LOOP™
ENERGY

Hydrogen Fuel Cell Solutions

For Commercial Mobility & Stationary Power

Our industry leading fuel efficiency:
Your lowest capital cost and
lowest operating cost.

Technology

Proprietary eFlow™ Technology

Unique bipolar plate with trapezoidal flow field and narrowing channels.

Key Benefits:

- Higher fuel efficiency
- Greater longevity
- Lower TCO

Robust Fuel Cell Stacks

Manufactured in-house to ensure state-of-the-art performance and quality management.

Products

High Efficiency Fuel Cell Modules

Plug-and-play solutions that lower integration cost and enable fastest time-to-market.

Factory Programmed Fuel Cell System

Taking it a step further with a system containing our fuel cell control unit directly managing a cooling system and DC-DC converter.

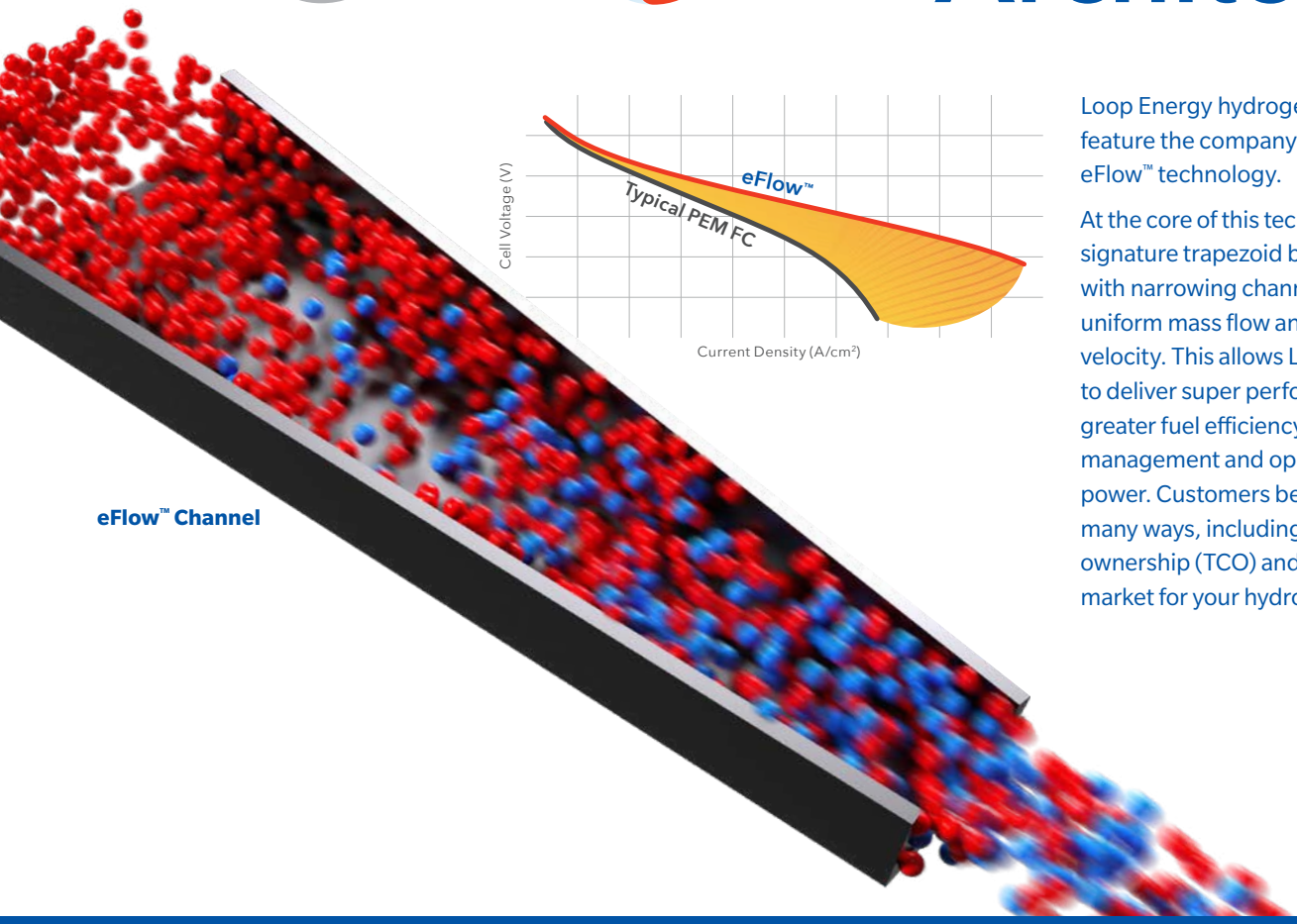
Loop Energy is Powering Hydrogen Electric Products Worldwide

Our fuel cells encapsulate over 20 years of technology that is second to none. Customers choose Loop Energy not only for our superior technology and product performance, but also for our unmatched level of support for customers. Today, Loop Energy's fuel cells are used in a wide variety of applications around the world, including transit buses, trucks, material handling equipment, special purpose vehicles, stationary power and more.

Primary Applications

- Trucks
- Buses
- Stationary Power
- Material Handling

Loop Energy's Patented eFlow™ Architecture

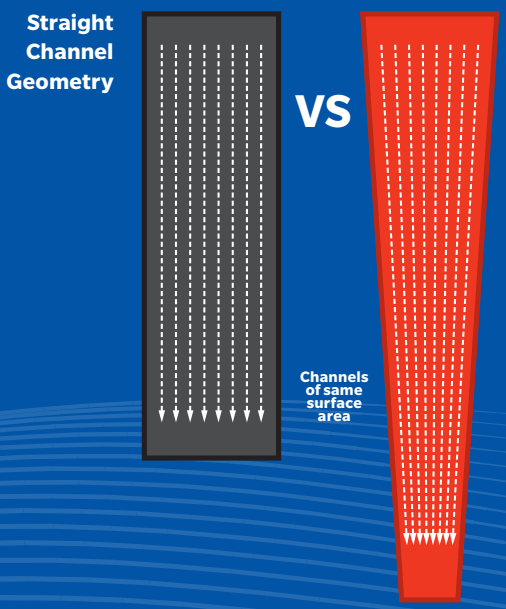


eFlow™ Channel

Loop Energy hydrogen fuel cell solutions feature the company's proprietary eFlow™ technology.

At the core of this technology is our signature trapezoid bipolar plate design with narrowing channels, which enables uniform mass flow and increases gas velocity. This allows Loop Energy fuel cells to deliver super performance including greater fuel efficiency, improved water management and operate at higher peak power. Customers benefit from this in many ways, including lower total cost of ownership (TCO) and enable a faster time to market for your hydrogen electric product.

How eFlow™ Architecture Delivers Superior Performance



eFlow™ Characteristics

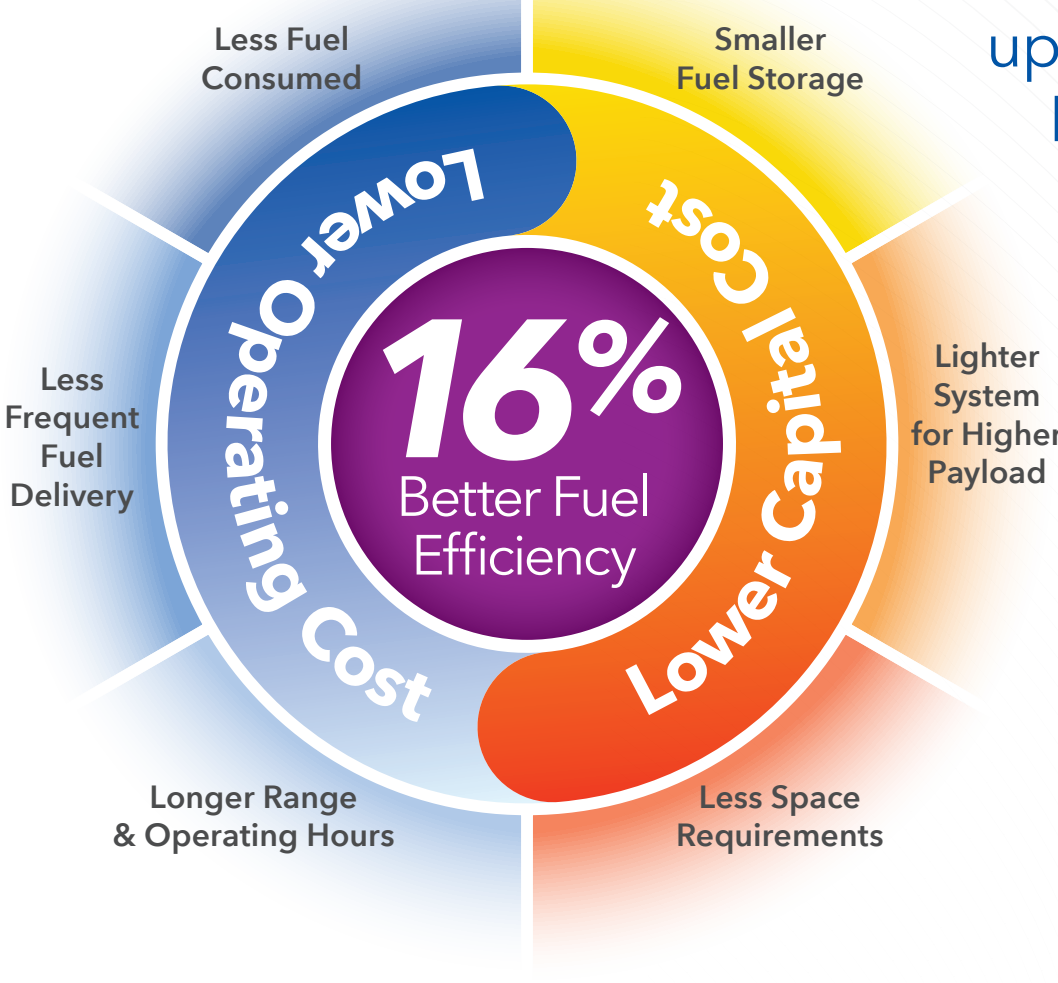
- **Increased channel flow velocity (Bernoulli's Principle)**
- **Uniform mass flow per unit area**
- **Improved mass transport**

Key Benefits

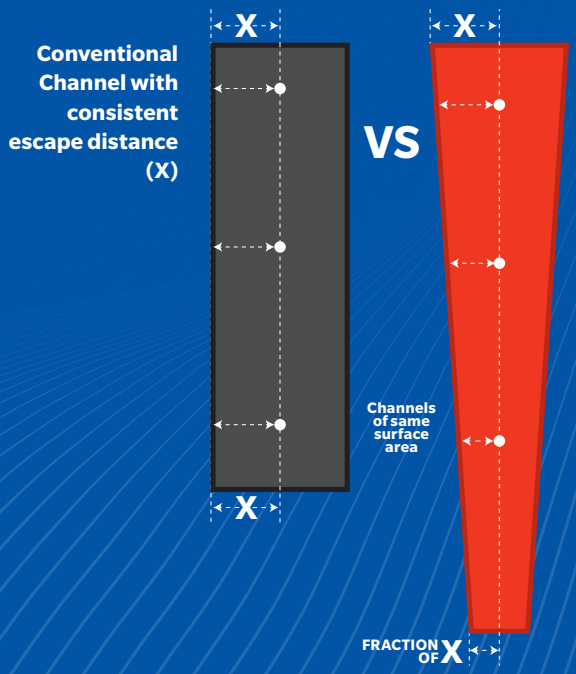
- **Better Fuel Efficiency**
- **Higher Peak Power**
- **Uniform Cell Operation**
- **Improved Water Management**

OEMs & End-Users Benefit by Gaining up to **16%** Better Fuel Efficiency

with Loop Energy's eFlow™ Technology



How eFlow™ Architecture Enables Higher Fuel Efficiency



eFlow™ Characteristics

- Decreasing escape distance (fraction of X)
- Electron resistance average distance of escape is lower
- Reduced Electrical Loss

Key Benefits

- Higher Fuel Efficiency

LOOP ENERGY

Hydrogen Fuel Cell MODULES with eFlow™ powered stacks

Loop Energy hydrogen fuel cell modules are designed to be a plug-and-play solution for any electrification application. All products use Loop Energy's eFlow™ powered fuel cell stacks, packaged with balance-of-plant components in a compact enclosure with a single-side interface for ease of integration and operation.

What's Inside:

- Fuel cell stack with eFlow™ technology
- Humidifier
- Intercooler
- Air compressor
- Hydrogen injector and ejector assembly
- Temperature, pressure, and mass air flow sensors
- Integrated condensate trap
- 24 to 12 V DC-DC converter
- Check valve, isolation valve, drain valve manifold
- Air inlet and outlet manifolds
- Hydrogen sensor manifold
- Solenoid valves
- Level sensor

30 kW

50 kW

60 kW

LOOP ENERGY Hydrogen Fuel Cell **MODULES**

	30kW S300	50kW T505	60kW T605	120kW S1200
Power & Efficiency				
Net Rated Power	30 kW	50 kW	60 kW	102 kW
Fuel Consumption at Cruise Mode (Est.)*	<0.78 kg/hr	<1.39 kg/hr	<1.61 kg/hr	0.87 – 4.98 kg/hr
Net Operating Efficiency at Cruise Mode (Est.)*	58%	54%	56%	50 – 60%
Net Cruise Mode	15 kW	25 kW	30 kW	17 – 83 kW
Physical Dimensions				
Length	719 mm	939 mm	996 – 1,090 mm	1,018 mm
Width	457 mm	511 mm	626 – 702 mm	605 mm
Height	450 mm	545 mm	410 mm	700 mm
Weight	93 kg	135 kg	150 kg	<250 kg
Standard Volume	148 L	252 L	256 L	432 L
Electrical Interface				
Output Voltage Range	115 VDC – 235 VDC	180 VDC – 360 VDC	204 VDC – 407 VDC	155 VDC – 340 VDC
Maximum Output Current	300 A	350 A	350 A	900 A
Power Supply Voltage	24 VDC (12 VDC Optional)			
Control Interface	CAN Bus V2.0B			
Hydrogen & Air Interface				
Hydrogen Fuel Supply Pressure	8.5 bara	8.5 bara	10.5 bara	14 bara
Hydrogen Fuel	SAE J2719 or ISO 14687 (Grade D)			
Oxidant	Ambient air			

Cooling & Environmental Temperatures (All Models)

Minimum Coolant Temperature	+2°C
Maximum Coolant Temperature	+80°C
Ambient Operating Temperature Range	-30°C to +50°C
Storage Temperature Range	-40°C to +85°C

Additional / Peripherals

DC-DC Converter
Cooling System
Air Filters
Maintenance Kit

Compliance (All Models)

Ingress Protection
IP 55 (Standard), IP 67 (Optional)

Emissions
Zero Emission Compliant

Vibration & Mounting Requirements
MIL-STD 810. No special damping requirements. Direct mounting to vehicle chassis permitted.

Regulatory Compliance
EMC: 2014/30/EU
Automotive EMC: UN ECE R10
LVD: 2014/35/EU
MD: 2006/42/EC
RoHS: 2011/65/EU and EU 2015/863

Product Standards
General Fuel Cell Module Safety: IEC 62282-2-100:2020
Light-Industrial EMC: IEC 61000-6-1:2016, IEC 61000-6-8:2020
Electric Vehicle Safety: ISO 6469-2:2009, ISO 6469-3:2018
Fuel Cell Vehicle Safety: ISO 23273:2013
ROHS: IEC 63000:2016
Cold Start & Operation: GB/T 33979-2017
Fuel Cell Engine Performance: GB/T 24554-2009
Low & High Temperature Storage: GB/T 33978-2017

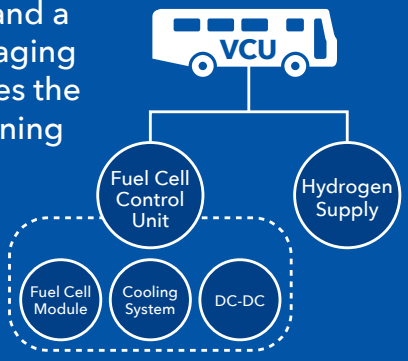
All specifications are subject to change without notice.

* Cruise Mode defined as operating power equal to 50% of rated continuous net power for S300, T505 and T605, and in the range of 17-83% of rated continuous net power for S1200

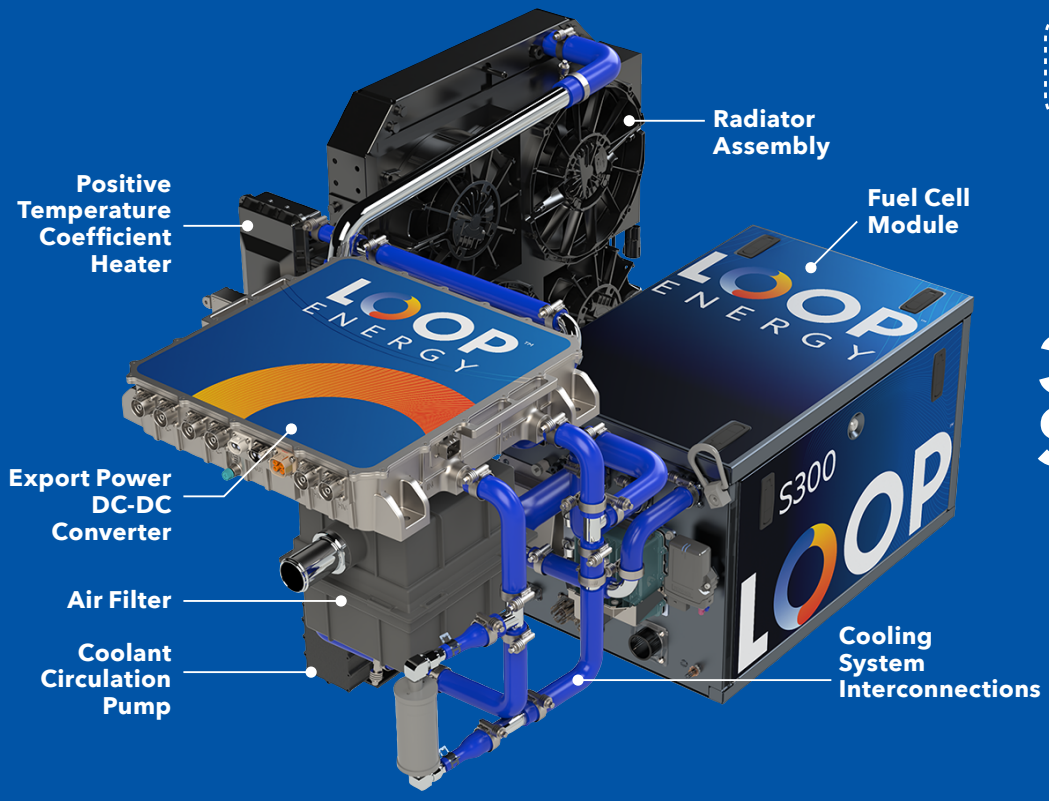
LOOP ENERGY

Hydrogen Fuel Cell SYSTEMS

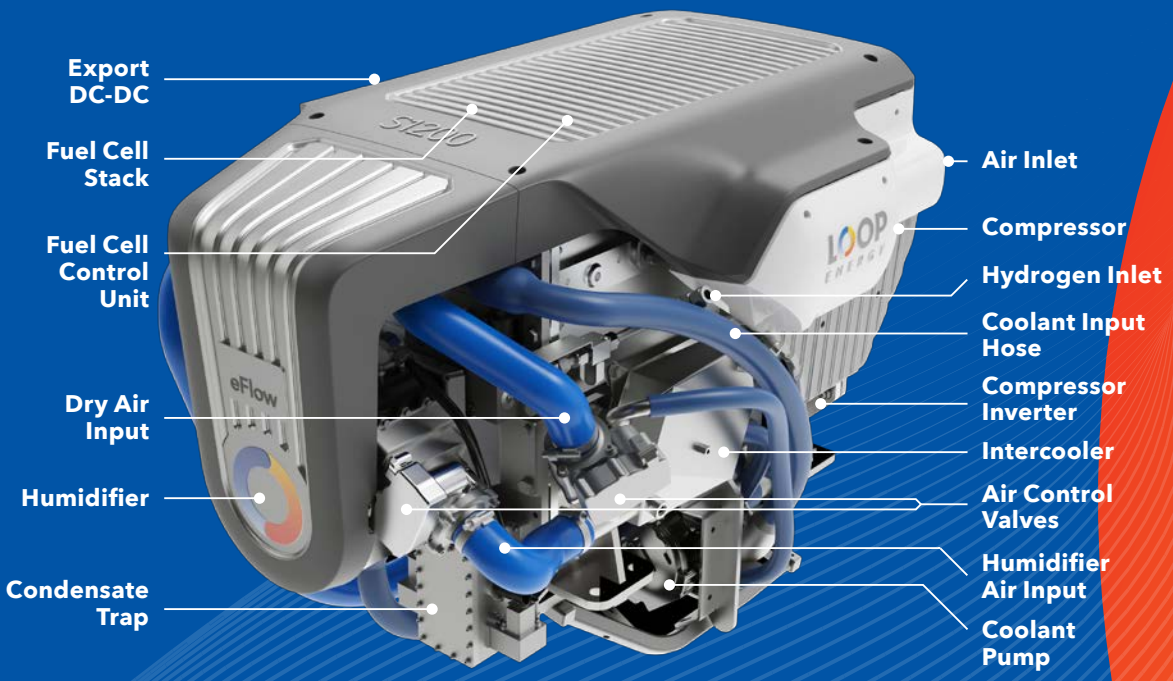
Our systems combine our fuel cell modules with a **cooling system** and a **DC-DC converter,** with our built-in **fuel cell control unit.** This packaging offers significant reduction in integration engineering, as it eliminates the need for multiple integration from the Vehicle Control Unit, streamlining your integration timeline for an accelerated time to market.



30-60 kW System



120 kW System



LOOP ENERGY™ Hydrogen Fuel Cell SYSTEMS

	30kW S300-S	50kW T505-S	60kW T605-S	120kW S1200-S
Power & Efficiency				
Net Rated Power†	27 kW	47 kW	56 kW	100 kW
Net Rated Power Efficiency	42%	42%	42%	48%
Combined Heat and Power (CHP) Output	36 kW	62 kW	76 kW	125 kW
System (CHP) Efficiency at Cruise Mode‡	69%	67%	70%	65 – 68%
Net Intermittent Peak Power	–	–	–	110 – 120 kW
Net Peak Power Efficiency	–	–	–	40 – 44%
Net Cruise Mode	14 kW	23 kW	28 kW	17 – 83 kW
Net Cruise Mode Efficiency	53%	50%	52%	50 – 60%
Physical Dimensions				
Length*	719 mm	939 mm	996 – 1,090 mm	1,018 mm
Width*	457 mm	511 mm	626 – 702 mm	517 mm
Height*	450 mm	545 mm	410 mm	568 mm
Weight*	93 kg	135 kg	150 kg	<300 kg
Total System Weight**	200 kg	290 kg	305 kg	410 kg
Additional System Component Volume***	163 L	261 L	261 L	419 L
Total System Volume***	311 L	513 L	517 L	719 L
Electrical Interface				
Output Voltage Range	500 VDC – 700 VDC			440 VDC – 850 VDC
Power Supply Voltage	24 VDC			
Control Interface	CAN Bus V2.0B			
Hydrogen & Air Interface				
Hydrogen Fuel Supply Pressure	8.5 bara	8.5 bara	10.5 bara	14 bara
Hydrogen Fuel	SAE J2719 or ISO 14687 (Grade D)			
Oxidant	Ambient air			
Cooling & Environmental Temperatures				
Coolant Type	50/50 DI/Glycol mix FC-specific coolant			
Ambient Operating Temperature Range	-30°C to +50°C			
Storage Temperature Range	-40°C to +85°C			-30°C to +85°C

All specifications are subject to change without notice.

† Excludes radiator parasitic
‡ Cruise Mode defined as operating power equal to 50% of rated continuous net power for S300, T505 and T605, and in the range of 17-83% of rated continuous net power for S1200

* For module only
** Dry weight. Includes DC-DC & cooling system and radiator
*** System components include export power DC-DC, air compressor system, fuel recirculation and cooling system and radiator

Accessories & Components

We offer a variety of add-ons to complement your system's integration.

Examples:

- Heat Exchanger
- Air Filters
- System Assembly Frame
- Interconnections
- Maintenance Kit

Cabin Heating with Heat Exchanger

Integrate a heat exchanger into your system, which further increases efficiency by up to 30%.

Integration Services for Our Customers

Our Global Technical Services team is dedicated to supporting customers through each stage of their journey towards electrification.

Procurement

Application Engineering

- Drive cycle analysis & system sizing
- Budgetary component placement
- Assist in component selection (e.g. battery, fuel storage)
- Intro to our ecosystem of preferred partners and suppliers

Integration & Start-up

System Packaging

- Detailed component placement support
- Controls, electrical, and mechanical integration support

Integration & Commissioning

- On-site support for final integration
- System startup and commissioning

Homologation & Scale Production

Homologation Support

- Documentation support
- Testing support
- Troubleshooting support

Maintenance Planning

- OEM specific maintenance and extended warranty service package development

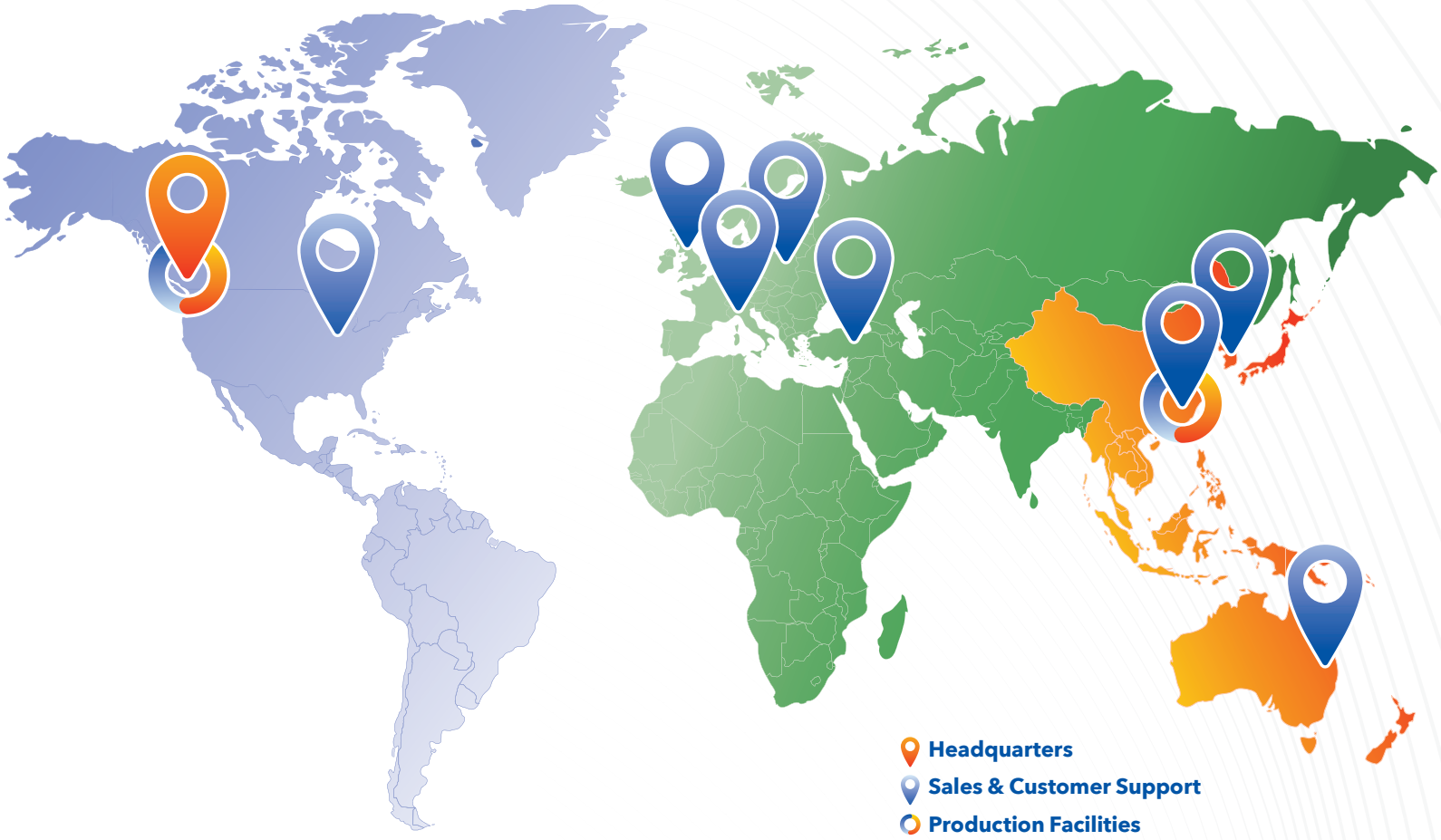
Fleet Deployment

After-Sales Support

- Preventative and corrective maintenance package implementation

Worldwide Support for Our Customers

Centrally headquartered from the world's top fuel cell cluster, Loop Energy has a well-developed network with offices and support centers across North America, Europe and Asia-Pacific.



Contact Us Today

Loop Energy's Network

Visit **loopenergy.com/inquire** to begin your journey towards a zero-emissions future or email us in your area:

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LOOP™
ENERGY

Hydrogen Fuel Cell Solutions

with Loop Energy's eFlow™ Technology

More Power To Move You

loopenergy.com

1. As of March 31, 2023. Inclusive of patents in different stages (issued, in examination, and pending).
2. Based on Loop's internal testing and comparisons of published studies of the performance of fuel cells from other manufacturers and competitors. In order to quantify the benefit of eFlow™ technology directly, Loop purchased commercially available CCM materials from a top competitor, built them into Loop eFlow™ fuel cell stack, and then operated this stack at Loop's best estimate of the top competitor's operating conditions using publicly available information.

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