WATER4GAS SCAM???

Well, the answer maybe yes and maybe no. The HybridCar2008AS Team began experiments in connection with electrolysis and **Water4Gas** one year ago. Originally Ozzie Freedom "discovered" **Water4Gas** technology in California, this fact seems to be irrelevant in this point of view, but the geographical location may be important in the later evaluations. Our website's visitors may read our previous reports. According to our latest reports they may say that **Water4Gas** is a gigantic scam because most of our devices went down. Our reports also tell you that **Water4Gas** devices may spare fuel. Now, you may ask: What is the truth?

Now, we would have to apply word "well" again. "Well" it can be un-amusing for you. Let's try to find a "scientific" approach to explain what happens in these devices while they are working. We should like to ask you to keep on reading because we are going to use only some basic mathematical and physical knowledge to understand behavior of **Water4Gas** devices.

Water4Gas devices are simple hydrolysis units. Water consists of Hydrogen and Oxygen; its chemical formula is H_2O. So it may be disassembled to gases. Chemical formula shows that water contains twice more amount of Hydrogen than Oxygen. Hydrolysis requires a minimum potential, because it's necessary to exceed the potential inside molecules. This potential can be called "threshold voltage" because under this voltage hydrolysis will not start. It would be relatively difficult to deal with temperature dependence of this threshold voltage this is why we will a simple fix value of it, which is 1.6 V. (This is a temperature independent value, this can be 1.57V in the reality.)

The amount of the gas, which is generated by a **Water4Gas** device, depends only on the amperage of the system. (It has a very simple explanation, because a given number of electrons can dissolve a given number of water molecules. Amperage measures number of electrons going through the wires in a given time interval.) **Water4Gas** devices are connected to the car's battery, which yields more than 13 V, while the engine is on. (Because of continuous charging.) If we try to connect our **Water4Gas** device to a lower voltage source it will produce much less gases. What are the reasons?

Amperage depends on the surface size of electrodes and also depends on the distances between electrodes. (Of course it depends on the temperature and on the amount of applied electrolyte (baking soda). But let's neglect these facts.) If we increase voltage amperage increases also. The problem is that only 1.6 V will generate gases. What happens to the remaining part of the energy? (Battery yields energy, which equals to product of voltage and amperage.)

Unfortunately most of the energy produces heat. (Please think about an incandescent lamp.) This heating energy will increase the temperature of the water. Let's assume that we have "I" amperage and "U" voltage in the input lines of our **Water4Gas** device. This case, our battery yield power according to the next formula:

$$P_{battery} = U \times I$$

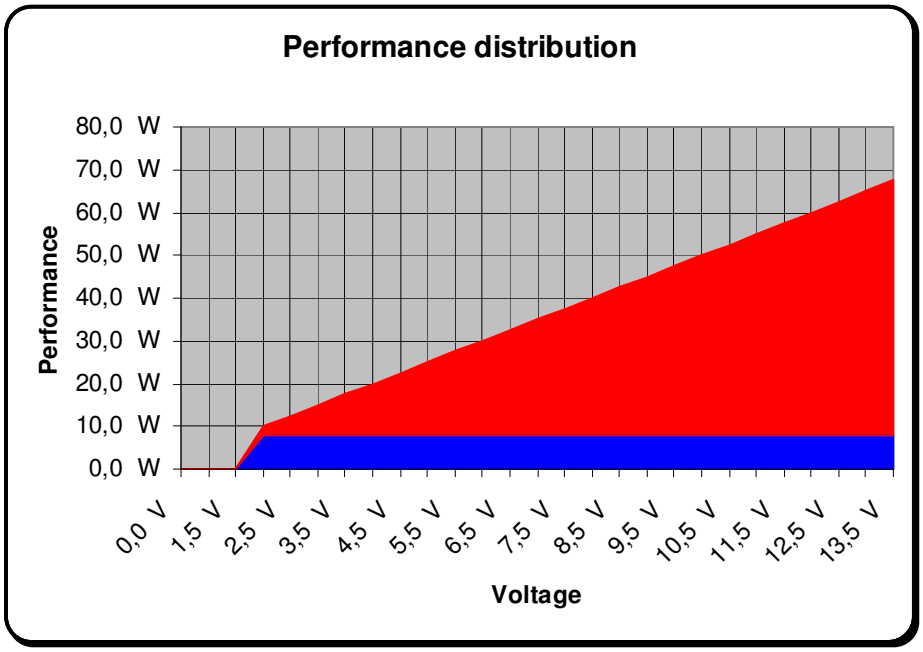
The performance of our electrolysis is in connection with threshold voltage:

$$P_{electrolisys} = 1.6 \times I$$

The difference between them will produce heating:

$$P_{heating} = (U-1.6V) \times I$$

If we apply 13 V in our **Water4Gas** device, you may see that most of the energy will produce heat. Let's construct a function for visualization. Let's assume that 5 amps current flows in our devices and this amperage is the same at each voltage:



This figure shows that 8 Watts is used for gas production at each voltage if we fix amperage. Blue area shows how much energy can be used for gas production, red area shows how much energy heats our device. (A note for experts: This is an assumption, if you use the same electrolyte amount and you measures your system's amperage you will find that its absolutely different to this diagram.) Finally this diagram shows that most significant part of the energy will produce heat in case of 13 Volts.

Continuing our draft approach we may say that only 12 percent of the energy serves gas production in our **Water4Gas** unit in case of 13 Volts input. Why are we talking about 5 amps? Our overall experiences show that 5 amps produces appropriate gas amount, which is enough to measure some fuel consumption changes. One amp current produces approximately ten cubic centimeter gas volumes; this is why 5 amps produce five times more. Why don't we talk about Brown Gas? (Ozzie Freedom prefers this expression.) This Brown Gas consists of atomic Hydrogen and Oxygen, but our **Water4Gas** device produces so much heat, which allows production of molecular Hydrogen and Oxygen gases. Practically this device produces $H_2H_2O_2$ gas instead of HHO. We may consider if it is a scam or not, but this fact is neutral for us if we can spare fuel anyway.

Our basic problem is the temperature level of **Water4Gas** device. The heat production of the device is significant. Let's try to simplify our calculations and let's use rounded values for better understanding. When using **Water4Gas** device with 13 Volts input and 5 amps current value, we produce 60 Watts heating power. Please think about a 60 W incandescent lamp! How warm is it?

60 Watts is very significant heating power! Unfortunately we have to deal with a very small physics in this section. There is water in our **Water4Gas** device. If you want to increase the temperature of this water with 1 Celsius you need some energy. In case of 1 Kg water, this energy value is 4168 Joule, in other words 4168 J/KgC is the specific heat of water. Let's convert this measurement unit into better form, to use with electrical measurement units. 1 Watt equals to 1 Joule/second therefore this specific heat can be converted to Wh units: 4168/3600 = 1.163 Wh/KgC.

The question is: How much time is necessary to boil our water in the **Water4Gas** device. Please think about a 600 W microwave oven, which boils half liter of water within 6 minutes, but it need only 3-4 minutes in summer period. Is it possible that **Water4Gas** device boils water? If the answer is yes, how long can it work?

Thermodynamics may answer our question:

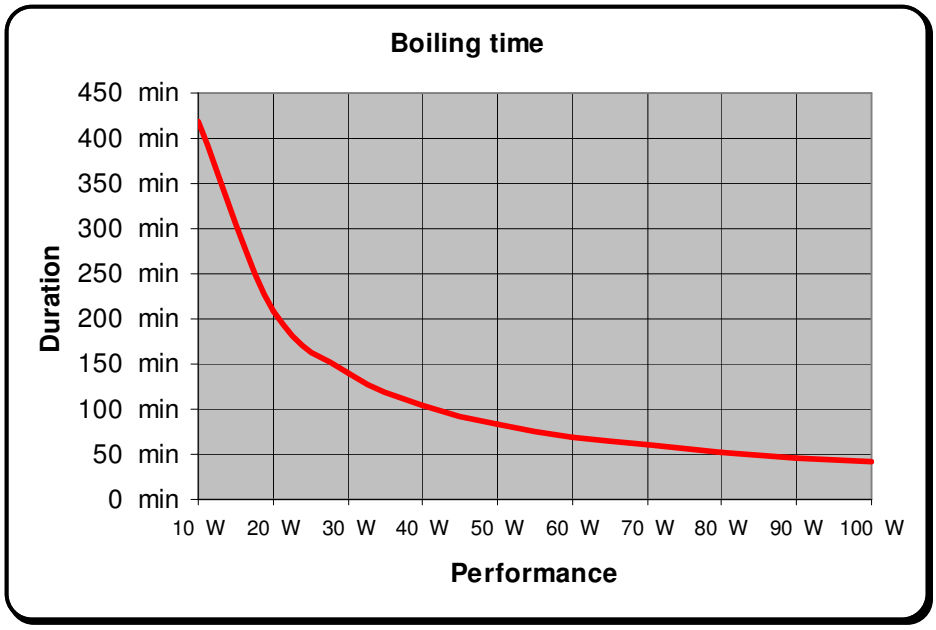
$$\Delta Q = c_{water} \times \rho_{water} \times V \times \Delta T$$

ΔQ energy is required to increase the temperature of V volume water wit ΔT temperature difference. If we heat this water wit "P" power this energy depend only on the time: $\Delta Q = P \times \Delta t$ (where Δt is the duration.) **Water4Gas** device heats water continuously so the boiling time can be evaluated:

$$\Delta t = \frac{c_{water} \times \rho_{water} \times V \times \Delta T}{P}$$

This formula is valid if only our **Water4Gas** device is fully insulated. (There is no heat loss.)

Most of our units kept “Ozzie Freedom standard”, so these units contained 1 liter water usually. This means that the mass of water is 1 Kg, because the density of the water is 1 Kg/liter. Let’s try to examine a summer day. (It is not valid for today, because it is January. But we think that it is valid for California.) Let’s assume that the temperature is around 40 Celsius under the hood. Our basic question is: How much time is necessary for our **Water4Gas** unit to boil the water inside.



Yeah! You are right! These time values are valid if only our **Water4Gas** system is fully insulated and there is no heat loss from the bottle. Yes! But! Our evaluation does not take into account that the engine also produces heat. Our evaluation does not take into account the heat, which is generated by the radiator fan (this heat is higher if air conditioning system works). These things make temperature higher under the hood. So, we may say that this very limited and absolutely simplified approach can be considered as reality. Of course we shall examine those facts, which may cool our **Water4Gas** device. Let’s see what this diagram mean! It means, that using 60 watts heat production our water will boil after an hour!

Now we have some kind of explanation why our devices went down when they were used for long distance trips. This explanation is not exact and not complete, but is shows some facts. We have to know also: The higher temperature the more gas production. So, this process is positively coupled. The iron (or stainless steel) electrodes cannot resist to Oxygen at high temperatures. In other words: Oxygen eats electrodes. (When the temperature is going up, higher amount of gas is produced, therefore it “eats” electrodes faster.)

It can be also explained how survived **Water4Gas** devices this fact, when they were used only for short distance (city) trips. These devices have never become hot!

You are absolutely right, there must be some heat loss, because our device is cooled a little bit. It is possible that this cooling may delay boiling but it is also possible that the cooling is not enough to do it. Heat loss ways are the next:

- Heat radiation: We hope that this process can be neglected, because it is relevant only in case of high temperatures. We are also sure that the next two cooling methods are more efficient.
- Heat conduction: It is a very efficient way in case of a **Water4Gas** unit, because we use glass jar. Glass is a very good heat conductor therefore it warms up in a very short time period. If we could make a shield around our device and this shield could be contacted via a metal conductor to the car-body, all the head would be conducted via car-body. Unfortunately we usually install our devices separately; there is no physical connection between the car-body and the **Water4Gas** device. Moreover, we usually use plastic material as device keeper and these materials are insulators.
- Heat convection: This cooling needs some material around the **Water4Gas** device. This material "carries" heat from there. Your car's engine works the same way, it uses water, which carries heat from the engine to the radiator, where it is cooled by air. If you install a **Water4Gas** device in your car, there is only air around it. This is an air-cooled system.

Let's neglect first two possibilities in our very simplified theorem. Radiation and conduction is not relevant in our case. The only possibility is heat convection, which may or may not cool our **Water4Gas** device. As it has been already mentioned, we have fortune with using glass; this glass conducts the heat to the surface of our jar very quickly. We should like to note that we have seen plastic made, "enhanced" **Water4Gas** devices for sale on the Internet. Plastic is a good insulator, so its surface will not be useful for cooling. So, we should like to forewarn the users of these devices, that they might experience high temperatures in it. We should like to suggest using of glass jars for single cell **Water4Gas** solutions.

What parameters may influence the efficiency of the cooling system?
Let's simplify again:

- Specific heat of cooling media,
- Density of cooling media,
- Surface of cooling area,
- Input and output temperature of cooling media.

If you are an engineer of cooling systems you may smile reading these lines. You may create your own theory, but we should like to avoid using differential equations in this simplified work. Last row is an unknown notion, this means the temperature difference of cooling media between its arrival and departure.

Do not hesitate more! We have only air around **Water4Gas** device. This air has specific heat of 1004 J/KgC and its density is 1.2 Kg/m^3.

Turning back to the last parameter (temperature difference). This approach is a little bit difficult. Of course the input and output temperatures of cooling media depends on the cooling surfaces and on the speed of the cooling material. This system can be modeled with a very difficult equation system. Now, in this material, we should like to avoid it, we are going to use the simplest approach.

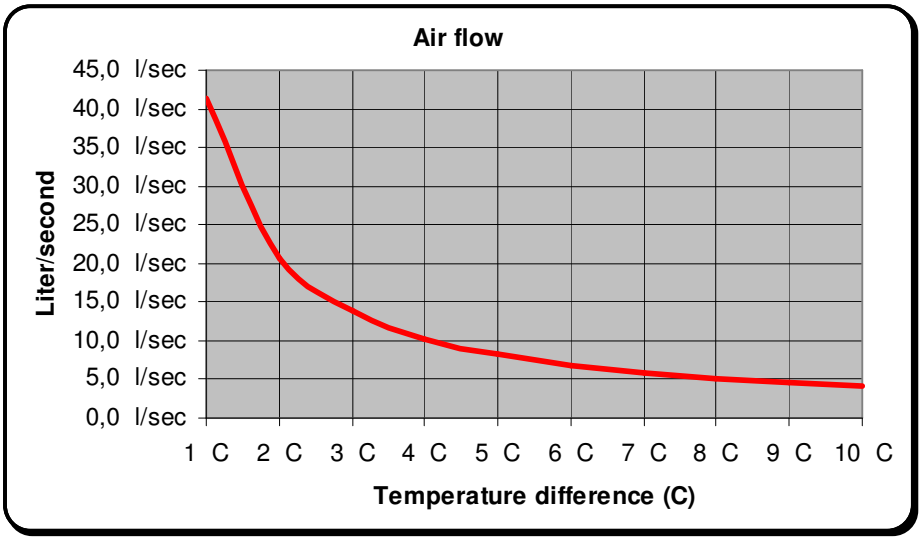
Let's use 50 Watts heating power. This heats **Water4Gas** device inside. Our basic question is: How much air is necessary to cool this device and keep it in the same temperature. (We should like to give you a short comparison: There are computers in your household, these computers work with central processing units (CPU or microprocessor), these processors works at 20-50 Watts power consumption. Please check your computer! There is a big gill above it and there is a strong fan above it! All right their surface is smaller.) When we try to evaluate the necessary air amount, we have to use the same formula like before:

$$\Delta Q = c_{air} \times \rho_{air} \times V \times \Delta T$$

Of course it is the same formula like it was in the case of the water. The air may keep energy, which is equivalent to the product of the density, specific heat, mass and the temperature difference of the air. We have to exchange the dimension of the specific heat unit of the air also, it is 0.28 Wh/KgC. We don't want to bore you with writing details of formula changing, but you can divide it by time and you may rearrange it and finally you will get this:

$$\Delta V = \frac{P}{c_{air} \times \rho_{air} \times \Delta T}$$

ΔV is the necessary volume of air in a time unit. ΔT is the temperature difference between input and output air. We don't know DT exactly, so let's see the result as a function of ΔT.



We don't know air properties around **Water4Gas** devices, so let's estimate what can happen.

Can we cool our device with using air? If the car does not move it is impossible. Our latest measurements show that a **Water4Gas** device warms up within one and half hour if it stands on the table and gets 5 amps continuously. The air cannot cool it down around the jar. This is why it is absolutely bad idea to install **Water4Gas** device in a corner under the hood. There must be airflow around the device. It is much better to place a **Water4Gas** device behind the radiator fan, than to place it into a retired corner of our car. The best place is in front of the radiator, if there is any. (Underway wind will significantly cool our device at that place.) Of course you may use more difficult solutions too. You may install a gill, a fan or complete cooling system together with **Water4Gas** device. But it will increase difficulties and costs.

Why do double cell solutions work longer? If we use a double cell **Water4Gas** system and our requirements are the same (so we need 50 cm3/minutes gas production from our system), we need only 2.5 amps in one device and our devices will get 6.5 Volts only. (because of serial connection). One device will produce 12.25 Watts heat. If you look up our diagram on page 4, you can see that the water would be boiling after 6 hours if it were totally insulated. Probably, the air can cool this system.

We have not been talking about a significant problem. If we connect our **Water4Gas** devices to a line of intake manifold then the air pressure is lowered above the water. Water has a special property: Under lower pressure it has lower boiling temperature. If you have a good vacuum this temperature maybe 78-80 Celsius. We have already gotten some experiences about high water consumption. Maybe this is the explanation, maybe not.

Now is it a scam or is it a solution??????????????????????

Basic theorem of Water4Gas is good, realization is bad.

HybridCar2008AS Team is continuously working on processing experiences and we are also tracing similar solutions on the Internet. We hope that we shall be able to construct a simple device, which can be used for longer trips and longer durations. Please visit our website to get more information in the future:

www.water4gas-eu.com

Best regards,

HybridCar2008AS Team