

# Hydrogen Fuel Cells - Wireline Applications



The addition of broadband services to the demands already faced by wireline telecommunications has mandated that network reliability become a top priority. The ability for sites to remain operational in adverse conditions is absolutely critical, affecting life safety E-911 services and long term customer satisfaction and retention. ReliOn fuel cell solutions offer a key solution to wireline companies actively pursuing initiatives to harden the network against service-impacting issues.



Fuel Cells

Simply Powerful

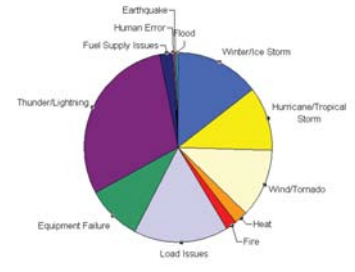
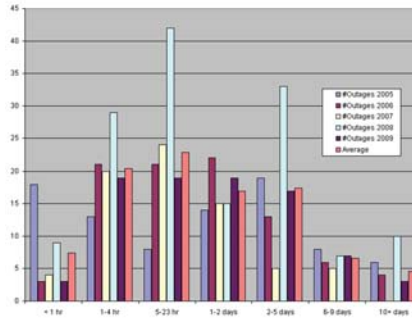
# your sites

The challenges faced by large and small wireline telecommunications companies are changing. No longer are companies providing only “landline” telephone service. In order to retain customers, companies offer broadband and other services, which necessitates further development of the network. Stable service is essential due to Federal mandates for provision of E-911 services. There are more remote sites to cover, more work to do, and more critical services relying on communications equipment needing more power, but companies are not able to increase their staff at the same rate. The same number of people are trying to serve a much higher work load.

The question becomes how to accomplish more in terms of product delivery and reliability with the same amount or fewer resources available.

Maintaining a robust network is a difficult challenge for all service providers. The wireline market demands quality-of-service; high reliability and 24/7 availability, particularly in severe conditions. Regional and seasonal threats to grid power vary, from hurricanes to tornadoes, ice storms to thunderstorms, but the number of events is not decreasing. 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. The need for “always on” service remains.

2005-2009 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 provide power for some sites.

	Broadband DLC sites	Broadband Access/Transport
< 1kW	●	●
2kW	●	●
4kW	●	●

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.

## 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 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-1100™ Rack Mount

### Physical

Dimensions (w x d x h)

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

Weight  
Mounting  
Rated net power

### Performance

Rated current  
DC voltage

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

### Fuel

Composition  
Supply pressure to unit

Standard industrial grade hydrogen (99.95%)  
10 psig / 69 KPag / 0.69 bar operating

Hydrogen Storage Capacity

Modular solutions scalable  
from 2.5 kWh to 300 kWh

### Operation

Ambient temperature  
Relative humidity  
Altitude  
Location

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



## E-2500™ Rack Mount

21.25" x 24" x 14" (in rack)  
54.7cm x 61cm x 35.6cm  
81 lbs / 37 kg\*  
23" rack mount (8U)  
0 to 2,500 Watts

0 to 104A @ 24 VDC / 0 to 52A @ 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



## E-2500™ Extended Run

50" x 35" x 72"  
127cm x 89cm x 183cm  
470 lbs / 212 kg\*

0 to 2,500 Watts per chassis

0 to 104A @ 24 VDC / 0 to 52A @ 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

-40°F to 122°F / -40°C to 50°C  
0-95% non-condensing  
-197 ft to 13,800 ft / -60m to 4,206m  
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  
96 to 162 lbs / 44 to 74 kg\*  
19" or 23" rack mount  
0 to 1,200 Watts

Weight  
Mounting  
Rated net power

### Performance

Rated current  
DC voltage

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

### Fuel

Composition  
Supply pressure to unit

Standard industrial grade hydrogen (99.95%)  
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  
Relative humidity  
Altitude  
Location

32°F to 115°F / 0°C to 46°C  
0-95% non-condensing  
-197 ft to 13,800 ft / -60m to 4,206m  
Indoors



## T-1000® Extended Run

43" x 35" x 72"  
109cm x 89cm x 183cm  
470 lbs / 212 kg\*

0 to 1,200 Watts

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

Standard industrial grade hydrogen (99.95%)  
13.5 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 122°F / -40°C to 50°C  
0-95% non-condensing  
-197 ft to 13,800 ft / -60m to 4,206m  
Outdoors



## T-2000® Rack Mount

21" x 21.5" x 26"  
53.3cm x 54.6cm x 66cm  
134 to 244 lbs / 61 to 110 kg  
23" rack mount  
0 to 2,000 Watts

0 to 80A @ 24VDC / 0 to 40A @ 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

35°F to 115°F / 2°C to 46°C  
0-95% non-condensing  
-197 ft to 13,800 ft / -60m to 4,206m  
Indoors



**ReliOn**  
FUEL CELLS  
SIMPLY POWERFUL

\* weight references fully equipped solutions, without hydrogen cylinders

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