

What comes with my order when I buy a Smack unit?

The Smack unit comes shipped to you as seen on the front page of my site. Just the booster only. No EFIE, no wires, no tubing, no relays, no catalyst. Although some of these items are now available, including my new Smack controller with built in EFIE. See my parts pages for more info. Otherwise, its just the assembled booster unit itself. I discuss some of the reasons why I do this in my installation videos.

Do I need an EFIE device?

This depends on application. You may not need one. None of my older vehicles do. But every vehicle past 1999 that I have tested has needed one. The way to determine this is by trial and error. Some ECM's have the capability of "learning" the hydroxy curve, while others do not. How to tell? Install the booster and record mileage results. If there is no increase after a few days, the ECM is overcompensating for the cleaner burn and an adjustment will be needed. You must allow the ECM enough time to relearn the mixture first. This may take a few days. General rule of thumb, anything newer than 1996 and you will need an EFIE unit. If you have a newer vehicle with 2 or more, you will need one for each sensor. But the most critical ones are the ones closest to the exhaust ports. For those who do need to make engine management adjustments, I recommend using an EFIE device that alters the O2 signal wire output to the ECM. Covert auto makes a very good unit – but quantities are limited. Search on line, there are many options out there.

For those like myself who are more serious about controlling parameters I suggest you take a look at this:

<http://www.xo1ox.net/hho/shop/item.asp?itemid=33>

http://www.youtube.com/watch?v=LA72J_IN8MY

<http://www.freewebs.com/covertautoengineering/index.htm>

So how do you adjust your EFIE unit? Doing this blindly is a dangerous proposition. If you lean out your engine to much you can cause damage. You must replace the amount of gasoline removed with a comparable amount of hydroxy. So how to do this? You need 2 gages – and AFR (Air Fuel Ratio) and an EGT (Exhaust Gas Temperature) gage. The AFR gage will show the band of mixture you are running. The EGT will tell you if that band is to rich or lean. Generally, if you exceed 1400F EGT, you are running close to the damage zone. So your AFR should show more lean than rich, but your EGT should stay below 1400F. See my videos for more on this. The good news is this: manufacturer's set the cars overly rich to start with to ensure no damage can occur even under the most extreme conditions. This means, now that you have control over you mixture, you can lean out with no hydroxy and see some improvement with no hydroxy at all. By adding hydroxy, this allows you to lean out even more without raising EGT's.

Do I need a PWM (Pulse Width Modulator) of current limiter?

I do not use one on my units personally. I allow the units to reach operating temp and stabilize. Some may want to run their cells at a constant amp draw without ramp up. In that case, it is important to understand cell voltage and heating characteristics. It's really simple physics, like rubbing your hands together or starting a fire with a couple of sticks. Speed makes heat. Think of the Blackbird being an electron, and the air being the electrolyte. At mach 2, the wingtips of that bird are glowing.

But an electron going too slow can mean no production – below 2VDC per cell the electron does not have enough energy to overcome random molecular motion in the liquid and never crosses the cell gap. This is why 2VDC per cell is needed, even though officially the minimum voltage calculated is 1.24VDC. Think of it as a measured nudge.

With this in mind, remember that PWM's and current limiters do have a slight inherent voltage drop across them. In these cases, a 7 cell system will not work properly because the limiting device will drop the applied cell voltage enough to hamper production. So if you want to use a PWM, etc, make sure you have a 6 cell unit, not a 7 cell unit. In my design, one plate from each side of the stack can be easily removed to make it a 6 cell unit.

Remember that PWM's do NOT increase production, but rather help to flatten the output curve. So in that respect – over time – a PWM has the effect of increasing production as it allows the cell to receive maximum current with no ramp up time

Can I put water right out of my tap into my booster? Can I add some baking soda to help increase production?

Many people often ask - why not use rainwater, or spring water, or tap water in an electrolysis cell? Rainwater is super clean - right? Not hardly. All these different types of water contain impurities - minerals, suspended solids, etc which precipitate out of the water when subjected to electrolysis. These precipitates manifest themselves in the form of brown, black, or green scum on top of the water, as well as severe discoloration of the water itself. The gunk serves not only to clog up the electrodes, but impedes the operation of the cell overall. The formation of these solids are accompanied by the formation of unknown gases which mix with the hydroxy to form "who-knows-what" - a mixture that is of unknown content and possibly toxic to you and your engine. So for this reason only use distilled water in your cell.

Another topic of great debate is the electrolyte of choice. Because of its availability, many are adamant about using baking soda or salt. But the easy road is almost never the right road, and this is no exception. Since distilled water cannot conduct electricity on its own, a catalyst must be added. The definition of a catalyst is a substance that facilitates a reaction without becoming a part of that reaction. Unfortunately, baking soda and salt are not good catalysts. During electrolysis, they break down and combine with hydrogen and oxygen and form toxic gases that can injure you as well as your engine. Chlorine gas is

one of those fun byproducts - very toxic. More sludge precipitates out of the solution. SS electrodes can be completely dissolved in a matter of hours - destroying your cells. Fortunately this problem can be avoided by simply using a catalyst that does just what it's supposed to do - conduct electricity. Potassium hydroxide (KOH) and sodium hydroxide (NaOH) are two substances that catalyze efficiently. They are commonly used in the production of soap and can be easily obtained on the WWW and shipped to your door after a simple security check is filled out.

You will find that when you combine distilled water with one of these two catalysts you will experience a cleaner cell bath and more homogeneous hydroxy mix. This will result in a more efficiently operating unit which will reflect in improved mileage gains and performance.

Why is my new cell not making 1.7LPM? (Gen I and II units only)

A "green" Smack usually puts out about 1.2LPM. The plates are not fully conditioned yet. You will find as you turn the cell on and off, and run it for longer and longer periods of time, your production will increase. The 1.7LPM output can take a couple of weeks to achieve in some cases depending on plate prep. This is due to the driving out of impurities from the pores in the SS, and the formation of the catalytic layer on the plates themselves.

So what if you are not getting at least 1.2LPM right out of the gate? Most common problem is $V=IR$ losses in under gage wire and insufficient electrical connections. Use 10 gage wire or larger, and make sure all your connections are soldered, not just crimped. A sure sign your connections are not good are hot terminals and wires. Properly built, they should be no more than slightly warm to the touch, even at 30 amps.

Also, break the cell in gently at 5 amps or so. Don't try to force maximum current through it right out of the gate. This causes those catalytic layers to crack - reducing production later on. See the plate preparation question...

Why can't I hook my cell output tube to engine vacuum?

You do not under any circumstances want to hook your electrolyzer unit up to an engine vacuum source. There are three important reasons for this:

1. Exposing the surface of a body of water to a pressure less than atmospheric results in a lower boiling temperature. This is due to the fact that the drop in pressure allows water molecules to escape their liquid confinement and be liberated into a vaporous state more easily. In small quantities, this can be desirable when attempting to improve the performance of an ICE. The problem is there is no easy way to monitor just how much and under what conditions this is maximized. Too much vapor/steam will dilute to hydroxy mix and render it useless by reducing its volatility. This will nullify any fuel efficiency gains you may otherwise have had. In fact, too much steam and you may actually decrease your mileage. The way to utilize vaporous water is by mist injection

where the process can be monitored and controlled. Those of you using engine vacuum now on your boosters probably have no idea how much and of what quality your cells output has. Now add this to the problem of already hot running cells and after a very short period of operation you basically have nothing but a big steam generator piped into your manifold vacuum. This can wreak havoc on sensors and components within your engine.

2. It is true that putting an electrolyzer unit under vacuum will increase its hydroxy output as long as the temperature of the bath remains below its new boiling point. So the temptation to do this is great - but there is a problem even more serious than boiling. Think of how manifold vacuum works. For those of you that have a gage you know that vacuum is the highest when the throttle plate/s is/are closed. Vacuum is at its lowest value when the valve is wide open. This is the exact opposite of what you desire. You want the unit to be outputting its maximum when the throttle is wide open, not fully closed. This will cause engine management problems and reduce the effectiveness of your fuel savings. If one wishes to use vacuum to increase production, one would need to use a vacuum pump that provided a consistent value. The problem with that - now you have a larger volume of flammable hydroxy gas prone to ignition and being pumped through a mechanical device which could fail and blow up.

3. Manifold vacuum is not stable. It pulses violently with every cycle, and surges with every movement of your right foot. This causes large fluctuations which cause bubblers and cells to be evacuated very quickly - almost instantly sometimes.

So hook your cells output to the intake piping just before and as close as possible to the butterfly valve as you can. This minimizes the stored hydroxy volume while still avoiding the vacuum phenomenon.

On a turbocharged or supercharged vehicle, where should I connect the cells output tube?

As in all installs, I have revised my installation advice due to information provided by other experts in the field. I have learned that for any concentration below 4%, the hydroxy is dilute enough in the air stream to not pose a significant hazard. The Smack unit does not produce enough gas to exceed the 4% ratio in large engine applications, so introducing the hydroxy output tube just before the air cleaner in these applications is acceptable. The air filter acts as a diffuser to more evenly distribute the gas throughout the air charge. This means that inducted applications are much simpler than I had previously thought. There is no need to pressurize the unit to above boost pressure. The only region susceptible to damage is the run between the unit and the end of the output hose where the concentration is very high. This is why one must always use a bubbler between the cell and the introduction point.

Why is my water turning brown?

Even when you use distilled water, you will still observe some brown deposits in your

electrolyte. There is iron content in lower grade SS plates like those used in my Gen I and II design. Home depot wallplates are made from 302 SS, so for some time iron deposits will continue to leach out of the SS and discolor your water. For the first few months, it is recommended to change out your electrolyte frequently. As time progresses and the plates condition and the iron is drawn out of the SS, flushing intervals will decrease. It is up to the users discretion as to how often the electrolyte is changed. I change it once a week for the first few weeks, then once a month as the water becomes less tinted. The GenIV uses 316 SS plates, so there is less leaching.

How do I prevent my electrolyte from freezing?

There are several suggestions to address this problem. Just adding KOH or NaOH helps lower the freezing point of your water – but in some climates that is not enough. Some suggest using low power heat elements to keep the unit liquid. My personal solution – use quick connects for the gas and power lines and just remove the unit when driving is complete. A bit of a pain, yes – but it's worth the 20% to me. The GenIV unit is good to about 10 below because of its heavier concentration.

Why do my plates have a bronze tint to them?

It is normal for the plates in your unit to bronze out. This is not because of the iron in the water. SS will discolor when current is passed through it. You may notice a rainbow appearance to the metal. This is not indicative of a problem and is a sign of a perfectly healthy cell. Those who deal with electrical devices may have seen this same kind of discoloration with copper terminals as well.

How do I prepare and condition my plates?

The following is extracted from the Bob Boyce files. Bob is one of the foremost experts on this subject. Certain portions have been removed because they do not pertain to this particular design.

At no time are the plates to be handled with bare hands. Use clean rubber gloves to handle the plates.

1. Plate Preparation

First, you must deeply crosshatch the plates in an X pattern. Sandblasting or using an orbital sander will NOT work the same. This sanding is typically done by hand or on a belt sander using 60 or 80 grit sandpaper.

Rinse the plates clean of particulate matter. Acids or other cleansing chemicals are never to be used on the plates. The only chemicals that should EVER touch these plates are sodium hydroxide and/or potassium hydroxide. Clean tap water (not city water though due to all the chlorine and other chemicals added) may be used to rinse, but distilled water only is to be used for final rinse.

2. Cell Assembly

Assemble the plates into the series cell container. Mix up a dilute solution (5% to 10% by weight) of sodium hydroxide in distilled water. Pour this solution into the series cell container until the solution is just covering the plates totally.

3. Plate Cleansing

During this stage, we are operating in submerged plate condition, where the liquid level is maintained just over the plates. Run this cell stack at full power for several hours at a time, which can be 4 amps or more. As the cell stack runs, the boiling action will loosen particulate from the pores and surfaces of the metal. Be sure to do this in a well vented area. Shut down and pour this solution into a container. Rinse the cells well with distilled water. Filter the dilute solution through paper towels or coffee filters to remove particulate. Pour the dilute solution back in and repeat this cleansing process. You may have to rinse and repeat many times until the cells stop putting out particulate matter into the solution. Optionally, you can use new solution each time you cleanse, but be forewarned, you can go through a lot of solution just in this cleansing stage. When cleansing is finished (typically 3 days of cleansing), do a final rinse with clean distilled water.

4. Plate Conditioning

Using the same concentration of solution as in cleansing, now fill the cell stack with dilute solution. Monitor current draw. If current draw is fairly stable, continue with this conditioning phase straight for 2 to 3 days, adding distilled water to just replace what is consumed. If the solution turns color or skims over with crud, the cell stack needs more cleansing stages. After 2 to 3 days of run time, pour out the diluted solution and rinse well with distilled water.

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How do I adjust a Smack unit for the proper current draw (Gen I and II)?

Due to recent heat complaints and questions about Smack running temp, I have performed a prolonged test of 4 hours.

Previous to this test, my longest official test was 1.5 hours as recorded on utube. My reasoning for this length of test is that few people drive longer than that on a daily basis. My commute isn't much more than .5hr per day. Based on this, I advised that the starting current be set at 14 amps or so. As the unit heats, it will draw more current, and after about an hour it stabilizes at 20 amps and 60C - approximately.

For longer duration runs, I have discovered the parameters must change to avoid higher

current and overheating. If one starts at too high a current and runs for long durations, the unit becomes overheated and draws more than the designed 20 amps. With this in mind, I started my test with a lower initial current draw. The following are my results.

$v_{app} = 13\text{VDC}$:

time = 0,

13C, 7.0amps.

time = 1hr:

53C, 15.3amps

time = 2hr:

92C 26amps

time = 3hr:

91C, 29amps

time = 4hr:

94C, 29.4amps

My conclusions are as follows:

I have observed a direct relationship between current and temperature. Most of you are already aware of this - so no surprise there. The important thing to note is that if one is able to maintain a constant current, one can maintain a constant temp. As the current rises, temperature rises at slightly more than proportionally.

Prior to the 4 hr test, I did some temp vs current data points. I found no matter how long the cell ran, if I kept the current down below 20amps, the cell ran around 60C. This is why I was claiming my cell ran around 60C. Based on my driving habits, there was not enough time for the unit to heat past this point. This is notable because it is important to know that heating is not a runaway side effect. It can be controlled by the amount of current (power) applied to the cell. There is a stabilization point for the Smack unit, and it's based on electrolyte concentration. In short, I am suggesting that for those who make long commutes over 2 hours, a cell can be adjusted cold to 20amps, then as it heats up one can use an adjustable DC motor controller (such as sold on hydrogen garage) to control the current and maintain proper temperature. I do not recommend a Smack be used for long distances without a PWM controller UNLESS one sets the cell up cold for low amperage draw. My initial draw was 7 amps, and the unit stabilized at 29 amps after 2 hours of operation. I believe further time trials would show the current draw and temperature stabilizes after this 2 hour period and no further heating would be observed.

I say this based on the data above. After the first 2 hours the temp only rose 2C and current only rose 3.4amps. During the first 2 hours, current rose 19 amps and temp rose 79C. This indicates a stable operation point was reached based on the data I observed. I feel that if I had started at a lower current of 4 -5 amps I would have been able to stabilize the unit at 20 amps instead of 29 amps. I will confirm this with a future test, I just wanted to get this preliminary info out there now. It is a trial and error process to find the proper starting current that yields the desired final stable current draw. My first test was aborted because I started at 14 amps and stabilized at 40 amps - way too much current for the plate area. I can confirm this theory of stabilization with my own experience with the Bike Smack. Set up cold at 5 amps, it would never exceed 10 amps no matter how long I rode. My longest rides were from PHX to Palm springs, a 4.5 hour drive. I have an amp meter mounted right on the bars as you will see in a future video.

94C is too hot to run for long periods of time, even though it is still below boiling - just barely. The PVC cannot take this temperature for prolonged periods. Lots of vaporization is also occurring at this temperature. The gas quality was still good as an ignition test revealed during the time trial, however.

So it is my conclusion that heat and current are not runaway demons in a Smack cell. Depending on concentration, the cell will stabilize.

For short commutes of less than 2 hours, I recommend the same protocol be followed as before. Set cold current draw to 14amps. For longer periods, either use a PWM or set your cell cold to draw 4 - 5 amps. This will allow the unit to stabilize at an acceptable level. This may vary from one unit to the next, so trial and error will be necessary at first.

I have purchased a PWM and will be conducting more temperature trials using it as described above.

Does hydroxy implode inside an internal combustion engine?

There have been tests done which allow for the rapid expansion of volume while maintaining seal integrity using a tube and sliding piston arrangement (not an engine). Igniting a volume of hydroxy in this apparatus allows the observation of the removal of the latent heat of condensation (LHC) after the initial explosion in which the resultant water vapor/steam is allowed to cool and condense resulting in a rather rapid decrease in volume, sucking the piston back in the other direction. Many who have observed this tag it as implosion. I do not agree with this at all. I call it $PV = nRT$.

The main point here is that inside a running ICE, there is no time for this removal of the LHC, so therefore there cannot be anything even remotely resembling an implosion. There is no time during the rapid cycle (even at idle) for this LHC to be removed, especially with cylinder walls that are well above the boiling temperature of water.

Also remember that in the reverse pressure direction, the only thing keeping the valves seated would be spring pressure – some 300 psi or so. The spring pressure exerted on the valve seats would not be enough to allow the piston to do much work since the vacuum of the "implosion" would overcome spring pressure and lift the valve - compromising the desired vacuum and stalling the engine immediately.

Assuming that implosion could happen - which it does not.

So where does the energy come from? You cannot get more out than you put in... right???

Think of free energy devices as a "valve". We all know that with very little energy, we can turn a water valve from the "off" to the "on" position. The energy contained within that water is much greater than the energy required to open the valve. Granted, the energy imparted on that water is from another source (pumps, gravity, etc.) I'll come to that in a moment. What matters now is the fact that act of turning the valve on is really easy compared to the amount of work the water pressure it redirects can do.

Another analogy is the bear claw trap. It takes a relatively small amount of energy to activate the trigger mechanism compared to the amount of energy released when the trap slams shut. Granted, it takes energy to set the trap – but the animal in the trap did not supply that energy, so from it's perspective it may seem like the trap is an “overunity” device.

Another example is the hydrogen bomb. This is a publically disclosed phenomenon of a device yielding more energy out than man put in. Granted, it is not a reversible process like electrolysis, but in terms of man's energy input verses output, it serves the purpose. The energy released comes from within the atomic structures which were imparted during the creation of the matter used ($E=MC^2$). While I'm on the topic of atomic structures, Stan Meyer calculated that the amount of atomic energy locked with in the atoms of one gallon of water equals that of 1 million barrels of oil. Looking at the detonation of an atomic bomb – I can see how this is plausible. Your average fountain pen contains enough energy within its atomic structures to equal the release over Hiroshima. The trick is of course how to unlock this energy. I am quite sure the Smack Booster does not take full advantage of this source. But it would be interesting to see the results of before and after electrolysis mass analyzation. Would the mass of water resulting after combustion EXACTLY equal that before electrolysis? If one has accurate enough equipment, or the proper method for measuring down to the closest neutron mass unit, I wonder about the results. Sound and light are forms of energy, and that energy has to come from somewhere. Could some of it come from the conversion of mass to energy: $E=MC^2$? Anyone out there who feels qualified to answer this question feel free to contact me. It is one question I would like to have an answer to – not an opinion but a factual answer.

Now, it is generally believed that the process of brute force electrolysis is not an over

unity process. That issue is under debate:

<http://www.rexresearch.com/puharich/1puhar.htm>

It's no mystery that the Smack unit yields a 20% increase in fuel economy. The above reference may provide some insight to this figure. The numbers do not and cannot lie. But let's assume that electrolysis is NOT an over unity process. So where do the energy savings come from? Stored potential energy within the molecular bonds of the water molecule imparted during their formation perhaps? Or maybe the answer may lie in the Latent Heat of Evaporation and Condensation... During phase changes, the water molecule may store energy imparted from its surrounding environment that is released during the process of electrolysis. I am speculating here, and I do not have proof of this statement. **What I do have proof of is a 20% increase in fuel mileage using this technology. And that savings is brought on by the faster flame front of the hydroxy gas mixed into the incoming air charge. The presence of the hydroxy gas promotes a more complete and efficient burn of the gasoline within the combustion chamber thanks to not only the faster flame front, but the localized increased burn temperature. The overall effect is a more complete burn of gasoline that would normally exit the exhaust as partially unburnt hydrocarbons. So the argument about the 2nd Law of Thermodynamics is moot. Take a very inefficient device such as the internal combustion engine (18% efficient) – add a superior fuel like hydroxy with excellent properties – and it's easy to see how you can squeeze a mere 20% of that 18% out. The science is simple, easily understood, and breaks no laws of the Universe.**

With the new String Theory concept being widely accepted, it should come as no surprise that some of the processes we witness have the potential to utilize energy within the environment. Scientists already know that the universe is a vast expanse of infinite energy. Every cubic inch of our universe contains HUGE amounts of energy. Some have referred to this as the “Zero Point Energy Field”. So I think it is time the main stream begin to recognize the existence of this energy field and begin thinking of ways to use it in order to save our planet. With the new discovery of Global Dimming which is temporarily offsetting Global Warming, we are in for big problems. As soon as we reduce the amounts of man made particulates in the air, cloud reflection will decrease and the greenhouse gases present in our atmosphere will spike global temperatures catastrophically. The time to act is NOW.

How much hydroxy gas is need to run my car engine alone?

One common mistake many people make is the incorrect assumption that ALL the CFM requirement of the engine must be met by hydroxy production. This is not the case - not by a long shot. Many people want to claim you cannot add any air to the hydroxy mix - but they are wrong! The hydroxy is metered into the engine and mixed with air similar to the way propane or natural gas is. Another common mistake is failing to convert the liquid volume of water into a vapor volume.

Remember, the water is split first and resulting gases are what combust. The third mistake is people using hydrogen properties instead of hydroxy properties to perform their calculations.

For example: Hydrogen - oxygen mix in its monatomic forms has more energy in it than a similar volume of propane. A typical propane company work vehicle consumes .3 liquid liters per Km of propane, at an expansion rate of 270:1 that's 81 L/Km gaseous propane. Traveling at a very normal speed of 100 Km/hr, that's a consumption rate of 135 LPM gaseous propane.

<http://oee.nrcan.gc.ca/transportation/business/documents/success-stories/cars-minivans-london.cfm?attr=16>

Propane gas has an energy density of 2.3K BTU/ft³ at 1 atm. Hydrogen gas has an energy density of 270 BTU/ft³ at 1 atm. That means the same vehicle would need 8.5 times the propane fuel rate, or 1147.5 LPM H₂ gas. Remember this number you will see it come up again in close proximity later in this post.

http://www1.eere.energy.gov/hydrogenandfuelcells/tech_validation/pdfs/cm01r0.pdf

There are plenty of hydrogen powered ICE cars out there. Here is a hydrogen powered Cobra built to break a land speed record.

<http://www.clean-air.org/Hydrogen%20Cobra%20Story/Hydrogen%20Cobra.htm>

Note the tank on this car holds 590 standard cubic feet of H₂, and it empties in 5 min while doing a run. That's 118cfm, or 3342 LPM. This would seem to support some of those outrageous claims. But this is not your typical engine. First of all, that is what was consumed at WOT during a land speed attempt. Secondly, it's a huge bored and stroked 527CI. There is no air metering (no throttle plates, engine speed determines airflow, not throttle position) and they engineered the engine to run at a crazy fuel ratio of 80:1 in order to eliminate the Nox emissions we have been talking about. Not many of us are going to try and build our engines like this. Most of us will be using air metering devices, running an A/F closer to 34:1, and closer to the 350CI range or smaller. My Olds motor is less than 1/2 the size of this beast, so if I wanted to set it up with this configuration (which I wouldn't) I would be using around 1400 LPM H₂ gas. Put some throttle plates on it and drive it normally and I'd be closer to 1000 LPM. There is that number range again.... On that note - look at this next H₂ car:

The BMW hydrogen car uses 17.6 lbs, or $17.6 \text{ lbs} / (4.432 \text{ lbs/ft}^3) = 3.97 \text{ ft}^3 = 112 \text{ L}$ of liquid H₂ to go over 125 miles (201.2Km) = .56L/Km.

<http://www.autobloggreen.com/2006/09/12/bmw-officially-announces-the-bmw-hydrogen-7/>

Hydrogen has an expansion rate of 1:848 which means the car uses 472L/Km H₂ gas. Assume a nice speed of 100KPH, and you get a fuel demand of 787 LPM. Somewhere in the ballpark of what I predicted for the Olds and calculated for the propane rig above...

Now take into account that hydroxy is NOT H₂. Here is where we all need to sit up straight in our chairs:

One researcher calculated via experimental data hydroxy gas contains 60,000 KJ/m³ of energy at 1 atm. Now there have been varied reports up to ten times this value - but this is the lowest one I could find so I chose it for the worst case scenario. Keep in mind our ongoing discussions about the mysterious "soup" some of our cells generate.

<http://www.phact.org/e/bgas.htm>

Compare this to hydrogen gas which contains 10,000 KJ/m³ at 1 atm. That's 1/6th the energy of hydroxy! With that observation, let us substitute hydroxy into the previous calculations:

The propane powered rig would need 190 LPM hydroxy gas.

The Cobra would need 560 LPM hydroxy gas.

My Olds would need 170 LPM hydroxy gas based on the comparison to the Cobra.

The BMW would need 130 LPM hydroxy gas.

Let's talk about the Olds some more. My Olds gets about 23 MPG at 60 MPH, or .165 LPM liquid gas. Gasoline has an energy density of 31,150,000 BTU/m³ liquid compared to 8,491,000 BTU/m³ liquid H₂. This would mean that almost 4 times the amount of liquid hydrogen would be needed, or .66 LPM. With an expansion ratio 848, that's 560 LPM gaseous H₂. Now, I calculated that hydroxy has at least 6 times the energy of H₂, so the projected demand for my Olds is 93 LPM based on my observed gasoline mileage and the conservative reported BTU's of hydroxy. Notice how this calculation supports my previous statement concerning the comparison with that bad ass Cobra. Even that beast could be designed to run on less fuel. Frank Roberts has made a claim of 20 - 30 LPM with his Taurus which is not that far from my own Olds

estimate and certainly no where near to being close to 3000 LPM. Perhaps with the proper tuning, correct hydroxy mix and good driving habits I could get into the 30 LPM range like Frank did, an order of 2 magnitudes less than other's estimates.

That brings the technology right back into the realm of possible!