SELECT COMMITTEE SUBMISSION

Increasing the use of sustainable biofuels in Aotearoa New Zealand

To the Minister of Energy and Resources, Hon Dr. Megan Woods, and Minister of Transport, Hon Michael Wood. I am a student of Social Policy at Massey University and I would like to submit my **support** towards the mandate of increasing the use of sustainable biofuels in Aotearoa New Zealand.

I support this mandate because biofuels are the better alternative for fossil fuel in the transportation industry (Ministry of Transport, 2021). Biofuels are renewable energy that can be produced in a short period of time by sustainable farming practices. In contrast, fossil fuels take millions of years to form and are not renewable (Hassan & Kalam, 2013). Conventional biofuels are exclusively obtained from human food chain, for example, biodiesel is produced from vegetable oil and animal fats, ethanol is produced from sugarcane, corn and wheat (Dutta, et al, 2019). The increased usage of fossil fuels by humans resulted in the emission of GHG. This has caused the greenhouse effect where these gases trap the energy from the sun and cause Earth's temperature to rise (Dutta, et al, 2019). New Zealand is facing temperature rise in its environment, affecting the glaciers and crop cultivation (Stats NZ, 2020). The size of particulate matters (PM) in air is also a concern in New Zealand cold areas due to usage of coal and firewood (fossil fuel) for heating and burning of fossil fuel in transport. The coarse and fine PM results in the adverse health of lungs and cause respiratory system damage (LAWA, 2021). Apart from New Zealand's own benefits, New Zealand is also morally bound to play its role in the climate change movement as a part of Paris Agreement (Fernendez & Daigneault, 2016).

Environmental problems of fossil fuel consumption

It is well accepted that fossil fuels when combusting, produce CO_2 and other greenhouse gases (GHG) that includes methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride (Parera, 2017). These gases remain in the atmosphere for hundreds of years damaging the earth's atmosphere and temperature raise (Dutta, et al, 2019) This is resulting in the melting of the glaciers, increased frequency of storms, heat waves, wildfires and heavy rain. Climate change is also causing sea levels to rise, acid rain and ocean acidification (Thompson, 2010). The accumulation of GHG emission in the atmosphere has also resulted in the poor air quality and regular smog in some cities like New Delhi, Mexico and Lahore, making them the worst cities to live (Raza, et al, 2021).

The increase in the GHG emission cause the rise of temperature globally (Thompson, 2010). New Zealand's national temperature from NIWA's 'seven-station' temperature series from 1909 to 2019 data shows an increase of temperature by 1.13 degrees Celsius due to GHG emissions (Stats NZ, 2020). While the increase seems relatively small, these small changes can have huge effects on our environment. Every year, globally, temperature is rising and causing heat waves in different countries. This increased warmth may not affect the people living in cold countries, but it is melting the glaciers more rapidly which leads to increased sea levels. Over most of the 20th century, sea level rose about 2 mm per year. Since 1990, the rate has been about 3 mm per year (Thompson, 2010).

According to Stats NZ (2020), the gross GHG emission of New Zealand in 2018 was made up of CO_2 (44.5 percent), methane (43.5 percent) and nitrous oxide (9.6 percent). One of the major contributors of emitting GHG is the transport. In New Zealand, about 47 percent of CO_2 is produced by transport that includes 67 percent light vehicles, 24 percent heavy vehicles, 7 percent aviation, 1 percent rail and 1 percent shipping. Road transportation emissions in 2018 were up 2.3 percent from 2017 and up 101.6 percent from 1990. Our net GHG emission were 57.2 percent higher than 1990 due to increase in the GHG emission due to transportation and decrease in carbon uptake by New Zealand plantation forest (Stats NZ, 2020).

Smog pollution is becoming one of the serious health concerns throughout the world. The chemical formation of smog is very complex but greenhouse gases including carbon dioxide, carbon monoxide, nitrous gases and sulfur dioxide are the main components of smog formation (Layne, 1995). Smog is a mixture of many pollutants, each of which is harmful for humans, plants, animals and ecosystem. Due to smog, various human health effects are observed in cardiovascular and respiratory systems (Raza, et al, 2021). In recent years, the city of Pakistan, Lahore, has been affected by smog pollution in winter due to increase usage of fossil fuels for heating purposes as well as in transport (Raza, et al, 2021).

Biofuels—A solution

Biofuels are obtained from the process of biological carbon fixation (a process that converts inorganic carbon to organic compounds). Different compounds like proteins, fats and alcohols can be used to produce energy (Gerali, 2020). However, biotechnology has improved the advanced biofuel production and they are produced by new food feedstocks such as agricultural and forestry residues, grasses, algae, industrial and organic municipal waste. They are called 'drop-in' biofuel as they do not require mixing with fossil fuels like ethanol and biodiesel. They are compatible with fossil fuels, conventional vehicles, aviation and shipping (Suckling, et al, 2018).

All types of vehicles (cars, heavy freight vehicles, rails, aviation and shipping) produce high amounts of CO_2 in the environment, making it hazardous and potentially unbreathable. Biofuels can play an important role in decarbonizing the transport system. Electric vehicles (EVs) are the lead transport to minimize the CO_2 emission. Companies like Tesla and Nissan have already started selling their EVs in the market. However, it will take around 20 years to change the conventional cars to EVs. Until then, biofuels can be used as transition fuels in light conventional vehicles and biofuels can be mixed with fossil fuels to minimize carbonization (Ministry of Transport, 2021). Biofuels can be blended with conventional fuels, for example, biodiesel and conventional diesel, to be used in heavy trucks. Major truck manufacturing companies like Scania, are making truck engines that can use 100 percent biofuels (Ministry of Transport, 2020). These truck engines are not yet in the market as they require infrastructure investment. However, Brazil launched a fuel cell bus that uses hydrogen as its fuel power in 2007 as Brazil is a leading renewable energy producer and has several hydrogen sources (Road Vehicles, 2009). About 7 percent CO_2 transport emission is due to aviation. Air New Zealand has proposed sustainable aviation fuel to decarbonize its operation. Electricity and hydrogen are not suitable for long flights. Air NZ has stated that sustainable fuel has the potential to control about 50 percent of the decarbonization by 2040-2050, if New Zealand produces its own sustainable fuel. Railway transportation is another area for consideration. Electrifying rail freight is very costly option. Electrification of the rail system is prevalent in Europe as they decided to electrify their rail system after World War I (Marsh, 2021). However, it is very costly option for countries like U.S., Australia and New Zealand. The industry observers have estimated the cost for electrifying rail per track mile is around $5-6 million USD (Marsh, 2021). Instead, these countries are focusing on low-carbon options like alternative fuel sources including biofuels, hydrogen fuel cells and zero-emission battery cells (Marsh, 2021). Kiwirail is testing biodiesel in one of its shunter locomotives to test the efficiency of Neste's 100 percent drop-in renewable diesel. This option is more cost effective than electricity (Ministry of Transport, 2021). Marine shipping industry is one of the major goods transportations, internationally. Around 80 percent of all goods are transported via marine shipping routes (Hsieh & Felby, 2017). Marine ships have flexible specifications to use biofuels and Mediterranean Shipping Company (MSC) has started to use 30 percent biofuels in their ships in Netherlands (MSC, 2019). The trials were started with a minimal 10 percent biofuel blend. However, the suitability of marine ships to use biofuel in their operation allowed MSC to increase the blending percentage to 30 (MSC, 2019). Using biofuel on container ships could significantly help reduce GHG emissions, especially Sulphur, which can cause ocean acidification (Hsieh & Felby, 2017).

Economic impacts of biofuels

Not all countries have fossil fuel reserves in their lands. About two-thirds of the world's oil reserves are present in the Gulf countries (Iran, Iraq, Kuwait, Oman, Saudi Arabia, United Arab Emirates). This results in the vulnerability and dependency of the developed and developing countries to import their oil reserves. Due to this, these countries face physical hardships and economic burdens by spending their foreign currency treasuries on oil imports (Coelho, 2005).

Biofuels can contribute to reduce this dependency of oil importing countries. Biofuels can be the option to change the world economic and energy matrix in developed and developing countries (Coelho, 2005). Most of the developing countries are still using firewood as their main source of energy. This fossil fuel generates a huge amount of CO_2 when combusted and it also impacts adversely on the health of women and children who spend a lot of time collecting it (Coelho, 2005). Biofuel production can be beneficial in these areas where open lands are available to grow different crops for biomass (biomass is an organic material that produces biofuel) (Coelho, 2005). This will create opportunities for not only the farmers and land owners but also the biofuel production plants will result in giving the jobs for engineers and workers for example, Brazil Ethanol Programme generated about 700,000 jobs direct and 3.5 million indirect jobs in just sugarcane sector in 2004 (Meyer, et al, 2013). Due to the large production of ethanol in Brazil, multinational automobile companies introduced necessary vehicle modifications for ethanol use. Almost four million vehicles use 100 percent pure hydrated ethanol in Brazil and up to 26 percent of ethanol is blended in fossil fuel that results in long vehicle life and minimal environment hazards (Grad, 2006).

The U.S. makes ethanol from corn that has become the primary feed grain accounting for more than 95 percent feed grain production due to high demand of ethanol as biofuel (USDA, 2021). Primarily, Brazil produced ethanol with sugarcane as part of its Brazil Ethanol Programme and was the major producer of ethanol. However, U.S. started more production of ethanol than Brazil. About 25 percent of corn croplands are used for the ethanol production in U.S. It has given energy security and increased rural and farming sector economy. Du and Hayes (2008) conducted a study on U.S. gasoline prices with and without ethanol blend. They found that due to local production of ethanol from corn has been beneficial for its consumers. The ethanol-gasoline blend had prevented dramatic petroleum price increase that would have been expected without ethanol local production. Another study in U.S. conducted from 2005 to 2019 showed the reduction in carbon intensity (CI) by 23 percent due to corn ethanol usage (Lee, et al, 2021). Hence, ethanol is a fuel that burns clean and its blend with gasoline has proved to reduce the GHG emissions in the environment (Lee, et al, 2021).

New Zealand's corn cultivation can also contribute in ethanol production. The Government's mandate of increase usage of sustainable biofuels would support and encourage the corn producers by giving them subsidies and grants to increase their corn production. This will increase the economical sustainability for farmers and help to reduce the international dependency and gasoline prices that are sky rocketing. Bioenergy Association (2015) reported that Anchor New Zealand produces bioethanol as a by-product of dairy industry and about 68 percent of which is exported. Tallow is an animal fat that can be converted into biodiesel. New Zealand produces around 150,000 tons of tallow annually but about 120,000 tons is exported (Bioenergy Association, 2015). Many other potential biomasses such as straw, waste wood, Salix (willow), food waste and rapeseed oil (canola) are being produced in New Zealand. However, without Government's intervention, there would be no progress towards biofuel production.

Around 60 countries are trying to find different ways to contribute in the increase of biofuel production. As part of the Paris Agreement, New Zealand is bound legally as well as morally to take actions towards biofuel production and consumption (Suckling, et al, 2018). However, there are some barriers that New Zealand will face to establish the production and usage of biofuel, for example, financial problems as biofuels are costly than fossil fuel, implementation on using biofuel as there is no societal and political concurrence towards biofuel within New Zealand and environmental awareness as the public need to understand the importance of biofuel for the future of our planet (Suckling, et al, 2018). These barriers are not impossible to overcome as many countries have faced these and many other challenges in which they are succeeded. New Zealand can use their knowledge to overcome these short-term problems. One of the many success examples is Brazil Ethanol Program which became an international achievement in the fuel industry. As the ethanol production increased overtime, the costs of ethanol production and consumption dropped in Brazil. New Zealand has fertile land to cultivate the selective biomass if the farmers get higher returns and the risk is low. The Government needs to make policies that are beneficial for both, the farmers and the consumers. In this way, New Zealand can come out of the fossil fuel dependency. Right now, New Zealand spends $5 billion on fossil fuels. The production of biofuels within New Zealand will provide job opportunities for the people as biofuel production plants will be established and biomass will be cultivated on large scale. This will create opportunities for farmers, engineers and labor.

Land grabbing problem in developing countries

Despite all the success and advantages of biofuels, there are some downfalls that developing countries are facing. In UNDP Human Development Report 2007/2008, it was highlighted that in developing countries, like African countries, Malaysia and Indonesia, international companies have taken control

over the lands that were used by indigenous people. The creation of biofuel producing plants has also been used as justification for harvesting timber. The study conducted in Ghana, Africa, showed that even though the demand of biofuel is producing opportunities for jobs, the direct and indirect effect of biofuel production on local communities in Ghana relates to land loss. International large companies buy land from the Government and villagers involuntarily move from their homelands without any compensation or relocation. Apart from land grabbing's in developing countries by international companies, FAO (United Nation's Food and Agricultural Organization) said that agro fuel policies must be reviewed to preserve the goal of world food security, protect poor farmers, promote broad-based rural development and ensure environmental sustainability to stop the controversial land deals. A report by Elbehri, Segerstedt & Liu (2013) suggested all the Governments should adopt the policy that biofuel production must not compromise the food security and all the necessary resources for food cultivation are not put at risk. The Governments must work with co-ordination when making biofuel production and consumption policies in their countries so that food security does not compromise (HLPE, 2013).

Countries are making policies that will address the problems of developing countries and working on more advanced technologies that will make the biofuel production more efficient and cost effective. New Zealand must make its contribution for the betterment of the planet and future generations.

I support the Bill that Government proposed to increase the use of biofuels in transport.

It is a difficult but achievable task. People need more awareness on this issue as they are not aware of the scientific and physical benefits of the biofuels. Every new change is difficult for people to adapt to, however, with the efforts of the Government and private organizations like Greenpeace and World Widlife Fund, people should be able to see the destruction that fossil fuels are making in the environment.

Recommendations

- Government should advertise the advantages of using biofuels on the radio and television.
- Different organizations and non-profit organizations should hold workshops and awareness programs where they can make people understand the disasters our environment is facing and the standing of biofuel in reducing those disasters.
- Schools should talk about the benefits of using biofuel in transport and the technologies that are used to produce biofuels to develop interest in our young generation to adapt the biofuels.
- In some countries, development of policies and differential taxation systems or subsidies have supported demand for biofuels and influenced price developments. New Zealand Government can study those mandates and policies to make its own set of policies that can build confidence in people to adapt the transition of biofuel usage in transport.

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