

Dispelling Common Hydrogen Safety Myths

[Hydrogen Solutions](#)

Jul. 12, 2018

Article by [Mike Pearson](#)

Most people's image of hydrogen fuel is the incredible video footage of the Hindenburg airship alight in flame. It is powerful and intense. So much so that it's become synonymous with hydrogen use.

So is hydrogen flammable? Yes.

Is hydrogen dangerous? More dangerous than the gasoline that powers most of the world's vehicles? No it is not. In fact, it is safer.

In this blog, we'll discuss why hydrogen is safer than conventional fossil fuels. We'll also look at the extensive safety features of Ballard's hydrogen fuel cell modules and fuel cell powered vehicles.



Shell
Hydrogen

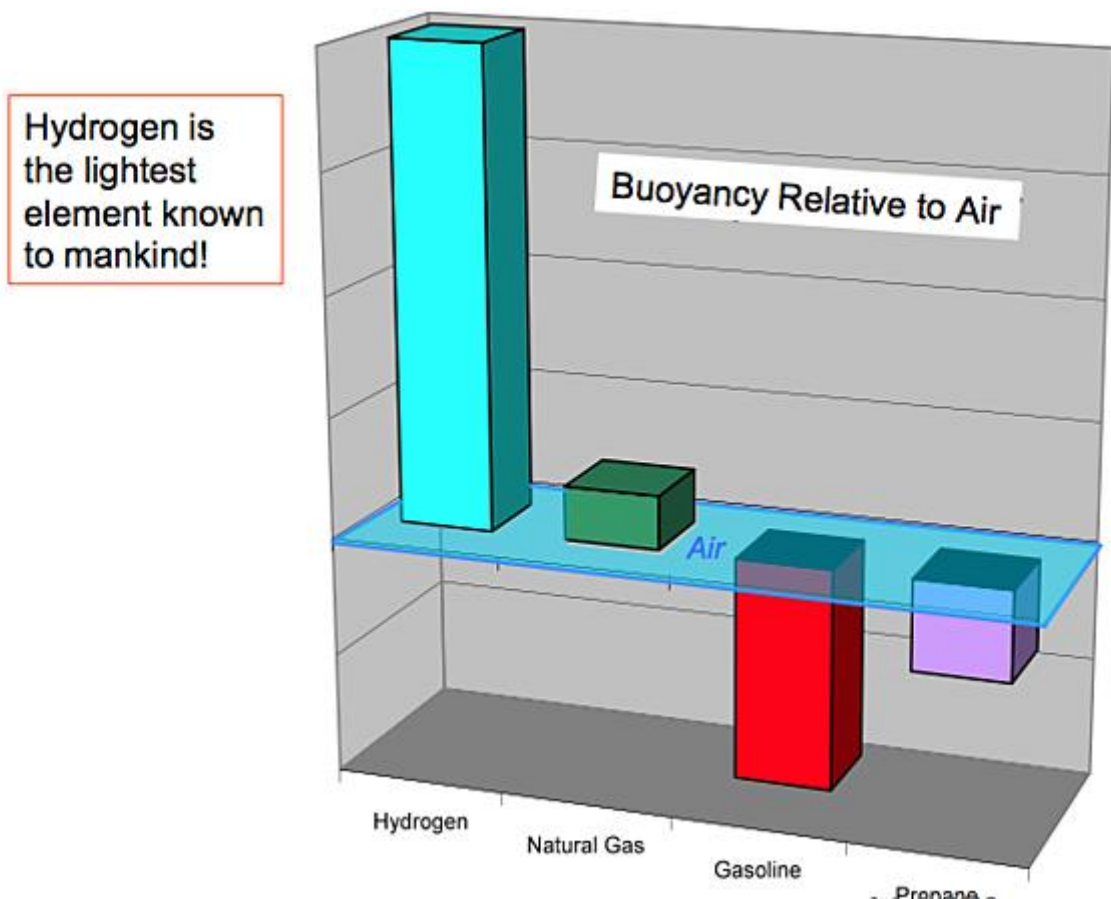
The image shows a close-up of a white sign with a grey border. The sign features the Shell Hydrogen logo, which consists of the word "Shell" in red and "Hydrogen" in blue. The sign is mounted on a structure, and the background shows a white corrugated metal roof and green foliage.

Ballard Power Systems' Nicolas Pocard fueling a hydrogen-powered vehicle.

Hydrogen Safety Facts: Why Is Hydrogen Safer Than Fossil Fuels?

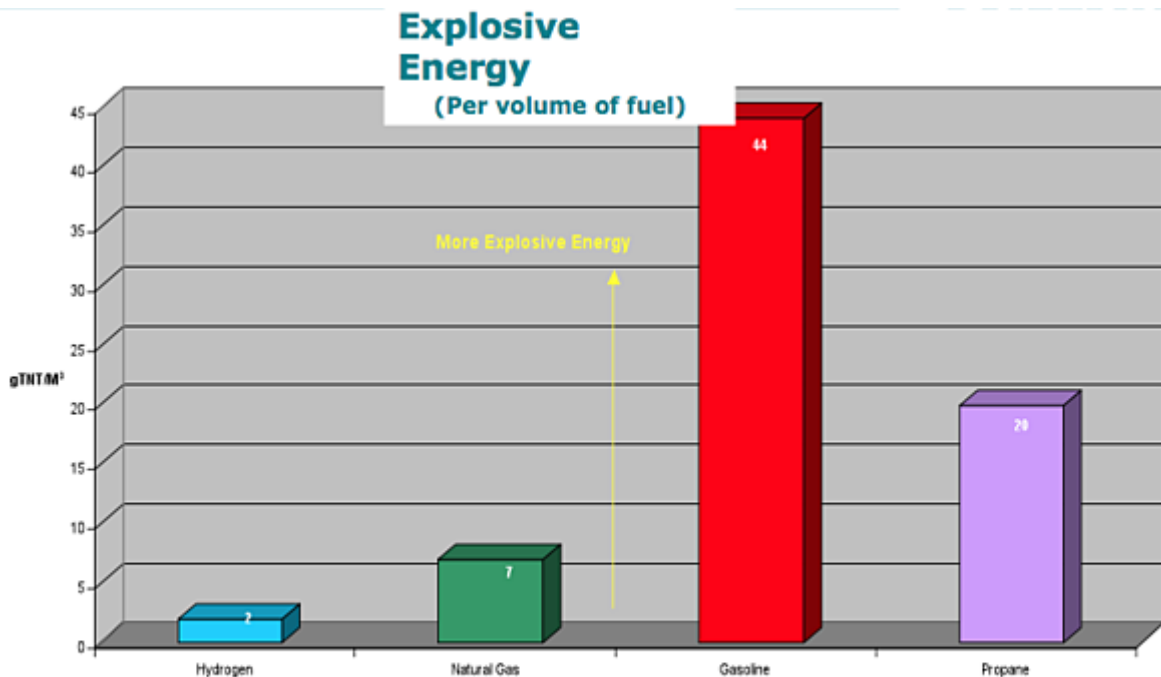
So what makes hydrogen the safer alternative? Here are some key characteristics to know:

- It is 14 times lighter than air: if released, hydrogen disperses quickly, rising into the atmosphere at a rate of 20 meters per second (at normal ambient temperatures). In comparison, propane and gasoline vapor are heavier than air. If released, they pool at ground level, where any accidental ignition presents a clear danger.



- The flames emit low radiant energy, which means they're less likely to move to surrounding areas and spread fire.
- It is non-toxic: leaks or spills do not contaminate the environment.

- It is less combustible: gasoline in the air is flammable at a lower concentration limit of 1.4%, compared to hydrogen's 4%. To put it another way, gasoline is two to three times more flammable in the air. The optimal mixture for hydrogen combustion is 29%—which in the real world is quite unusual, since hydrogen rises and will generally diffuse. Gasoline vapor's optimal mixture for combustion is only 2%—a ratio that is very easy to reach.



The worst-case explosion scenario for each fuel. Hydrogen gas does not have a lot of "bang-power" volume-wise compared to other common fuels.

- Flammable mixtures of hydrogen have relatively low energy density compared to other fuels.

While [hydrogen is safe](#), it isn't completely free from potential dangers. Here are some hydrogen gas safety issues operators need to be aware of:

- It has a wide explosive range, compared to other fuels
- It burns with an invisible flame
- You cannot smell, see, or taste it

(Related post: [Hydrogen Fuel Safety: Essential Facts for Transit Operators](#))

Built-in hydrogen safety systems offer robust protection

The fuel storage tanks used in cars and buses are extremely robust, especially when compared with vehicle gas tanks, which are typically made of plastic.

Typically these fuel storage tanks are carbon-fiber wrapped cylinders that are lined with metal (Type III) or polymer (Type IV). They're far stronger and more crash-safe than conventional gasoline tanks. Each tank is equipped with its own thermally-activated pressure relief device that is designed to safely vent the tank's contents if temperatures rise.

Tank testing standards are nationally and internationally recognized (meeting SAE International/FMVSS and Global Technical Regulation standards) for a typical service lifetime of 15 years. Manufacturers are confident that their tanks could qualify for 20+ years of service life with additional testing.

And if there is a leak, then what?

At some point over its service life, any fuel cell system could develop a leak. This could happen because of a vehicle collision, poor maintenance, or age. But if it happens—what then?

If it's a Ballard fuel cell module, it is engineered to be "fail safe" by design. Ballard fuel cell systems' include:

- Onboard leak detection
- Ventilation systems to prevent leaks from reaching flammable levels
- Fire detection via smoke detectors or heat detectors
- Pressure-relief devices that vent fuel cells

Ballard fuel cell power modules are designed with passenger and operator safety in mind. A couple of examples:

- A small leak may trigger an early warning, to allow a driver to stop and park the vehicle while it is still safe.
- Collision sensors are designed to activate a "safe shutdown" sequence that locks the high-pressure hydrogen in the tank, and isolates the high-voltage components from the system.

Final thoughts: Why choose hydrogen?

So is hydrogen explosive? Yes—but it's inherently safer than conventional fossil fuels. As with any fuel, hydrogen must be treated with respect and care.



Perhaps it's simple familiarity, but people are generally comfortable with gasoline—even though it's far more flammable and dangerous than hydrogen.

Furthermore, today's hydrogen fuel cell technologies are mature in their [safety features](#). Ballard systems are designed and built for safety, and the protocols for safe storage and refueling are well developed and understood.

Compared to fossil fuels, the choice is clear:

- Hydrogen fuel cells are key to zero-emissions heavy-duty transportation systems, including bus, rail, and truck transport.
- Hydrogen is commercially available.
- Hydrogen can be produced from renewable energy.

- Hydrogen fuel cells are proven in real-world use: Ballard-powered fuel cell buses have travelled millions of kilometers, carrying billions of passengers, for years.

Next Step:

Hydrogen Fuel Safety: Essential Facts for Transit Operators

[Clean Energy Fuel Cell Electric Buses](#)

Oct. 12, 2017

Article by [Silvano Pozzi](#)

Are hydrogen buses safe?

In May 2012 a [hydrogen fuel storage tank](#) in Emeryville, California ignited. While the resulting fire quickly burned itself out and injured no one, the incident sparked public concern over hydrogen fuel safety.



That fire underscored the central argument of hydrogen skeptics: hydrogen is too unstable and unsafe to be used as fuel for public transportation. As a transit operator, your mission is to keep passengers, fellow operators and the general public safe.

It's natural to wonder if these concerns over hydrogen fuel are correct, or if public fear is preventing operators from harnessing an abundant [clean energy source](#) that could power our public transit systems.

There are inherent risks handling any flammable gas or liquid, including traditional gasoline. When used in accordance with proper guidelines, hydrogen fuel is safe for public transportation.

Hydrogen Fuel is Safer Than Gasoline, Causes Fewer Dangerous Explosions

More than a century of gasoline reliance has bred a natural public familiarity and comfort with this fuel. Yet gasoline is far more flammable and dangerous than hydrogen fuel.

When petrol or diesel fuels leak, these fuels pool close to the ground, increasing ignition likelihood. When ignition does occur, it can result in a dangerous and long-lasting fire. Between 2004 and 2008, [1 in every 13 conventional service stations](#) experienced a fire.

In contrast, between 2007 and 2010, the US Department of Energy has only recorded one hydrogen fueling station incident resulting in an ignition (the Emeryville incident) and no injuries or fatalities have been recorded.

If a leak in a hydrogen tank or fuel cell were to occur, the gas disperses rapidly, rising upwards at a speed of 72 km/hr, minimizing the likelihood for ignition. In the event that hydrogen does ignite, hydrogen flames generate a low radiant heat due to the absence of carbon and the fire will quickly burn out.

Strict Fueling Protocols Protect Transit Operators and Ensure Hydrogen Fuel Cell Safety

Another concern raised by critics is that hydrogen is a colorless, odorless gas: how will operators know if a leak has occurred? Strict safety measures govern the operation and fueling of hydrogen vehicles, limiting the risk for leaks and potential ignition.

Buses are equipped with hydrogen detectors to immediately detect if a leak has occurred. Should a leak be detected, vehicle operators can push the emergency stop button and immediately switch off the fuel cell system.

Like all fuels, hydrogen should be handled responsibly. Bus operators receive required training on correct refueling procedure at [hydrogen refueling stations](#). This includes using an “earthing cable” during refueling, which prevents sparks caused by static electricity.



Hydrogen refueling in Aberdeen, Scotland.

Hydrogen, like CNG and any combustible fuel, is not without risk. However, the risks associated with using hydrogen are far less than conventional gasoline and CNG. Furthermore, the upside to using hydrogen over conventional gasoline is substantial.

Hydrogen is the most abundant element in the universe and a renewable energy source. Thanks to its high energy density, hydrogen can power heavy-duty vehicles and meet zero-emission requirements, lower air pollution in congested cities and the health risks associated with fossil fuel related smog.

Final thoughts

Even though the use of hydrogen to fuel vehicles is relatively new, hydrogen has been used, transported, and stored safely in industrial applications for decades. Ballard's hydrogen-fuelled fuel cell buses have traveled millions of kilometers in varied environments around the world, safely transporting thousands of passengers.

The use of zero-emission, renewable energy sources for public transportation is a contemporary imperative. Don't let unfounded hydrogen fuel safety concerns prevent your city from reaping the benefits of this clean, renewable energy source.