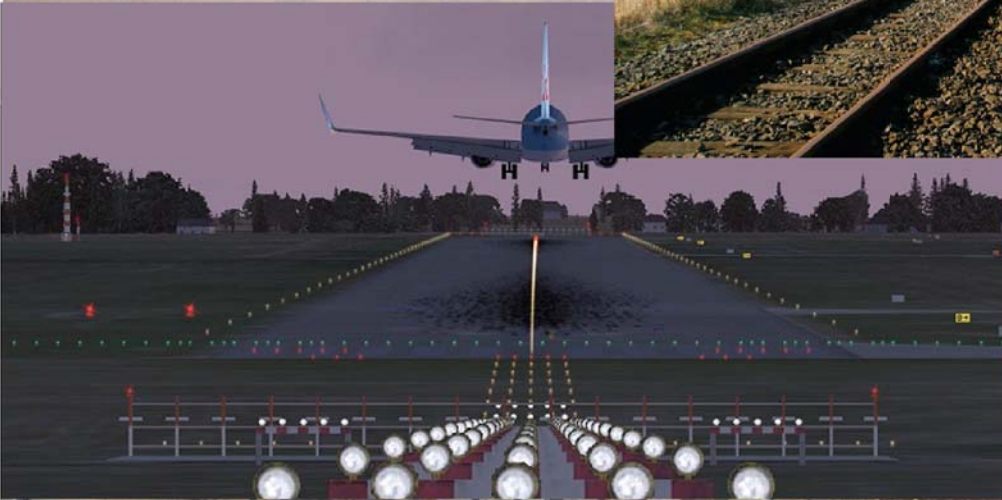


Hydrogen Fuel Cell Applications - Transportation Networks



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.

Reli On
+ -[®]

Fuel Cells

Simply Powerful

your sites

Transportations network communications include a lot of different applications. They cover the railroad signal that tells the train operator 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.

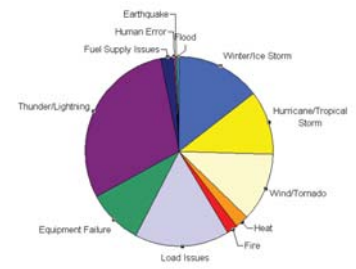
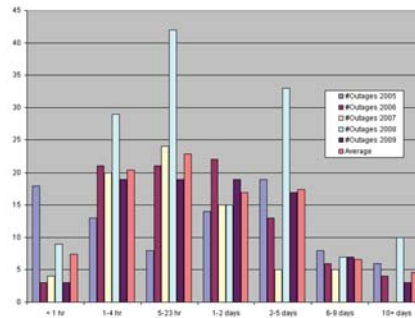
According to an average of the 2005 through 2009 data provided by the DOE's Energy Information Administration, these major disturbances caused more than 192 cumulative days of lost grid power per year in the U.S. alone, with durations lasting between minutes and weeks, affecting more than 9 million customers. This does not include the day-to-day disturbances we all experience from time to time. Most of these outages center between one hour and two days in length.

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 as little as 50 Watts as well as those needing several kilowatts - for sites needing hours of backup power and those needing days.

ReliOn's forward-thinking design provides a fuel cell power solution that gives you the ability to grow as power requirements increase. Modular, fault-tolerant architecture enables a highly-reliable, cost-effective backup solution with a seamless upgrade path, maximizing initial investments in fuel cell backup systems and dramatically reducing the impact on operating budgets.

2005-2009 U.S. Grid Outage Data



Source: Energy Information Administration

	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 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	Batteries	Generators
Modular	●	●	●
Scalable	●	●	●
Hot-swappable*	●	●	●
Reliable	●	●	●
Simple Design	●	●	●
Environmentally Friendly	●	●	●
Environmentally-hardened	●	●	●
Low Maintenance	●	●	●
Ease of Permitting	●	●	●
Extended Runtime 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
Weight	30 lbs / 13.6 kg
Mounting	19" or 23" rack mount
Rated net power	0 to 175 Watts @ 12/24 VDC / 0 to 150 Watts @ 48 VDC
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

Dimensions (footprint)	43" x 35" x 72"
	109cm x 89cm x 183cm
Weight	350 lbs / 159 kg
Rated net power	0 to 175 Watts @ 12/24 VDC / 0 to 150 Watts @ 48 VDC per chassis
Rated current	0 to 80A @ 24VDC / 0 to 40A @ 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
Hydrogen Storage Capacity	Modular solutions scalable from 2.5 kWh to 300 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



E-1100™ Rack Mount

Dimensions (w x d x h)	17.25" x 24" x 7"
	43.8cm x 61cm x 18cm
Weight	58 lbs / 26.4 kg*
Mounting	19" or 23" rack mount
Rated net power	0 to 1,100 Watts
Rated current	0 to 46A @ 24 VDC / 0 to 23A @ 48VDC
DC voltage	24 or 48 VDC nominal
Composition	Standard industrial grade hydrogen (99.95%)
Supply pressure to unit	10 psig / 69 KPag / 0.69 bar operating
Hydrogen Storage Capacity	Modular solutions scalable from 2.5 kWh to 300 kWh
Ambient temperature	35°F to 122°F / 2°C to 50°C
Relative humidity	0-95% non-condensing
Altitude	-197 ft to 13,800 ft / -60m to 4,206m
Location	Indoors



E-2500™ Rack Mount

Physical	
Dimensions (w x d x h)	21.25" x 24" x 14" (in rack) 54.7cm x 61cm x 35.6cm
Weight	81 lbs / 37 kg*
Mounting	23" rack mount (8U)
Rated net power	0 to 2,500 Watts
Performance	
Rated current	0 to 104A @ 24 VDC / 0 to 52A @ 48VDC
DC voltage	24 or 48 VDC nominal
Fuel	
Composition	Standard industrial grade hydrogen (99.95%)
Supply pressure to unit	10 psig / 69 KPag / 0.69 bar operating
Hydrogen Storage Capacity	Modular solutions scalable from 2.5 kWh to 300 kWh
Operation	
Ambient temperature	35°F to 122°F / 2°C to 50°C
Relative humidity	0-95% non-condensing
Altitude	-197 ft to 13,800 ft / -60m to 4,206m
Location	Indoors



T-1000® Rack Mount

Dimensions (in rack)	14" x 21.5" x 26"
	35.6cm x 54.6cm x 66cm
Weight	96 to 162 lbs / 44 to 74 kg*
Mounting	19" or 23" rack mount
Rated net power	0 to 1,200 Watts
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
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® 1 Meter Enclosure

Dimensions (footprint)	29" x 26" x 35"
	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
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
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



**FUEL CELLS
SIMPLY POWERFUL**

Corporate Headquarters:

15913 E. Euclid Ave. Spokane, WA 99216

Phone: 509-228-6500 Toll Free: (U.S.) 1-877-474-1993 Fax: 509-228-6510 fuel.cells@reli-on.com www.reli-on.com