

## Straight Talk About Hydrogen

I occasionally see people saying things like “hydrogen is the solution to our energy problems”

The argument is that burning hydrogen only produces water

But that's only an issue for hydrogen already produced--there are no huge deposits of hydrogen gas to be found

What is the real reason libertarians are wary of electric cars?

Short range, need attachment to grid, inability to repair/maintain, lose freedom of movement/escape

Setting the carbon emissions “problem” aside

The issue is getting energy from a central production point (i.e. a power plant) to individual consumers  
Doesn't matter what kind of power plant

If the consumer is “on the grid,” just use high-tension wires. Very efficient

Cars and other mobile machinery can't be constantly hooked to the grid, though  
Long-distance consumers, too

The problem for those is storage and energy density

Hydrogen has serious problems in both areas

- Storage dangerous, requires high pressure or cryogenics
- (as far as I can tell, fuel cells work off of a pressurized tank, so they have the same issue)
- $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$  has low energy density per volume (not per kg)

What are hydrogen's advantages?

- No carbon emissions at point of consumption
- Ease of production via electrolysis

Market may prefer to centralize carbon emissions away from population centers

This makes hydrogen possibly more useful for intracity transit

Rural case or bug-out vehicles, carbon emissions likely not an issue

Centralized energy production might also be more efficient due to larger allowed temperature variation (Carnot efficiency)

Ease of production via electrolysis is a technological limitation, may be solved by market

Can already produce hydrocarbons from carbon sequestration + energy source

E-fuel

Octane:  $0.703 \text{ g/cm}^3$  <https://pubchem.ncbi.nlm.nih.gov/compound/Octane>  
44-46 MJ/kg (47.3 gross)

1 kg = 1.42 L

Hydrogen: 2.01568 g/mol; 0.0899 g/L  
120-142 MJ/kg (141 gross)

1 kg = 11123 L at 1 atm; 1.42 L at 7833 atm (~50x pressure of compressed gas cyl)

Typical compressed gas cylinder is ~150 atm (and already very dangerous already for inert gas)

<https://world-nuclear.org/information-library/facts-and-figures/heat-values-of-various-fuels.aspx>

[https://www.thermalfluidscentral.org/encyclopedia/index.php/Heat\\_of\\_Combustion](https://www.thermalfluidscentral.org/encyclopedia/index.php/Heat_of_Combustion)

As a physicist, it always bugs me when people ostensibly on the side of liberty say things that have no real basis in reality

Anyone who says X is the solution without backing it up thoroughly needs to be met with skepticism

Bastiat--seen and unseen