

Hydrogen Fuel Cell Applications - Transportation Networks



The focus of transportation network communications is to help people and products get safely to their intended destinations. The importance of these systems cannot be overstated. Traffic signals for automobiles and railroads, road signage, air-to-ground communications and other critical applications must continue to function even when grid power fails or when locations are off-grid. Otherwise, chaos ensues. ReliOn fuel cell products offer a proven solution to harden critical components against service-impacting issues.



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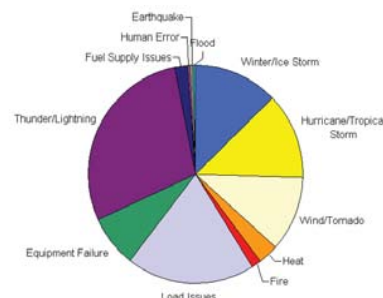
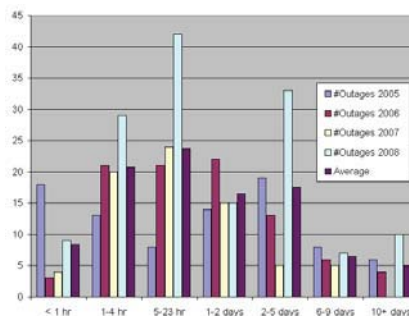
A New Era In Critical Backup Power

Your Sites

Transportation network communications include a lot of different applications. They cover the railroad signal telling the train whether it's safe to continue down the tracks as well as the message sign alerting drivers to an accident ahead. Airports use low power equipment to communicate with airplanes and guide them home. There are many other examples. The theme among them is critical communication equipment affecting the safety of many people, all of it needing reliable power all the time. Extreme weather, human error, and sabotage all pose threats to stable power service and solutions need to be in place to keep the equipment running.

Regional and seasonal threats to grid power vary, from hurricanes to tornadoes, ice storms to thunderstorms, but the number of events is not decreasing. In 2008, according to data provided by the DOE's Energy Information Administration, these major disturbances caused more than 365 days of lost grid power around the U.S. alone, with durations lasting between minutes and weeks, affecting more than 27 million customers. This means that, on average, power was out somewhere due to a major disturbance each day during the year. While that is not generally how power outages are distributed (they tend to cluster during certain times of the year), the point is that one cannot always rely on grid power for critical loads.

2005-2008 U.S. Grid Outage Data



Source: Energy Information Administration

In these situations, backup power becomes key. Redundancy is required to supply consistent power, ensuring an absolute minimum of downtime and stable services by improving reliability and availability. Fuel scarcity in times of disaster can threaten the fuel supply for backup generators, and in some regions, generators themselves become threatened with theft. Additionally, environmental issues can come into play - noise and air pollution requirements and spill containment issues can make it difficult to get permitting for some sites.

At ReliOn, we understand the headaches - with over 100 years experience with communications networks on our management team, many of us have been where you are. We provide backup power solutions for large and small operators in the United States and in many other world locations - through hurricanes, snowstorms and extreme cold. In applications needing hundreds of Watts as well as those needing several kilowatts - for sites needing hours of backup power and those needing days.

ReliOn's fuel cell solution is forward-thinking, designed with the ability to grow as capacity increases. Modular architecture for power generation and system control enables a cost effective backup solution with a seamless upgrade path. By adding power cartridges or electronic cards, 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	Aircraft Markers, Beacons, ILS
< 200W	●	●	●	●	●	●	●
< 1kW	●	●	●	●	●	●	●
< 2kW	●	●	●	●	●	●	●
2kW+	●	●	●	●	●	●	●

High Reliability & Availability

ReliOn's fuel cells are field proven through extreme weather conditions in customer locations. 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. 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.

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. 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 telecommunications sites, substation control houses and locations equipped with remote terminal units. ReliOn's Eco-200™, T-1000® and T-2000® systems provide several advantages over traditional backup power methodologies - batteries and internal combustion generators. Like batteries, fuel cells provide current directly to the DC bus, but have a significantly increased service life and decreased maintenance costs. Additionally, fuel cell runtime, as with a generator, is a function of fuel storage, but with few moving parts and lower maintenance.

Reliable

- Modular Cartridge Technology© enables advanced “care and feeding” of fuel cell membranes, which adds up to increased reliability of the system.
- N+1 or 1+1 redundancy is designed into the system.
- A redundant fan system makes sure that even our one rotating component is ultra-reliable.

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.
- Changing DC voltage output is simple and completed at the customer site.

Scalable

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

- From under 100 Watts to 12,000 Watts.
- Scalable hydrogen storage provides for up to hundreds of hours of runtime easily.

Low Maintenance

- Annual air filter inspection.
- Refueling as needed.
- Mean time to repair - minutes.

Environmentally friendly

- Hydrogen in, power and warm water out.
- Low noise signatures under 60 dBA @ 5 feet.

Tax Credits 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 46°C.
- Field-proven ability to perform during hurricanes, ice storms and other harsh weather.

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

* Hot-swappable maintenance available in T-1000® and T-2000® fuel cell product offerings.

Specifications



Eco-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
Weight	17 lbs / 8 kg
Mounting	19" or 23" rack mount
Rated net power	0 to 180 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	n/a
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
Emissions	
Water	Max. 30mL / kWh
Noise	53 dBA @ 3.28 ft / 1 meter
Monitoring / Control	
Remote	System configuration & status / Historical & operational data
Communications	RJ45 / DB9 / Dry Contact



T-2000® 2kW Rack Mount

Dimensions (w x d x h)	21" x 21.5" x 26" (in rack) 53.3cm x 54.6cm x 66cm
Weight	129 to 239 lbs / 59 to 108 kg
Mounting	23" rack mount
Rated net power	0 to 2,000 Watts
Rated current	0 to 80A @ 24VDC / 0 to 40A @ 48VDC
DC voltage	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



T-2000® 2kW in Enclosure

Dimensions (w x d x h)	50" x 35" x 72" (footprint) 127cm x 89cm x 183cm
Weight	555 lbs / 252 kg*
Rated net power	0 to 2,000 Watts
Rated current	0 to 80A @ 24 VDC / 0 to 40A @ 48VDC
DC voltage	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
Hydrogen Storage Capacity	Modular solutions scalable from 48 to 96 kWh
Ambient temperature	-40°F to 115°F / -40°C to 46°C
Relative humidity	0-95% non-condensing
Altitude	-197 ft to 13,800 ft / -60m to 4,206m
Location	Outdoors



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
Weight	96 to 162 lbs / 44 to 74 kg*
Mounting	
Rated net power	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 48 to 96 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

Dimensions (w x d x h)	43" x 35" x 72" (footprint) 109cm x 89cm x 183cm
Weight	455 lbs / 206 kg*
Rated net power	0 to 1,200 Watts
Rated current	0 to 50A @ 24VDC / 0 to 25A @ 48VDC
DC voltage	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
Hydrogen Storage Capacity	Modular solutions scalable from 48 to 96 kWh
Ambient temperature	-40°F to 115°F / -40°C to 46°C
Relative humidity	0-95% non-condensing
Altitude	-197 ft to 13,800 ft / -60m to 4,206m
Location	Outdoors



T-1000® 1 Meter Enclosure

Dimensions (w x d x h)	29" x 26" x 35" (footprint) 73.7cm x 66cm x 89cm
Weight	185 lbs / 84 kg*
Rated net power	0 to 1,200 Watts
Rated current	0 to 50A @ 24VDC / 0 to 25A @ 48VDC
DC voltage	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
Hydrogen Storage Capacity	Modular solutions scalable from 9.6 kWh
Ambient temperature	-40°F to 115°F / -40°C to 46°C
Relative humidity	0-95% non-condensing
Altitude	-197 ft to 13,800 ft / -60m to 4,206m
Location	Outdoors

* weight references fully equipped solutions, without hydrogen cylinders



NEBS Level 3



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and other patents pending. Product specifications
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