No Good Oil

to Burn

Biofuel Policy in South Korea

Contents

Summary

Korean Biofuel Production on the Rise

In South Korea, bioenergy has come to be seen as a cornerstone of the country's fight against climate change. Defined as a renewable energy source, bioenergy now accounts for more than 25% of what Korea terms New/Renewable Energy generation.* Bioenergy encompasses both biomass, such as wood pellets burnt for electricity production and biofuels, such as liquid fuels produced from food crops. For this report, our focus is on two liquid biofuels, namely biodiesel and bio-heavy oil, and the active government support they receive.

In Korea, biodiesel is produced primarily from palm oil, palm oil by-products, and waste cooking oil (WCO), and since 2012 has been blended with petroleum diesel as part of a government-mandated program. As of July 2021, the blending ratio is 3.5%, but this is expected to rise to 5% by 2030.

Bio-heavy oil is a Korean term for biofuels currently used for power generation, but which are hoped to gain wider use in the industrial and maritime sectors in the future. Bio-heavy oil, produced primarily from palm oil by-products and biodiesel production process by-products, with smaller amounts of palm oil, has been commercialized since March 2019, after a pilot supply project in 2014.

In response to Korea's New/Renewable Energy Portfolio Standard (RPS), power generators are converting power plants from petroleum fuel oils to bio-heavy oil, in an attempt to meet their quota for new/renewable energy production under the RPS. In addition, tradable New/Renewable Energy Certificates (REC) are earned on new/renewable energy produced, multiplied by the energy source weight. Currently, bio-heavy oil has a weight of 1.0.**

*** New/Renewable Energy is a unique Korean government classification that includes renewables (wind, solar, bioenergy etc.) and a small number of new fossil fuel technologies.**
**** All electricity producers with greater than 500 MWh of generation capacity are required to reach a certain percentage target of new/renewable electricity production. If not, they are required to buy RECs from other producers. In 2021, the annual RPS target was 9%, set to increase to 10% from 2022 onwards. A producer's obligations for a year are calculated as the total power generation of the previous year (excluding new/renewable power generation) multiplied by this year's RPS target. RECs are issued by the Korea Energy Agency according to each MWh of new/renewable electricity produced, multiplied by the energy source's weight. Some current weights include: on-site solar over 3,000 kW, 0.7; onshore wind, 1.0; fuel-cell, 1.9.**

Biofuels Delaying the Transition to Renewable Energy

Korea's southern island of Jeju has become a center for bio-heavy oil expansion. Fossil fuel power plants currently account for 59.3% of power generation capacity and 52.5% of actual power generation on the island. An additional 29.7% of the island's power generation comes from the mainland via a high-voltage, direct current (HVDC) submarine cable, most of which is produced by fossil fuel power plants.

When Jeju Island's power utilities previously introduced liquefied natural gas (LNG)-based power generation units, they planned to keep the existing petroleum-fired power plant units for emergency backup only. But after bio-heavy oil was first piloted in 2014, these units were converted to bio-heavily oil and are now in continuous use. As a result, cleaner renewables, such as wind power, have been crowded out of the market. Wind power generation was curtailed 77 times in 2020. In 2021, instanced of curtailment are expected to surpass 200.

Biofuels Expansion in the Aviation and Maritime Sectors

The government is expanding the use of biofuels to achieve its goal of carbon neutrality by 2050. In addition to the blending of biofuels for cars, Korea is considering mandatory biofuel use in aircraft and shipping fuels. In the aviation industry, Korea is a participant in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) established by the International Civil Aviation Organization (ICAO). The scheme aims for emissions reductions through alternative fuels, offsetting, and technological/efficiency improvements. The Ministry of Land, Infrastructure and Transport is preparing for the introduction of bio-aviation fuels in Korea, and the aviation industry is actively announcing plans for such fuels' production and use.

Meanwhile, the International Maritime Organization (IMO) proposes to reduce greenhouse gas (GHG) emissions in international shipping by 70% by 2050, compared to 2008 levels. It also plans to limit the sulfur content of marine fuel oil from 3.5% to 0.5%. In response, the Korean government declared its intention to develop eco-friendly fuels and ships. Korea's biofuel producers are in the process of signing agreements with the shipping industry to promote the use of bio-heavy oil.

Majority of Biofuels Coming from Palm Oil and Its By-Products

Korea's expansion of biofuels is all dependent on the import of palm oil and palm oil by-products. Imports of these feedstocks for biofuel production more than doubled between 2014 and 2020, from 274,200 to 644,000 tons. Over the same period, palm oil and palm oil by-products, as a proportion of total biofuel feedstocks, rose from 48.2% to 55%.

In the past, biodiesel was widely praised as an eco-friendly fuel due to the heavy use of WCO in its production. But a rise in biodiesel production, and greater demand for WCO, have meant an ever-greater reliance on alternative biodiesel feedstocks. Palm oil and palm oil by-products are now the largest feedstock for biodiesel production, increasing from 43.2% of total feedstocks in 2009 to 63.5% in 2020. Over this period, imports of palm oil and palm oil by-products quadrupled from 122,000 tons to 488,300 tons.

Bio-heavy oil is another fuel once commended as eco-friendly, due to its use of pitch left over from the biodiesel production process. But the proportion of this by-product's use in bio-heavy oil production has decreased from 30.9% in 2014 to 18.3% in 2020. Meanwhile, the proportion of imported feedstocks rose from 53.1% to 73.4% over the same period. These imports are dominated by palm oil and palm oil by-products, alongside cashew nut shell liquid (CNSL).

The expansion of biofuel production has led to a sharp increase in the import of palm oil and palm oil by-products. Imports from Malaysia and Indonesia, the world's largest palm oil producers, have more than doubled over the past decade. For Indonesia alone, the increase has been tenfold.

Palm Oil Production Causing Environmental and Social Harm

As Korea's demand for bioenergy expands, the government has been encouraging companies to develop overseas agricultural and forestry resources to secure feedstocks. The Overseas Agriculture and Forest Resources Development and Cooperation Act of 2011 enabled loans totaling 72.435 billion won (USD 63 million) to be provided to Korean companies developing palm oil production.

However, palm oil production is linked to environmental and human rights abuses. In Indonesia and Malaysia, palm oil production has resulted in massive deforestation. This results in the destruction of biodiversity, and the release of GHGs. Palm oil production has also caused the loss of peatlands, a critical carbon sink. The result is that biofuels that are supposed to reduce GHG emissions, can do more harm than the fossil fuels they are replacing.

Acquiring land for palm oil plantations has often come at the expense of smallholder farmers and indigenous peoples. In the process, such peoples are often denied access to land they once farmed, or forests where they once collected food. Access to water is also undermined, as the chemicals used on plantations pollute local waterways, preventing local use of this essential resource. Those who resist often face oppression, with environmental and human rights defenders operating at great risk. Workers in palm oil plantations often perform long hours of high-risk work, for low wages. For women workers, they face unique risks to their health, as they are often assigned to the spraying of chemicals, alongside the risk of sexual exploitation.

International condemnation of such abuses has led many in the palm oil industry to pursue greater corporate responsibility. This has resulted in many companies and investors adopting No Deforestation, No Peat, No Exploitation (NDPE) policies. However, among Korean companies in the palm oil industry, the adoption of such policies remains extremely low.

Environmental and Social Standards Emerging for Biofuels

In the European Union (EU) and the United States (US), efforts are underway to establish environmental and social standards for biofuels. In both the EU and the US, biofuels are classified by feedstocks, with special attention paid to crop-based biofuels, such as palm oil. This is because such feedstocks often have the greatest social and environmental impacts, and can result in food insecurity and competition.

Despite its strong goals for increased renewable energy use, the EU has placed limits on the use of crop-based biofuels. For such biofuels used in road and rail transport, total national energy consumption is limited to 7%. In addition, biofuel feedstocks that pose a high risk to forests and peatlands, such as palm oil, will be phased out by 2030. In the US biofuel standards have focused on GHG emissions reductions relative to fossil fuels that would have been used. Biofuels are only recognized as renewable if they meet a certain level of reductions. In Korea, nothing beyond basic fuel quality standards yet exists.

What We Propose

If biofuels continue to be produced in the same way as they are now, they will not only cause environmental and social harm, but they will fail to achieve their stated goal of reducing GHG emissions. Therefore, the following recommendations are made so that biofuels can play a meaningful role in the fight against climate change while avoiding damage to the environment and the people involved.

1. In order to recognize biofuels as a renewable energy source, the government must establish eligibility standards that take into account environmental and social impacts. In particular, the use of crop-based biofuels, such as palm oil, which competes with food production and is highly dependent on imports, should be restricted and phased out in the mid to long term.

2. The government should recognize that the use of biofuels perpetuates the use of diesel vehicles, thus undermining GHG emissions reductions. The government should speed up the elimination of all internal combustion engine (ICE) vehicles.

3. The government should stop issuing RECs to bio-heavy oil power plants, as it undermines the deployment of cleaner renewable energy sources. The government should also seek to end the use of bio-heavy oil power plants outside of emergency use.

4. Biofuel producers should establish and implement environmental and social policies that apply to the entire supply chain in order to identify and respond to environmental and human rights risks.

5. The government should enact laws to make it mandatory for businesses to implement supply chain due diligence, particularly in regards to deforestation.

Preface

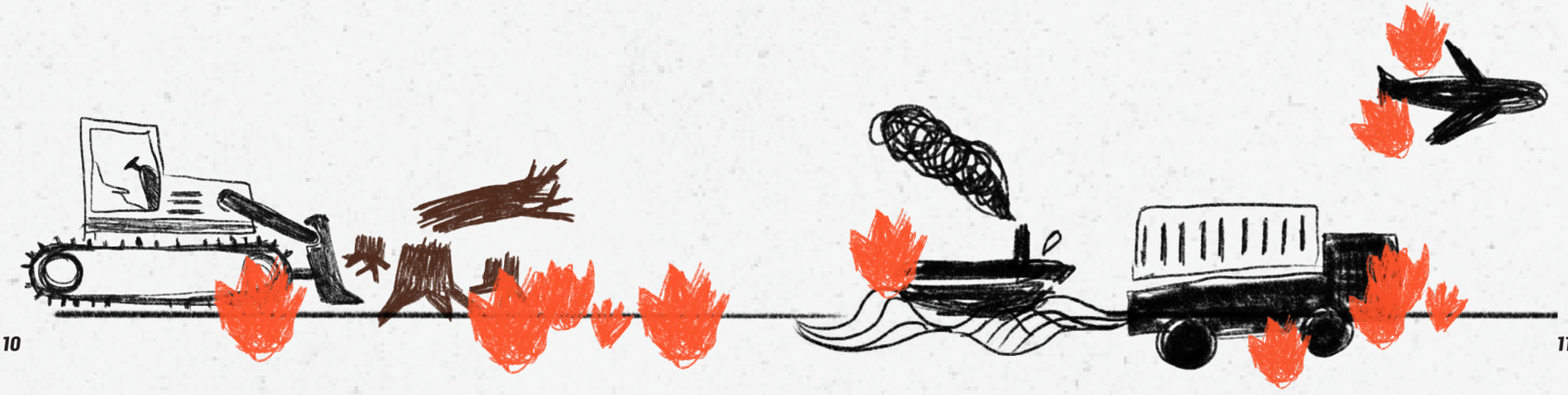
2021 has shown us what awaits the planet if we fail to address the climate crisis. Massive wildfires and horrific flooding have shown us just how vulnerable we all are to a changing climate. But we know that it will be the world's poorest and most vulnerable who will be impacted the most by a warming planet.

In the meantime, the world's leaders allay fears with the promise of future clean fuels, eco-friendly products, and sustainable certification systems. Sipping from reusable tumblers, they talk of new technologies that will save us all. This obscures the reality that major cuts in emissions have to happen today.

Central to this is the energy transition; a necessity, not an option. But laid before us are a variety of energy sources, and all are labeled renewable. In Korea, biofuels are viewed as a renewable silver bullet that solves many of the country's transportation and electricity emissions. But such biofuels come from palm oil, from tropical countries, with vast rainforests. Palm oil production comes at the cost of deforestation, alongside carbon emissions, biodiversity loss, and rights abuses of workers and indigenous peoples alike.

A growing knowledge of these problems has led to restrictions on crop-based biofuels, such as palm oil, emerging worldwide. In both the EU and the US, new standards are being introduced to take into account the impact of biofuels on GHG emissions, land-use change, biodiversity conservation, and competition with food resources. In the EU, palm oil in biofuels is to be phased out by 2030. In Korea, no such environmental or social standards have been introduced.

Through this report, the Korean Federation for Environmental Movements, Solutions for Our Climate, and Advocates for Public Interest Law aim to highlight problems and identify solutions in the biofuel industry. We hope that this report can provide a better understanding of biofuels' role in the coming climate crisis.



1. Biofuels Overview

In response to the climate crisis, policy support and investment in renewable energy sources continue to grow. In Korea, biofuels are subsidized by the government as they are recognized as renewable energy sources under the Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy (hereinafter New/Renewable Energy Act) and its subordinate statute, the New/Renewable Energy Portfolio Standard (RPS). In these acts, the term renewable energy includes solar power, solar heat, wind power, hydropower, marine power, geothermal power, hydrothermal power, bioenergy, and waste-to-energy. The term new energy incorporates new fossil fuel-based power sources, such as grey-hydrogen fuel cells, and integrated gasification combined cycle technologies.

Bioenergy encompasses both biomass, such as wood pellets burnt for electricity production, and biofuels, such as liquid fuels produced from food crops. Biofuels are an energy source derived from plant, microbial or animal materials, and can come in gas, liquid, or solid forms. Important biofuels include bioethanol, biogas, biodiesel, and bio-heavy oil. The latter two are the focus of this report.

The standards and scope for regulating bioenergy are specified in the New/Renewable Energy Act and its related Enforcement Decree. In this report, "biofuel" follows the bioenergy standards specified in domestic laws and regulations, but our scope is limited to "biodiesel and bio-heavy oil, which are liquid fuels converted from animal and plant oils, and fats."[1] Therefore, this report is focused on biodiesel and bio-heavy oil, and related government policies and recent statistical data.

Biodiesel is produced by physically or chemically treating various oils and converting them into liquid fuels. In Korea, the main feedstocks for biodiesel are palm oil, palm oil by-products, and waste cooking oil (WCO). On the other hand, bio-heavy oil is a unique Korean fuel term and is defined as a liquid biofuel made by reacting animal and vegetable oils, fatty acid esters, and mixtures thereof with methanol or ethanol.[2] The feedstocks for bio-heavy oil are primarily palm oil by-products, and pitch left over from the biodiesel production process. In earlier periods bio-heavy oil was produced from about 50% palm oil, but this has declined to less than 5% now.

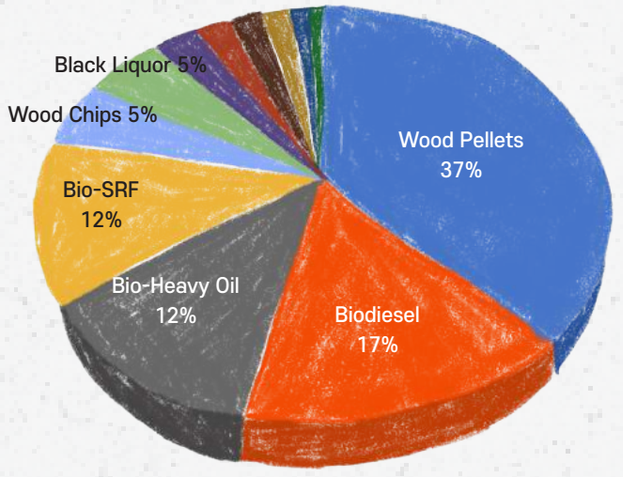
As of 2019, Korea's energy production from all bioenergy sources reached 4,162,427 toe (tonne of oil equivalent). This is roughly 27% of Korea's total domestic renewable energy production of 15,539,093 toe.[3] The following table identifies the annual changes in bioenergy generation by energy sources. The energy production of palm oil-based biofuels, namely biodiesel and bio-heavy oil, accounted for about 29% of total bioenergy production in 2019.

[Table1] Current New/Renewable Energy Production in Korea[4]

(unit: toe)

Source	2015	2016	2017	2018	2019
Renewable Energy	13,061,532	13,860,688	15,861,216	17,098,676	15,539,093
Bioenergy	2,765,657	2,765,453	3,598,782	4,442,376	4,162,427
Biogas	108,734	95,000	98,123	91,740	96,281
Landfill Gas	75,804	71,133	77,036	65,179	75,518
Biodiesel	441,345	442,859	428,053	683,234	699,713
Wood Chips	373,308	223,392	122,443	140,232	226,865
Coal Briquettes	15,828	15,432	15,663	17,221	16,505
Forest Fuel	44,790	123,810	648,298	674,167	131,073
Wood Pellets	823,763	817,172	1,099,049	1,486,488	1,543,390
Waste Wood	103,998	82,395	75,605	73,771	66,663
Black Liquor	231,008	228,848	230,016	218,902	205,286
Sewage Sludge Solid Fuel	78,484	77,843	100,749	114,451	102,061
Bio-Solid Refuse Fuel	208,392	281,394	437,734	532,943	510,194
Bio-Heavy Oil	260,203	306,175	266,012	344,048	488,877

[Figure1] 2019 Bioenergy Production Korea



According to Korean domestic data, bioenergy accounts for more than 25% of total new/renewable energy generation in terms of both energy production and electrical generation. The large amount of bioenergy electrical generation is a result of the high utilization rates of bioenergy power plants. This utilization rate, or capacity factor, refers to the ratio of actual generation to the maximum available power generation per year, including when the power plant cannot be operated due to breakdown or maintenance. The utilization rate of power plant units that use bio-heavy oil or biomass is particularly high, resulting in a large amount of bioenergy generation. For example, in 2019 the utilization rate of bio-heavy oil power plants was more than 60%, while wind power stood a 20%, hydropower at 17%, and solar power at 12%.[5] While power plants using bio-heavy oil are in steady operation, other renewable energy generation is falling behind.

CPO Mill in Indonesian Oil Palm Planation
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2. Korean Domestic Biofuels: Policies and Consumption

1) Biofuel Subsidies and Renewable Fuel Standards

Under Korea's New/Renewable Energy Act, biofuels are defined as a renewable energy source, and thus can be used to fulfill power generation utilities' new/renewable energy production obligations. Utilities can burn bio-heavy oil, alongside other fuels, in existing oil-fired power units, instead of investing in new solar or wind generation. Under this act, utilities with a total generation capacity of more than 500 MW (excluding new/renewable energy plants), are obliged to supply at least a certain percentage of their power generation through new/renewable energy. In addition, tradable New/Renewable Energy Certificates (REC) are earned on new/renewable energy produced, multiplied by the energy source weight. Currently, bio-heavy oil has a weight of 1.0.???** (Footnote: See footnote 2.)

Through such policies and related legislation, the Korean government is encouraging the increasing production of biofuels. The replacement of existing fuel oil (Bunker C oil) with bio-heavy oil in the electricity sector is a result of Article 5 of the Enforcement Decree of the Petroleum and Alternative Fuel Business Act. In the transportation sector, biofuels are encouraged under the New/Renewable Energy Act, as since 2015 transportation fuel suppliers have been obliged to mix a certain ratio of biodiesel with existing fossil fuels.

2) Biofuel Policies and Consumption

Biodiesel Policies and Consumption

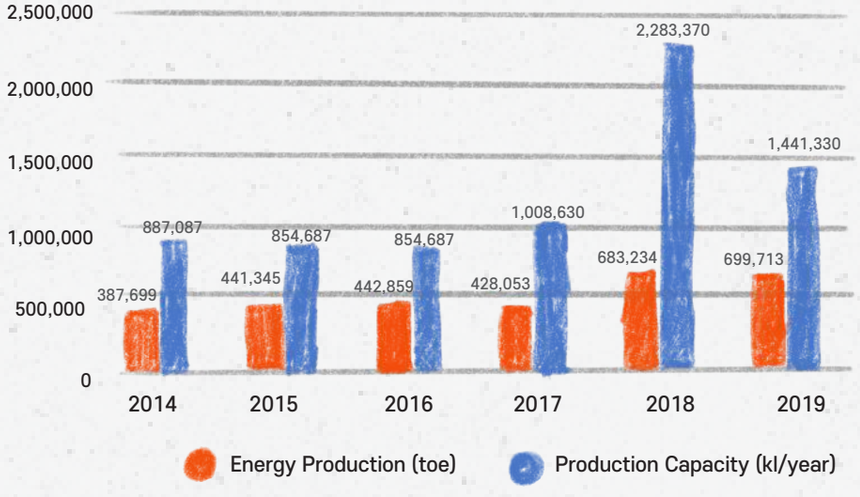
In 2006, Korea's government and oil refiners came to a voluntary agreement to add 0.5% biodiesel to diesel fuels for automobiles nationwide, following a pilot project in 2002. The government granted tax incentives for biodiesel to promote its distribution. This was made possible by amending the Restriction of Special Taxation Act in 2007 to exempt biodiesel from transportation, energy, and environmental taxes. The duty-free period lasted from 2008 to 2011. From 2012, with the duty-free period ended, a new fuel quality standard was established for diesel fuels, enforcing a biodiesel blending minimum of 2%, and a maximum of 5%.

This effectively marked the beginning of Korea's renewable fuel standards (RFS) system, but RFS were not officially enacted into law until 2015. The mandatory blending ratio of biodiesel in automotive diesel was 2.5% from August 2015 to 2017, 3.0% from 2018 to June 2020, and 3.5% from July 2021. According to Appendix 6 of the Enforcement Decree of the New/Renewable Energy Act, regarding "the calculation formula for mixing amount," the mixing ratio of biodiesel will be increased by 0.5% every year until reaching 5% by 2030.

There are a total of seven domestic biodiesel producers in Korea, each with the following percentage of market share: SK Eco Prime (33%), Aekyung Petrochemical (17%), Dansuk Industrial (14%), GS Bio (14%), JC Chemical (12%), EMACBIO (6%), and ECOSolutions (4%).[6] All companies also export biodiesel manufactured in Korea. Exports in 2020 totaled USD 236.7 million, an increase of more than 86% compared to the previous year. Considering current growth rates, exports are expected to increase further this year.

The following graph analyzes trends in biodiesel production capacity and energy production over the past 6 years. There was one sharp increase in production capacity in 2018, and thereafter it decreased, but there was no significant change in energy production.

[Figure 2] Biodiesel Production Capacity and Energy Production[7]

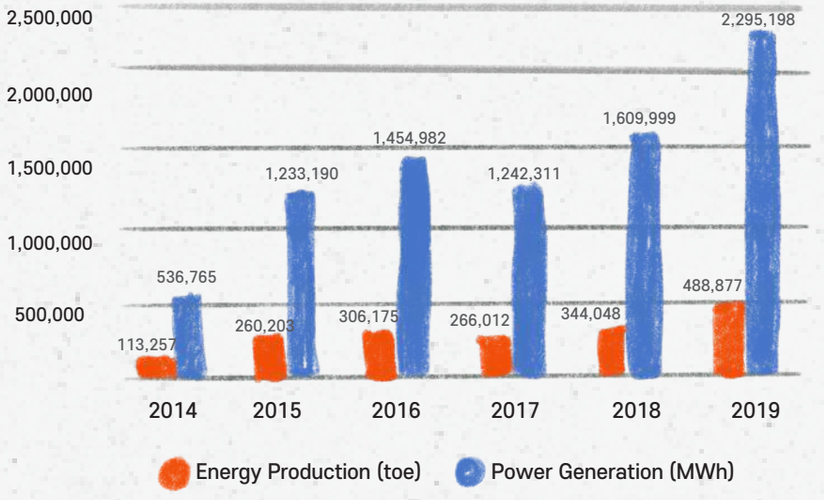


Bio-Heavy Oil Policies and Consumption

Utilities subject to the RPS system have started to switch their oil-fired power plant units from Bunker C oil to bio-heavy oil in order the required new/renewable energy quotas. In the Korea Petroleum Research Institute's pilot bio-heavy oil project, conducted from 2014 to 2019, five subsidiary utilities of the Korea Electric Power Corporation (KEPCO) participated, with each providing one power plant for the pilot program. The participating power plants were the Pyeongtaek Thermal Power Plant of Korea Western Power, Daegu Cogeneration Power Plant of Korea District Heating Corporation, Ulsan Energy of Korea East-West Power, Jeju Thermal Power Station of Korea Midland Power, and South Jeju Thermal Power Plant of Korea Southern Power. 21 biofuel producers were also selected to partake in the pilot project. Commercialization (full supply) of bio-heavy oil for power generation started in March 2019. In September of the same year, the New/Renewable Energy Act was amended to include bio-heavy oil and assign it an REC weight.

The table below shows annual power generation (MWh) and energy production (toe) from bio-heavy oil over the past 6 years. It shows a steady increase in power generation, especially between 2014 and 2019 when production tripled.

[Figure 3] Bio-Heavy Oil Power Generation and Energy Production[8]



At present, two Korean power plants have been completely converted to bio-heavy oil and both are on the southern island of Jeju: Jeju Thermal Power Station run by Korea Midland Power, and the South Jeju Thermal Power Plant operated by Korea Southern Power. The plants have a combined capacity of about 350 MW. These two plants consume about 75% of domestically-used bio-heavy oil. The remaining bio-heavy oil is used by KEPCO's other subsidiary utilities. There are nine biofuel producers supplying fuel to these power plants, including EMAX solutions and Dansuk Industrial, with an annual production capacity of about 2.14 million kiloliters.

The following table shows the amount of bio-heavy oil supplied to the five KEPCO subsidiary utilities.

[Table 2] Bio-Heavy Oil Supplied to Five KEPCO Subsidiary Utilities

Utility	2014	2015	2016	2017	2018	2019
Korea Midland Power	73,582	110,857	126,633	117,309	122,853	193,895
Korea Western Power	1,627	4,958	4,308	0	982	0
Korea Southern Power	94,061	176,574	200,221	173,081	175,151	219,461
East-West Power	10,083	60,200	110,371	156,812	149,043	141,638
Korea District Heating Corporation	0	695	2,085	2,256	1,729	0
Total Supply (kL)	179,353	353,284	443,618	449,458	449,758	554,994

* As of 2021, Korea Midland Power's bio-heavy oil power plant units (2 units of 75 MW), and those of Korea Southern Power (2 units of 100 MW) run on 100% bio-heavy oil, while East-West Power's units (3 units of 400 MW) use 80% bio-heavy oil.

3) Case Study: Jeju Island Bio-Heavy Oil Power Plants

Fossil Fuel and Bio-Heavy Oil Power Plants on Jeju Island

When Koreans think of the island of Jeju, off the southern coast of the Korean peninsula, they usually think of pristine nature and eco-friendliness. However, when it comes to energy generation, this is far from the truth. Due to the nature of the island's topography, Jeju Island has long relied on fossil fuel power plants, which currently provide about 60% of the island's electricity. The table below shows the power generation performance of each power generation source on Jeju Island over the past two years.

[Table 3] Power Generation by Source in Jeju Region, 2019-2020

Unit: MWh

Source	Power Generation		Rate of Increase (%)	Share (%)	
	2019	2020			
HVDC from Mainland	1,807,934	1,689,556.0	-6.5	**29.7**	
Steam Turbine	1,852,074	1,366,890.0	-26.2	**24.1**	
Combustion	265,458	124,747.0	-53.0	**2.2**	
Gas Turbine	7,369	0.0	-	-	
Combined Cycle	965,253	1,490,519.0	54.4	**26.3**	
Waste	6,767	86,892.0	1184.1	**1.5**	
Wind	548,487	580,344.0	5.8	10.2	
Solar	252,368	326,927.0	29.5	5.8	**16.2**
Other	14,350	11,841.0	-17.5	0.2	
Total	5,720,060	5,677,716.0	-0.7	**100.0**	

As of December 2020, the total fossil fuel power plant capacity on Jeju Island was 910 MW. In February 2021, the maximum power demand on Jeju Island was 985 MW, meaning fossil fuel power generation is able to satisfy a significant amount of maximum power demand by itself. The total power generation capacity on Jeju Island is 1,532 MW as of December 2020, and about 59.3% of that capacity is from fossil fuel power plants. In terms of power generation output, a total of 5,677,716 MWh of electricity was produced or transmitted to Jeju Island in 2020, of which fossil fuel power generation on the island accounted for 52.5% (2,982,156 MWh). The next largest source was power from the mainland, provided by HVDC submarine cable, accounting for 29.7% (1,689,556 MWh). Jeju Island remains dependent on fossil fuel power generation.[9]

New liquefied natural gas (LNG) supply to the island saw the construction of a new LNG power plant on Jeju Island, but this has not stopped the use of existing oil-fired power plant units.[10] Rather than replacing oil-fired generation with supposedly cleaner LNG, the result has been an overall increase in fossil fuel power generation. Fossil fuel power plant capacity has continued to increase, with 635 MW in 2017, 777 MW in 2018, and 798 MW in 2019. Last year, it increased to a whopping 910 MW. In addition, there are also oil-fired power generation units still in place, with a combined capacity of 430 MW. As to fuels used, 80 MW of capacity is produced from Bunker C oil, and 350 MW comes from units converted to use bio-heavy oil.

[Table 4] Power Generation Capacity by Source Jeju Island (As of Late December 2020)

Unit: MW

Source	2019	2020
Steam Turbine	350	350
Combustion	80	80
Gas Turbine	55	-
Combined Cycle	313	480
Wind	290	295
Solar	253	299
Other	9	28
Total	1351	1532

[Table 5] Bio-Heavy Oil Power Plants by Utility, Jeju Island

Utility	Power Plant Name	Capacity (MW)	No. of Units	Completion Date	Lifetime
Korea Midland Power	#2, #3 Jeju Steam Turbine #2, #3	150	2	#2: 03/2000 #3: 12/2000	30 years
South Jeju Power Headquarters	#1, #2 South Jeju	200	2	#1: 09/2006 #2: 03/2007	30 years

Korea Midland Power and Korea Southern Power, which initially operated fossil fuel power plants on Jeju Island, assumed that when the LNG power plant was built on the island, the existing oil power plant would be used as an emergency power source only. This assumption was spelled out to residents by Korea Midland Power during its resident briefing session on the new plant's Environmental Impact Assessment. The utility was the first to promote the construction of an LNG power plant on Jeju Island and alleviate pollution for residents by replacing dirty oil with cleaner LNG. However, this position changed significantly in 2014, when the company announced that the old oil power plant units would be converted to bio-heavy oil and put back into use. Nonetheless, the utilities still claimed that bio-heavy oil was an eco-friendly fuel, effective at reducing air pollution and responding to the climate crisis.

As of late December 2020, the bio-heavy oil power plant units in operation on Jeju Island are Jeju Steam Turbine Units 2 and 3 (75 MW each) owned by Korea Midland Power, and South Jeju Units 1 and 2 (100 MW each) of Korea Southern Power. Power generation in 2020 was 600,027 MWh for Korea Midland Power and 764,205 MWh for Korea Southern Power. The amount of bio-heavy oil used was 170,760,400 liters by Korea Midland Power and 218,278,214 liters by Korea Southern Power. The total amount of bio-heavy oil used on Jeju Island in 2020 was 389,038,614 liters.

[Table 6] Bio-Heavy Oil Power Plant Generation and Fuel Consumption by Utility, Jeju Island (As of Late December 2020)

Utility	Power Generation (MWh)	Fuel Consumption (L)
Korea Midland Power	600,027	170,760,400
Korea Southern Power	764,205	218,278,214
Total	1,364,232	389,038,614

Problems with Bio-Heavy Oil Power

The bio-heavy oil power plants on Jeju Island contribute to the climate crisis, despite their promotion as being eco-friendly. Most of the fuel supplied to these power plants is imported palm oil and palm oil by-products. Palm oil plantations cause local ecosystem destruction, environmental pollution, and contribute to the climate crisis.

In fact, doubts about whether bio-heavy oil generation is truly eco-friendly only deepen when you look at the interviews of power generation business officials reported in the media.[11] When burnt, bio-heavy oil, like its petroleum oil counterpart, emits carbon dioxide, sulfur oxides, nitrogen oxides, and particulate matter (fine dust). Bio-heavy oil still emits 70-80% of the pollutants of petroleum heavy oil. Therefore, promoting its eco-friendliness in response to the climate crisis or local air pollution is at best misleading.

A bigger problem is that biofuels, while promoted as an alternative to fossil fuels, are not reducing overall fossil fuel power generation. With the introduction of LNG power plant units, the scale of fossil fuel power generation on Jeju Island increased and resulted in an excess of power generation facilities on the island. This is an obstacle to the spread of other renewable energy sources, such as wind power. Rather than encouraging renewable energy, excessive power generation is forcing the government to curtail wind generation. In 2020, wind power generation was curtailed a whopping 77 times. In 2021, it is expected that forced curtailment could occur anywhere from 100 to 200 times. This will also be applied to solar power plants with a scale of 1 MW or larger, undermining cleaner renewable energy and the overall goal of reducing fossil fuel power generation.

If power plants that use petroleum heavy oil and bio-heavy fuel oil were only used for emergency power supply, as promised, the current issue of excess energy and renewable curtailment would not have occurred. As a result, bio-heavy oil has ended up displacing other renewable energy sources. It is clear that maintaining bio-heavy oil power generation hinders the supply of other renewables, negatively affects the overall energy policy of the region and is a poor response to the climate crisis.

Korea Midland Power's Bio-Heavy Oil Power Plant, Samyang-dong, Jeju City
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3. Biofuel Feedstocks

Biofuels That Make Energy Independence Impossible

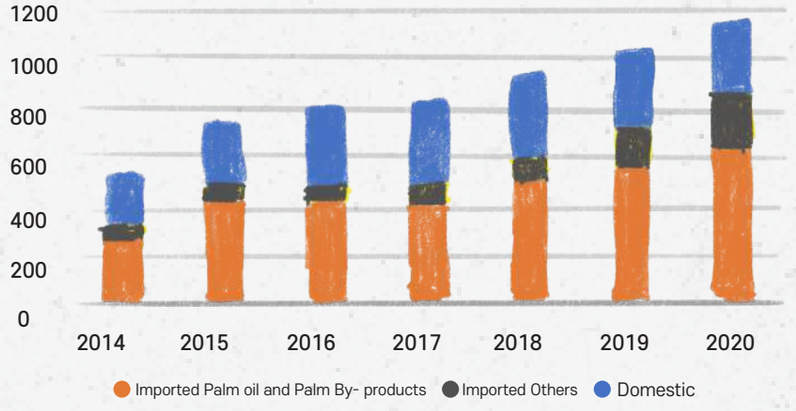
The most used feedstocks for biofuel production are palm oil and palm oil by-products. According to the Korea Bioenergy Association the amount of palm oil, palm oil by-products, and Refined Bleached Deodorized Palm Oil (RBDPO) imported to produce biodiesel and bio-heavy oil more than doubled from 2014 to 2020, from 274,200 tons to 644,000 tons.[12] In addition, the proportion of palm oil and palm oil by-products as a percentage of total biofuel feedstocks increased from 48.2% to 55% over the same period.

[Table 7] Biofuel Feedstocks Current Status of Supply and Demand

(Unit : 1,000 ton)

		2014		2015		2016		2017		2018		2019		2020	
Total		568.9		740.43		795.6		831.7		942.6		1063.8		1170.6	
Imported	Imported Palm oil and Palm By-products	317.7	274.2	463.2	410.9	477.3	411.2	493.7	388.3	614.3	516.1	755	568.9	879.8	644
	Imported Others		43.5		52.3		66.1		105.4		98.2		186.1		235.8
Domestic		251.2		277.23		318.3		338		328.3		308.8		290.8	

[Figure 4] Biofuel Feedstocks Current Status of Supply and Demand



1) Biodiesel Feedstocks

Biodiesel's Increasing Dependence on Imported Palm Oil

Palm oil and palm oil by-products account for the largest proportion of feedstocks for Korea's biodiesel, and all are entirely dependent on imports. For the five member companies of the Korea Bioenergy Association, imports for biodiesel quadrupled from 59,000 tons of RBDPO and 63,000 tons of palm oil by-products in 2009 to 151,300 tons of RBDPO and 337,000 tons of palm oil by-products in 2020. In 2009, palm oil and palm oil by-products accounted for 43.2% of total biodiesel feedstocks, in 2020 they had risen to 63.5%, showing their growing importance for biodiesel production.

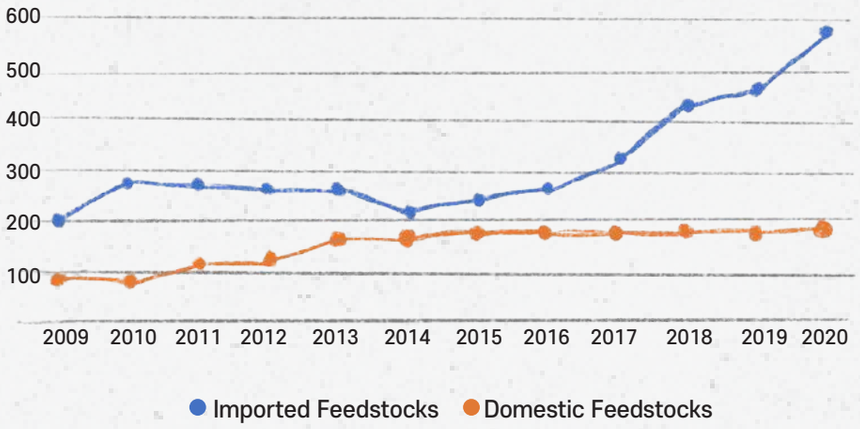
In the case of soybean oil used for biodiesel production, 52,000 tons were imported in 2009, accounting for 18.4% of total feedstocks, while in 2020 it was only 16,000 tons or 2.1%. As a result of this decrease, the source of imported biodiesel feedstock appears to have been diversified, with 24,900 tons of "other" feedstocks imported in 2019, including rapeseed oil, palm oil, and cottonseed oil, and a year later 3,100 tons of beef tallow was imported.

[Table 8] Current Status of Supply and Demand of Biodiesel Feedstocks[13]

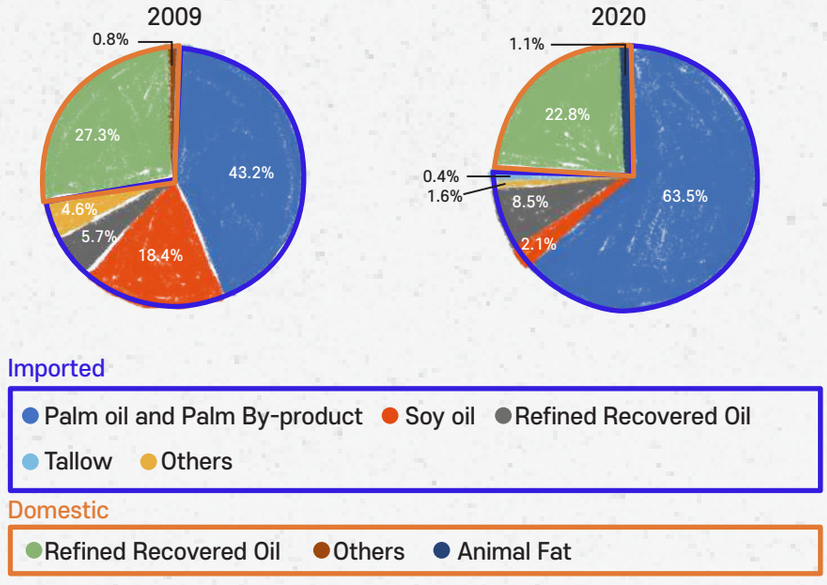
classification		2009		2010		2011		2012		2013		2014	
		Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)
Domestic	Refined Recovered oil	77	27.3%	78	21.8%	109	28.4%	121	31.4%	150	35.1%	144.3	37.6%
	Animal Fat	-	-	-	-	-	-	-	-	13	3.0%	14.9	3.9%
	Others	2.2	0.8%	-	-	3	0.8%	-	-	0.5	0.1%	5.3	1.4%
	Sub-total	79.2	28.1%	78	21.8%	112	29.2%	121	31.4%	163.5	38.3%	164.5	42.8%
Imported	Soy Oil	52	18.4%	80	22.3%	34	8.9%	19	4.9%	12	2.8%	3.5	0.9%
	Palm By-product	63	22.3%	102	28.5%	115	29.9%	136	35.3%	187	43.8%	154.8	40.3%
	Refined Palm Oil	59	20.9%	69	19.3%	74	19.3%	62	16.1%	12	2.8%	21.4	5.6%
	Refined Recovered Oil	16	5.7%	25	7.0%	35	9.1%	38	9.9%	44	10.3%	34.8	9.1%
	Tallow	-	-	-	-	-	-	-	-	3.2	0.8%	-	-
	Others	13	4.6%	4	1.1%	14	3.6%	9	2.3%	5.3	1.2%	5.2	1.4%
	Sub-total	203	71.9%	280	78.2%	272	70.8%	264	68.6%	263.5	61.7%	219.7	57.2%
Total		282.2	100%	358	100%	384	100%	385	100%	427	100%	384.2	100%

classification		2015		2016		2017		2018		2019		2020	
		Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)
Domestic	Refined Recovered oil	147.1	34.9%	151.6	34.1%	151.3	30.3%	162.8	26.5%	160.9	25%	175.4	22.8%
	Animal Fat	27.4	6.5%	26	5.8%	21.2	4.2%	17.1	2.8%	16	2.5%	8.7	1.1%
	Others	4.5	1.1%	2.6	0.6%	2.7	0.5%	0.6	0.1%	0.7	0.1%	-	-
	Sub-total	179	42.5%	180.2	40.5%	175.2	35.1%	180.5	29.4%	177.6	27.6%	184.1	23.9%
Imported	Soy Oil	2.8	0.7%	1.5	0.3%	8.2	1.6%	4.9	0.8%	1	0.2%	16	2.1%
	Palm By-product	169.6	40.3%	208.6	46.9%	241.7	48.4%	250.1	40.8%	336.7	52.4%	337	43.8%
	Refined Palm Oil	28.3	6.7%	27.6	6.2%	43.7	8.8%	158.7	25.9%	97.1	15.1%	151.3	19.7%
	Refined Recovered Oil	34.5	8.2%	23.5	5.3%	14.3	2.9%	11.4	1.9%	5.4	0.8%	65.2	8.5%
	Tallow	-	-	-	-	-	-	-	-	-	-	3.1	0.4 %
	Others	7.1	1.7%	3.1	0.7%	16.2	3.2%	8.1	1.3%	24.9	3.9%	12.6	1.6%
	Sub-total	242.3	57.5%	264.3	59.5%	324.1	64.9%	433.2	70.6%	465.1	72.4%	585.2	76.1%
Total		421.3	100%	444.5	100%	499.3	100%	613.7	100%	642.7	100%	769.3	100%

[Figure 5] Changes in Ratio of the Imported/ Domestic Feedstocks for Biodiesel



[Figure 6] Changes in Feedstocks for Biodiesel



Domestic Waste Cooking Oil's Declining Role

The reason biodiesel is often portrayed as aiding environmental protection is that it can be produced from WCO, or what the Korean government refers to as refined recovered oil. WCO is collected from large catering establishments such as schools, apartment complexes, and restaurants, and large users of oil, such as Korea's ubiquitous fried chicken restaurants. In 2009, 77,000 tons of WCO were used as a feedstock for biodiesel in Korea. As biodiesel production increased, the amount of WCO input also increased steadily, reaching 175,400 tons in 2020. This is close to the maximum amount of WCO that can be secured in Korea. In concert, imports increased almost fourfold between 2009 and 2020, from 16,000 tons to 65,200 tons.

The proportion of WCO in biodiesel is gradually decreasing, undermining claims that the fuel helps protect the environment by promoting a circular economy. In the case of domestic WCO, it accounted for 27.3% of biodiesel production in 2009, but only 22.8% in 2020. Imported WCO increased significantly from 16,000 tons in 2009 to 65,200 tons in 2020, but its proportion in biodiesel production decreased from 33% to 31.3%. Moreover, it is estimated that most of the imported WCO comes from China, and opening Korea to potential future supply chain risks.[14]

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2) Bio-Heavy Oil Feedstocks

The most important feedstocks for bio-heavy oil are palm oil by-products and biodiesel production process by-products. Palm oil by-products account for the largest proportion of feedstocks, alongside various feedstocks such as palm oil mill effluent, palm acid oil, oleo-pitch, oleochemical refining by-product, soybean, and rapeseed oil by-products, and dark oil. All of these feedstocks are entirely dependent on imports. 2,500 tons of palm oil by-products were imported in 2014, and 136,200 tons in 2020.[15]

Among other imported feedstocks, cashew nut shell liquid (CNSL) use is steadily increasing alongside palm oil and palm oil by-products. CNSL is also entirely dependent on imports. In 2016 4,400 tons were imported, but in 2020 68,200 tons were imported, with Vietnam the main country of origin.[16]

Meanwhile, pitch left over from the biodiesel production process is a key feedstock for bio-heavy oil, but its share, relative to other feedstocks, is continuously decreasing. Among the feedstocks for bio-heavy oil, biodiesel by-products accounted for 30.9%, or 57,100 tons, in 2014, but only 18.3%, or 73,500 tons, in 2020. However, strictly speaking, biodiesel itself is produced largely from imported feedstocks, so domestically produced biodiesel by-products are effectively imports.

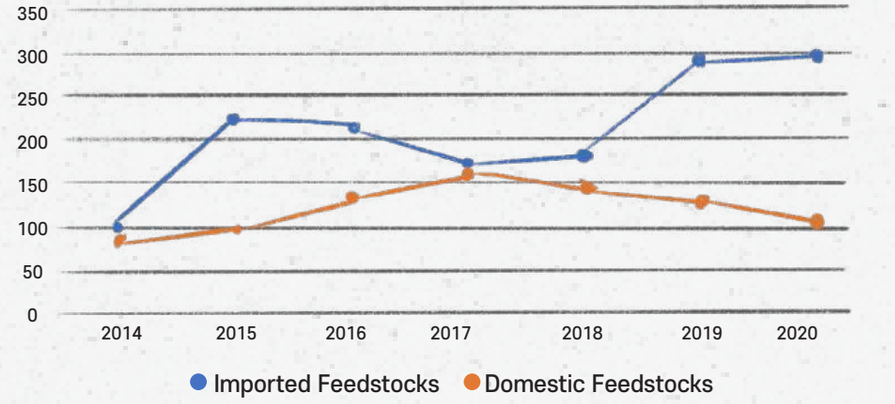
Much effort is being put into securing feedstocks for bio-heavy oil production, both at home and abroad. For example, since 2015, Korea has been using WCO recovered from animal and vegetable oils for bio-heavy oil production. In 2015, 3,330 tons of WCO was used for bio-heavy oil production, while in 2020 this increased to 20,400 tons. In addition, the amount of other biodiesel production by-products used as feedstock has also steadily increased, with 44,600 tons of such materials used for bio-heavy oil production in 2019.

However, despite this diversification of feedstocks, the proportion of domestic feedstocks such as pitch, glycerin, waste oil, and animal fat, is steadily decreasing. In 2014, domestic feedstocks totaled 86,700 tons, accounting for 46.9% of the total feedstocks for bio-heavy oil production. But in 2020 it was 106,700 tons, accounting for only 26.6%. On the other hand, the proportion of imported feedstocks increased steadily, from 98,000 tons in 2014, accounting for 53.1%, to 294,600 tons in 2020, accounting for 73.4%.

[Table 9] Bio-Heavy Oil Feedstocks Current Status of Supply and Demand [17]

구분		2014		2015		2016		2017		2018		2019		2020	
		Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)	Used amount (1,00ton)	Ratio (%)
Imported	Refined Bleached Deodorized Palm Oil	75.8	41%	6.7	2.1%	-	-	26	7.8%	8.1	2.5%	15.6	3.7%	4.6	1.1%
	Palm Oil	19.7	10.7%	112.5	35.3%	82.7	23.6%	33.9	10.2%	28	8.5%	37.9	9.0%	14.9	3.7%
	Palm By-products	2.5	1.4%	93.8	29.4%	92.3	26.3%	43	12.9%	71.2	21.6%	81.6	19.4%	136.2	33.9%
	CNSL	-	-	-	-	4.4	1.3%	31.3	9.4%	39.6	12.0%	67.7	16.1%	68.2	17.0%
	Animal Fat	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.1%
	Others	-	-	7.9	2.5%	33.6	9.6%	35.4	10.6%	34.2	10.4%	87.1	20.7%	70.4	17.5%
	Subtotal	98	53.1%	220.9	69.2%	213	60.7%	169.6	51.0%	181.1	55.1%	289.9	68.8%	294.6	73.4%
Domestic	Animal Fat	21.3	11.5%	20.8	6.5%	18	5.1%	12.3	3.7%	9.4	2.9%	5.2	1.2%	9.1	2.3%
	Biodiesel By-product	57.1	30.9%	74.1	23.2%	96.3	27.4%	92.8	27.9%	49.7	15.1%	59.9	14.2%	73.5	18.3%
	Biodiesel	8.3	4.5%	-	-	-	-	-	-	-	-	-	-	-	-
	Food Waste Oil	-	-	3.33	1.0%	13.1	3.7%	35.8	10.8%	20.6	6.3%	21.5	5.1%	20.4	5.1%
	Others	-	-	-	-	10.7	3.0%	21.9	6.6%	68.1	20.7%	44.6	10.6%	3.7	0.9%
	Subtotal	86.7	46.9%	98.23	30.8%	138.1	39.3%	162.8	49.0%	147.8	44.9%	131.2	31.2%	106.7	26.6%
Total		184.7	100%	319.13	100%	351.1	100%	332.4	100%	328.9	100%	421.1	100%	401.3	100%

[Figure 7] Changes in Ratio of the Imported/Domestic Feedstocks for Bio-heavy Oil



3) Imported Feedstocks

Palm Oil Imports

Korea's imports of "palm oil and its fractions" more than doubled from 252,555 tons in 2009 to 598,503 tons in 2020.[18] More than 85% of the world's palm oil production is produced in Indonesia and Malaysia, with Indonesia alone responsible for more than 50% of world palm oil production.[19] Both are critical sources for Korea's imports. Korean imports from Indonesia have increased more than tenfold in the past 10 years, and since 2017 have become comparable or even surpassed imports from Malaysia.

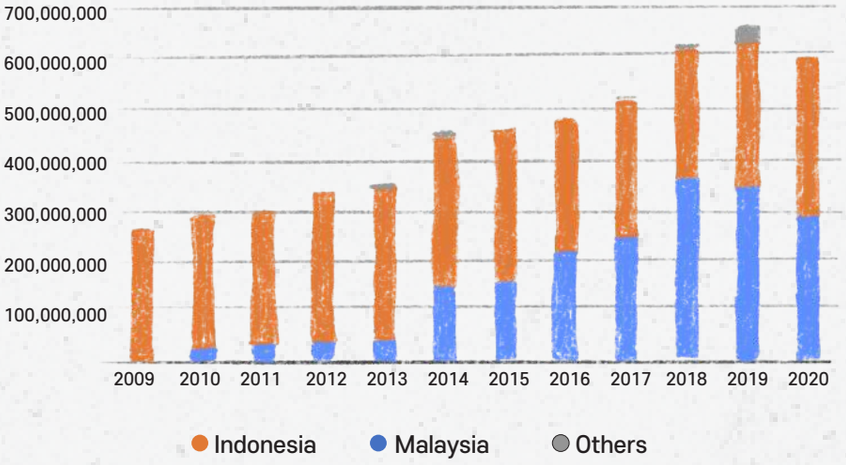
[Table 10] Palm Oil Imports by Country

(Unit : kg)

	2009	2010	2011	2012	2013	2014	2015
Indonesia	787,270	23,727,791	30,046,506	37,972,803	41,916,820	146,763,678	154,932,972
Malaysia	260,144,012	263,988,025	270,169,654	297,329,822	299,091,929	294,754,370	301,591,191
Others	1,624,519	877,626	1,228,549	708,231	1,242,557	9,123,078	2,486,024

	2016	2017	2018	2019	2020
Indonesia	213,134,430.6	241,545,638.4	361,889,505.3	341,462,076.8	283,028,154.2
Malaysia	263,726197.2	275,298,497.2	252,178,430.5	286,386,579.3	313,977,696.6
Others	1,385,536.57	1,163,036.39	2,832,420.44	27347321.41	1497323.21

[Figure 8] Palm Oil Import by Country



Palm oil is used for food processing and biofuel production, and a significant portion of the increase in imports and consumption appears to be attributable to biofuel production. According to the Korean Ministry of Food and Drug Safety, imports of palm oil for food increased almost twelvefold between 2019 and 2020, from 1,575 tons to 18,856 tons.[20] However, this is less than 3% of the 644,000 tons of palm oil used for Korea's biofuel production in 2020. In addition, 70% of palm oil exported from Indonesia to Korea in 2019 was purchased by companies that produce biofuels.[21] In other words, increased biofuel, and in particular biodiesel production, is responsible for an increase in palm oil imports.

Waste Cooking Oil Import Risks

Among the feedstocks for biofuels, imports of WCO have increased significantly, but demand for WCO is increasing not only in Korea but also in Europe. In Europe, the demand for WCO is increasing as the feedstock can be double-counted for carbon credits if used instead of corn, soybean, or palm oil. It has been reported that the increase in European imports of WCO has, in fact, stimulated palm oil production and consumption in WCO exporting countries. [22]

In China, it was found that exported WCO often contained palm oil, ostensibly left over from other uses and mixed in to increase volume. Accordingly, Europe has decided to improve its verification system for the origin of WCO used in biodiesel. Another important improvement, some argue, is to remove the ability of WCO to be double-counted for carbon credits.[23] Since the supply chain for WCO imports to Korea remains opaque, it would be advisable to look at European examples of how to verify supply chains.

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4. Biofuels in the Aviation and Maritime Sectors

Currently, the Korean government is expanding the use of biofuels to achieve its stated goal of carbon neutrality by 2050. In addition to the increase in the mandatory fuel mixing rates for automotive diesel, similar measures are planned for aircraft and ships.[24] In this section we will look at domestic and international efforts to reduce greenhouse gas (GHG) emissions from the aviation and shipping sectors.

1) Biofuels in the Aviation Sector

Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

GHG emissions from the aviation industry account for about 2% of global emissions, and the share continues to increase each year. (National Assembly Legislative Research Service, 2020). In response the International Civil Aviation Organization (ICAO) initiated international discussions on reduction and offset proposals, resulting in the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

CORSIA aims to freeze emissions from the international aviation sector at 2020 levels. Airlines that exceed this are required to purchase offsets. It consists of the pilot operation stage (2021-23), the first stage (2024-26), and the second stage that includes mandatory participation (2027-35). 88 countries, including Korea, have officially announced their participation in CORSIA, from the pilot stage onwards.

Under CORSIA, airlines aim to reduce emissions by 1) improving aircraft operations, 2) improving aviation technology, and 3) developing alternative fuels and/or offsetting emissions. In addition, they are obliged to calculate, report, and verify GHG emissions. However, the industry remains focused on emissions reductions from alternative fuel development and offsetting, as options remain limited for reductions from aircraft operations or technological improvements. Therefore, the role of bio-aviation fuel becomes more important. Currently, bio-aviation fuel accounts for about 0.1% of total aviation fuel usage. The ICAO aims to increase this share to 2% by 2025, 32% by 2040, and 50% by 2050.[25]

Domestic Investment in Bio-Aviation Fuels

Korea is in the process of drawing up plans for the production and distribution of bio-aviation fuel. The Ministry of Land, Infrastructure and Transport announced that it would lay the groundwork for the introduction of bio-aviation fuel through the 2020-2024 Aviation Policy Master Plan. In 2020, the Ministry of Science and ICT set a budget of 1.45 billion won (USD 1.25 million) for research related to bio-aviation fuel production. In addition, the Agency for Defense Development announced in July 2021 that it had developed and secured technology capable of manufacturing about 5 tons of bio-aviation fuel per year from palm oil, and suggested the possibility of using it for mass production in the military and civil aviation sectors. Thanks to such policy signals, the industry is also spurring investment and production of bio-aviation fuel. Hyundai Oilbank and Korean Air have recently signed a memorandum of understanding to cooperate in the production and use of bio-aviation fuel. They plan to cooperate on commercialization research, airport infrastructure establishment, and other policy responses. Hyundai Oilbank is considering establishing Korea's first bio-aviation fuel manufacturing facility at its Daesan plant in Seosan, on Korea's west coast.

Major airlines in countries such as China, the United States (US), Japan, the United Kingdom, and the Netherlands voluntarily formed the Sustainable Aviation Fuel User Group (SAFUG). This international partnership aims to promote the development and commercialization of sustainable bio-aviation fuel. As of December 2020, no Korean airlines have joined this partnership.

2) Biofuels in the Maritime Sector

Sluggish Emissions Reductions Efforts in Maritime Sector

Marine transportation emits about 940 million tons of carbon dioxide annually and accounts for about 2.5% of global GHG emissions.[26] In 2018, the International Maritime Organization (IMO) adopted the Initial IMO GHG Strategy which proposed cutting annual GHG emissions from international shipping by at least half by 2050, compared with their level in 2008. The strategy also proposed reductions in the carbon intensity (carbon dioxide emissions per transport work) of international shipping of at least 40% by 2030 and 70% by 2050, from 2008 levels. The strategy calls for regulations to be rolled out in stages.[27]

Compared to the international aviation sector, the discussion on emissions reductions in the maritime sector has been sluggish, despite the two industries having similar emissions. Environmental groups have pointed out that the IMO's internationally agreed targets remain insufficient.[28]

On January 1, 2020, the IMO's enhanced sulfur oxide regulation came into effect. According to this, ships around the world must reduce the sulfur content of fuel oil from 3.5% to 0.5%. Existing ships need to either install an exhaust gas cleaning system, replace existing engines with LNG engines, or change from fuels like Bunker C oil to a low sulfur alternative.[29]

Countries, particularly in the developed world, are in the process of reorganizing legislation and regulatory systems to reduce shipping emissions. The UK became the first country to begin incorporating international aviation and shipping sector emissions into its national inventory, starting with this year's carbon budget, and the European Parliament is encouraging member states to adopt a similar system.[30]

Minister of Oceans and Fisheries attending 2021 P4G Oceans session
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Preemptive Uptick in Domestic Bio-Heavy Oil Use

Ships account for 9.9% of Korea's particulate matter (fine dust) emissions. In 2016, large ships that use high-sulfur marine fuel oil, were responsible for 34,260 tons of port emissions, or 77% of total port emissions.[31] In Korea, the sulfur content of marine fuel oil is regulated by Article 10 of the Port Air Quality Act, and Article 44 of the Marine Environment Management Act. On December 16, 2019, five major domestic ports were designated as emission control areas with stricter sulfur content standards (0.1%). This was done in accordance with the Marine Environment Management Act and will take effect on September 1, 2020, and apply to all ships that moor at these ports.

In Korea, the Ministry of Oceans and Fisheries has announced its First Framework Plan for the Development and Supply of Eco-Friendly Ships 2021-2030.[32] This plan is linked to Korea's Green New Deal and carbon neutrality pledge, the IMO's GHG Strategy, and the EU's Emissions Trading System. The plan is also referred to as the "2030 Green Ship-K Promotion Strategy."

Through the development and construction of LNG, electric, hydrogen, and other new ships, the ministry plans to reduce GHG emissions from shipping by up to 70% by 2030 and increase the proportion of ships using alternative fuels to 15% (528 out of 3,542 vessels). The government expects to reduce about 400,000 tons of GHG emissions (about 3% of 2017 emissions) and about 3,000 tons of fine dust (about 18% of 2017 emissions).

The domestic bio-heavy oil industry is proposing to expand the use of bio-heavy oil beyond power generation, to the industrial and shipping sectors. Producers promote bio-heavy oil as a way for the Korean shipping industry to cope with stricter sulfur content regulations, although it is unclear how realistic this is.[33]

In August 2020, Hyundai Merchant Marine, Korea Bio-energy Association, Hyundai Heavy Industries, Korean Register, and Korea Shipbuilding & Offshore Engineering signed a memorandum of understanding for a "Bio Ship Oil Demonstration." Each company will have a different role in testing the use of bio-heavy oil in large ships. Hyundai Merchant Marine is in charge of real-world testing of bio-heavy blending on a 13,100 TEU container ship, while Hyundai Heavy Industries and Korea Shipbuilding & Offshore Engineering will work onshore, providing testing facilities and test engines. The Korea Bio-energy Association will promote the commercialization of bio-heavy oil by sharing research on oil blending, while Korean Register is in charge of evaluating data derived from land and sea testing.[34]

5. Supply Chain Risks of Biofuel Production

Korean Palm Oil Plantations and Government Support

As previously mentioned, more than 50% of domestic biodiesel and bio-heavy oil feedstocks depend on imported palm oil and palm oil by-products. Accordingly, the government has been encouraging companies to develop overseas agriculture and forest resources to secure feedstocks for bioenergy.[35] In 2011, the Overseas Agricultural Development and Cooperation Act was enacted, creating a framework for planning, creating investment companies, and developing projects.[36] Accordingly, Korean companies operating palm oil plantations in Indonesia receive government subsidies and loans through the Ministry of Agriculture, Food and Rural Affairs and the Korea Forest Service. Through this, the government has provided a total of 72.435 million won (USD 62,881) in loans to companies operating plantations in Indonesia since 2011.

[Table 11] Korean Companies Operating Palm Oil Plantations in Indonesia, and Government Loan Support[37]

Company	Subsidiary Company	Business Area (Ha)/ Location	Reported Crude Palm Oil Annual Production (Tons)	Loan Support (KRW)	Adoption of NDPE Policy[38]
POSCO International	PT Bio. Inti Agrindo	34,184/Merauke, Papua	80,000	35,427,000,000	Yes (Adopted in 2020, in progres
LG International (now LX International)	PT Parna Agromas PT Tintin Boyok Sawit Makmur PT Tintin Boyok Sawit Makmur Dua PT Grand Utama Mandiri	31,513/Sekadau, West Kalimantan	150,000	9,975,000,000	No
Samsung C&T	PT Gandaerah Hendana PT Inecda Plantation	21,703 (RSPO: 23,830 ha)/ Pelalawan & Indragiri Hulu, Riau	100,000	Not Applicable	Yes (Adopted in 2019)
Daesang Corporation	PT Sintang Raya	11,212 / Kubu Raya, West Kalimantan	35,000	6,924,000,000	No
JC Chemcial	PT Niagamas Gemilang	3,774 (JC Chemical: 7,200 ha)/Kutai Kartanegara, Eastern Kalimantan	45,000	20,109,000,000	No
Total		102,386 ha	410,000 (ton)	72,435,000,000 (KRW)	

In addition to subsidies and loans from the Ministry of Agriculture, Food and Rural Affairs, and the Korea Forest Service, the Export-Import Bank of Korea is also actively providing loans to secure bioenergy feedstocks.[39] However, none of the companies that received funding from the government have exported crude palm oil (CPO) into Korea.[40]

Palm Oil's Environmental and Social Costs

Environmental destruction and human rights violations are widespread issues in palm oil plantations. Palm oil plantations run by Korean companies are no exception.

1) Deforestation, Emissions, and Land Use Changes

Although the feedstocks used for bioenergy in other areas of the economy are becoming more diverse, crop-based biofuels remain dominant in the transportation sector, especially palm, sugar cane, and corn. The expansion of feedstock cultivation for bioenergy production causes direct and indirect changes in land use, potentially resulting in soil damage, deforestation, and greater GHG emissions.

According to the European Commission's 2015 report, "The Land Use Impact of Biofuels Consumed in the EU," palm oil-based biodiesel produces more GHG emissions than equivalent fossil fuels. Furthermore, peatland oxidation further increases GHG emissions from biofuel production. Peatlands are a type of wetlands formed by the centuries-long accumulation of dead plants without decomposition. These can hold 18 to 28 times more carbon than ordinary forests.[41] Indonesia has the fourth-largest area of peatlands in the world, which store an incredible 60 trillion tons of carbon.[42] 69% of palm oil related GHG emissions are a result of peat oxidation in Indonesia and Malaysia.[43]

FFB transported from PT. SR ©Advocates for Public Interest Law

[Korean Company Case]

Korindo

Korindo is an Indonesian-Korean company that owns approximately 160,000 ha of palm oil concessions across eight regencies (municipalities) in the Indonesian provinces of Papua and North Maluku.[44] Seven concessions are in Papua, occupying a combined area of 149,000 ha, and the remaining sites are in North Maluku, occupying 11,000 ha.[45] From 1998 to 2016, more than 50,000 ha of forest was destroyed on Korindo's palm oil concessions.[46] Between 2016 and 2017, Korindo destroyed 4,276 ha of forest in Papua. During the same period, 930 ha of forest was cleared in North Maluku.[47] Korindo is suspected of deliberately setting fires during land clearing activities.[48]

In 2017, the Forest Stewardship Council's (FSC) complaints investigation committee found that Korindo had destroyed more than 30,000 ha of rainforest in the past five years and violated both the traditional rights and human rights of local indigenous peoples.[49] At the time, the FSC declared that Korindo would maintain 'conditional association' status while they sought cooperation to resolve highlighted issues. However, in July 2021 it was announced that Korindo would forfeit its FSC membership because it did not agree to an independent verification process.[50]

Deforestation in PT Papua Agro Lestari, oil palm planation by Korindo group (2016.8.25)
©Mighty Earth

PT Bio Inti Agrindo (POSCO International, Papua, Indonesia)

POSCO International is a subsidiary of Korean steel giant, POSCO (formerly Pohang Iron and Steel Co.). POSCO International operates its palm oil concessions through PT Bio Inti Agrindo (PT BIA), a company it acquired in Ullilin, Papua, Indonesia. Between 2012 and 2017, PT BIA was responsible for the destruction of 26,500 ha of forest. PT BIA's total area of concessions is 34,184 ha. The company is also suspected of using fires to clear the land.[51]

POSCO International, through PT BIA, began its operation in Papua in 2011. PT BIA produces CPO in its harvesting, milling and processing operations, and sell in both Indonesia and neighboring countries. As of April 2020, PT BIA operates on 34,195 ha of land, producing 8,000 tons of CPO per month.[53] The company plans to expand its operations into biodiesel production in the future.[52]

POSCO International's Palm Oil Concessions (PT Bio Inti Agrindo) site view ©Mighty Earth

[Table 12] Deforestation by Korindo and POSCO International since 2016[54]

Company	Subsidiary Company	Location	Area of Operations (ha)	Area of Deforestation (ha)		Total Area of Deforestation (ha)
				2016	2017	2016~2017
Korindo Group	PT Papua Agro Lestari	Merauke, Papua, Papua	25,203	1,854	562	2,416
	PT Tunas Sawaerma 1B	Boven Digoel, Papua, Papua	11,351	1,192	0	1,192
	PT Gelora Mandiri Membangun	Halmahera Selatan, Maluku Utara, Maluku	8,432	911	19	930
	PT Dongin Prabhawa	Mappi, Papua, Papua	33,537	668	0	668
POSCO International	PT Bio. Inti Agrindo	Merauke, Papua, Papua	34,184	7,134	5,264	12,398

Korindo Group's Deforestation Site at PT Papua Agro Lestari (2016.8.25)
©Mighty Earth

2) Biodiversity Loss

Palm oil is made from the fruit of a palm species of West African origin, that thrives in tropical regions. Such tropical regions are often areas rich in biodiversity. Malaysia and Indonesia account for 85% of the world's palm oil production, alongside other countries with tropical rainforests, such as Thailand, Colombia, and Nigeria. Palm oil production is a major cause of deforestation in these countries. For example, in Malaysian Borneo deforestation from palm oil production accounted for half of all deforestation between 2005 and 2015.[55] According to the International Union for Conservation of Nature's Red List, at least 193 endangered species are affected by palm oil production, with about 54% of endangered mammals and 64% of endangered birds affected.[56]

3) Land Conflicts

As the demand for land for crop-based biofuels increases, there are impacts not only on the environment but also on indigenous peoples and smallholder farmers. The land used for palm oil cultivation is often land or forest once used for food. In Indonesia, where more than half the world's palm oil is produced, 14 million ha of land is used to produce palm oil. To secure this land, the land of indigenous people and smallholder farmers is often taken away, resulting in constant land conflicts.[57]

Palm oil plantations in Indonesia and Malaysia are in many cases located on land originally owned by indigenous and local peoples. In the map below, one can see the distribution of palm oil plantations, and land owned by indigenous peoples and locals where the government does not recognize their customary rights.

Source: Global Platform and Community and Indigenous Lands. (2021. 7. 23). retrieved from URL: http://www.landmarkmap.org/

[Korean Company Case]

Korean companies have entered Indonesia to operate palm oil plantations, and most are causing land conflicts during the development process.

PT Bio Inti Agrindo (POSCO International, Papua, Indonesia)

In the process of developing a palm oil concession in Papua, Indonesia, PT BIA caused land disputes by violating the rights of indigenous peoples to free, prior, and informed consent (FPIC). At the end of 2010, PT BIA claimed "the right to cultivate" (Hak Guna Usaha) in forests in "Zone A" after paying only 50,000 IDR (USD 5.53) per hectare to members of the Marind tribe. This is despite customary rights to this land being held by a different tribe, the Mandobo tribe. The Mandobo people only learned about this transaction after 2012, when the forests in Zone A were cleared. Disputes over the land have continued ever since.[58]

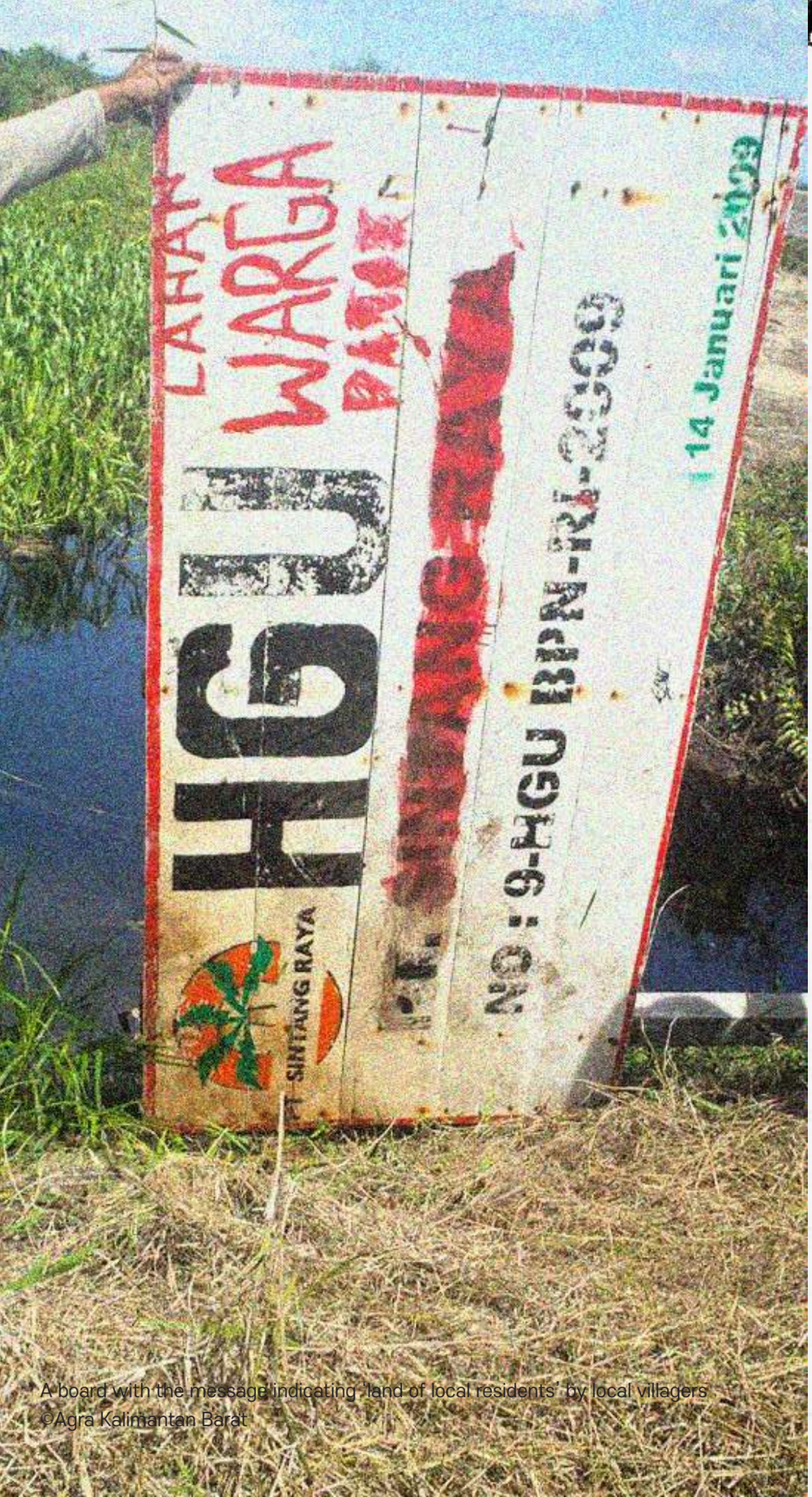
PT Sintang Raya (Daesang Corporation, West Kalimantan, Indonesia)

Korea's Daesang Corporation operates its concessions through a subsidiary, PT Sintang Raya (PT SR), which is developing palm oil concessions in West Kalimantan, Indonesia. Here there are continuing land disputes due to the unauthorized use of local residents' land. PT SR operates concessions across eight villages, but it has been reported that the company failed to properly get consent for the right to cultivate from residents of nearby Suroat Dua and Mengkalang Jambu. Villagers discovered in 2008 that outsiders were clearing the forest and found that PT SR was trying to expand its palm oil plantations without informing residents. The company secured the right to cultivate the land by mobilizing acquaintances to sign consent forms without proper explanation.[59] Local residents continue to try and secure rights to their land.

In another case, PT SR took over a company that had previously operated plantations in the area of Olak Olak village and proceeded to resume operations without consent from the villagers. Villagers argued in court that PT SR had no right to cultivate, and in 2014, the Supreme Court of Indonesia ruled that the company could not use the land. However, even after the Supreme Court's ruling, PT SR continues to illegally use the villagers' land.[60]

Daesang Corporation acquired both PT SR and PT Miwon Agrokencana Sakti in 2009, giving Daesang a total of 11,130 ha of palm oil concessions. Daesang also completed a CPO mill in 2014 that produces 35,000 tons of palm oil per year.[61]

Olak Olak villagers protesting against PT. Sintang Raya ©Agra Kalimantan Barat



A board with the message indicating 'land of local residents' by local villagers
©Agra Kalimantan Barat

PT. Gandaerah Hendana/PT Inecda (Samsung C&T, Riau, Indonesia)

Samsung C&T's subsidiary, PT Inecda, operates in the Rakit Kulim area in Indonesia, which is home to the Talang Parit and Talang Sungai Limau tribes. Both tribes are Talang Mamak indigenous peoples. These people have long depended on the forest to live self-sufficiently. They claim that PT Inecda expanded their plantation without the proper right to cultivate in the affected land and forests, where the tribes held customary rights. The company does not provide evidence that it legally obtained the right to cultivate, but rather encourages land disputes by mollifying or monitoring those who raise questions about land issues.[62]

Samsung C&T acquired PT Gandaerah Hendana and PT Inecda in Riau, on the Indonesian island of Sumatra in 2008, and now operates palm oil concessions totaling 24,000 ha. In 2020, they produced about 100,000 tons of CPO.[63] Most of the CPO produced was sold to refining companies in Indonesia, but some was reportedly sold to Korean and other international biodiesel companies.[64]

PT Parna Agromas/PT Grand Utama Mandiri/PT Tintin Boyok Sawit Makmur/PT Tintin Boyok Sawit Makmur Dua (LG Corporation, West Kalimantan, Indonesia)

LG International operates through an acquired company, PT Parna Agromas, which runs concessions near the village of Semadu, in West Kalimantan. Here, residents faced land disputes with the company as the plantation included an area of 318 hectares that should have been preserved as a forest.[65] Residents near another LG operation run by PT Tintin Boyok Sawit Makmur Dua, have also raised questions about the company's unauthorized expansion of plantations onto land used by residents.[66]

LG International, through a subsidiary, acquired PT Parna Agromas in West Kalimantan, Indonesia, in 2009, gaining a total of 20,000 ha of palm oil concessions. In 2018, the company acquired PT Grand Utama Mandiri, PT Tintin Boyok Sawit Makmur, and PT Tintin Boyok Sawit Makmur Dua, leading to a total concession area of 31,513 ha, and the production of 150,000 tons of CPO per year[67]

4) Violation of the Right to Food

The right to food protects the right of people to have physical and economic access to adequate food at all times, free from the fear of starvation. Indigenous peoples and smallholder farmers around the world rely on land and forests to make a living through small-scale farming, fishing, hunting, and gathering. Traditional knowledge is often employed to provide food and maintain self-sufficiency. However, when land and forests are taken away for biofuel production, local food production can be lost, infringing on the right to food. In addition, crop-based biofuels can often cause global food price rises as a result of reduced food stocks, large-scale land appropriation, speculation, and export bans.[68] This in turn makes it harder for many in the developing world to access food.

[Korean Company Case]

In areas where Korean companies operate, one can see indigenous peoples and smallholder farmers being deprived of land and forests, and the right to food.

PT. Bio Inti Agrindo (POSCO International, Papua, Indonesia)

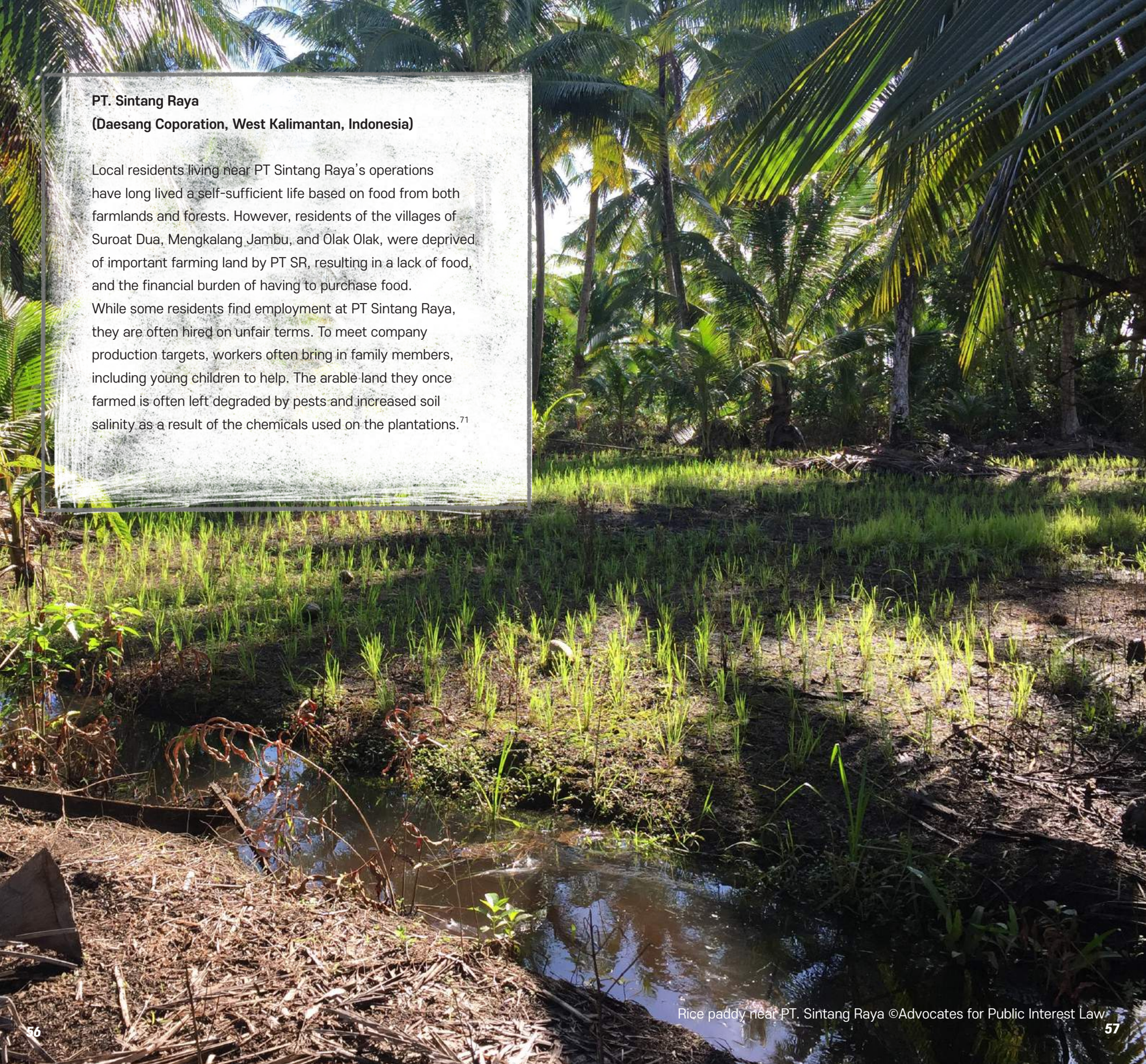
PT BIA developed a concession in Papua, Indonesia, in an area with a large indigenous population. PT BIA's operations resulted in land being dishonestly taken from the local population, including forests that were destroyed. Papua's indigenous peoples have long relied on the forests for hunting and the gathering of food staples, such as starch powder extracted from the stems of sago palm trees. The loss of forest to PT BIA meant the loss of access to food.[69]

As a result, indigenous residents have had to look to PT BIA for jobs to buy food, but this has proved difficult. Most indigenous locals are employed as day laborers, rather than workers with formal contracts, and face discrimination in the hiring process.[70] By denying both the means to obtain food in a traditional way and the ability to secure enough income to purchase food, PT BIA's plantations violate indigenous peoples' right to food.

Friska Basik-basik and her youngest son suffering from malnutrition in the Kindiki village © Albertus Vembrianto for The Gecko Project/ Mongabay

PT. Sintang Raya
(Daesang Coporation, West Kalimantan, Indonesia)

Local residents living near PT Sintang Raya's operations have long lived a self-sufficient life based on food from both farmlands and forests. However, residents of the villages of Suroat Dua, Mengkalang Jambu, and Olak Olak, were deprived of important farming land by PT SR, resulting in a lack of food, and the financial burden of having to purchase food.
While some residents find employment at PT Sintang Raya, they are often hired on unfair terms. To meet company production targets, workers often bring in family members, including young children to help. The arable land they once farmed is often left degraded by pests and increased soil salinity as a result of the chemicals used on the plantations.[71]



Rice paddy near PT. Sintang Raya ©Advocates for Public Interest Law

5) Violation of the Right to Water

Large-scale monoculture palm oil plantations require substantial amounts of herbicides, pesticides, and fertilizers, alongside the chemicals required for the milling process. Wastewater from CPO mills is disposed directly into nearby lakes and rivers, leading to a rapid decline in water quality.[72] As a result, residents near palm oil plantations are unable to use the water resources that they once relied on, infringing on their right to water.

PT. Bio Inti Agrindo (POSCO International, Papua, Indonesia)

Adjacent to PT BIA is the Bian River, which along with its tributaries is used by the local indigenous peoples for drinking water, cleaning, and other daily tasks. However, since the plantation was built, the water quality of the Bian River has rapidly deteriorated, and its tributaries have become polluted or disappeared. Residents are forced to rely on collected rainwater, or digging wells to access groundwater. But in the dry season, both water supply and water quality are threatened, causing anxiety in the community.[73]

PT Gandaerah Hendana/PT Inecda (Samsung C&T, Riau, Indonesia)

Local residents around PT Gandaerah Hendana and PT Inecda also suffer from water pollution and water scarcity. Before the development of the plantations, residents relied for their water on rivers and wells. After its development the river's tributaries became depleted and the underground water became scarce. The alternative was relying on rainwater or purchasing water, which can be financially burdensome.[74]

Water supply facilities used by villagers after Jembayan River's pollution ©JATAM Kaltim

Polluted Jembayan River ©JATAM Kaltim

A dried well in the village near PT Inecda ©Advocates for Public Interest Law

Water provided by clean water program ©Advocates for Public Interest Law

PT Niagamas Gemilang/PT Sukses Bina Alam
(JC Chemical, East Kalimantan, Indonesia)

The Jembayan River, adjacent to PT Niagamas Gemilang, is a water source for the residents of the neighboring villages. However, since PT Niagamas Gemilang started operation, the Jembayan River has become polluted, and since about 2014, residents can no longer use the river for drinking or domestic tasks. In 2017, PT Niagamas Gemilang caused an incident in which the river water turned black, let off a noxious smell, and killed many of the fish. Residents reported it to the local Environment and Forestry Agency.[75] Residents now must purchase purified water, provided by the central government.

JC Chemical, a company that produces and sells biofuels, acquired a palm oil plantation in East Kalimantan, Indonesia, in 2012, to secure feedstocks. The total area of overseas concessions is 10,700 ha, with a CPO mill completed in 2016. In 2017, 23,600 tons of CPO was produced, and since then the production has steadily increased, producing 45,300 tons of CPO in 2020.[76]

[Do Palm Oil Plantations Bring Prosperity to Locals?]

Since 2007, it has been stipulated by law that enterprises operating plantations of 250 hectares or more in Indonesia must contribute at least 20% of the area covered by their Plantation Business Permit (Izin Usaha Perkebunan) to the local community to promote local development.[77] Based on this regulation, companies enter into partnerships so that 20% of the plantations are managed by smallholder farmers. This cooperative relationship, so-called plasma farming, is also used to convince residents to acquire rights to cultivate on land that will soon be developed.

However, palm oil companies often do not allocate plasma farms to residents who have been deprived of their land-use rights. Even if someone signs a contract with a company as a plasma farmer, it is not easy to make a profit. Plasma farmers have no choice but to accept the operating rules and palm fruits prices presented by the company. This is related to the unique characteristics of the palm fruit, where freshness is important, as it must be processed within 24 hours of harvest. However, on remote farms there is no other option than selling to a company-run CPO mill, thus plasma farmers are always forced to enter into contracts at a disadvantage.[78] In this situation, critics argue, plasma farming is causing conflict rather than bringing economic prosperity to local residents.[79]

Harvest workers in the PT. Inecda ©Advocates for Public Interest Law

6) Threats to Environmental and Human Rights Defenders

The striping of land use rights from local peoples is a common consequence of large-scale resource mining and agricultural projects. Those who resist are often called Environmental Human Rights Defenders, and many face harassment, threats, and violence. Repression is so widespread that in 2018 it was estimated that at least three defenders died each week opposing large development projects.[80] In the process of rapid palm oil expansion, land disputes in Indonesia have increased rapidly, alongside oppression of environmental human rights defenders.

PT Bio Inti Agrindo (POSCO International, Papua, Indonesia)

Papua, where PT BIA is located, is Indonesia's easternmost province and the site of widespread military repression and surveillance of "anti-government activities" related to local independence struggles. In Papua, environmental human rights defenders, who oppose corporate activities, are often regarded as "anti-government, separatist forces" and face repression. Linus Omba, the leader of the Mandobo tribe that was deprived of forests by PT BIA, has been visiting the company and protesting since 2012. However, after Indonesian special forces fired shots at protesters on August 5, 2016, opposition activities have declined.[81]

Police and Special Army Force who came to oppress indigenous peoples (2016. 8. 5) © PUSAKA

Bullets shot by Special Army Force to disturb the demonstration by the indigenous peoples (2016. 8. 5) © PUSAKA

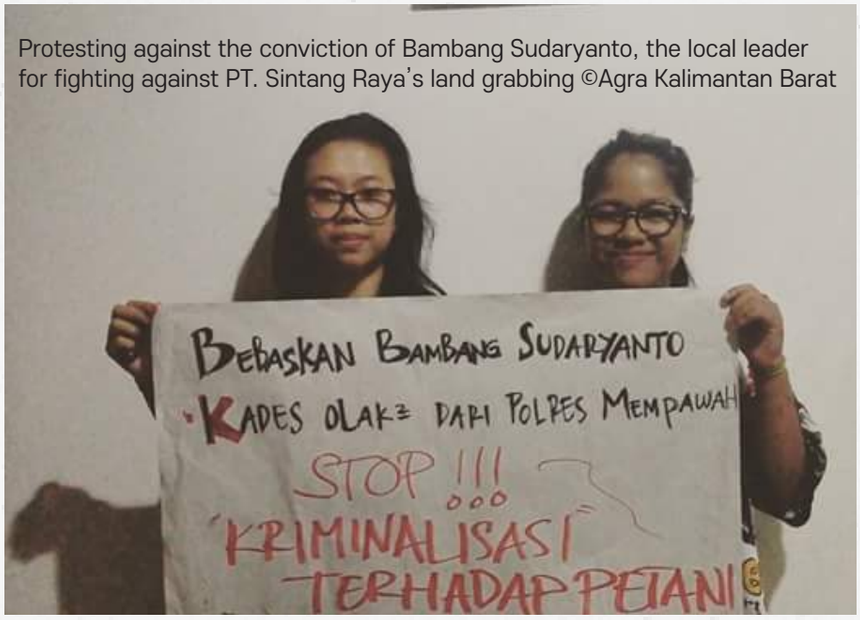
Olak Olak villagers protesting against PT. Sintang Raya ©Agra Kalimantan Barat

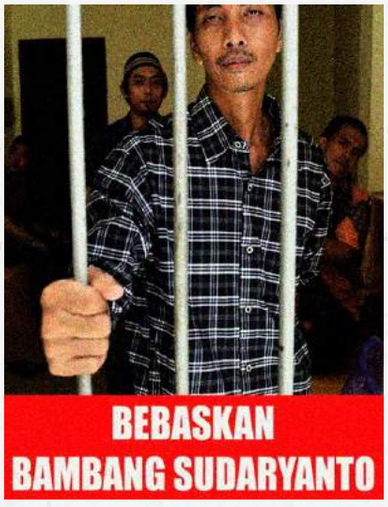
PT Sintang Raya (Dasang Coporation, West Kalimantan, Indonesia)

Villagers who had been deprived of land and forests by PT Sintang Raya have raised objections and protested in cooperation with NGOs. In the process, many people have been arrested, arbitrarily detained, and unfairly prosecuted. In 2016, there was a massive demonstration in the village of Olak Olak demanding the implementation of the Supreme Court's previous decision that villagers still maintained land use rights. Eventually, four trucks carrying armed police arrived and arrested 60 villagers.[82]

In 2018, residents who opposed PT Sintang Raya faced many instances of intimidation and arbitrary arrests committed both by police and company-hired gangs. For example, at a protest in Olak Olak, a local representative of the peasant organization AGRA (Aliansi Gerakan Reforma Agraria), was arrested and falsely charged with stealing fertilizer and sentenced to one year in prison. Since then, it has been reported villages now fear protesting or voicing opposition to the company's seizure of land.[83]

Protesting against the conviction of Bambang Sudaryanto, the local leader for fighting against PT. Sintang Raya's land grabbing ©Agra Kalimantan Barat





7) Exploitation of Palm Oil Plantation Workers

Workers working in palm oil plantations are mainly engaged in harvesting palm fruits, spraying chemicals, and transporting the harvested fruits. All of them have a set amount of work to be completed in a day, which is called a target. If the target is not met, the wages are deducted. However, there are many cases where workers work overtime or bring their wives or children to work in order to fulfill these targets. Despite long, high-risk work, plantation workers are exploited at low wages, and in many cases work as daily or temporary workers without any protection from the social security system.[84]

Female workers working on palm oil plantations are exposed to the double risk of chemical exposure and sexual exploitation. Women workers are mainly responsible for spraying herbicides, pesticides and fertilizers, without being educated on their harmfulness or being provided with protective equipment.[85] It is also reported that plantation managers in remote areas often harass or sexually assault vulnerable female workers.[86]

PT Gandaerah Hendana/PT Inecda (Samsung C&T, Riau, Indonesia)

In 2016, a field investigation conducted by Korea Transnational Corporations Watch highlighted how excessively high targets at PT Gandaerah Hendana and PT Inecda, resulted in long hours, low wages, and precarious work. The survey also raised concerns about workers' exposure to harmful chemicals and hazardous working conditions without proper protective equipment, as well as generally poor housing conditions.[87] It has not been confirmed whether working conditions have improved since then. In 2020, a report by the US think-tank Chain Reaction Research found that PT Inecda workers had recently been on strike over bonus issues.[88]

Indigenous woman working with her child in a palm planation in Boven Digoel
© Albertus Vembrianto for The Gecko Project/Mongabay

8) Absence of Socio-Environmental Policies

As the issues of environmental destruction, exploitation, and human rights abuses on palm oil plantations became more widely known, the palm oil industry and investors started to adopt No Deforestation, No Peat, No Exploitation (NDPE) policies. The production and distribution processes in the palm oil industry have an hourglass-shaped characteristic. CPO is produced by a large number of growers, who sell it to a small number of refiners, who produce a wide range of products sold to various manufacturers. Therefore, refiners adopting NDPE policies is the most important goal, as they can influence both growers and buyers to adopt similar policies.

[NDPE Policy]

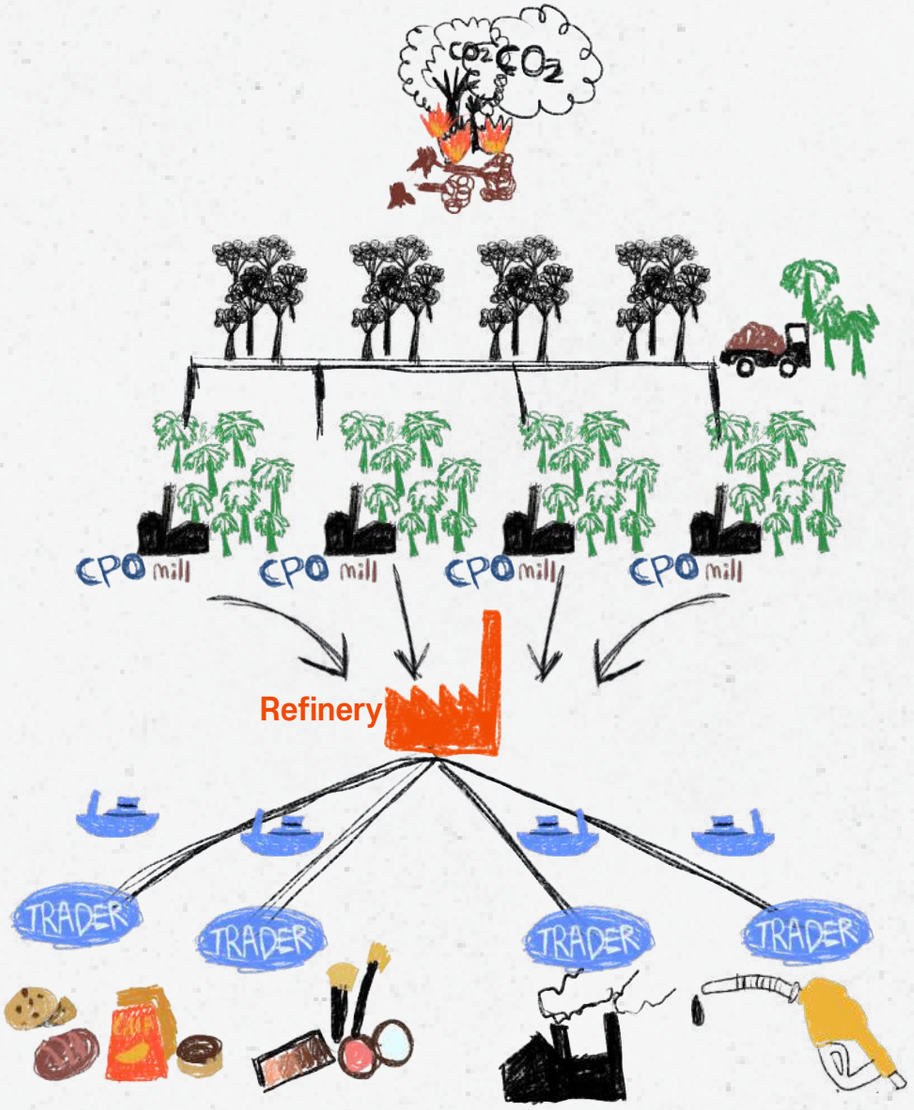
An NDPE policy is a voluntary declaration that companies will engage in agriculture in a sustainable fashion. Specifically:

No Deforestation - A declaration that there will be no deforestation in order to grow crops. Accordingly, companies take measures to protect High Conservation Value areas with natural vegetation or culturally important value, and High Carbon Stock areas with a particularly high amount of carbon stored in trees and vegetation.

No Peat - A declaration not to develop peatland for agricultural purposes. Peatlands cover 3% of the world's surface area, but store one-third of the world's soil carbon.[89] As such, businesses must ensure that ecosystems, alongside local people and wildlife, such as orangutans, remain healthy.

No Exploitation - A declaration to protect the human rights of residents and workers in the areas where agriculture takes place. Accordingly, businesses must protect workers' human rights, as well as facilitate the active participation of affected local residents, such as indigenous peoples and smallholder farmers, in decision-making processes.

[Figure 9] Palm oil supply chain



In the palm oil industry, more and more companies are adopting NDPE policies. As of April 2020, refiners accounting for 83% of the refining capacity in Malaysia and Indonesia have adopted such policies.[90] However, in the palm oil industry in Korea, the adoption rate of NDPE policies is remarkably low.[91] Two out of five Korean companies that produce palm oil in Indonesia have adopted NDPE policies, but it has not been confirmed whether or not these have yet been implemented.

In April 2021, KFEM asked all Korean companies that directly operate palm oil plantations in Indonesia, as well as the eight largest importers of Indonesian palm oil, whether they currently have, or plan to adopt NDPE policies.[92] Only four companies responded.[93]

[Table 13] NDPE Adoption by Company and Future Plans (As of 2021.04)

Company		Plan to NDPE Policy	Note
LG International	**Palm Oil Producer and Importer**	Yes	LG International responded that the company is currently unable to adopt an NDPE, as it is in the early stage of acquiring Roundtable on Sustainable Palm Oil (RSPO) certification.[94] After acquiring RSPO certification, they tentatively plan to adopt an NDPE policy. It is expected after 2023.
Samsung C&T	**Palm Oil Producer and Importer**	Yes	Adopted NDPE in 2019. First in Korea.[95]
Daesang Corporation	**Palm Oil Producer and Importer**	No	No response.
JC Chemical	**Palm Oil Producer and Importer**	No	No response.
Aekyung Petrochemical	**Palm Oil Importer**	Yes	The company replied that they would increase the proportion of transactions with suppliers who have adopted NDPE policies as soon as possible, and play a positive role concerning NDPE policies as a palm oil purchasing company.
GS Global	**Palm Oil Importer**	Yes	Replied that they are looking for ways to deal with companies adopting NDPE policies when new contracts are signed and are planning their review of NDPE policy adoption.
Dansuk Industrial	**Palm Oil Importer**	No	No response.
Hahn & Co. (SK Eco Prime)	**Palm Oil Importer**	No	No response.

6. International Biofuel Policies

Globally, biofuel support policies have been expanded for reasons such as diversification of energy sources, reduction of GHG emissions, and development of biofuel crop industries. The most important forms of support are 1) budgetary support (tax reductions or direct subsidies for biofuel producers, sellers, and users); 2) mandatory minimum mixing ratios; and 3) import taxes on imported biofuels.[96] Thanks to such policy support, biofuels have grown into one of the largest renewable energy sources in the EU and the US. According to IEA statistics, bioenergy accounts for 50% of global renewable energy consumption.[97]

However, the expansion of biofuels comes at the risk of damaging international food price stability, alongside environmental and social concerns. Palm oil, the main feedstock for Korean biodiesel, is a perfect example. This is because Indonesia's rainforests are being destroyed to produce palm oil, and the rights of workers and indigenous peoples are being undermined. In addition, when we consider land-use changes, biodiesel from palm oil can emit up to three times more GHG than conventional diesel.[98] The UK's Royal Academy of Engineering published a report on the sustainability of biofuels in 2017, concluding that most first-generation biofuels, including palm oil, do not meet the GHG standards set by the EU's Renewable Energy Directive (RED).[99]

In response, the EU and the US have established standards, which biofuels have to meet to receive support or be counted towards renewable energy targets. These standards take into consideration social impacts, land-use change, biodiversity conservation, and competition with food. In Korea, there are quality standards related to transportation biofuels to ensure compatibility and mechanical performance, but there are no social or environmental standards.

According to a 2019 research report by the Korean National Assembly Research Service, there are two major differences between EU and US biofuel policies, and those of Korea. First, the former both have criteria for whether a biofuel can be recognized as renewable energy. For the EU they are called "sustainability criteria" and for the US "minimum GHG emissions reductions compared to baseline emissions from fossil fuels." Second, after classifying biofuels into sub-categories according to feedstock components, they encourage those biofuels deemed better.[100]

○ Biofuel Policies in the European Union

■ The EU introduced the Renewable Energy Directive (RED) in 2009 to reduce GHG emissions and ensure stability in energy supply and demand. RED was replaced by the updated RED Ⅱ that came into effect on July 1, 2021.

(1) RED I (2009.4.)

- Overall EU target for renewable energy use of 20% by 2020.
- 10% of all energy used in transport should be from renewable sources by 2020. [101]
- Biofuels are eligible for incentives only if they meet environmental sustainability criteria.[102]

Sustainability Criteria[103]

- Requires a certain percentage of GHG emissions reductions from the use of biofuels (50% reduction by 2017). GHG emissions are measured through Life-Cycle Assessment (LCA), including cultivation, processing, and transportation of biofuels.
- Biofuels produced on the following land are not recognized as renewable energy: lands that previously reduced GHG emissions, such as wetlands and forests; areas rich in biodiversity; areas of nature conservation; or ecological areas with rare or endangered species.
- Each member state must establish a system for businesses to demonstrate that they have complied with biofuel-related sustainability criteria.[104]

Even when biofuels meet sustainability standards, they are divided into subcategories, such as traditional biofuels and next-generation biofuels. The latter are those that have a lower impact on food security and land-use change, and are thus recommended.

[Table14] Classification of EU Biofuels by Feedstock[105]

Classification		Feedstock
1st Generation	Traditional Biofuels	Sugar Crops, Starch Crops, Vegetable Oils
2nd Generation	Controversial Ingredients for Second-generation Classification*	WCO, Animal Fat, Energy Crops
	Next Generation	WCO, Animal Fat, Energy Crops, Agricultural Residues, Forest Residues, Lumber Residues, Wood Waste, Municipal Solid Waste
3rd Generation		Algae

*WCO or animal fats classification depends on the process used, while for energy crops it depends on whether they compete with food or feed crops, or cause land-use changes.

(2) RED Ⅱ(2018.12)

- Overall EU target for renewable energy use by 2030 raised to 32%.
- Target of 14% share of renewable energy in the transportation sector by 2030.[106]
- Limit the use of crop-based biofuels in road and rail transport to 7%. Phase-out feedstocks with a high risk of Indirect Land Use Change, such as palm oil, by 2030.[107]
- On July 14, 2021, the EU Commission announced its “Fit for 55” package of policy proposals to meet the EU’s goal of cutting emissions to 55% below 1990 levels, by 2030. Transport-related proposals included: all new cars registered from 2035 must be zero-emission; increased minimum rates of duty on jet-fuel; and no duty for alternative fuels. The proposals also include increases to the RED II targets.
- The package includes special provisions related to bioenergy: new regulations on the supply of feedstocks for bioenergy from natural forests, wetlands, and peatlands; 2026 end to subsidies for electricity from bioenergy, in electricity-only-installations; and minimum GHG reduction standards for biomass facilities.

○ Biofuel Policies in the United States

■ In the US, the Renewable Fuel Standard (RFS), run by the Environmental Protection Agency, makes it mandatory for suppliers of transportation fossil fuels (oil refiners, importers, blenders) to blend a minimum volume of renewable fuels.[108]

■ RFS1, implemented in 2007, was expanded with the implementation of RFS2 in 2010, expanding the scope of application and implementing improvements to the system.

RFS2 classifies biofuels into four categories by feedstock components: total renewable fuel, advanced biofuels, cellulosic biofuels, and biomass-based diesel. For a fuel to qualify under the RFS system it must achieve a minimum lifetime GHG reduction compared to a 2005 petroleum baseline.[109]

■ Under RFS1, the system was dominated by the use of ethanol produced from corn, but with the introduction of RFS2 fuels with a greater GHG reduction impact, such as advanced biofuels and cellulosic biofuels, are being promoted.[110]

[Table 15] Comparison of US RFS1 and RFS2[111]

	RFS 1	RFS 2
Period	Jan 2007 - 30 Nov 2010	1 Dec 2010 -
Applicable Fuels	- Gasoline	- All Transportation Fuels (Gasoline and Diesel)
Biofuel	- Corn-based Ethanol	- Classified into 4 Categories According to GHG Reduction
Goal	- 7.5 billion gallons (2012)	- 360억 갤런(2022년)
Other	-	- Use of Feedstocks That Meet the New Definition (prohibition of cultivation in certain areas, etc.)

[Table 16] Classification of Renewable Fuels in RFS2[112]

Renewable fuel	Feedstock	Minimum GHG Reduction*
Renewable Biofuel	- Corn Starch Ethanol	20%
Advanced Biofuel	- Non-corn starch-based bioethanol (Sorghum, wheat etc.)	50%
Cellulosic Biofuel	- Cellulose - Hemicellulose - Lignin	60%
Biomass-based Diesel	Biodiesel (FAME)	50%

* Biofuel grades according to the amount of GHG reduction through LCA.

7. Recommendations

First, the Korean government must establish environmental and social standards for biofuels and exclude unsatisfactory biofuels from subsidies and financial support.

Separate accreditation standards should be introduced that consider environmental and social impacts, such as GHG emissions, biodiversity loss, environmental pollution, and human rights violations. These must also consider land-use changes and LCA. Only biofuels that meet the relevant standards should be considered compliant with the RPS and RFS, and those that do not should be excluded from policy support, such as subsidies and financial support.

Grounds must be established for the exclusion of biofuels whose feedstocks are produced on former primary forest, peatland, or wetland areas. These standards must also exclude biofuels where human rights violations are involved in the supply chain. A system that mandates intensive supply chain due diligence to monitor and detect such violations should be created. Also, when the government provides public funds for the development of bioenergy feedstocks, it should take into account environmental destruction and human rights violations and provide support only when there are no such issues.

Second, the government should consider an early phase-out of internal combustion engine (ICE) vehicles.

As of 2017, GHG emissions from the Korean transportation sector amounted to about 100 million tons or 14% of total emissions. Of the transport sector, road emissions accounted for 96% of the total in 2017. The above figures prove that the elimination of ICE vehicles is an urgent task in responding to the climate crisis. However, government policy for carbon neutrality in the transportation sector is focused only on expanding the supply of eco-friendly vehicles and increasing related subsidies. There is no timeline or roadmap for the end of new ICE vehicle sales.

Countries around the world are accelerating the goal of ending ICE vehicle sales. The UK will ban the sale of new ICE vehicles in 2030, Norway in 2025, and Japan in 2035. Korea needs to speed up the reduction of GHG emissions in the transportation sector by clearly setting a timeline for an end to the sale of new ICE vehicles.

Third, the government should stop issuing RECs to bio-heavy oil power plants and shut down bio-heavy oil power plants as soon as possible.

On Jeju Island, bio-heavy oil power plants have replaced existing oil power plants, without any environmental benefit. On the contrary, they cause pollution and block cleaner renewable alternatives. Bio-heavy oil is an obstacle to the expansion of cleaner renewable energy generation, such as wind and solar power. Moreover, it is being used as a means to easily fill the RPS quota of KEPCOs' subsidiaries. Therefore, the RECs issued to current bio-heavy oil power plants should be withdrawn, and bio-heavy oil power plants should also be closed as soon as possible.

Fourth, companies must establish and implement environmental and social policies that apply to the entire supply chain.

According to the UN Guiding Principles on Business and Human Rights, businesses have a responsibility to respect human rights. To this end, companies must identify human rights violations that occur in business operations, prevent human rights violations, and mitigate and take responsibility for human rights violations that have already occurred. This process is called human rights due diligence. To this end, companies need to establish and implement appropriate environmental and social policies.

In particular, companies that produce palm oil or biofuels from palm oil should adopt company-wide NDPE policies to actively respond to environmental destruction and human rights violations in the supply chain. For companies that have already adopted NDPE policies, information on implementation should be disclosed and monitored in an appropriate manner so that all stakeholders can verify it. In addition, biofuel producers should increase transparency by disclosing information on the entire supply chain and identifying areas of high environmental and social risk.

Fifth, the government should enact laws that make it mandatory for companies to implement supply chain due diligence.

Supply chain due diligence laws require companies to identify human rights and environmental risks arising from all businesses they have relationships with. This includes not only parent companies but subsidiaries as well. It also requires them to establish measures to prevent or remedy such risks. To this end, biofuel manufacturers must transparently disclose information on supply chains so that they can identify and respond to environmental degradation and human rights violations.

For any environmental degradation or human rights violations identified through a supply chain due diligence law, companies should be required to take adequate measures in response. A dedicated law that requires companies to implement supply chain due diligence would help remedy some of the worst environmental and human rights violations that occur during the production of biofuels.

Endnotes

1. Attached Table 1 in accordance with the Act on Promotion of Development, Use and Distribution of New and Renewable Energy, Article 2, Item 2 (f), and the Enforcement Decree of the Act on Promotion of Development, Use and Distribution of New and Renewable Energy Act Article 2, Paragraph 2.
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4. Ibid., pp. 870-871.
5. Kim, Jun-han. (2021). Bio Utilization in Terms of Electricity Supply and Demand (Expanding the Use of Biofuels and Biomass for Low Carbon and Presentation of Business Strategy Seminar in 2021), p. 11.
6. Yoon, Byung-ho. (June 15, 2021). Export ↑, Blending Rate ↑ ... Biodiesel Industry's 'Upper Price' for Double-Sided Materials. Electric Newspaper. http://www.electimes.com/article.asp?aid=1623651186218725114
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13. Korea Bio-energy Association. (2021). Biodiesel and Bio-Heavy Oil Supply Performance in 2020.
14. For more information, see in this report section 5. Biofuel Supply Chain Risks.
15. As with biodiesel, there is no government data on the supply and demand status of feedstocks for all bio-heavy oil producers, so this report is based on data from four member companies identified by the Korea Bioenergy Association. The sales volume of these member companies accounts for about 88% of the total volume (as of 2020). Korea Bio-energy Association. (2021). Biodiesel and Bio-Heavy Oil Supply Performance in 2020.
16. Based on South Korea HS Code 1302192000 Cashew Nut Shell Liquid.

(unit : kg)

Country	2014	2015	2016	2017	2018	2019	2020	Total
Vietnam	2,690,959.00	14,303,151.00	56,309,457.77	94,200,649.21	71,409,057.98	121,844,277.14	125,287,871.22	486,045,423.32
India	1,459,915.00	1,420,347.00	843009.35	696,817.40	592,880.70	542,783.94	291,760.00	5,847,513.39
Indonesia	138,879.00	1.00	0.5	86,005.00	84,002.30	1.62	418,905.81	727,795.23
China	146,800.00	109,202.00	93600.00	124,605.00	124,800.00	140,414.50	109,200.03	848,621.53
Others	9.00	19.00	34.60	7.46	18.45	6,079.08	751.29	6,918.88
Total	4,436,562.00	15,832,720.00	57,246,102.22	95,108,084.07	72,210,759.43	122,533,556.28	126,108,488.35	493,476,272.35

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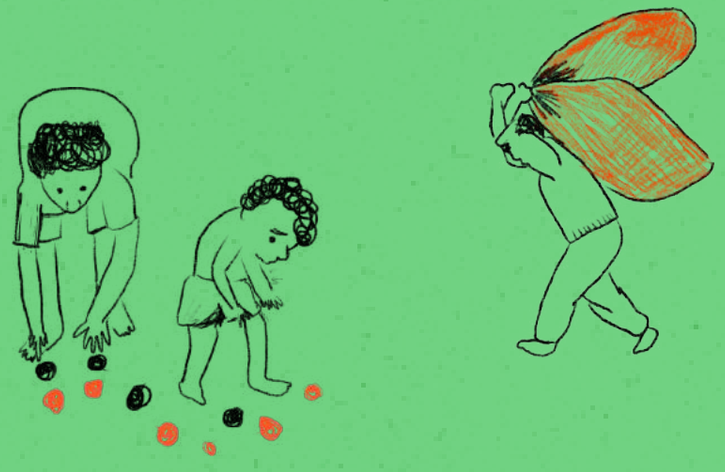

No Good Oil to Burn
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APIL is a non-profit public interest law organization that defends the rights of vulnerable migrants and refugees in our society and monitors human rights violations by Korean companies in overseas markets. Our goal is a world of justice and peace where the innate dignity and inherent human rights of all people are guaranteed. To this end, we advocate for the human rights of refugees, detained migrants, stateless persons, and victims of human trafficking and monitor multinational corporations for human rights violations through litigation and petitioning, research and legislative campaigns, education and public relations, solidarity with national and international organizations, and the use of international human rights mechanisms.

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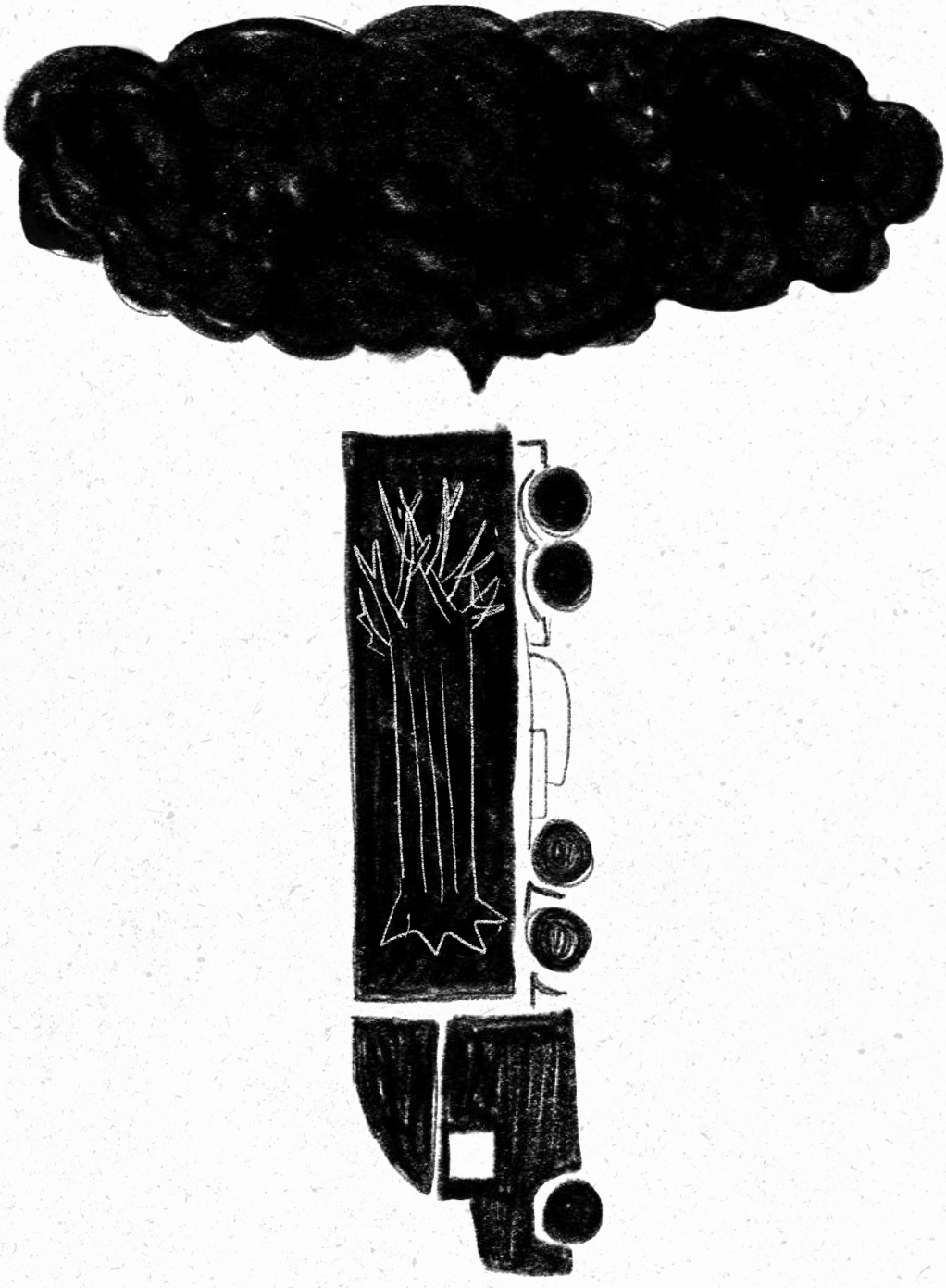

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