**SUBMISSION TO :**

**THE AUSTRALIAN PRODUCTIVITY COMMISSION**

**For Public Distribution**

**In relation to:**

**THE AUSTRALIAN AUTOMOTIVE MANUFACTURING INDUSTRY**

**SUBMITTED BY: MARSHA FOXMAN –**

**Member for Wentworth - Palmer United Party.**

**To be read as a supplement to my address to the Grattan Report of April 2013**

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**PRELUDE to Report:**

**AUSTRALIA IN THE LATE 1950s** – Population approx 9,000,000 – average housing affordability was between 3 and 4 years wages – vibrant manufacturing in all sectors from clothing to food; from electrical appliances to motor & other vehicles – strong agricultural interests – small mining interests – low welfare recipients, high skills level in all fields – low international ownership of Australian properties, corporations and assets.

**AUSTRALIA IN 2013 –** Population past 23,000,000 – average housing affordability is more than 10 years wages – no significant manufacturing in any sector – declining agricultural and receding mining interests, after a mining boom there is nothing to show but a huge deficit – high welfare recipients 20% (27% of 18 to 25 year olds in some areas) and low skills level per capita in all fields – high international ownership of Australian property, corporations and assets. (NB Nil foreign ownership in China and other countries which now have extensive Australian ownership).

**COMPARATIVE –** Australia has been seriously compromised in its ability to continue being self-sustaining, in all sectors of our economy and in relation to the continual sell-offs to foreign, private and corporate ownership over the past 60 years, of our assets. This together with Unions enforcing harsh conditions; governments imposing excessive red tape and in compliance with international agreements, in the inept pursuit of a global economy, before the best interests of Australia.

Both the ALP & the LNP have subscribed Australia to slanted international treaties, not adapted or reciprocated by other countries, and our businesses have moved offshore for better economic conditions. At the rate we are going, Australians will in the foreseeable future, be an unskilled and totally dependent welfare society versus what ought to have been - at least 30% higher manufacturing and agricultural interests, owned by Australians than there were in the 1950s. Other than Unions gouging for their members, wages have not generally kept up with the cost of living, albeit the cost of living varies across the country.

At December 2013 the Chief of the National Australia Bank warns of “*modest economic growth*”, while one of very few remaining iconic Australian canned fruit producers, SPC, pleads for government aid to the tune of $25m to remain in business, yet it was governments at the hands of Unions and of paid political lobbyists, who allow cheap imports and Free Trade Agreements, thus creating the demise of our primary and secondary agricultural businesses and the financial dilemma SPC suffers. SPC may eventually close-down or be sold off to yet another international interest, as has been the case for so many other Australian iconic businesses and industries.

It may sound harsh to suggest that the demise of Australian industry is a deliberate agenda, but evidence to the contrary is difficult to establish.

**THE CURRENT MOTOR INDUSTRY STATUS is at a STALE MATE:**

Legislations by the LNP & the ALP have enabled political donations to political parties. One feature of this is that Unions are major contributors to the ALP, e.g. $20m was paid to the ALP prior to the 2010 election, and then the ALP-controlled government paid “training grants” to Unions, in apparent pay-back.

The ALP ought to have intervened in the manufacturing industries, but rather facilitated in allowing Unions to dictate their terms to businesses, making them non-viable and creating a conflict of interest, of government against the Australian people. It should be noted that most of the demands by the Unions are rarely the objectives of their members and all under the watchful eye of the political LNP “Opposition”.

The current Holden situation has resulted in that company withdrawing manufacturing in Australia in 2017. This has been created by a range of reasons, including the lowering of tariffs over many years, loss of economies of scale and pressures from Unions. Holden will join the ranks of other car manufacturers who have left for the same reasons as they no longer wish to comply or adhere to (*Source: The Australian*):

1. Wages & allowances spiralling to more than three times community standards.
2. Forced employment of Union members “*Many people who work at Holden don’t actually work for Holden; they work for the union. OH & S people are given 10 days paid time off a year to be trained by the union....and two of these delegates are entitled to an extra Holden sponsorship of one paid month off to further their industrial and or leadership developments.....because* ***their knowledge is used to control the workplace to the benefit of the union*”**
3. Restricted ability to employ casuals and every step of Holden’s operations overseen and to be approved by Unions. “*Holden has to... consult and reach agreement with the union*” and it is acknowledged that “*It is impossible to run a business like this”.*
4. An ex-employee described the workforce as “*over-managed, with one team leader for every six workers on a production line, when one for every 25 workers would suffice*” and “*some of us workers felt it wasn’t necessary to get paid what we were getting paid to do the jobs we were doing”* and adding that *“their work is probably worth about 20 bucks an hour with mates taking redundancy packages in the order of $280k plus..”*
5. *“It is made clear that if you don’t join the union you will be sacked”* and “*Union representatives don’t actually do any work for Holden, but rather make themselves full-time enforcers of union control”*
6. While the Australian workplaces have a zero tolerance for drug use “*the union won’t let the company sack any workers caught dealing, taking or being on drugs”* and “*If they did a random drug test tomorrow they’d probably have to sack 40% of the workforce”.*
7. “*Holden would rather leave the country...”* and “**The union thinks members are better off jobless than on award wages”** and they are right as “*workers will receive the most generous redundancy benefit....leaving will cost $600m....to staff payouts....the average production-line worker will walk away with a package of between $300k-$500k*” or up to 10 years wages upfront and for no work required and no work available but to increase our welfare recipients.

Unions and their government allies have sabotaged the car industry, which has overwhelmed and defeated the industry. In fostering the Union, the ALP under the Union-sympathetic PMs Rudd and Gillard presented an open taxpayer cheque book (which the Opposition Leader, Bill Shorten, supports) in providing:

**TAXPAYER SUBSIDIES of $300 million to Holden alone (contributing to our national deficit),** which irrespective of these subsidies, Holden cannot trade viably. NB There was no government assessment to determine the termites in the company’s viability to warrant subsidies nor was there any government facilitation to tackle adverse issues. The continued taxpayer subsidies of the Australian Automotive Manufacturing Industry has produced continued financial losses for all concerned, and has not achieved the objective of creating jobs; rather continued job losses occurred, and it appears that there has been no guarantee sought by government from Holden that in receiving subsidies that the continuity of trading would be assured from the taxpayer funds provided.

**CLOSURE OF THE AUSTRALIAN CAR MANUFACTURING INDUSTRY:** While the cost of subsidies is excessive, currently it is justified as a better means of keeping more than 45,000 people working versus using those same “subsidies” and much more towards welfare but in both scenarios a massive unproductive cost/loss will be produced rather than a profit to our country.

Of these two evils, closure would produce a far more damaging effect with tens of billions of dollars lost each year together with thousands of jobs gone and full time unemployment reaching record levels and reaching far beyond the direct employees of the industry, to all auxiliary industries reliant on the automotive industry. Hardship and misery of unemployment leads to crime and a further drain on all areas of the public service and society. The potential effect of this closure could perhaps create a massive recession to where it may be near impossible to regain this or any new asset by Australians in any attempt to over-turn the carnage.

**CLOSURES & SUBSIDIES ARE NEGATIVE & DESTRUCTIVE:**

**“*If we keep doing the same old things the same old way, we will get the same old results*”**

The current constrictive business stimuli, taxation generally and Union domination, clearly indicates that on the current course taxpayers are forced to continue and even increase subsidising this industry or alternatively, withdrawal of subsidies will result in the causation of the total collapse of our automotive industry. This would be yet another and perhaps the last bastion of our major manufacturing industries to add to our massive industrial fatalities.

Governments pandering and appeasing Unions with subsidies, has yielded corruption at its worst, at all levels of government; by and with corporations and by selfish individuals to the demise of the industry and in creating adversity to the Australian people which now threatens the long term sustainability of our country.

One consideration is that continuity of manufacturing fossil fuelled vehicles, by almost every western country to retain employment, means that **Australia and others are vulnerable to international oil interests in controlling oil prices and oil availability and thus our entire economy.**

Toyota appears to currently be the only survivor and now holds the trump-card in demanding excessive subsidies “if we want them to stay”. Some commentators have criticised Holden and Ford for continuing to make large cars, in spite of consumer preferences, but this criticism is too simplistic. Most car manufacturers offer large cars (including big 4WDs) as part of a range from large to small cars, and then consumer choices have dictated market directions.

Some Australians have been expressing a desire for a more environmentally-friendly car, and a range of technologies that could provide this (e.g. electric commuter cars, solely-LPG cars, hydrogen fuel-cell cars etc) remain of interest, but none have been developed commercially and offered to consumers. (NB the current type of ‘hybrid’ cars, such as the Toyota Prius, are mere gimmicks and are not regarded by automotive engineers as a serious attempt).

There is opportunity for a selfless government to pursue and provide an *“****Australian made and owned green car”*** and that government will be rewarded in the long term.

At 23 million people, with approximately 20% welfare dependant in some form or another, it is estimated that our population will be more than 40 million in the next few decades but the welfare dependency rate will be determined in this decade. Australian governments must develop strategies immediately to grow infrastructure and new industries, first and foremost for localised Australian benefits rather than pander to international interests.

That is, Australia needs to become self-sustaining in every facet of our lives from our national water resources to national industries. **It is more cost-effective and productive in the long term to subsidise and invest into growth of new industries**, that ‘value-add’ our raw resources and with new methods and incentives than it is to subsidise a growing unemployment and suffer the carnage created by “*doing the same old things the same old way*”.

**PROPOSED: MEGA VEHICLE MANUFACTURING PLANT:**

**A Mega Manufacturing Plant would Consolidate Resources & introduce High Tech cost saving methods:** A major fundamental of any ailing industry or business is for the consolidation of all resources – from the fixed cost of premises; inventory; depreciating plant and equipment, including reinvestment into new equipment; the number of employees required to sustain the business at competitive wages and benefits; compliance requirements and all up against the greatly variable return on investment which cannot be guaranteed – even, as proven, after taxpayer subsidies.

To date, each manufacturer has had to bear the entire cost of their operations, where a “Mega Plant” would produce greater **economies of scale**, thus greatly reducing costs and improving the bottom line profit.

One of the Palmer United Party pre-election policies was for the establishment of a **“Mega Automotive Vehicle Manufacturing Plant”** with resources able to be shared by say Toyota: Holden and Ford. As an alternative, and able to produce a greater return would be for this new operation to be government run under license from those entities, with a royalty component on each vehicle sold paid to Holden, Ford, Toyota etc of a “Clean Energy Australian Car” as opposed to the continued importation of more than one million cars per year.

It will always be the consumer who determines the products they choose to purchase, not the manufacturer and the choice of purchase is greatly determined by the best benefits for the price paid by the consumer.

* **The Green Alternative: Creating a new energy sourced fully Australian made and owned vehicle.**

**Australia has been the leader in so many fields and we have the opportunity to introduce alternative energy vehicles.**

The Australian car manufacturing industry could be re-invigorated by a public-private partnership in a mega-manufacturing plant producing a new type of vehicle. Research by others more expert than this author would be needed to examine the alternatives which would include:

* Hydrogen Cell cars as described in Appendix 1. Hydrogen fuel cells have applications beyond useage in cars, for example cells will be capable of powering a house.
* Electric battery-powered cars to be used by many urban dwellers who own two cars. Prototype electric cars were built over 20 years ago, having a range in excess of 120km, with recharging overnight from off-peak electricity.
* Cars, buses, trucks solely running on LPG or CNG (compressed natural gas)

In introducing a reliable alternative fuelled vehicle, we would be reducing pollutants and making Australia less reliant on fossil fuels and less susceptible to the effects of world oil prices.

**Australian manufacturing and our entire economy can and must be reinvigorated with excellent opportunities presented but also subject to and very dependent on providing creative national economical and technological reforms.**

**INTERNATIONAL COMPETITION:** Developing countries with less inhibitive government business constraints and greater government investment into technology have provided an environment where their automotive industries are stand-alone profit generators.

However we as a highly developed country have not only failed to achieve the level of profit that developing nations have achieved, but we also have produced losses because of the factors described above.

* Australia has been selling its raw mineral resources to countries such as Japan who after manufacturing and producing motor vehicles, sell back to Australians our value added mineral resources with a 40,000% mark-up.

**AUSTRALIA TO RECREATE OUR MANUFACTURING INDUSTRY:**

In taking back our manufacturing industries, creating jobs, skills and wealth for our country, the following factors need to considered:-

* **The creation of economic zones** for new and reinvigorated industries.
* **Sub-Contract labour directly with employees** – Invoice at a fair industry rate, including holiday and sick pay, all allowances and entitlements for the hours worked per week plus GST (GST retained and paid by the employer for the sub-contractor) will eliminate Unions; reduce administrative red tape and greatly increase productivity and personal and national income.
* **New Positions be extended to: Unemployed, particularly the** 18 to 25 year olds to be as sub-contractors, with failure to accept employment resulting in forfeiture of welfare payments.
* **Free Trade Agreements** have deprived Australian governments of the income from tariffs (which are, after all, only a tax on imports), and have made Australian-made products non-competitive and has created ongoing huge trade deficits. Reintroduction of Tariffs on imported vehicles **-** The average price of a standard sedan is between $20,000 and $30,000 which equates to less than one year’s salary based on an average wage. This compared to 40 years ago makes buying a new car much cheaper today than it did decades ago, but car sales decades ago were more profitable than today.

At say 20% import duty, those funds could be utilised to subsidise the Australian manufacturing industry and make the Australian product more competitive, thus increasing Australian car sales and increasing jobs, both producing more taxes towards eliminating the huge deficit. A tariff tax would allow for reduction of other forms of taxation (such as payroll tax or income tax), and this would be of benefit for all Australians.

* **“Made In Australia”** cannot be achieved, unless it is made and supported in Australia:

It is proposed that with newly competitive pricing of locally-produced automobiles:

1. That it be mandatory that all government departments be compelled to support the Australian products, particularly this automotive industry.
2. Australian consumers will prefer to purchase locally-produced vehicles at competitive prices ie without import tariffs.
3. Increased demand will increase profits, taxation and employment.
4. Australian made automobiles sales will increase from 200,000pa to more than 1 million units pa.

* **New High Tech plants will reduce the costs of operation**, which can ensure competitiveness on a world market, and allow for exports of components and of whole cars.

Since the GFC the USA has sought to be more self-sufficient and developing nations have forged ahead in taking our market share, while we have sat back and allowed this to happen. We cannot afford to continue to be complacent rather we need to be assertive in the best interests of our country as our primary objective.

**CONCLUSIONS:**

1. Through the consolidation of the resources of say Holden, Ford and Toyota overhead and expenditure would reduce, and their profitability would increase, diminishing the need for tax-payer contribution and ensuring the end products are competitive on a world stage, or
2. Australian manufacturing plants to pay a royalty to Holden, Ford, Toyota and others, and
3. Australian made “Green Car” to provide opportunities now and for future generations.

There are many alternatives for a new car industry, including electric cars or those using a Hydrogen Fuel Cell.

**Take Note: If a young person can make a Lego car powered by “*Compressed Air*” – the sky is the limit and the only resistance can be lack of will or the pursuit of an alternative (fossil fuel tax) agenda by government.**

**Take Further Note: In looking outside the square from Fossil Fuel to rebuilding our Country:** *(Source: Cairnsnews)***“This car runs on hydrogen produced in a garage: 400 mile range one tank”** US Gov Suppresses Solar Hydride Free Energy System! – Just like Australia the US oil companies rule the roost. Posted on [January 4, 2014](http://lucas2012infos.wordpress.com/2014/01/04/us-gov-suppresses-solar-hydride-free-energy-system-4-january-2014/) by [lucas2012infos](http://lucas2012infos.wordpress.com/author/lucas2012infos/)

# Project Nsearch Glenn Canady [www.project.nsearch.com](http://www.project.nsearch.com)

Bob Lazar, former Area 51 Engineer has a proven method that could let everybody run their cars and home completely for free by using solar energy to create hydrogen that is then stored in a hydride material to safely store the hydrogen. Once the hydrogen is stored in the hydride, it is 100% safe. You could shoot the tank with an incendiary bullet or a cut the tank with a chain saw and it will not blow up!

To release the hydrogen as it’s needed you simply supply heat the tanks and hydrogen is released as needed. Bob Lazar has converted a Corvette to run on this solar hydrogen hydride system. The Corvette, converted to run on hydrogen has a 400 mile range with 4 small tanks in the back of the car. Bob can then fully recharge the system overnight with his home hydrogen unit that is powered by solar energy. So he drives the Corvette for free!

So why can’t we all start doing this? Well, Bob says that the US Government has banned anybody from selling this hydride material! The reason they give is that one of the materials used in the hydride is used in nuclear weapons! This material is not radioactive or dangerous in any way but they still won’t let you buy it because it’s been restricted by the US Government!

This material for the hydride could be mass produced right now to free the world from the greedy oil corporations that are taking more and more of the wealth of the planet but of course the US Government is in bed with these oil corporations and politicians get lots of money to keep the status quo raping of the world going! Bob Lazar had to make the material because it’s legal to make it. The catch is that you have to build a particle accelerator to make it! Bob Lazar made his own miniature particle accelerator to make his own hydride! He and others could begin selling the material tomorrow but the US Government prevents anybody from selling it.

Please spread truth about the technology that could get the world off fossil fuels tomorrow. Join [www.project.nsearch.com](http://www.project.nsearch.com/) if you want to be informed of the very latest free energy devices, natural cures and much more!

Here’s all the details about Bob Lazar’s incredible hydrogen powered Corvette that the US Government doesn’t want you to have in your garage! <http://www.project.nsearch.com/> [link to original article](http://www.project.nsearch.com/profiles/blogs/us-gov-suppresses-solar-hydride-free-energy-system) [**cairnsnews**](http://cairnsnews.wordpress.com/author/cairnsnews/) | January 5, 2014 at 11:15 pm |

***It is no longer an option to cease and desist from manufacturing in Australia.***

**Appendix RE: HYROGEN CELL VEHICLE - COMPARISON TO FOSSIL FUELED:**

General Motors introduced Hy-wire vehicles in 2002 which run on hydrogen fuel cells capable of producing 94 kilowatts of power continuously (without refuelling) running on a ***saltwater*** (no fossil fuels) solution and at 129 kilowatts for short periods.

**Fuel Cell Vehicles:** Powered by 200 fuel cells inside an 11-inch-thick [chassis](http://www.gm.com/company/gm_exp_live/events/paris_2002/gm/hywire/index.html) fixed like a giant skateboard under the car, the Hy-wire's most exciting element is its environmental footprint - it has none. According to General Motors, the car takes in only air and leaves behind nothing but water. Simple as fifth-grade science: O2 + H = H20. And there is no internal-combustion engine.

The vibrating whine of its air compressor inhaling all that O2 makes the Hy-wire sound like a getaway car in *Minority Report* -- or an electric hedge trimmer, depending on how impressed you are.

In its present incarnation, the Hy-wire allows full front and rear visibility because it has more windows than steel or fiberglass. For those who are happily locked inside their moving steel cages as they drive to the office, this kind of exposure can be disconcerting. A GM rep said the clear glass below the windshield that emphasizes the car's engine-free front end could be replaced by "crumple zones" for increased safety and psychological comfort.

Video cameras and monitors that replace the rear-view and side mirrors increase outside visibility but are also disconcerting. Roving cameras are possibly more effective for driving purposes, but privacy advocates will be frothing.

Named for the technology it uses to replace conventional steering, accelerating and transmission controls, the Hy-wire has electronic wires in its chassis instead of mechanical parts. Those wires are connected to a docking port, sitting a few feet forward of the driver's seat. With the press of another button, the controller moved toward me, with a futuristic whizzing sound.

The vertical handles, or paddles, work like a motorcycle -- twist to go, squeeze to stop. Steering is done by rotating the control mechanism like a joystick, causing the wheels to turn.

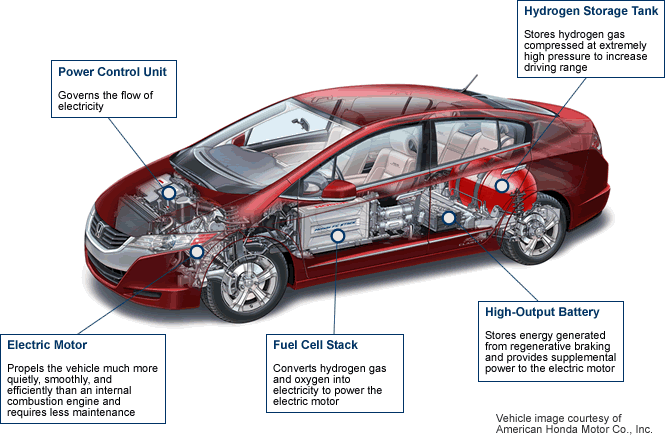
"It's for the PlayStation generation, when they grow up," the rep told me. I asked if they made an Atari version. Quite seriously, I was told that, yes, they could make one. General Motors recently announced its plan to be the first seller of 1 million fuel-cell vehicles between 2015 and 2020.

Invisible to everyone but the designers, the skateboard-like chassis is designed to be the ultimate advance in interchangeable parts. "Imagine, after owning it a few years, being able to order any new snap-on body in any color or style you like," said another GM rep. Just like cell phones.

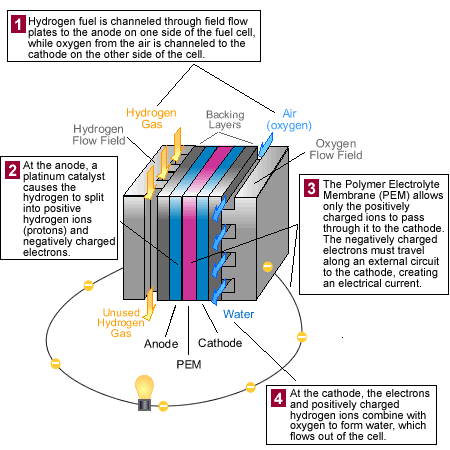
The engineer assured that the Hy-wire could reach 100 mph, though the car had its speed capped at 40 mph.

 Fuel cell vehicles (FCVs) have the potential to significantly reduce our dependence on foreign oil and lower harmful emissions ie eliminating pollutants. FCVs run on hydrogen gas rather than gasoline and emit no harmful tailpipe emissions. Several challenges must be overcome before these vehicles will be competitive with conventional vehicles, but the potential benefits of this technology are substantial.

**A Look Inside:** FCVs look like conventional vehicles from the outside, but inside they contain technologically advanced components not found on today's vehicles. The most obvious difference is the [fuel cell stack](http://www.fueleconomy.gov/feg/fcv_PEM.shtml) that converts hydrogen gas stored onboard with oxygen from the air into electricity to drive the electric motor that propels the vehicle. The major components of a typical FCV are illustrated below.



**How Fuel Cells Work**

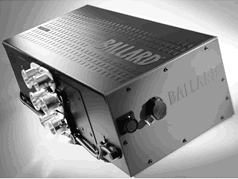
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[View Animation](javascript:void(0))

(Flash 5.0 or higher required)

Polymer Electrolyte Membrane (PEM) fuel cells used in automobiles—also called Proton Exchange Membrane fuel cells—use hydrogen fuel and oxygen from the air to produce electricity. The diagram to the right shows how a PEM fuel cell works.

**Fuel Cell Stacks:** Most fuel cells designed for use in vehicles produce less than 1.16 volts of electricity—far from enough to power a vehicle. Therefore, multiple cells must be assembled into a fuel cell *stack*. The potential power generated by a fuel cell stack depends on the number and size of the individual fuel cells that comprise the stack and the surface area of the PEM.



**Benefits and Challenges**

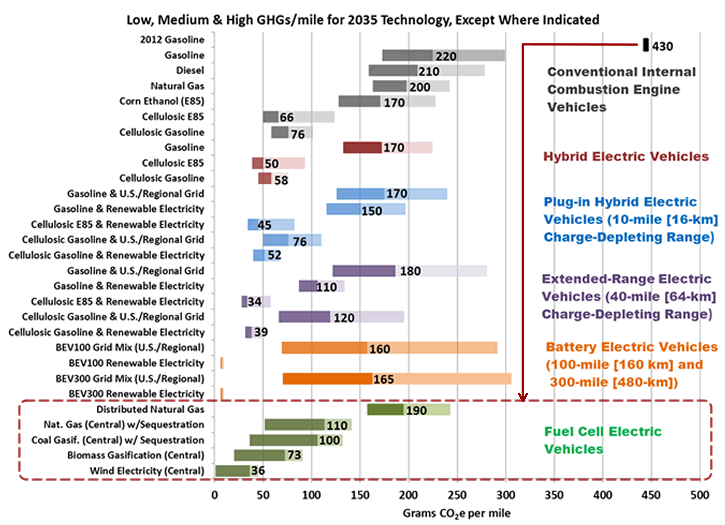
**Less Greenhouse Gas Emissions:** Gasoline- and diesel-powered vehicles emit greenhouse gases (GHGs), mostly carbon dioxide (CO2), that contribute to global [climate change](http://www.fueleconomy.gov/feg/climate.shtml). Fuel cell vehicles (FCVs) powered by pure hydrogen emit no GHGs from their tailpipe, only heat and water.

Producing the hydrogen to power FCVs *can* generate GHGs, depending on the production method, but much less than that emitted by conventional gasoline and diesel vehicles. [more...](javascript:toggleText('Climate'))

The chart below shows the GHGs generated by various vehicle types and considers all steps of the energy chain from fuel extraction or production to fuel use by the vehicle, not just tailpipe emissions. Even when accounting for the GHGs emitted during hydrogen production, conventional gasoline vehicles generate roughly 2 to 12 times more GHGs per mile than fuel cell vehicles.

Well-to-Wheels Greenhouse Gases Emissions for 2035 Mid-Size Car

(grams of CO2-equivalent per mile)



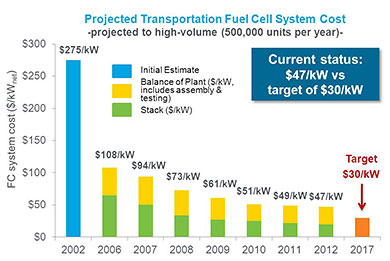
U.S. Department of Energy. 2013. [Well-to-Wheels Greenhouse Gas Emissions and Petroleum Use for Mid-Size Light-Duty Vehicles.Adobe Acrobat Icon](http://www.hydrogen.energy.gov/pdfs/13005_well_to_wheels_ghg_oil_ldvs.pdf) Hydrogen Program Record #13005 (rev. 1). May 10.

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**Reduced Oil Dependence:** FCVs could [reduce our dependence](http://www.fueleconomy.gov/feg/oildep.shtml) on foreign oil since hydrogen can be derived from domestic sources, such as natural gas and coal, as well as renewable resources such as water, biogas, and agricultural waste. That would make our economy less dependent on other countries and less vulnerable to oil price shocks from an increasingly volatile oil market.

**Less Air Pollutants:** Highway vehicles emit a significant share of the air pollutants that contribute to smog and harmful particulates in the U.S. FCVs powered by pure hydrogen emit no harmful pollutants. If the hydrogen is produced from fossil fuels, some pollutants are produced, but much less than the amount generated by conventional vehicle tailpipe emissions.

**Challenges:** Fuel cell vehicles are not yet commercially available, but a few hundred are being evaluated in field tests. Several challenges must be overcome before fuel cell vehicles (FCVs) will be a successful, competitive alternative for consumers.

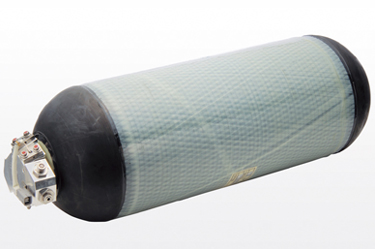


Source: USDOE, Fuel Cell Technologies Office, [Accomplishments and Progress](http://www1.eere.energy.gov/hydrogenandfuelcells/accomplishments.html).

**Vehicle Cost:** FCVs are currently more expensive than conventional vehicles and hybrids, but costs have decreased significantly and are approaching DOE's goal for 2017 (see graph). Manufacturers must continue to lower production costs, especially for the fuel cell stack and hydrogen storage, for FCVs to compete with conventional technologies.

**Onboard Hydrogen Storage:** Some FCVs store enough hydrogen to travel as far as gasoline vehicles between fill-ups—about 300 to 400 miles—but this must be achievable across different vehicle makes and models and without compromising customer expectations of space, performance, safety, or cost. [more...](javascript:toggleText('Range'))

FCVs are more energy efficient than conventional cars, and hydrogen contains three times more energy per *weight* than gasoline does. However, hydrogen gas contains only a third of the energy per *volume* gasoline does, making it difficult to store enough hydrogen to go as far as a gasoline vehicle on a full tank—at least within size, weight, and cost constraints.



The following storage methods are being explored:

* **As a gas in high-pressure tanks.** Current FCV designs use high-pressure (5,000- to 10,000-psi) tanks to store hydrogen. These systems are large, heavy, and costly, but they are the most cost-effective solution in the near term.
* **As a liquid at sub-zero temperatures (-423°F).** Since hydrogen is densest as a liquid, this method allows more hydrogen storage than gaseous high-pressure storage. Issues with liquid storage include hydrogen boil-off, the energy required for hydrogen liquefaction, volume, weight, and tank cost.
* **Materials-based storage.** Hydrogen can be stored on the surface of solids (by adsorption), within solids (by absorption), and through chemical reactions. Materials-based systems have the potential to be small and lightweight and may prove to be the best solution in the long term. However, they are still in the early stages of development.

For more information about hydrogen storage, visit the following EERE Fuel Cell Technologies Office web pages:

* [Hydrogen Storage](http://www1.eere.energy.gov/hydrogenandfuelcells/storage/)
* [Hydrogen Storage: Basics](http://www1.eere.energy.gov/hydrogenandfuelcells/storage/basics.html)
* [Hydrogen Storage: Current Technology](http://www1.eere.energy.gov/hydrogenandfuelcells/storage/current_technology.html)

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**Fuel Cell Durability and Reliability:** Fuel cell systems are not yet as durable as internal combustion engines, especially in some temperature and humidity ranges. Fuel cell stack durability in real-world environments is currently about half of what is needed for commercialization. Durability has increased substantially over the past few years from 29,000 miles to 75,000 miles, but experts believe a 150,000-mile expected lifetime is necessary for FCVs to compete with gasoline vehicles.

**Getting Hydrogen to Consumers:** The current infrastructure for producing, delivering, and dispensing hydrogen to consumers is cannot yet support the widespread adoption of FCVs. In 2013, [H2USA](http://energy.gov/articles/energy-department-launches-public-private-partnership-deploy-hydrogen-infrastructure) was launched as a public-private partnership between DOE and other federal agencies, automakers, state government, academic institutions, and additional stakeholders to coordinate research and identify cost-effective solutions for deploying hydrogen infrastructure.

**Public Education:** Fuel cell technology must be embraced by consumers before its benefits can be realized. As with any new vehicle technology, consumers may have concerns about the dependability and safety of these vehicles when they first hit the market. Plus, they must become familiar with a new kind of fuel. Public education can accelerate this process.

File: PUP PRODUCT COMMISSION ON AUTOMOTIVE INDUSTRY v3