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Prevailing Action And Future Prospects Of Sustainable Fuels

N. Muneer

Bachelor of Technology in Mechanical Engineering,
A P J Abdul Kalam Technological University, Kerala, India

Abstract: ***Sustainable fuel is a concept in which the humans use the fuel to meet the needs of the present without compromising the ability of future generations to meet their fuel demands. Sustainable fuel emphasis cleaner methods of production of fuel and environment conservation. Sustainable fuels are also described as advanced fuels. These are any substance that can be used as fuels other than conventional type, as well as artificial radioisotope fuels that are made in the nuclear reactors.***

Keyword: ***Fossil fuels, Biomass, Algae-based bio-fuels, Carbon-neutral fuels, Hydrogen Fuel***

I. INTRODUCTION

The search for sustainable fuels is one of our biggest challenges. Fossil fuels driven automobiles are de-promoted, worldwide. Electric vehicles have the capability to deliver on both fuel and carbon savings. But battery weight and limited range are barriers. The first generation of alternative fuels, generally referred to as 'biofuels' are produced from biogenic sources, such as crops, which are subjected to additional sustainability concerns beyond carbon reduction (competition with food and water, land usages, among others). However, current technology allows the production of the fuels from non-biogenic sources such as municipal wastes, used cooking oil and even agricultural residues. In 2017 the worlds primary energy sources consisted of petroleum (34%), coal (28%), natural gas (23%), amounting to an 85% share for fossil fuels in primary energy consumption in the world.[1] Non-fossil in 2006 included nuclear (8.5%), hydroelectric (6.3%), and others (geothermal, solar, tidal, wind, wood, waste) amounting to 0.9%. In 2015 about 18% of worldwide consumption was from renewable sources.[2] Burning of fossil fuels causes sulfuric acid, carbonic, and nitric acids, which fall to earth as acid rain, impacting natural environment. Monuments and sculptures are vulnerable, as the acids dissolve calcium carbonate. Fossil fuels also consist of radioactive materials. In 2000, about 12,000 tonnes of thorium and 5,000 tonnes of uranium were released worldwide from burning coal.[3] It is estimated that during 1982, US coal burning released 155 times as much radioactivity into the atmosphere as the Three Mile Island accident.[4] Now, we are in a phase of transition from fossil to clean fuel. The future of our planet depends on the extend of sustainability of our fuels.

II. WHAT ARE FOSSIL FUELS?

Fossil fuels as the name suggest are derivatives of plant and animal fossils that are millions of years old. These are primarily shaped from the remains of the decayed plants and animals of the carboniferous era. The three fuel sources i.e. coal, natural gas and oil/petroleum help to meet the energy and electricity demand of the world. The demand for energy will never be in the declining path. Industrial revolution has shown the way and it is still going on. But over consumption can lead to serious environmental issues. Fossil fuels release carbon-dioxide, Nitrogen dioxide, Sulphur dioxide, carbon monoxide etc. when burnt, that may have severe consequences on the habitats. They are non-renewable sources of energy as they are derived from pre-historic fossils. Their sources are restricted and they are depleting at a quicker rate.

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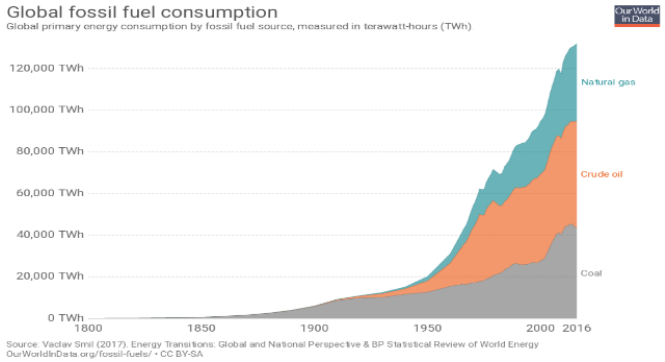

Figure 1

III. DRAWBACKS OF FOSSIL FUELS

Non-renewable energy sources are going to be depleted in the future. Fossil fuels cannot be called as renewable energy resources, because they are limited with supply. They may get depleted in the next 50 years. Also, formation of fossil takes years. Environmental pollution is a major drawback of fossil fuels. It is a known fact that carbon-dioxide, gas released when the fossil fuels are burnt, is one of the primary gas responsible for global warming. Global rise in temperature has impacted in melting of polar ice caps, flooding of low-lying areas and rise in sea levels. If the adverse conditions continue, our planet earth might face serious consequences. Unlike renewable energy resources like solar and wind, accidents involving fossil fuels are highly dangerous and can cause massive damage. Oil spills cause pollution of water bodies, in addition to death of marine animals including those living offshore. Emissions of greenhouse gases and other toxic elements as a result of fossil fuel combustion can cause serious health complications such as chronic asthma, low lung functioning, chronic bronchitis and cardiovascular diseases. Fossil fuels are highly susceptible to price fluctuation and market manipulations. This aspect is greatly felt by developing countries like India, that heavily rely on importation of fossil fuels. The coal power plant requires huge and regular supply of coal to produce large amount of energy on a constant basis. This means that these plants need train-load of fuels near power stations to carry out the process of generating power.

IV. SUSTAINABLE FUELS

Sustainable fuel is a concept in which the humans use the fuel to meet the needs of the present without compromising the ability of future generations to meet their fuel demands. One of the alternatives for the fossil fuel is bio-fuels, which are also renewable source. Although renewable energy is used mostly to generate electricity, it is often assumed that some form of renewable energy or a percentage is used to create sustainable fuels. Using the current yields, vast amounts of land and fresh water would be needed to produce enough oil to completely replace fossil fuels usage. Research is ongoing into finding more suitable sustainable fuel that would power the planet. Some of advanced fuel are the following.

A. BIOMASS

Biomass in the energy production industry is living and recently dead biological materials which can be used as the fuel or for industrial production. Now, more coal plants are converted into biomass plant without wasting existing generating plant and infrastructure. Biomass most often refers to plant or plant-based materials that are not used for food or feed, and are specially called nitrocellulose biomass. Biomass can either be used directly by combustion to produce heat, or indirectly after converting it to various forms of bio-fuel. The graph showing different sources of biomass are shown below

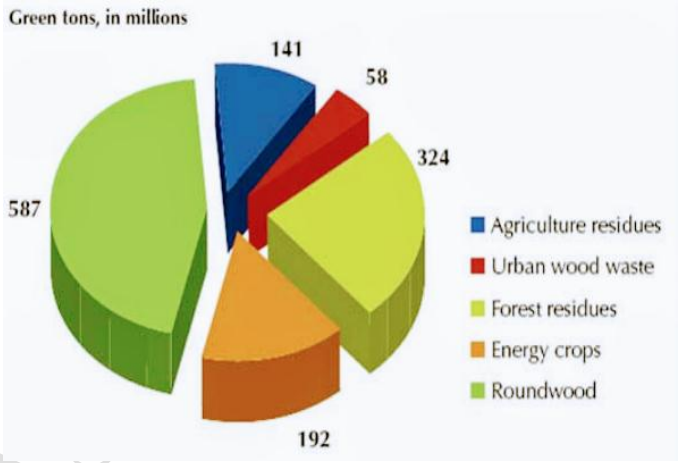

Figure 2

B. ALGAE-BASED FUELS

Algae-based bio-fuels have been promoted in the media as a potential panacea to crude oil. Algae could yield more than 2000 gallons of fuels per acre per year of production [5]. Algae are ideal source of biodiesel, as the oil found inside algal cell is similar to other vegetable oil, which can easily be transformed into diesel. With potentially millions of species, algal diversity gives researches many options for identifying production strains and also provides sources for genetic information that can be used to improve these production strains. The process of obtaining biofuel from algae is explained in the figure below

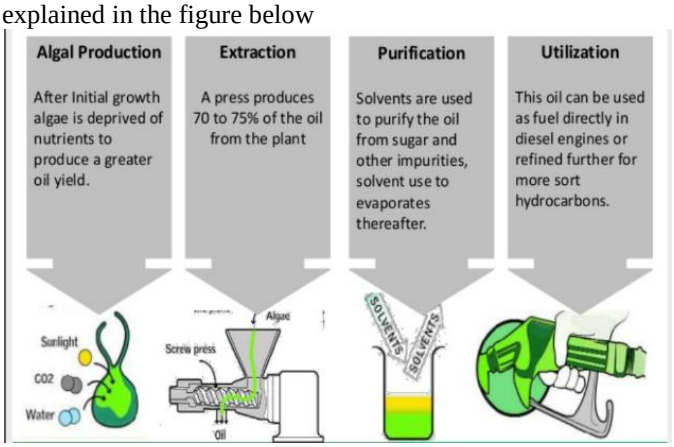

Figure 3

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C. BIODIESEL

Biodiesel can be produced from vegetable oils, animal oils/fats, tallow and waste cooking oil. The process used to convert theses oils to biodiesel is called transesterification. The biodiesel has many environmental beneficial properties. The main benefit is that it is described as 'carbon neutral'. Biodiesel is biodegradable and non-toxic and spillages have less risk, when compared to fossil diesel spillages. Biodiesel has a higher flash point than fossil diesel making it safer in the event of a crash. The process for biodiesel production is shown below

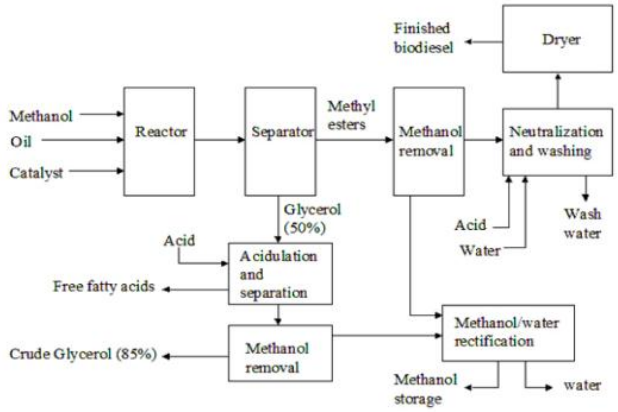

Figure 4

Alternative diesel is also produced from waste plastics. The pyrolysis of plastic for fuel production is practised by several small-scale companies worldwide, especially those of emerging countries. The pyrolysis of plastic can yield on average 45-50% of oil, 35-40% of gases, and 10-20% of tar depending on pyrolysis technology [6].

D. CARBON-NEUTRAL AND NEGATIVE FUELS

Carbon-neutral fuels is synthetic fuels. Carbon neutral is a term introduced to describe carbon-based fuels that once burned won't increase CO2 (CO2) within the atmosphere. These fuels neither contribute to nor reduce the amount of carbon (measured in the release of CO2) into the atmosphere. Carbon dioxide within the atmosphere is chemical, which is a good thing, and it also helps keep our planet warm. However, too much CO2 can lead to what we now call global warming. Carbon neutral fuels will facilitate forestall an excessive amount of greenhouse gas from accumulating within the atmosphere. It accomplishes this once the free carbon is absorbed by plant crops that may facilitate manufacture tomorrow's next gallon of a carbon-neutral fuel. Every time we travel in a gasoline or diesel-powered vehicle, we add greenhouse gases to the atmosphere. That's because burning a petroleum fuel (which were created millions of years ago) releases CO2 into the air. As a nation, 250 million passenger vehicles are currently registered, about 25 percent of all passenger vehicles in the world. In the U.S., our vehicles burn around a hundred and forty billion gallons of fuel and forty billion gallons of diesel a year. With those numbers it's not difficult to see that every gallon of a carbon-neutral fuel that is burned can contribute to the reduction of CO2 in the atmosphere, thus helping to reduce global warming.

E. HYDROGEN FUEL

Hydrogen is a clean fuel that, once consumed in an exceedingly fuel cell, produces only water. hydrogen often created from a spread of domestic resources, like gas, atomic power, biomass, and renewable power like solar and wind. These qualities create it a lovely fuel possibility for transportation and electricity generation applications. It is often employed in cars, in houses, for transportable power, and in more applications. hydrogen is an energy carrier which will be used to store, move, and deliver energy created from alternative sources. Today, hydrogen fuel often created through many ways. the foremost common ways nowadays are natural gas reforming (a thermal process), and electrolysis. alternative ways embrace solar-driven and organic process. Thermal processes for hydrogen production usually involve steam reforming, a high-temperature method during which steam reacts with a hydrocarbon fuel to supply element. several organic compound fuels are often reformed to supply element, as well as gas, diesel, renewable liquid fuels, vaporized coal, or vaporized biomass. Today, regarding ninety fifth of all element is created from steam reforming of gas. Electrolytic methodes- Water are often separated into gas and element through a process known as electrolysis. Electrolytic processes ensue in an electrolyzer, that functions very like electric cell in reverse—instead of exploitation the energy of element molecule, sort of electric cell will, an electrolyzer creates element from water molecules. Solar-driven processes use lightweight because the agent for element production. There are a number of solar-driven processes, as well as photobiological, photoelectrochemical, and star thermochemical. Photobiological processes use the natural chemical action activity of microorganism and chlorophyte to supply element. Photoelectrochemical processes use specialised semiconductors to separate water into element and gas. star thermochemical element production uses targeted alternative energy to drive water rending reactions usually in conjunction with alternative species like metal oxides. Biological processes use microbes like bacterium and microalgae and might turn out element through biological reactions. In biomass conversion, the microbes break down organic matter like biomass or sewer water to supply element, whereas in photobiological processes the microbes use daylight because the energy sources.

F. AMMONIA AS FUEL

Gasoline and diesel fuel internal combustion engines can be converted to run on ammonia. The first utilization of liquid anhydrous ammonia as a fuel for motor-buses took place in Belgium during the year 1943. The motor-bus fleet logged thousands of miles during WWII with no difficulties. Ammonia has high octane rating (about 120 versus gasoline at 86-93). So, it does not need an octane enhancer and can be used in high compression engines. However, it has a relatively low energy density per gallon – about half of gasoline. The fuel mileage of ammonia is about half of gasoline's mileage. Along with hydrogen, ammonia is the only fuel that has no carbon emission when combusted because it doesn't contain carbon. It may contribute a small amount of nitrous oxide

emission, which can be controlled. Ammonia can also be used in diesel engines. However, ammonia will not compression ignite except at very high pressures. So, a small amount of high-cetane (the combustion quality during compression ignition) fuel is added. Research is showing that a 5 percent biodiesel and 95 percent ammonia blend works well in farm machinery.

G. COMPRESSED AIR

Compressed air is a variety of hold on energy that wont to operate machinery, equipment, or processes. Compressed air is employed in most producing and a few service industries, usually wherever it's impractical or risky to use power on to provide power to tools and instrumentation. Compressed air has been used since the 19th century to power mine locomotives and trams in cities such as Paris and was previously the basis of naval torpedo propulsion. Compressed air was conjointly utilized in some vehicles for enhancing the initial force or motion. In the Seventies, Willard Truitt made-up CAV however sold-out the planning to the United States Army as a result of money constraints. In 1979, Terry Miller made-up the air automobile and proprietary it. In 2007, Tata Motors signed an agreement with the Motor Development International (MDI), a French firm, to roll out a car that would run on compressed air. The AIRPod is one of five derivative vehicles designed by the MDI based on compressed air engines. The mdi developed 2 versions: one fuel engine that depends only upon compressed gas, designed just for urban areas (like the AIRPod) and a duel fuel version that uses compressed air and a combustible fuel. The MDI has claimed that an air car would be able to travel 140 kilometers (km) in urban driving, and have a range of 80 km with a top speed of one hundred ten Kmon highways once operational on compressed gas alone, besides promoting vi CAV models starting from single travel cars to 6-seater urban minibuses. One of the major automobile manufactures, Tata Motors has conjointly with success completed the primary part of the project. The second stage of the elaborate development started a number of years past. Air-powered cars can weigh below 907 Kilogram, which will make them more fuel-efficient.

V. CONCLUSIONS

Long-term biofuel developments are likely to keep IC engines fuel costs competitive with electricity costs for fueling for electric vehicles in most applications. In case biofuels considerably underperform expectations, ammonia or hydrocarbon syn-fuels produced from clean hydrogen will only be competitive on a fuel cost basis in long-range applications where an electric vehicle would have to charge from dedicated fast charging infrastructure at higher electricity prices. Naturally, a long-range vehicle with an IC engine or fuel cell will always be significantly cheaper than a long-range electric vehicle. However, the transport and storage costs of hydrogen are significant, thereby limiting the locations to which hydrogen can be profitably distributed. Hydrogen will so not become a very present fuel supply as oil is nowadays. Overall, a decent range of alternatives exist for clean fuel production within the long-run future to make sure a various transport energy combined. A diverse vary of energy sources can guarantee a reliable offer and a high degree of competition to stay costs low, so benefiting shoppers and general economic potency.

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