

## Recycling Fuel Using Solar Energy

Mr. Niraj G. Bandewar , Miss. Shyamali S. Shendekar  
Assi . Prof. of Dept of Mech Engg  
At DBNCOET, Yavatmal

**Abstract:-** With increasing demand of fuel CO<sub>2</sub> emissions are increasing at a large rate, leading to greenhouse effect which has created an alarming condition all over the world, also increased prices, and within some duration fossil fuel will come to end. Today's need is to generate power efficiently and eco-friendly, also to conserve fuel so as to reduce the shift of technology to other fuel source. The paper discusses the same, and gives the best solution for the above. As plants by "photosynthesis" generate food, the same way we can also generate fuel. We have something called "reverse technology" with which we will "reverse the combustion process." By this fuel can be generated using carbon dioxide, water and sunlight i.e. "CO<sub>2</sub>/ water + solar energy = fuel." In this technology we synthesize gasoline by using carbon dioxide and solar energy in a "counter rotating ring receiver reactor recuperator" by setting this plant near any coal fired power plant or CO<sub>2</sub> can be directly extracted from atmosphere using "CO<sub>2</sub> reclamation technique." And here we use the greatest and renewable source of energy i.e. sun for generating electricity using latest solar panels having sensors which increases its both power and heat efficiency up to 80%. This will provide efficient power generation, will decrease global warming and help in completing fuel demands with a safer environment.

**Keywords:** Solar Energy, Photosynthesis

\*\*\*\*\*

### Introduction

Plants are the natural creators of fuel. They generate fuel i.e. their food by photosynthesis. Day by day with increase in industrialization fuel demand has increased with increase in its use and increase in greenhouse gases which has already created an alarming condition all over the world. Also fossil fuels will some day come to an end. This will create a need to search for an alternative fuel and also improve the technology to suit this fuel. Means double work. It would be fascinating if we regenerate fuel. Just like plants we can also synthesize fuel from CO<sub>2</sub> or water and sunlight. This is possible by doing a thermo chemical process. Just like photosynthesis we will also use CO<sub>2</sub> to generate food for our industry. All this is possible by reversing the process. The combustion process is to be reversed to synthesize fuel. Combustion in ic engine is an open cycle. Here we have to complete the cycle by reusing CO<sub>2</sub>. With the help of CO<sub>2</sub> and sunlight fuel can be generated. Basic idea was to synthesize hydrogen from water with the help of concentrated solar energy. But this will create a need to shift ongoing technology to hydrogen technology and also as hydrogen is very hard to compress and safely stored, so technology to safely use hydrogen will have to be made. Means double work. Also there is nothing included to decrease greenhouse gases. Thus all the above problems can be resolved by only one answer i.e. using CO<sub>2</sub> for generation of fuel. It can be done just in two simple steps. We use "counter rotating ring receiver reactor recuperator" to synthesize fuel from CO<sub>2</sub> and sunlight are used. This can be used with CO<sub>2</sub> emitting industry or CO<sub>2</sub> can be directly taken from air. All the fuel needs will be

fulfilled and greenhouse problem is solved. It's like clearing two targets with one arrow.

### Synthesis of fuel

Thinking of fuel, we come across natural gas, gasoline and coal. Amongst this coal is the one which INDIA is having in large quantity. Natural gas, gasoline is to be imported. All this generate the most concerning fear of the day i.e. global warming. Measures are been taken to reduce but with increase in fossil fuel use it will go on increasing. Shifting to non conventional energy sources will some how reduce all this but some hurdles are there. They are, in case of nuclear the nuclear waste which takes years to degrade, solar energy for power generation this is the good one but very costly and less efficient. Thinking of INDIAN history in power generation we come across that the country has shifted from hydroelectric power generation to coal fired power generation again increased CO<sub>2</sub> emission. Vehicular emission is also increased. The best option which we are having today is to convert CO<sub>2</sub> into fuel. The fuel demand will also be tackled and the main concern of today i.e. global warming will also solved. The reverse technology will prove all this. In thermodynamic we have two cycles:

- 1) Open cycle;
- 2) Closed cycle.

IC engines which we use are open cycles. Fuel is burnt and the emissions are off into atmosphere. Synthesizing fuel from CO<sub>2</sub> is all about closing the cycle. It is basically a heat engine not thermodynamic but a thermo chemical which instead of taking heat and converting it to mechanical work it takes heat and converts it to chemical work.

Main idea was to synthesize hydrogen from water for the use of fuel cells. But it will be very much good to synthesize fuel from CO<sub>2</sub> thereby reducing global warming and meeting the increasing fuel demand.

Fuel can be easily generated from CO<sub>2</sub> / WATER +SUNLIGHT= FUEL. It is done in two simple steps. Take the concentrated solar heat use it to crack the above and the ultimate product is either hydrogen or fuel. The equipments used in this are solar furnace and counter rotating ring receiver reactor recuperator in short termed as CR5. The construction of CR5 and fuel generation will be discussed in the following sections.

## 1. SOLAR FURNACE



This device can thought as the energy building zone as it takes scattered solar energy concentrates it to make its value high and gives to the CR5. Solar furnace is a collection high reflecting mirrors assembled in parabolic solar collectors. They receive solar energy and increase their strength by concentrating them at their focus. The diagram is as shown. Here assembled solar high reflecting mirrors which concentrate at its focus thereby generating high temperatures as high as 1500<sup>0</sup> C to 2600<sup>0</sup> C. At this temperature not only water molecule but also CO<sub>2</sub> molecule can be broken which will help in achieving our target. This furnace generates huge amount of heat.

## 2. COUNTER ROTATING RING RECEIVER REACTOR RECUPERATOR

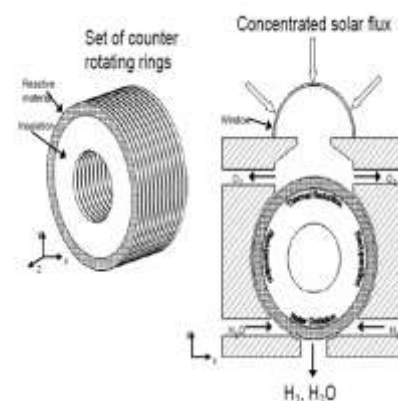
This is heart of the project. The main work of this device is to take out oxygen from CO<sub>2</sub> when gasoline is synthesized or oxygen from water when hydrogen is to be generated. Basically this was made to the later purpose. The prototype of this device as shown below:



Of what really this CR5 made? It has to be made of materials bearing high temperatures as generated by the solar furnace. So the best material is ceramic as it is inert. Here the combustion process is reversed. This reenergizes carbon dioxide taking concentrated solar energy from the solar furnace. It consists of stack of rings on which are made of reactive ferrite material. Every ring rotates in opposite direction to each other. First the production of hydrogen will be described in short.

### Synthesis of hydrogen

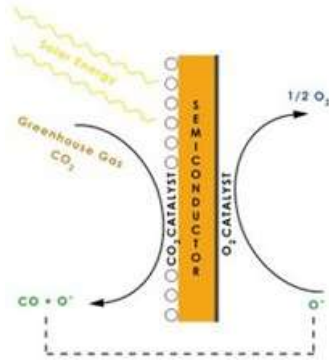
Initially concentrated solar heat is made to enter the device through a small hole onto one side of stack of rings. This creates a hot region there and other regions are cooler. As they rotate in opposite direction hot region heat up cooler region and colder rings cool down hot rings. Thereby regulating the incoming heat. The temperature generated is 1500<sup>0</sup> C which will remove oxygen from the zirconia. Zirconia is necessary to make the ferrite material withstand this high temperature. Then while the other ring rotates the oxygen free ferrite grabs oxygen from superheated steam at a relatively lower temperature i.e. 1100<sup>0</sup>. Thus oxidation of water produces hydrogen which is then used in fuel cells. This is demonstrated in the following diagram:



### Synthesis of gasoline

Synthesizing fuel would be much more beneficial than hydrogen as it is very difficult to store it safely, and synthesizing carbon neutral fuel will help us to reduce green

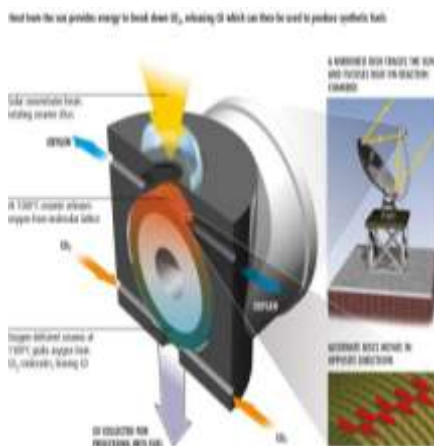
house gas as well as it will complete the demand of fuel. The same process is used here. But they are using cobalt ferrite instead of magnesium or any other. The rings are made of cobalt ferrite. In the prototype its number is less just up to 14. The temperature generated is higher than in hydrogen synthesis. The prototype is as shown. The function of CR5 here is



It breaks the carbon-oxygen bond in the carbon dioxide, which produces:

- 1) Carbon Monoxide and;
- 2) Oxygen.

Further stack of rings get heated and cooled alternatively due to opposite rotation and the concentrated heat coming through the small hole generating a temperature of nearly  $2600^{\circ}\text{C}$  in the hot region, cobalt ferrite loses oxygen by breaking bond. Then rings rotate and come across a cooler region where the temperature is up to  $2000^{\circ}\text{C}$ . Here reduced cobalt ferrite takes oxygen from carbon dioxide thereby breaking the bond. Thus leaving behind only carbon monoxide, which is the building block of many hydrocarbons. Methanol and natural gas can be easily formed by reacting CO with hydrogen. Higher hydrocarbons can also be generated by certain reactions. Thus we will have a renewable source of energy. The whole process is shown under:



Now we have CO molecule to build higher hydrocarbon molecules. Fuel will be used twice thus

reducing the  $\text{CO}_2$  emission. This device can be setup with coal fired power plants as well as we can extract  $\text{CO}_2$  directly from air by a technology called  $\text{CO}_2$  reclamation. Thereby leading to a clean and safe energy future.

## 1. $\text{CO}_2$ reclamation

Researchers have made a new device which we can call as an artificial tree which does the same work as trees do. It takes out carbon dioxide from atmosphere.



Although there are techniques to reduce  $\text{CO}_2$  emissions. But this will be a great savior of environment from global warming. A device of one square meter area can extract 10 tons of carbon dioxide each year. The air extraction device, in which sorbents capture carbon dioxide molecules from free-flowing air and release those molecules as a pure stream of carbon dioxide. Then this can be dumped below oceans or it can be poured into porous rocks, but yet there is no surety that it will not come out into the atmosphere or if mixed with ocean's water it may form brine. Thus best thing will be to accompany this device with the solar to petrol project i.e. converting carbon dioxide to fuel.

## Conclusion

Big problem of global warming will be solved. At the infant stage of this research it would look like it is expensive but if we calculate the cost of overcoming the global warming and their ill effects on environment as well as living beings, then this project of sunshine to petrol will look very cheap. Though this project has one or two decade to come into commercial market and its expense would be big initially, yet with increasing fuel demand and greenhouse gasses this will be the best technology accompanied with the  $\text{CO}_2$  reclamation. Both are not at all economic now. But as an alternative to fuel this will be thought of. Implementing this technology we will have an enormous renewable source of energy.