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Water Fuel Engines as An Alternative Concept

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ABSTRACT

A Water fuel engine (hydrogen vehicle) is an alternative fuel vehicle that uses hydrogen as its onboard fuel for motive power (1). Combustion of hydrogen with air is receiving increasing attention in the future energy scenario. The term may refer to a personal transportation vehicle, such as an automobile, or any other vehicle that uses hydrogen in a similar fashion, such as an aircraft. The power plants of such vehicles convert the chemical energy of hydrogen to mechanical energy by burning hydrogen in an internal combustion engine (spark ignition engine), Widespread use of hydrogen for fuelling transportation is a key element of a proposed hydrogen economy (1). Hydrogen fuel doesn't occur naturally on Earth and thus isn't an energy source but is an energy carrier. Currently it's most frequently made from methane or other fossil fuels. However, it can be produced from a wide range of sources (such as wind, solar, or nuclear) that are intermittent, too diffuse or too awkward to directly propel vehicles. Integrated wind- to-hydrogen plants, using electrolysis of water, are exploring technologies to deliver costs low enough, and quantities great enough, to compete with traditional energy sources. In the late 1990s Canada developed a world leading position in fuel cell and hydrogen technologies based in large part by advances in Proton Exchange Membrane fuel cell technology by Ballard Power Systems and a few smaller highly innovative firms. (2) Global trend is to move from fossil fuels to carbon free fuels, including renewable. Decarbonisation driven by protection of environment. For India and other oil importing developing countries, energy security is the main driver for decarbonisation this paper will provide an overview of the current state of the hydrogen in the spark ignition engine.

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KEYWORD: *water as fuel, spark ignition engine, using electrolysis of water*

1. INTRODUCTION

1.1. General Information

The development, prolixity and wide relinquishment of hydrogen powered internal combustion machines in both developed and developing industry has the eventuality for significant artificial, health and environmental benefits in terms of the emergence of a new, environmentally sustainable, knowledge-grounded assiduity; lower dependence on fossil energies; and dropped air pollution and hothouse gas emigrations. Canada has been laboriously involved in the development of hydrogen technologies, since the early 1980s. By the late 1990s Canada had achieved a world leading position in hydrogen technologies, moment there are an estimated 80 Canadian-grounded enterprises active in the sector. Hydrogenics (Mississauga, Ontario) is the hydrogen companies in Canada. numerous companies are working to develop technologies that might efficiently exploit the eventuality of hydrogen energy for mobile uses. The magnet of using hydrogen as an energy currency is that, if hydrogen is prepared without using reactionary energy inputs, vehicle propulsion would not contribute to carbon dioxide emigrations. The downsides of hydrogen use are low energy content per unit volume, high tank age weights, the storehouse, transportation and stuffing of gassy or liquid hydrogen in vehicles, the large investment in structure that would be needed to fuel vehicles, and the inefficiency of product processes. NASA uses hydrogen to launch Space Shuttles into space. There's indeed a working toy model auto that

runs on solar power, using a regenerative energy cell to store energy in the form of hydrogen and oxygen gas. It can also convert the energy back into water to release the solar energy. The current land speed record for a hydrogen- powered vehicle is286.476 mph (461.038 km/ h) set by Ohio State University's Buckeye pellet 2, which achieved a" flying- afar" speed of280.007 mph (450.628 km/ h) at the Bonneville Salt Flats in August 2008. For product-style vehicles, the current record for a hydrogen-powered vehicle is333.38 km/ h (207.2 mph) set by a prototype Ford Fusion Hydrogen 999 Energy Cell Race Auto at Bonneville Salt Flats in Wend over, Utah in August 2007. It was accompanied by a large, compressed oxygen tank to increase power. Honda has also created a conception called the FC Sport, which may be suitable to beat that record if put into product.

2. I.C Engine

Internal combustion machines are those heat machines that burn their energy inside the machine cylinder. In internal combustion machine the chemical energy stored in their operation. The heat energy is converted into mechanical energy by the expansion of feasts against the piston attached to the crankshaft that can rotate. The machine which gives power to propel the machine vehicle is a petrol burning internal combustion machine. Petrol is a liquid energy and is called by the name gasoline in America. Burning or combustions always fulfilled by the product of heat. When a gas is hotted, it expands. However, the pressure rises according to Charles's law, If the volume remains constant.

2.1. Suction stroke

The 4- stroke machine takes its name from the fact that it takes four strokes of the piston to complete one cycle. On the suction stroke the input valves open, and as the piston goes down in the cylinder, the air/fuel amalgamation is drawn into the cylinder. During this stroke the headwind meter in the energy injection system sends a signal to indicate how important air is coming in. also a computer-controlled energy injector sprays a precise amount of energy into the cylinder at just the right moment.

2.2. Compression stroke.

The input valves near as the piston travels up the cylinder, and the piston compresses the air/ energy admixture. The higher the contraction, the further power is generated in the coming stroke.

2.3. Power stroke

As the piston approaches the top of the compression stroke, the spark draws fires, burning the compressed air/ energy mixture. The fast-expanding gases push the piston back down the cylinder. This stroke generates the engine's power. The strokes in each cylinder are timed so they do at intervals that produce a smooth- running engine and quiet performance.

2.4. Exhaust stroke

During the exhaust stroke, the turning crankshaft forces the piston back up the cylinder, the exhaust stopcock (or valves) opens, and the piston pushes out the burnt air/ energy mixture past the exhaust stopcock.

3. Exhaust Pollutants

3.1. Hydrocarbons

Hydrocarbon emissions affect when energy molecules in the engine don't burn or burn only partially. Hydrocarbons react in the presence of nitrogen oxides and sunlight to form ground- level ozone, a major element of gauze. Ozone irritates the eyes, damages the lungs, and aggravates respiratory problems. It's our most wide and intractable urban air pollution problem. A number of exhaust hydrocarbons are also poisonous, with the possibility to cause cancer.

3.2. Nitrogen Oxides (Nox)

Under the high pressure and temperature conditions in an engine, nitrogen and oxygen atoms in the air react to form various nitrogen oxides, inclusively known as NOx. Nitrogen oxides, like hydrocarbons, are precursors to them formation of ozone. They also form acid rain.

3.3. Carbon Monoxide

Carbon monoxide (CO) is a product of deficient combustion and occurs when carbon in the fuel is partially oxidized rather than completely oxidized to carbon dioxide (CO). Carbon monoxide reduces the inflow of oxygen in the blood stream and is particularly dangerous to persons with heart disease.

4. Battery

In isolated systems away from the grid, batteries are used for storage of excess solar energy converted into electrical energy. The only exceptions are isolated sunshine load such as irrigation pumps or drinking water inventories for storage. In fact, for small units with output less than one kilowatt. Batteries seem to be the only technically and economically available storage means. Since both the photo- voltaic system and batteries are high in capital costs. It's necessary that the overall system be optimized with respect to available energy and local demand pattern, we use lead acid battery for storing the electrical energy from the solar panel for lighting the road and so about the lead acid cells are explained below

4.1. Lead-Acid Wet Cell:

Where high values of load current are necessary, the lead- acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H_2

SO_4). The lead acid cell is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, if the cell is in good physical condition. still, heat with inordinate charge and discharge currents ends the useful life to about 3 to 5 times for an automobile battery. For the different types of secondary cells, the lead- acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.

4.2. Construction

Inside a lead- acid battery, the positive and negative electrodes consist of a group of plates welded to a connecting strap. The plates are immersed in the electrolyte, consisting of 8 parts of water to 3 parts of concentrated sulfuric acid. Each plate is a grid or framework, made of a lead- antimony alloy. This construction enables the active material, which is lead oxide, to be pasted into the grid. In manufacture of the cell, a forming charge produces the positive and negative electrodes. In the forming process, the active material in the positive plate is changed to lead peroxide(pbo $_2$). The negative electrode is spongy lead(pb).

4.3. Chemical Action:

Sulfuric acid is a combination of hydrogen and sulphate ions. When the cell discharges, lead peroxide from the positive electrode combines with hydrogen ions to form water and with sulphate ions to form lead sulphate. Combining lead on the negative plate with sulphate ions also produces sulphate. thus, the net result of discharge is to produce more water, which dilutes the electrolyte, and to form lead sulphate on the plates. As the discharge continues, the sulphate fills the pores of the grids, retarding circulation of acid in the active material. Lead sulphated is the powder often seen on the outside terminals of old batteries. When the combination of weak electrolyte and sulphating on the plate lowers the output of the battery, charging is necessary. On charge, the external. source reverses the current in the battery. The reversed direction of ions flows in the electrolyte result in a reversal of the chemical reactions. Now the lead sulphates on the positive plate reactive with the water and sulphate ions to produce lead peroxide and sulfuric acid. This actioner-forms the positive plates and makes the electrolyte stronger by adding sulfuric acid. At the same time, charging enables the lead sulphate on the negative plate to react with hydrogen ions; this also forms sulfuric acid while reforming lead on the negative plate to react with hydrogen ions; this also forms currents can restore the cell to full output, with lead peroxide on the positive plates, spongy lead on the negative plate, and the required concentration of sulfuric acid in the electrolyte. The chemical equation for the lead- acid cell is Pb pbO_2 $2H_2$ SO_4 charge the result is $2pbSO_4$ $2H_2$ O when it's discharge it got reverse process.

5. Hydrogen

5.1. Necessity of Using Alternative Fuel

In the automobile field the fuel used is known as petrol and Diesel. Petrol is a volatile fuel which is used in spark ignition engines and fuel oil which is used in compression ignition engine. Basically, both the fuels petrol and diesel are obtained from the crude oil(i.e.) petroleum. Now the problem is, its availability is decreasing day by day in bulk and inadequate for future decades. Hence an alternative fuel is essential to fight against scarcity. In term of long sight some alternative fuels are suggested and experimented, such alternative fuels are as follows. Hydrogen Gas with LPG, Methyl alcohol, Compressed Natural gas (CNG), Liquefied Petroleum gas (LPG), Hydrogen gas with gasoline. In this project we've installed hydrogen gas with gasoline as alternative fuel in four stroke Gasoline engine. Toensure reliable systems with costs comparable with conventional internal combustion engine/ automatic transmission systems, future fuel cell power trains should have an Electric propulsion system with a 15-year life capable of delivering at least 55 kW for 18 seconds and 30 kW in a continuous mode, at a system cost of$ 12/ kW peak. A durable fuel cell power system (including hydrogen storage) that achieves 60 energy efficiency when operating at peak power and that offers a 325 W/ kg power density and 220 W/ L operating on hydrogen. Cost targets are$ 45/ kW by 2013, $ 30/ kW by 2017.

5.2. Production of Hydrogen

Hydrogen Gas is a volatile gas at room temperature, but when chilled to-253 C and compressed, it makes the perfect fuel. Hydrogen's greatest feature, as a fuel, is that it causes no pollution. A hydrogen fuel cell works by combining hydrogen gas with atmospheric oxygen. The resulting chemical reaction generates electric power, and the only produced by product is clean water. At a time when there's real concern about global warming due to carbon emissions, this makes hydrogen fuel a desirable technology and perhaps the most feasible alternative to petrol and gasoline.

Many scientists and researchers are working towards a vision of the hydrogen economy. Hydrogen based fuel could potentially be used to run our cars or even drive larger scale power plants, generating the electricity we need to light our buildings, run our kettles and fridges, and power our computers. But hydrogen doesn't occur naturally, and it must be processed. The big challenge is the large-scale

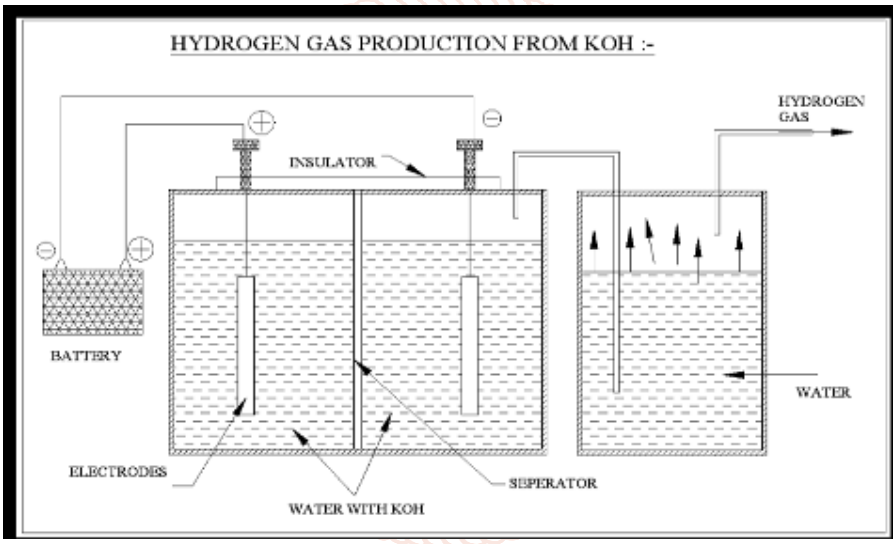
production of hydrogen in sustainable way. There are a number of challenges to be overcome before hydrogen gas is common place as a fuel.

Hydrogen fuel is used to generate electricity, but conversely, electricity is needed to generate the hydrogen fuel. Electrolysis uses electricity to break water into hydrogen and oxygen, with the two gases forming at opposite electrodes. Electricity is also required to power the compression of the hydrogen and the refrigeration to chill it to less than-200 degrees.

However, this initial requirement of electricity could be generated sustainably through wind power, biomass, tidal, hydropower, or even nuclear. Hydrogen can also be generated by extracting it from natural gas, but this process generates carbon dioxide and negates the main motivation for moving to hydrogen fuel- cell vehicles ending dependence on fossil fuels. Further exciting alternative technology at an early stage in development is Solar Powered Hydrogen Generation utilizing water- splitting solar panels.

5.3. Hydrogen Gas from Water Mixed With KOH

Here is some information on a simple homegrown method for producing pure hydrogen gas. The beauty of this system is that it uses a common affordable chemical which isn't consumed in the reaction, so it can be used again and again almost indefinitely (using pure water in the reaction). The chemical is Potassium hydroxide, usually called caustic potash. Its chemical formula is KOH, and it's used to manufacture soaps, dyes, alkaline batteries, adhesives, fertilizers, drainpipe cleaners, asphalt emulsions, and purifying industrial gases. The chemical reaction we're interested in occurs with water in the following equation.



KOH H2O = KOOH H2

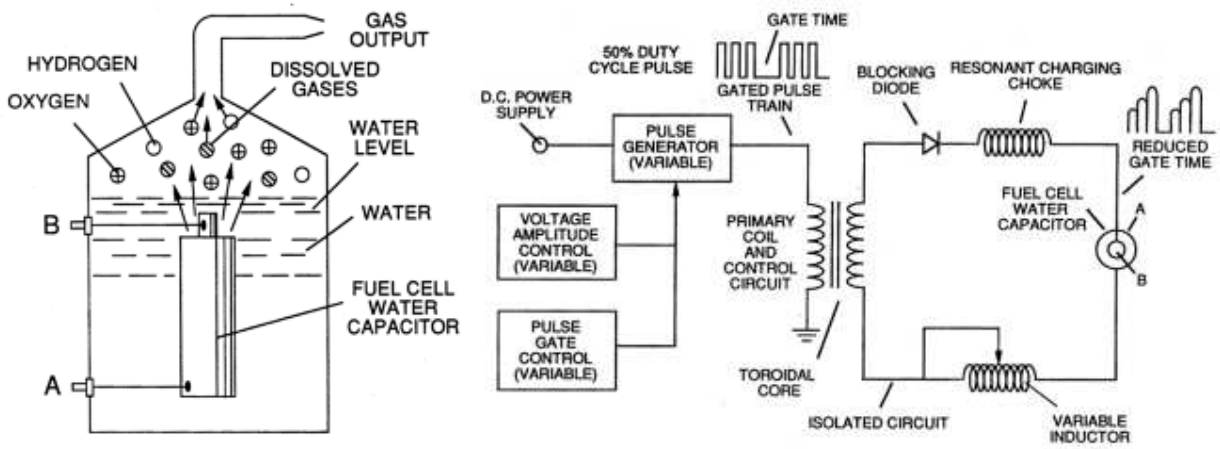
The balanced equation is

2KOH 2H2O = 2KOOH 2H2

Notice the free Hydrogen gas 2H2 which is stripped from the water added to the KOH. Making this reaction more than a one- time event is the key to cheap hydrogen production, which means controlling the reverse reaction to recover the KOH without giving back the hydrogen. Thus, heating the KOOH in a solar cooker will produce the following reaction KOOH HEAT--> KOH O. The balanced reaction is 2KOOH HEAT--> 2KOH O2 Notice the free Oxygen gas released in this reaction.

The combined result of our double reaction cycle is the splitting of H20 into 2 free gases, and our initial Potassium Hydroxide is ready to be used again. Furthermore, not only have we created a fuel supply, but also an oxygen supply. Designing a continuous fuel supply system from this reaction cycle would require 2 potassium hydroxide tanks. One for each reaction they would have to be exchanged between reactions on a regular timed schedule. Hydrogen production can be regulated with a flow control value from the H2O storage tank. O2 production is regulated by heat input. Matching gas production with consumption would reduce the size of tanks needed for surplus gas storage. I have not done the exact calculations on how much potassium hydroxide is needed to supply the average gas requirements per capita consumed in the US, but I'm guessing that it would not require very many pounds of KOH, so the system size could be small. The solar collector for the oxygen reaction would probably be the biggest element, and I suggest a focusing solar collector be used for higher heat input. There you have it, anon-polluting source of free hydrogen and oxygen from nothing but the Sun and water.

5.4. Water Fuel Capacitor and its implementation by circuit diagram



5.5. Combustion effects in hydrogen fuelled engine systems

It has been adequately emphasized earlier that hydrogen fuel possesses some properties which are uniquely different from the corresponding properties of conventional hydrocarbon fuels. In hydrogen several abnormal combustions they're (3)

A. Abnormally high-pressure rise.
B. Occurrence of pre-ignition in combustion chamber and sequential advancement of pre-ignition and backfire into intake manifold

It has usually been found that the two conditions occur under heavy load conditions. These often causes engine to stop. In this case the gasoline is stored in a petrol tank. This fuel is given to the input of the carburettor through the pump. Before given to the carburettor the petrol and Hydrogen gas is mixed in the proper ratio so that the vehicle runs continuously. This may avoid the abnormal combustion that caused by hydrogen fuel only.

5.6. Properties of fuel

When we use the hydrogen as a fuel, we can Reduce Dependence on Fossil Fuels it's Environment friendly fuel so we can reduce air pollution and also, it's renewable in nature it's a Carbon less Fuel, Higher Energy Content on Weight Basis and it have Higher Octane Rating, table 1 shows the property of the fuels

s.no	Description	H_2	CH_4	Gasoline
1	Minimum ignition energy (mj)	0.02	0.28	0.25
2	Ignition temperature (k)	858	810	530
3	Adiabatic flame temperature(k)	2384	2227	2270
4	Limits of flammability(% in air)	4.1-75	4.3-15	1.5-7.6
5	Maximum laminar flame velocity (cm/sec)	270	38	30
6	Diffusivity (cm^2/sec)	0.63	0.20	0.08

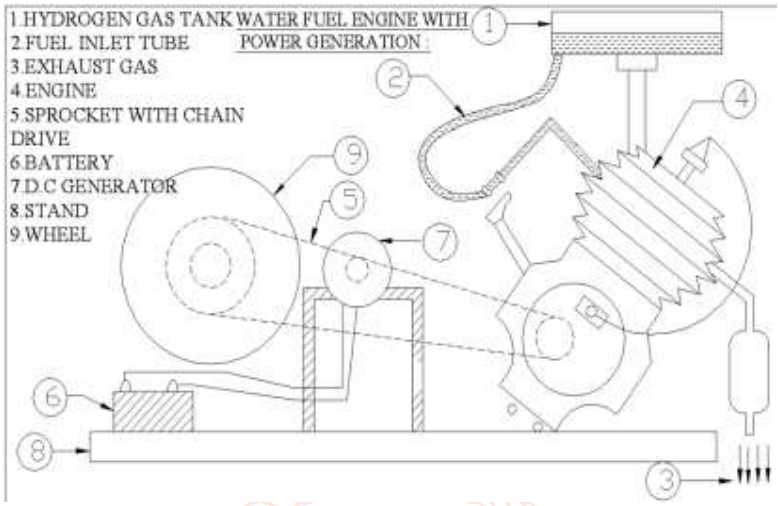
Table 1 Ignition and Flammability Properties:

6. Emission Control

Using the H2 as a blended fuel, it'll reduce, hydrocarbon and carbon monoxide, due to Carbon less Fuel hydrogen is blended with gasoline and also Hydrogen has a wide flammability limit which permit its use under lean condition, Due to wide flammability limits, pre-ignition on hot cylinder walls can occur, Flame speed for H2 is seven times higher than that of gasoline, therefore approaching the ideal constant volume cycle, Ignition energy is that of gasoline.

7. Design of water fuel engine

The general principle of this engine is founded upon the property, which hydrogen gas mixed with atmospheric air possesses, of exploding upon ignition, to produce a large imperfect vacuum. However, by volume, of atmospheric air are mixed with one measure of hydrogen, If two and a half measures. The products of the explosion are a globule of water, formed by the union of the hydrogen with the oxygen of the atmospheric air and a quantity of nitrogen, which in its natural state (density = 1) constitutes0.556



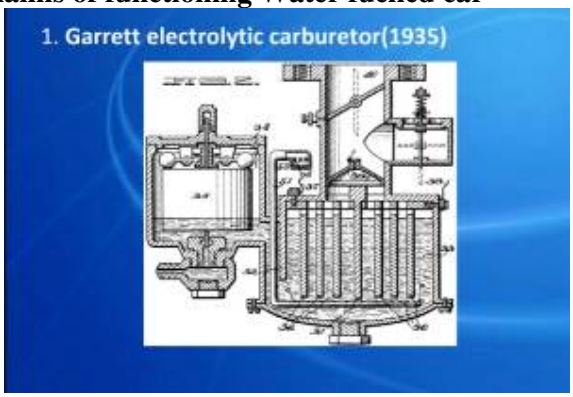
Description H2 CH4 Gasoline
1 Minimum ignition energy(mj) 0.020.280.25
2 Ignition temperature(k) 858810530
3 Adiabatic flame temperature(k) 238422272270
4 Limits of flammability (in air)4.1- 754.3- 151.5-7.6
5 Maximum laminar flame velocity (cm/ sec) 270 38 30
6 Diffusivity (cm2/ sec) 0.630.200.08

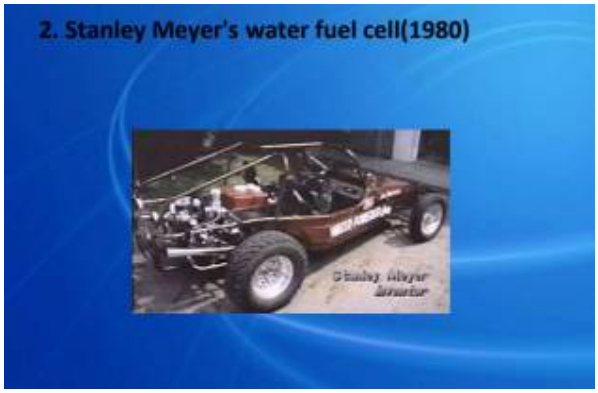
of the mixed gas, by volume. The same quantity of nitrogen is now expanded into a space somewhat greater than three times the original volume of the mixed gas; that is, into about six times the space which it previously occupied its density relative to the atmosphere is therefore about1/6. However, by a proper apparatus, from returning into this imperfect vacuum, If the external air is prevented.(4), The design of water fuel engine is designed in the figure 2, When starting the engine, fuel flows from the tank to the carburettor, and also at the same time the hydrogen flows through the carburettor from the battery that's filtered by the water and both the gas and fuel is properly mixed inside the carburettor with the air that from air filter and allow in to the combustion chamber due to vacuum creation inside the crank case, thus the engine starts.

8. Conclusion

It's formerly well- known that the pre-ignition reactivity and consequent backfire of hydrogen fuel demonstrate completely different characteristics in engine operation as against other thermal systems. There has been a boom of interest all over the world on hydrogen engine exploration and even some of renowned automobile industries are contemplate hydrogen fuelled machines. In this sector which is in horrible need of anon-polluting originator, free from the threat of fuel crisis.

9. Claims of functioning Water fuelled car





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