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Biofuels: The Renewable Energy Sector's Sleeping Giant

By
Andrew Ly

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BIOFUELS: THE RENEWABLE ENERGY SECTOR'S SLEEPING GIANT

Authors: ***Andrew Ly, International Biofuels Marketing Pty Ltd***

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Introduction

Australia generates 29% of its total electricity demand from renewable sources such as solar, wind, and hydro as of 2021; surprisingly, it generates less than 1% from bioenergy. According to the Global Bioenergy Statistics 2020, "…bioenergy is the single largest renewable heat source globally with a share of more than 95%..." as of 2018 data.

What are Biofuels?

Biofuels are genuinely the oldest form of renewable energy, used by humans worldwide since the dawn of human civilization. When troglodytes created the first ever wood fire for heating and cooking, they were the first humans to utilize biofuel to produce bioenergy. Thus, bioenergy is the energy that is derived from biofuels. These fuels can be liquid, solid, or gas, technically termed bioliquids, biomass, and biogas, respectively. All biofuels are derived from organic matter, which may be wood, crop, municipal waste, or other organic sources.

Are Biofuels really "Renewable"?

There will always be advocates and critics of bioenergy and biofuel manufacturers. The most significant criticism received in the biofuels industry is that it impacts natural forests, either directly or indirectly. Critics argue that biofuels produce the same, if not higher, carbon emissions than their fossil-fuel counterparts, but unlike fossil fuels, biofuels decimate natural forests.

This argument is a paradox as it is both valid and invalid. One only needs to have a fundamental sense of introductory physics and chemistry to understand the laws of energy conservation and mass conservation. In principle, the combustion of a certain mass of carbon-based matter (say coal or wood) will result in proportionate carbon emissions (say carbon dioxide and carbon monoxide). It is folly to believe that biofuels do not emit carbon or CO2.

Rather than the renewability and sustainability arguments, the biofuel argument should be based on the fact that the biofuels are sustainably replenished. The replenished organic matter absorbs carbon dioxide from the atmosphere; hence, the process is "carbon neutral" and forms a carbon cycle. Of course, in practice, the cycle is imperfect as some amount of fossil fuel will be burned in logistics, plant construction, etc.; however, this imperfection can be accounted for and can be negated by purchasing carbon offsets.

No government wishes to be seen as supporting a practice that emits more carbon or pollution than the fossil fuel it seeks to replace. However, it is true that if biofuels are generated directly from cutting down natural forests or from plantations that have replaced natural forests, then this would be counterproductive in the global fight against climate change. Currently, correct controls are in place to ensure that these practices are not supported and endorsed.

In most cases, government subsidies to biofuel ventures are dependent on proof of sustainability, such as certification from reputable international programs, such as **the Forest Stewardship Council (FSC), the Programme for the Endorsement of Forest Certification (PEFC), Green Gold Label (GGL) and the Sustainable Biomass Program (SBP).** These programs have varying levels of certification and, in general, ensure the credibility of the 'sustainably-produced' claim of biofuel ventures.

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What is the scope of Biofuels in Australia?

The renewable energy option of any jurisdiction depends on the availability and abundance of uninterrupted sunlight without cloudy skies for solar energy, stable wind speeds in the case of wind energy, or the required amount of rainfall and altitudes in the case of hydropower. In the case of Australia, the country is fortunate to have rich sources of biofuel. It has sustainable wood waste from its significant timber industry, straw from the wheat and barley industry, ethanol from the sugarcane industry, and biogas from municipal waste. Hence, it can be safely concluded that Australia has abundant organic reserves of biofuel because of its significant agriculture and forestry industries.

Yet, it is unfortunate that this potential is not being exploited for biofuel generation other than for the use of wood in fireplaces for residential heating in Australian homes. There is practically zero large-scale industrial generation of bioenergy for heating or electricity. It is difficult to fathom the ignorance about biofuels in Australia, particularly given their abundance and clear benefits. This article will explore some possible factors and rationales around this attitude.

While it has been established that the most viable option for any renewable energy is generally based on the most incredible abundance of its resources in a geographic region, it is also a fact that governments worldwide opt for a mix of renewable energies for their renewable energy policies. Subsidies and feed-in-tariff programs are typically legislated to incentivize markets to develop solar, wind, and geothermal power. It is acknowledged that each form of renewable energy has its advantages and disadvantages, and governments tend to target developing a portfolio of all the available types of renewable energies to create a renewable energy mix.

Reliance on energy from a mix provides security and dependability, as opposed to sole reliance on any one source. For example, due to night or low light conditions - the intensity of solar energy fluctuates, or due to seasonal fluctuation of wind speed, the amount of wind power generation also varies. Low seasonal rainfall may reduce the capacity to generate hydropower. Hence, further mitigation and contingency plans are necessary to address the natural fluctuation of renewable energy sources. We require a reliable energy storage system or battery system as a solution.

Batteries are no new solution; however, the large-scale use of batteries as a solution has only recently been recognized. Batteries are expected to provide a consistent power supply, mainly when renewable energy sources cannot deliver power. Hence, large-scale battery systems and

Issue: 4 Volume: 1 2022 ISSN: 2652-7987 (Online) ISSN: 2652-7995 (Print)

renewable energy are becoming interlinked.

Battery systems act as a buffer and offer grid support when the renewable energy supply in the power grid power is intermittent. One such system is the **Hornsdale Power Reserve Station** in Jamestown, South Australia. It is the world's first large-scale battery system and is considered a success story by experts. It is a 100MW system designed to supplement and stabilize electricity in the grid and pump a significant amount of electricity into the grid to prevent power failures. This is necessary for specific renewable energy sources prone to intermittent supply problems.

Fuels: A Energy System

Coal, gas, and oil are all fossil fuels that act as energy storage sources of dependable dispatchable baseload energy because the fuel itself is the energy storage system. When there is an energy demand, fuel is used in power plants to produce electricity. Whether day or night-time, windy or calm, the rainy season or drought, fossil fuels provide consistent energy around the clock. Unfortunately, supplies of fossil fuels are not renewable, and fossil fuels are the primary cause of global warming, as stated by the International Panel on Climate Change. It is estimated that about 89% of the world's anthropogenic carbon emissions derive from fossil fuels.

In this context, biofuels act as the renewable energy sector's sleeping giant. Biofuels are renewable and sustainable and a dependable, baseload energy source on demand. Biofuels are relatively easy to make from waste or other by-products. They eliminate the need for ecosystem destruction, mining, or drilling kilometers into the Earth's crust for oil. Biofuels are readily transportable in the form of gas or in liquefied or solid states. Biofuels have internationally tradeable commodity markets. Energy storage and transportability are some of the key barriers to the uptake of renewable energies. However, this is not the case for biofuels.

Investment in Biofuel-based power plants

Capital Expenditure (CapEx) is the capital required to acquire or upgrade physical assets such as property, plant and equipment, buildings, or technology. Operational Expenditure (OpEx) is the capital required to operate assets or to incur day-to-day operational expenses. The total capital requirement is calculated by summing all costs (CapEx and OpEx).

In the case of renewable energy generation out of biofuel, the OpEx requirement is comparatively low. For example, the raw material cost for biofuels is low because it is generated from low-cost by-products or waste. In the case of other types of renewable energy production, such as solar energy, there are significant costs associated with the purchase of solar panels; for

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wind energy production, the significant costs are associated with the transportation and assembly of wind turbines, whilst in the case of hydropower construction of the dam itself needs significant Capex. In this context, bioenergy generation perhaps has key advantages, as observed in biomass-based power generation plants worldwide.

It is possible to generate energy based on biofuel with only minor plant modifications of thermal power stations or by repurposing coal power stations to run partially or completely on biomass. This trend has been ongoing for more than a decade and has received significant subsidy support from Governments around the world.

The largest coal-converted power plant in the world is Drax Power Station in the United Kingdom. It has a total capacity of 3,906 megawatts, with 2.6 GW capacity from biomass and 1.29 GW capacity from coal. Several other examples exist worldwide that allow existing coal power plants to be converted and made renewable. This diminishes the CapEx requirements for bioenergy significantly. This success story should be replicated in Australia, as the country relies heavily on coal-based thermal power generation.

Since the late eighteenth century, coal has been mined in Australia for domestic consumption and export. Today, it represents a $50 billion dollar industry and has significantly contributed to the country's gross domestic product. Furthermore, domestic coal consumption accounts for 75% of Australia's electricity generation.

Coal has powered both Australia's homes and economic development. It has also provided Australian families with jobs and opportunities. It is understandable that any argument to replace or compete with the coal industry faces significant opposition or is perceived as adversarial. It could well be that attitude that prevails in Australia, which has then led to comparatively low uptake of renewables (when assessed against other developed countries). This is particularly true for bioenergy, as discussed earlier. It can completely displace coal in coal power stations. Rather than be seen as the replacement for coal in coal power stations, it should be seen as the prolonger of coal-based thermal power stations with biofuels. Already, the closure of coal power stations in Australia has been witnessed, in part or whole, due to pressure from environmentalists because of the polluting nature of these plants. Had biofuels been under consideration prior to these closures, it would have been possible to prolong and repurpose these plants to utilize biofuels in place of coal.

This would have maintained jobs, provided economic benefits, and may have given reliable, dispatchable baseload power. Furthermore, the production of biofuels-based energy could be seen as a new emerging industry that supports Australia's agriculture and forestry sectors, adding value to waste and by-products of these industries.

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Conclusion

Of all the reasons for ignorance about biofuels in Australia to date, perhaps the most plausible justification is the lack of understanding about biofuels and bioenergy. To date, biofuels have received comparatively little focus in Australia. In 2016, after several energy failures in various states, the Coalition of Australian Governments (COAG) energy ministers called for an independent review of the national electricity market.

This resulted in a highly anticipated report called the Independent Review into the Future Security of the National Energy Market, simply referred to as "the Finkel Report." It was chaired by Australia's Chief Scientist at the time, Dr. Alan Finkel AO. The key recommendation of this 210-page report was the adoption of a Clean Energy Target as a transitional instrument to a pathway for lower emissions.

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Biofuels are practically ignored in any policy recommendation scenarios. It was mentioned earlier that biomass represents only 1% of the energy mix at any given time. In other words, Finkel's recommendations showed there is unlikely any chance of an increase in biofuel use in Australia over the next 30 years.

Whether the recommendations are based on an unsound understanding of biofuels or for other unknown and undisclosed reasons, this public report and expert rhetoric are outrightly unconducive to the growth of the biofuels-based renewable energy industry in Australia. Australia lags significantly behind in its uptake and commitment to this logical renewable energy choice compared to other developed countries. It is hoped that this article will shed some light on some of the clear benefits of biofuels, in the hope that soon, there will be an awakening of the renewable energy sector's sleeping giant – biofuel.

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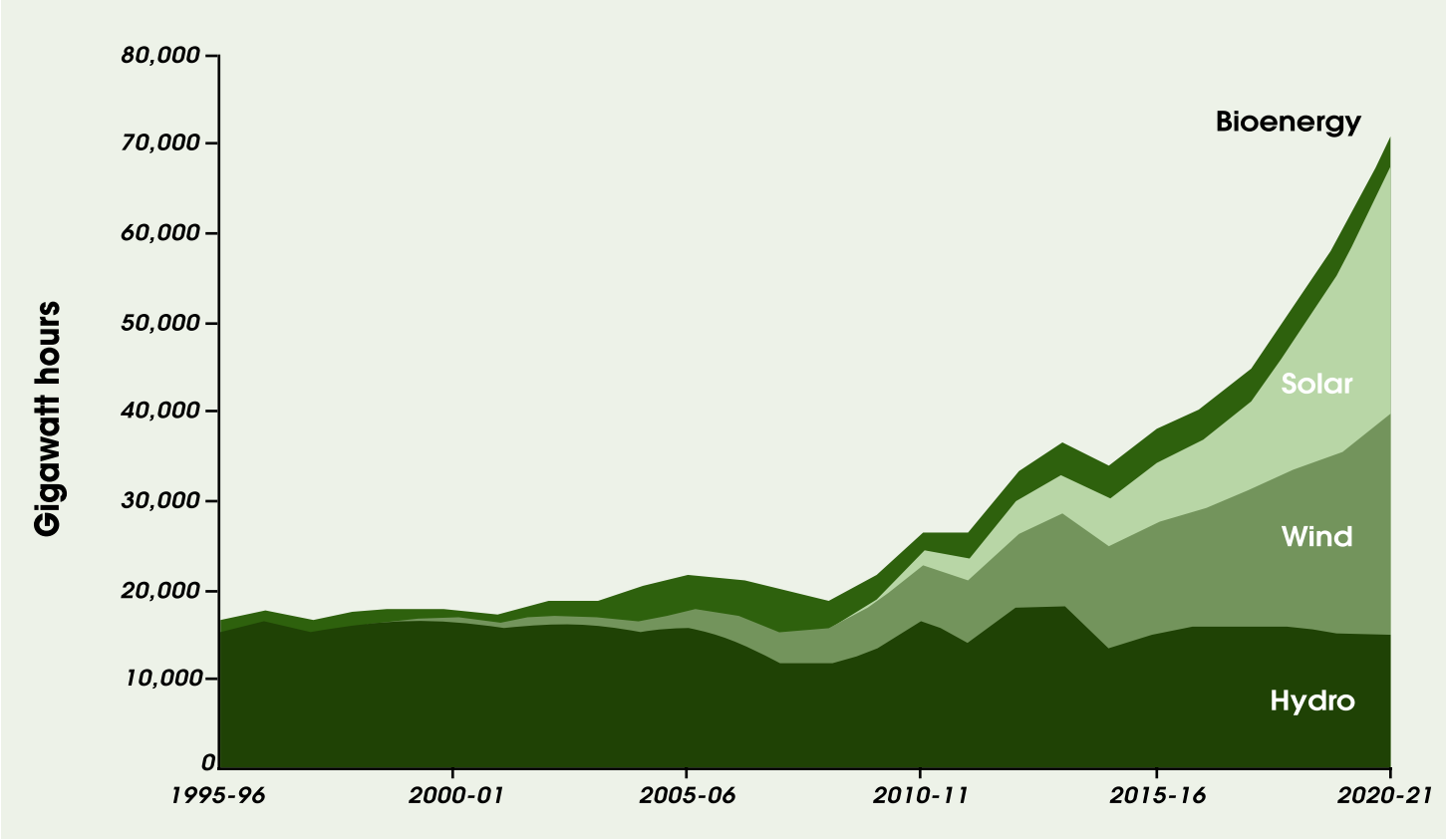
Graph-1 Australian Electricity Generation from Renewable Sources



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