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Alternative Fuels for the better Future

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Abstract: ***The transformation and reducing carbon emissions of the energy industry demands for new technology and energy sources should be used. Penetration level of intermittent renewable energy sources means the construction of energy recycling, storing of surplus electricity and increased performance of the grid. Such energy surpluses, which could arise more frequently in the upcoming energy system, can be efficiently used for alternate energy development. Many of the alternative energy sources identified for potential uses are chemicals or materials which are already identified and are already being used for other applications. Another important benefit of certain alternative fuels is their ability to serve as an energy carrier. While reviewing their possibilities for use and future advancement, this feature may be indispensable. In the meantime, fuels that could be utilised efficiently for power production and also as an energy source would have a more significant function and are expected to use on a higher scale. On the other hand, the use of renewable energy sources like biomass is already common and their position in the future system is also not uncertain. Although the substantial increase in biomass use poses important questions as to its stability, innovative methods are being pursued. In this study, in addition to their usage and advancement processes, the researchers aimed to investigate alternative energy features. In order to determine the optimal options, the researchers discussed the two renewable energies suggested, alongside their pros and cons, in order to select the most effective position for each energy.***

Keywords: Alcohol Derived Fuels, Alternative Fuels, Biomass, Hydrogen, Non-Recyclable Waste.

INTRODUCTION

The move towards a 100% Renewable Energy System is a dynamic process including numerous economic and technological hurdles. Many other efforts should be made concurrently to achieve predetermined targets, involving improved energy conservation, savings in primary energy usage, and ultimately, the introduction of intermittent renewable energy sources (VRES). Subsequently, a high proportion of intermittent renewables such as wind and solar in the energy mix affects the reliability of the grid and involves the versatile operation of traditional, base-load power plants. In addition, a greater proportion of VRES suggests that cycles with an abundance or lack of electricity generation would be more frequent; thus, short- and long-term energy storage needs to be included. It is recognized that the grid can regulation around 30 per cent of VRES. Utilizing demand response technology such as vehicle-to-gird (V2G), thermal storage, and other short-term storage types, up to 80 percent of VRES can be integrated.

Long-term energy storage is a must for incorporating 100 percent of VRES. Renewable energy sources, ideal for versatile activity in a decarbonized energy system, are hydroelectric power and biomass. Additionally, in certain nations or geographical locations, these resources may be

scarce, and even more, their overuse to fulfil the remaining 20 percent gap may be unsustainable. The chemical transformation of surplus energy into another form of alternative energy (Power-to-X) has recently been discovered as a feasible technique because it can serve as a source of energy or carrier, but also as a long-term energy storage [1].

Alternative fuels can be synthesised in a liquids, gases or solid Liquid and some gaseous fuels are by far the most effective alternative for the transportation industry, whereas solid fuels are probably to use for stationary purposes in power stations. Consequently, fuels which can be used in more than one type and used as an energy carrier or storing at the same time would be implemented on a larger scale. Cross-sectoral alignment is essential to achieve maximum energy and performance of the system. This means the output of combined heat and power (CHP), but even more so, a deeper integration of transportation and industries into the energy production market. Compared to the traditional power stations, cogeneration plants have a substantially greater performance; they are thus favoured for the potential energy grid. In addition, excess power may be used either for district heating or for industrial applications, or explicitly for alternate energy generation. In order to prevent unwanted misunderstanding, the phrase alternative fuels would be used for all considered fuels, including electrofuels, in this study.

The objective of the review is to identify and examine the most influential alternative energy sources that are now studied extensively as possible alternative energy sources and energy carriers or storage facilities. Different alternative fuel have been studied so far and comprehensive analyses are being carried out. Nonetheless, systematic analysis that would sum up and analyse proposed alternatives with the pros and cons, as well as the prospects for enhanced deployments is largely lacking. Moreover, alternative fuels are also competitively contrasted, allowing the use of one fuel for all purposes. The authors studied the most influential chemicals, biofuels and fuels extracted from alcohol in this study, with the intention of finding a role similar for each of these in future energy systems. It is particularly crucial to identify a closely correlated to proceed with the study in a way that would optimise the potential applications of each fuel evaluated.

ALTERNATIVE FUELS

Hydrogen

The cleanest documented source of energy which can be derived from different energy sources, such as fossil fuels, nuclear energy or VRES, is hydrogen. Hydrogen is currently commonly used in the aerospace sector as rocket fuel, as a processing material for the petroleum industry, and also in many other industrial processes. Globally, approximately 50 percent of hydrogen is used only for the manufacture of ammonia (NH3). Hydrogen oxidation produces only heat and water if used as a fuel, without additional pollution. Although the most plentiful chemical substance in the universe is hydrogen, its natural, elemental appearance on earth is unusual.

However, in different hydrocarbons, water or synthesised chemicals, hydrogen could be contained.

$$2H2(g) + O_2(g) \rightarrow 2H_2O(g) + heat$$

Ammonia

Ammonia (NH3) is a fully carbon-free chemical substance that is commonly used as a fertiliser and has recently attracted considerable interest as a possible energy carrier or alternative fuel. Ammonia is actually a commonly used chemical and accounts for nearly 200 million tonnes of production annually. Fossil fuels such as natural gas, coal, and oil and also nitrogen from the atmosphere are currently the primary raw material for the production through the Haber - bosch process. With the distribution network previously built, ammonia is at ambient temperature and 10 bar pressure in the liquid state and storage is very simple. With one of the maximum gravimetric hydrogen densities (17.8 wt per cent), the energy density of ammonia is about 22.5 MJ/kg, making it an excellent hydrogen energy carrier[2].

$$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_20 + heat$$

Biodiesel

A long chain of fatty acid oils extracted from sustainable lipid sources like non-edible plants, lignocellulose biomass or unprocessed meats. Biodiesel comprises of monoalkyl esters. Although only two of them have achieved market size, there seem to be four generations of biodiesel. Biofuel, produced from food products such as wheat, sugar cane, wheat and vegetable oils, was first implemented in the 1st generation of biodiesel. Power crops and non-edible crops, waste oils and lignocellulose feedstock are developed in the 2nd generation. It is important to mention that if processing doesn't really interfere with the food supply chain, biodiesel could only be generated sustainably. The third and fourth generations of biodiesel are also still evolving which included, namely, algal biomass and genetic modification microorganisms. Up until now, biodiesel has been applied successfully in fuel mixtures with conventional oil for the transportation industry.

Alcohol derived fuels

For internal combustion engines, alcohol dependent fuel such as methanol, ethanol and dimethyl ether (DME) have been already developed and deployed. (ICE). Because of the drawbacks of implementation, alcoholic fuels are mostly incorporated in fuel blends where share don't really surpass 20%. Methanol as the simplistic type of alcohol, ethanol as the commonly utilized fuel and DME as the influential fuel for potential use in IC engines are covered in this study [3].

Biomass

Biomass, utilized concurrently as a fuel and raw material for fuel processing, is among the few sources of energy. In 2010, total biomass usage in person, improperly effective stoves surpassed 56 EJ/yr, primarily for domestic as well as buildings cooking and heating. In contrast, biomass is used as a cogeneration fuel (CHP) for power plants (4.5 EJ/yr) as well as in the manufacturing and transport sectors, with an overall demand of roughly 15 EJ/yr. By 2050, obsolete heating systems are expected to be powered with newer models and biomass would remain a significant source of energy in rural communities. In the upcoming, consumption for the biomass is projected to double by 2030 from currently amounts to larger than 100 EJ/yr. In all domains, the growth is anticipated and is projected to be ~31 EJ/yr in transportation, and ~21 EJ/yr for the company.

Non-recyclable waste

First, it must be noted that in waste management practices, waste-to-energy should be the last step. Repurposing and recycle are preferred subsequent to power production, whereas vitrification of waste must be done only to non-recyclable waste. Presently, waste disposal for power and heat co-generation is a frequently used approach of energy recovery. Waste is used in the form of solid recovered fuel (SRF), waste-derived fuel (RDF) or by direct combustion of solid municipal waste (MSW). As waste generation is unavoidable and will be produced at high rates in the future, effective energy are important for the practise of waste management. Thermochemical conversion is a highly successful mass and volume reduction process, but higher emissions of SOX, NOX and other contaminants pose significant ecological consequences.

CONCLUSION

In the decarbonized energy environment of the future, renewable energies are unavoidable. Moreover, renewable fuels are particularly important for the decarbonisation of the transportation and industrial sectors, where energy is likely to get a much lower effect or is not appropriate as a substitute. In this study, the authors' main objective was to provide, through their implementations, the existing possible alternative fuel and to portray prospective different routes for their development. The bottom one is significantly relevant because it can be seen that in both words, raw material and fuel, present production mechanisms depend primarily on fossil fuels. The preceding conclusion is taken from this analysis:

- Biofuels, particularly biodiesel and solid biomass, are the only commercially viable substitutes that are already used for transportation and industries requirements. Because their usage is forecast to expand much more in the future, novel strategies for achieving sustainability must be sought.
- As an alternative energy source for different utilisation techniques, chemicals such as hydrogen and ammonia have been studied. Hydrogen has a high energy density, but hydrogen is still commonly used for other uses, which means that only a small quantity is sufficient for the application of fuel. In addition, for greater hydrogen implementation,

a new distribution network is needed, which poses a serious downside. On the other hand, ammonia has a lower heating benefit, many safety issues and weak properties of combustion. This indicates that there would be a very small position for ammonia as an alternative energy source. Nonetheless, ammonia has a high gravimetric density of hydrogen and may be used as an energy carrier or storing as it is not a problem for delivery.

- Alcohol-derived fuels have been regarded for some time as an alternative. Nonetheless, on a higher scale, industrial implementation is questionable. In particular, lower temperature rates are required to achieve better efficiency, suggesting higher fuel intake, specific adjustments or the production of dedicated IC engines. Nevertheless, when used in fuel blends, such fuels display favourable features, significantly in relation of lowering pollution levels. In addition, methanol was developed and tested for marine use as the simplest alcohol, with promising results about engine efficiency and exhaust emission reduction.
- Finally, the mechanisms of development must move towards effective practices and VRES coupling. This mainly includes direct use of solar power to drive the manufacturing process or incorporation with the VRES of different technologies such as electrolysis and carbon capture to ensure clean processing of raw material used during fuel production.

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