

Hydrogen Fuel Cells - Off-Grid Applications



Reli On
+ -[®]

Off-grid locations provide a unique set of challenges, including what to do about power. ReliOn fuel cell products offer a proven solution to harden critical components against service-impacting issues.

- Select Applications: • Traffic Messaging • Monitoring & Surveillance
• Radio/Repeater Sites • Microwave Communications • Well Monitoring Sensors

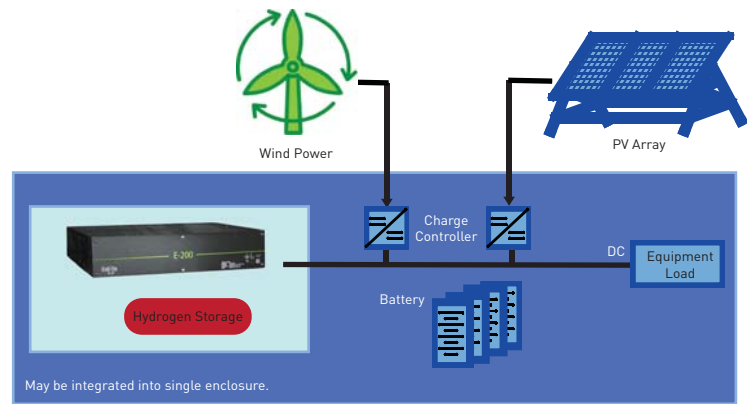
Fuel Cells

Simply Powerful

your sites

The cost of extending the grid can be daunting, and in some cases, impractical or impossible. Some estimate the cost at \$1,000,000* per mile or more. In many cases, it makes better business sense to employ a hybrid power solution at locations significantly off the main grid highway. An off-grid equipment station necessarily relies on a hybrid power solution. Whether using batteries and generators or fuel cells, wind power or photovoltaics, no one power source can cover the load full time. Nor would a customer want it to. Use of multiple power sources increases the reliability of a site.

Redundancy is required in order to supply consistent power, ensuring an absolute minimum of downtime and an increase in stable services by improving reliability and availability. Fuel cells are an important component to off-grid sites. Many sites are outfitted with battery strings and can benefit from a fuel cell connected in parallel. For outages that exceed the capacity of the batteries, the fuel cell serves to carry the site load when the batteries drop below a specified voltage. The fuel cell minimizes the deep level of discharge on the battery strings and allows the site to operate for much longer than on batteries alone. The addition of wind or photovoltaic sub-systems takes advantage of "free" power from the wind and sun. Combining the various backup power technologies allows an operator to quickly recover from a failure of any one component. For instance, at sites where wind and/or solar are used, the fuel cell operates to carry the equipment load when the sun and/or wind are not in evidence.



ReliOn's fuel cell products are a forward-thinking solution for off-grid power needs, designed with the ability to grow as needed. Modular architecture for power generation and system control enables a cost effective backup solution with a seamless upgrade path. By adding power cartridges, electronic cards or fuel cell chassis, system operators are able to leverage initial investments in fuel cell backup systems, balancing capex and opex. Modular architecture also means less maintenance and easier, quicker repairs for our fuel cells. This means your staff spends less time at your sites.

	Traffic Messaging	Radio/Repeater Sites	Traffic Signaling & Mgmt	Microwave Communications	Monitoring & Surveillance	Highway Alert Radio & Weather Information Systems	Well Monitoring Sensors
< 200W	●	●	●	●	●	●	●
< 1kW	●	●	●	●	●	●	●
< 2kW	●	●	●	●	●	●	
2kW+	●						

High Reliability & Availability

ReliOn's fuel cells are field proven through extreme weather conditions in geographically diverse customer locations. When added to an existing backup solution, ReliOn's fuel cells add another layer of site hardening. In a Greenfield site, they offer high reliability at a lifecycle cost comparative to incumbent technologies. The fuel, industrial-grade hydrogen, is available through local industrial gas suppliers. Because hydrogen is not widely used, there is little competition for supply during large outages. The fuel cell solution, whether installed indoors or in outdoor enclosures, gives no indication that it is a generator, resulting in significantly lower theft.

Capacity & Scalability

ReliOn's fuel cell systems can be installed in a wide variety of configurations, both indoors in standard racks, and in outdoor enclosures. Product scalability allows ReliOn systems to meet your actual power requirements, whether smaller or larger capacity is needed. Fuel cell systems are load-following, giving only the amount of power needed by site equipment. As your needs change, ReliOn systems adapt as quickly as your power demands require, protecting your investment going forward.

Siting and End-Of-Life Management

Environmental issues are in the forefront of many people's minds. Sensitive areas where noise, emissions, and fuel containment can be problematic create installation challenges. ReliOn fuel cell systems are quiet, emit no pollutants, have no spillage issues when fueled with bottled hydrogen, and the majority of components can be recovered at the end of operating life, making ReliOn fuel cells easier on the environment than incumbent solutions.

our solutions

ReliOn fuel cell systems have revolutionized the application of reliable backup power for critical equipment. ReliOn's E-series and T-series products provide several advantages over traditional backup power methodologies - batteries and internal combustion generators - as the sole power solutions. Like batteries, fuel cells provide current directly to the DC bus, but have a significantly increased service life and decreased maintenance costs, as well as a smaller footprint for longer runtimes. Installation is accomplished with ease. Additionally, fuel cell runtime, as with a generator, is a function of fuel storage, but with few moving parts and lower maintenance.

Reliable

- Modular, fault-tolerant design enables advanced management of fuel cell membranes, which leads to increased reliability of the system.
- N+1 or 1+1 redundancy is designed into the system.

Modular

- Patented modular cartridge design means ReliOn is the only company providing easy hot-swappable* maintenance in seconds, without tools, and while continuing to provide power to the customer load.
- ReliOn's E-series offers a modular, fault-tolerant design, ensuring continued power to customer equipment, using larger power module building blocks. Multiple bus and multiple voltage scenarios are easy to accommodate.

Scalable

ReliOn products allow the customer to configure the product to suit the load.

- From under 100 Watts to 20,000 Watts.
- Scalable hydrogen storage provides for up to hundreds of hours of runtime easily.

Low Maintenance

- Annual air filter inspection.
- Refueling as needed - hours to weeks of runtime between refueling cycles.
- Mean time to repair - minutes.
- Advanced diagnostics and self-testing

Environmentally friendly

- Hydrogen in, power and warm water out.
- No emissions
- Low noise signatures under 60 dBA @ 5 feet.

U.S. Tax Credit Availability

- Federal tax credits available for systems above 500W.
- \$3,000 per kilowatt or 30% of system cost, whichever is less.
- Additional incentives available in some States make value proposition very attractive.

Environmentally-hardened

- Temperature range from -40°C to 50°C / -40°F to 122°F.
- Field-proven ability to perform during hurricanes, ice storms and other harsh weather.
- Diverse geographic locations.

Monitoring and Control

- Remote / local system configuration and status monitoring for historical and operational data.

Hybrid configurations

- Whether off-grid or on, ReliOn fuel cells work well in hybrid solutions with solar and wind power for a complete clean energy solution.

	ReliOn	Generators
Modular	●	●
Scalable	●	●
Hot-swappable*	●	●
Reliable	●	●
Simple Design	●	●
Environmentally Friendly	●	●
Environmentally-hardened	●	●
Low Maintenance	●	●
Ease of Permitting	●	●
Extended Run-time Solutions	●	●
Monitoring & Control	●	●
U.S. Tax Credits	●	●

* ReliOn's T-1000 and T-2000 fuel cell systems offer hot-swappable maintenance

specifications



E-200™ Rack Mount

Physical

Dimensions (w x d x h)

17.25" x 18.5" x 3.38"
43.8cm x 47cm x 8.6cm
30 lbs / 13.6 kg
19" or 23" rack mount
0 to 175 Watts

Performance

Rated current

0 to 15A @ 12VDC / 0 to 7.5A @ 24VDC /
0 to 3.75A @ 48VDC

DC voltage

12, 24 or 48 VDC nominal

Composition

Standard industrial grade hydrogen (99.95%)

Supply pressure to unit

3.5 to 6 psig / 24 to 41 KPag
0.24 bar to 0.41 bar

Fuel

Hydrogen Storage Capacity

Modular solutions scalable
from 2.5 kWh to 300 kWh

Operation

Ambient temperature

35°F to 115°F / 2°C to 46°C

Relative humidity

0-95% non-condensing

Altitude

-197 ft to 13,800 ft / -60m to 4,206m

Location

Indoors



E-200™ Extended Run

43" x 35" x 72" (footprint)
109cm x 89cm x 183cm
400 lbs / 182 kg*

0 to 175 Watts per chassis

0 to 15A @ 12VDC / 0 to 7.5A @ 24VDC /
0 to 3.75A @ 48VDC

12, 24 or 48 VDC nominal

Standard industrial grade hydrogen (99.95%)

3.5 to 6 psig / 24 to 41 KPag
0.24 bar to 0.41 bar

Modular solutions scalable
from 2.5 kWh to 300 kWh

-40°F to 115°F / -40°C to 46°C

0-95% non-condensing

-197 ft to 13,800 ft / -60m to 4,206m

Outdoors



E-1100™ Rack Mount

17.25" x 24" x 7"
43.8cm x 61cm x 18cm
58 lbs / 26.4 kg*
19" or 23" rack mount
0 to 1,100 Watts

0 to 46A @ 24 VDC / 0 to 23A @ 48VDC

24 or 48 VDC nominal

Standard industrial grade hydrogen (99.95%)

10 psig / 69 KPag / 0.69 bar operating

Modular solutions scalable
from 2.5 kWh to 300 kWh

35°F to 122°F / 2°C to 50°C

0-95% non-condensing

-197 ft to 13,800 ft / -60m to 4,206m

Indoors



T-1000® Rack Mount

Physical

Dimensions (w x d x h)

14" x 21.5" x 26" (in rack)
35.6cm x 54.6cm x 66cm
96 to 162 lbs / 44 to 74 kg
19" or 23" rack mount
0 to 1,200 Watts

Performance

Rated current

0 to 50A @ 24 VDC / 0 to 25A @ 48VDC

DC voltage

24 or 48 VDC nominal

Fuel

Composition

Standard industrial grade hydrogen (99.95%)

Supply pressure to unit

3.5 to 6 psig / 24 to 41 KPag
0.24 bar to 0.41 bar

Hydrogen Storage Capacity

Modular solutions scalable
from 2.5 kWh to 300 kWh

Operation

Ambient temperature

32°F to 115°F / 0°C to 46°C

Relative humidity

0-95% non-condensing

Altitude

-197 ft to 13,800 ft / -60m to 4,206m

Location

Indoors



T-1000® Extended Run

43" x 35" x 72" (footprint)
109cm x 89cm x 183cm
455 lbs / 206 kg*

0 to 1,200 Watts

0 to 50A @ 24VDC / 0 to 25A @ 48VDC

24 or 48 VDC nominal

Standard industrial grade hydrogen (99.95%)

3.5 to 6 psig / 24 to 41 KPag
0.24 bar to 0.41 bar

Modular solutions scalable
from 2.5 kWh to 300 kWh

-40°F to 115°F / -40°C to 46°C

0-95% non-condensing

-197 ft to 13,800 ft / -60m to 4,206m

Outdoors



T-1000® 1 Meter Enclosure

29" x 26" x 35" (footprint)
73.7cm x 66cm x 89cm
185 lbs / 84 kg*

0 to 1,200 Watts

0 to 50A @ 24VDC / 0 to 25A @ 48VDC

24 or 48 VDC nominal

Standard industrial grade hydrogen (99.95%)

3.5 to 6 psig / 24 to 41 KPag
0.24 bar to 0.41 bar

Modular solutions scalable
from 2.5 kWh to 300 kWh

-40°F to 115°F / -40°C to 46°C

0-95% non-condensing

-197 ft to 13,800 ft / -60m to 4,206m

Outdoors



**FUEL CELLS
SIMPLY POWERFUL**

* weight references fully equipped solutions, without hydrogen cylinders

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