bicycle, Cargo bike, Scooter
- Rated Power : 0.5, 1.5, 2.5kW

## Stationary System



- Model Name : H-FC-Cogen
- Usage : Distributed power generation
- Application : Building Fuelcell, Distributed power generation, Power plant, Emergency generator
- Rated Power : 1, 3, 6 MW

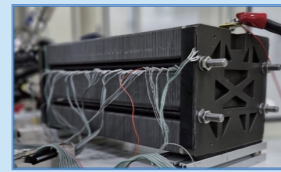
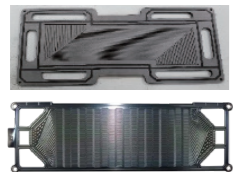
## HEPS Stack platform

- High Performance, Long Life, Low Price Stack
- Application of high temperature, low humidity MEA
- Application of thin carbon separator technology
- Cell Voltage Monitoring Technology
- Inlet/Outlet port compression plate integration

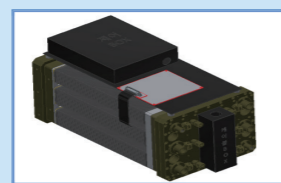
### MEA



### Thin Carbon Separator



### Stack

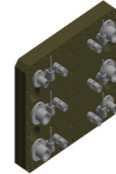


### Stack Module

### CVM



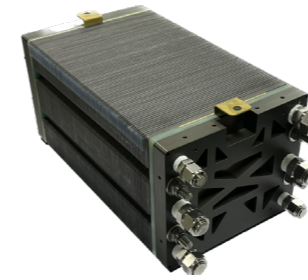
### Compression Plate Module



## Liquid-Cooled Stack Product - Stationary

### H-WCS-SP series

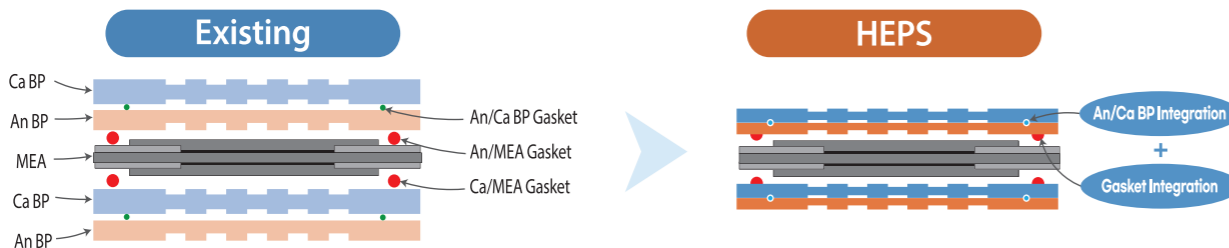
- PEM Fuel Cell Stack for stationary application (for building, plant fuel cell system)
- Application of thin carbon separator plate
- Application of MEA capable of high-temperature and low-humidity operation
- Ambient pressure operation
- Lower cost, High durability, Minimize stack volume



	H-WCS-SP-1K	H-WCS-SP-3K	H-WCS-SP-5K	H-WCS-SP-7K	H-WCS-SP-10K
Power (kW, DC)	1kW	3kW	5kW	7kW	10kW
Voltage (V)	12.8	38.3	63.8	89.3	114
Current (A)	80	80	80	80	120
Size (W/D/H, mm)	200/240/125	200/240/225	200/240/325	200/240/425	400/155/450
Weight (kg)	15	20	27	35	35
Fuel	H <sub>2</sub> , >99.97%				
Operating Condition	H <sub>2</sub> /Air=1.5/2.5 stoic, Temperature 70~80 °C, ambient pressure (<50kpa) An/Ca RH = 50%/80%				
Active area	200	200	200	200	300
Number cell of stack	17	51	85	119	114

## Integrated Thin-plate Carbon Bipolar Plate

- Improved durability compared to metal Bipolar plate
- Anode/Cathode/Gasket Integrated design technology
- Minimize the thickness of the Bipolar plate ▶ Increased unit volume power density



	Existing	HEPS	Effect
An,Ca BP Integration	▲/x	●	Volume ↓, Number of Part ↓
BP Gasket Integration	x	●	Volume ↓, Number of Part ↓
An BP Thickness	1.5mm	<b>0.9mm</b>	Volume, Weight ↓
Ca BP Thickness	2.5mm	<b>1.8mm</b>	Volume, Weight ↓
Number of unit cell parts	8	<b>3</b>	Simplify manufacturing process



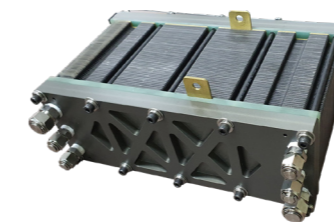
BP Thickness 3.2T > 2.2T > 1.4T > 1.0T

BP(Bipolar plate), An(Anode), Ca(Cathode), Gasket

## Liquid-Cooled Stack Product - Mobility

### H-WCS-HM series

- PEM Fuel Cell Stack for mobility application
- Application of thin carbon separator plate
- Vibration-resistant, Indentation-resistant, Environment-resistant stacks
- Output scalable stack, Lower cost
- High durability, Minimize stack volume



	H-WCS-HM-10k	H-WCS-HM-30k	H-WCS-HM-60k	H-WCS-HM-100k
Power (kW, DC)	10kW	30kW	60kW	100kW
Voltage (V)	38.2	111.2	222.4	375.3
Current (A)	270	270	270	270
Size (W/D/H, mm)	400/155/240	400/155/545	(400/155/545)*2	(400/155/545)*3
Weight (kg)	25	45	45*2	45*3
Fuel	H <sub>2</sub> : >99.99%			
Operating Condition	H <sub>2</sub> / Air max 200kpa, Temperature 75~80°C, Anode/Cathode Relative humidity = 50%/80%			
Active area	300	300	300	300
Number cell of stack	55	160	320	540

## Fuel Cell Powerpack Product - Mobility

### H-WCS-M series

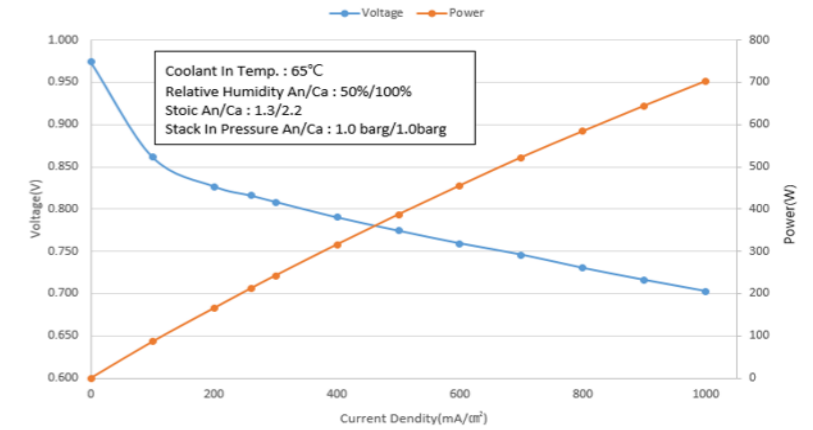
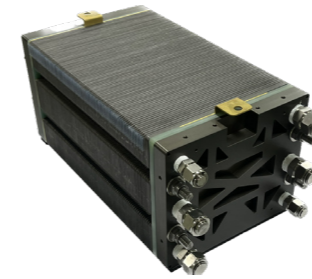


- Mobility Powerpack application : Construction machinery(Forklift, Excavator)
- Application of thin carbon separator plate
- Vibration-resistant, Indentation-resistant, Environment-resistant stacks
- Output scalable stack, Lower cost
- High durability, Minimize stack volume

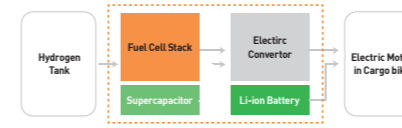
	Mobility		
	H-FC-M10	H-FC-M30	H-FC-M50
Power (kW, DC)	10kW	30kW	50kW
Voltage (V)	41.7	132	208.5
Current (A)	270	270	270
Fuel	H <sub>2</sub> : >99.97%		
Operating Condition	H <sub>2</sub> / Air max 200kpa, Temperature 75~80°C, Anode/Cathode Relative humidity = 50%/80%		

## Fuel Cell Stack and Powerpack Performance

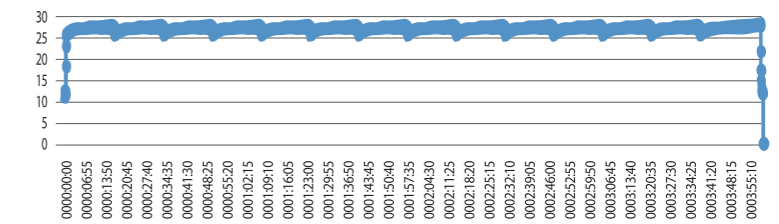
### Liquid-Cooled Stack IV Curve



### Air-Cooled Powertrain 4 hours continuous operation



#### Stack voltage



As a result of long-term continuous operation data, it was confirmed that the stack voltage was maintained without dropping.

## Fuel Cell Powerpack Product - Micro Mobility

### H-WCS-MM series



- Micro Mobility Powerpack application : Bicycle, Cargo Bike, Scooter
- Application of thin carbon separator plate
- System Simplification
- Output scalable stack, Lower cost
- High durability, Minimize stack volume

	Micro Mobility		
	H-FC-MM500	H-FC-MM1500	H-FC-MM2500
Power (kW, DC)	500W	1500W	2500W
Voltage (V)	31.6.6	94.0	158.0
Current (A)	17.5	17.5	17.5
Fuel	H <sub>2</sub> : >99.97%		
Operating Condition	H <sub>2</sub> <50kpa, Temperature 45~50°C, no humidification		

## Fuel Cell Powerpack Application

### Liquid-Cooled Powerpack



- Eco
- Low noise (<60db)
- Vibration Resistance
- Dust Resistance
- Charging time(<5min)
- 10kW, 30kW, 50kW



### Air-Cooled Powerpack



- Eco
- Low noise (<60db)
- System Simplification
- Charging time(<5min)
- 500W, 2.5kW, 5kW

