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Report Highlights:

Post sees Philippine biofuels consumption partially recovering in 2022 due to economic growth, as fuel ethanol demand grows 13 percent to 660 million liters and biodiesel increases 31 percent to 250 million liters with the projected movement from B2 to B5 blend and the fuel pool increases as forecast. Ethanol production is almost flat with one percent growth to 360 million liters. Limited feedstock continues to be a challenge, with local producers only able to supply half the requirements for gasoline blending. Imported ethanol will grow by 33 percent in 2022 to 300 million liters, which should continue to fill the gap. In support of climate action, the Philippines calculated its carbon intensity of biodiesel from crude coconut oil and refined coconut oil at 32.8 gCO2e/MJ and 31.5 gCO2e/MJ, respectively, and ethanol at 46.8 gCO2e/MJ. Fuel ethanol can bring down the true cost of gasoline. Moving up to E20 from the current E10 will lower gasoline prices and generate more savings from avoided GHG emissions.

I. Executive Summary

The Philippines has enacted two laws to promote renewable energy (RE): the Biofuels Act of 2006 (RA 9367) and the Renewable Energy Act of 2008 (RA 9513). The two laws were created to promote renewable energy, reduce dependence on imported fossil fuels, and reduce carbon emissions in response to climate change. In practice, domestically produced fuel ethanol is derived from sugarcane (mostly molasses) and blended with gasoline, while biodiesel is from coconut oil converted into coco methyl ester (CME) and blended with petroleum diesel.

The Department of Energy (DOE) leads the implementation of these two laws, together with seven government entities. The National Biofuels Program provides direction under the guidance of the National Biofuels Board (NBB). In compliance with the law, the five percent blend of fuel ethanol (E5) was mandated in the second year of the Biofuels Act in 2007. The 10 percent blend (E10) was mandated in 2011 but took effect in 2012. For biodiesel, three months after the Act a one percent biodiesel (B1) blend was implemented, and was increased to two percent blend (B2) two years after. The blends have remained at B2 and E10 and the targets initially set were not met to this date.

Post sees 13 percent growth in fuel ethanol consumption to 660 million liters attributed to economic growth, and a 31 percent increase in biodiesel consumption to 250 million liters prompted by the projected increase in biodiesel blend to B5 in 2022 and the fuel pool increases. Meanwhile, biodiesel production will increase by 25 percent to meet the demand from the B5 biodiesel blend. The rated production capacity of 707.9 million liters per year is a result of the industry's overexpansion in anticipation of the B5 blend, and is now more than enough to cover the required blending for 11 billion liters of diesel consumption. The overcapacity of fuel ethanol plants compared to the local feedstock available is a result of the unexpected shift of seven potable alcohol producers to fuel ethanol following the implementation of a 22 percent excise tax on potable alcohol.

There is no immediate solution to insufficient feedstocks for fuel ethanol production. There are recommendations to use corn as feedstock, but this would run counter to the government's food security program and would require huge investments to establish plants. To date, the Philippines has no option but to continue to use molasses and sugarcane. On average, local producers can supply only 50 percent of the bioethanol requirement for gasoline blending. The remaining 50 percent comes from imported fuel ethanol. The industry proposed to the government to temporarily allow importation of molasses to maximize plant capacity. The DOE declined the proposal in 2020, and was opposed by sugar planters, millers, and the Sugar Regulatory Administration (SRA).

Fuel oil companies can import fuel ethanol only if there is a shortage, a condition which should continue with the perennial problem of insufficient feedstocks. Imports have mainly been sourced from the United States. Total fuel ethanol imports in 2022 will accelerate to 300 million liters due to the expected increase in consumption. No importation of biodiesel is allowed under the Biofuels Act.

II. Policy and Programs

The Philippines has enacted two laws to promote renewable energy (RE): the Biofuels Act of 2006 (RA 9367) with its implementing rules and regulations (IRR) and the Renewable Energy Act of 2008 (RA 9513) and its IRR. For key features see Biofuels Annual 2021.

The **Biofuels Act** seeks to reduce dependence on imported fuels by promoting the development and mandating the use of locally sourced biofuels, specifically bioethanol and biodiesel. In practice, domestically produced bioethanol is derived from sugarcane (mostly molasses) and blended with gasoline, while biodiesel is from CME blended with petroleum diesel.

Renewable Energy and Greenhouse Gas (GHG) Emissions

The **Renewable Energy Act** aims to accelerate the exploration and development of RE sources such as biomass, geothermal, solar, hydropower, ocean energy sources, and wind. The Act envisions the Philippines to be energy self-sufficient through sustainable development of RE resources and reduce the reliance on fossil fuels, thereby minimizing vulnerability to international market price fluctuations. It encourages the development and utilization of RE sources to prevent harmful emissions.

With its signing of the Paris Agreement, the Philippines pledged to reduce carbon dioxide (CO_2) and other GHG emissions by scaling up renewable energy activities using biofuels as one of the solutions. The Nationally Determined Contributions (NDC) quantify the Philippines commitment to reduce the CO_2 and other GHG emissions. The Philippines submitted its first NDC on April 15, 2021, committing to GHG carbon dioxide equivalent (CO_2e) emissions reduction or avoidance of 75 percent by 2030 relative to its business as usual (BAU) scenario of 2020-2030. Reduction of CO_2e emissions will come from energy, transport, waste, agriculture, and industry sectors. Transport accounts for one-third of GHG emissions in the Philippines.

Biofuels Policy Framework and Mandates

Policy Framework. The Department of Energy (DOE) leads the implementation of the Biofuels Act and its IRR through Department Circular (DC) - DC 2007-05-006. The DOE prepared the National Biofuels Program consistent with Philippine Energy Plan (PEP) 2018-2040. The revised PEP sets the bioethanol and biodiesel targets from 2019 to 2040, changing the blend targets to production capacity targets. The Philippines met the 2019 and 2020 capacity targets set in PEP.

Table 1. Biofuels: Production Capacity Targets

Year	Production Capacity (MLPY)	
	Biodiesel	Bioethanol
2019	607.90	380.50
2020	707.90	425.50
2025	885.55	519.50
2030	1,285.55	919.50
2035		
2040		

Source: Chapter V, PEP 2018-2040

The National Biofuels Board (NBB) was established following the law as an oversight body composed of eight government entities which are part of the implementation of the biofuels law. The DOE Secretary chaired the NBB supported by the Administrator of the Sugar Regulatory Administration (SRA) as Vice Chair on bioethanol concerns, and the Administrator of the Philippine Coconut Authority (PCA) as Vice Chair for biodiesel concerns, with representatives from the Department of Agriculture (DA), Department of Trade and Industry (DTI), Department of Science and Technology (DOST), Department of Finance (DOF), and Department of Labor and Employment (DOLE). The NBB acts as recommendatory body on biofuels policies, assisted by a Technical Secretariat, whose powers and functions are monitoring implementation and recommending policies to be promulgated by the DOE.

Blend Mandates. The NBB determines the feasibility and recommends adjustment in the minimum mandated biofuel-blends subject to the availability of locally sourced biofuel. In compliance with the law, the five percent blend of fuel ethanol (E5) was mandated in the second year of the Biofuels Act in 2007. The 10 percent blend (E10) was mandated in 2011 but took effect in 2012. The mandated blend did not reach national average in most years. For biodiesel, three months after the Act went into effect, all diesel engine fuels sold in the country had a minimum of one percent biodiesel (B1), and this was increased to two percent blend (B2) two years after.

Table 2. Biofuels Blends: Date Mandated and Implemented

Blend Mandate	Date Mandated and Policy	Date Implemented
Bioethanol		
E5	February 2009 DC 2009-02-0002	February 2009
E10	February 2011 DC 2011-02-001	February 2012
Biodiesel		
B1	May 2007 DC 2007-05-006	September 2007
B2	February 2009 DC 2009-02-0002	February 2009

Source: DOE

Oil companies undertake the blending of gasoline and diesel fuels with fuel ethanol and biodiesel, respectively, in compliance with the Philippine National Standard (PNS), using appropriate blending methodologies at their refineries, depots, or blending facilities prior to the sale of biofuel blends.

Table 3. Biofuels Blend Targets

Year	Biodiesel Target Blend (%)	Bioethanol Target Blend (%)
2007	1	-
2008	1	-
2009	2	5
2010	2	5
2011	2	10
2015	5	10
2020	10	20
2025	20	20/85*
2030	20	20/85*

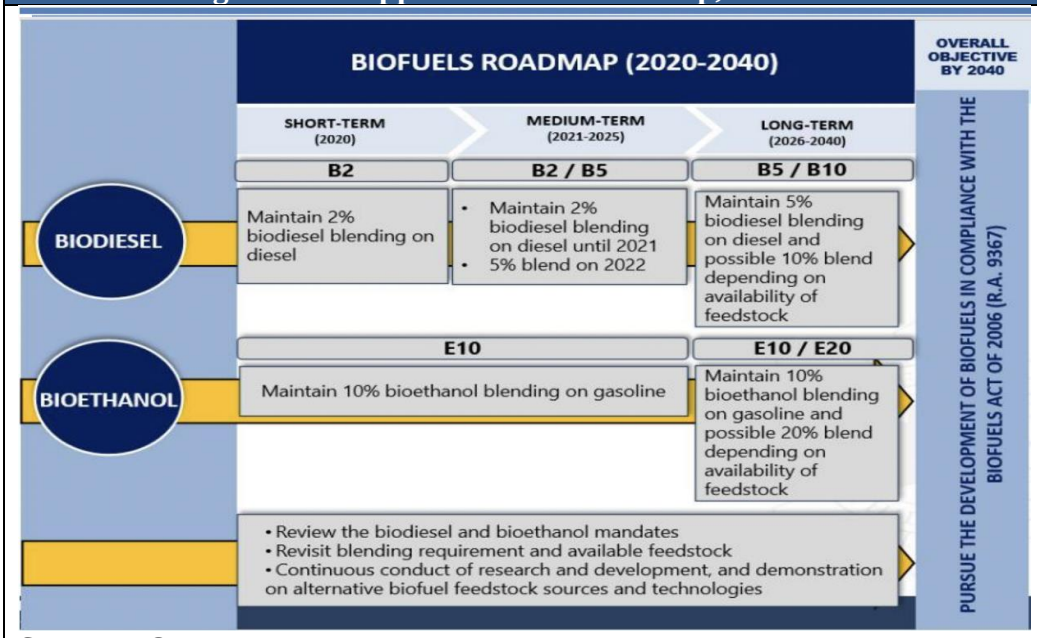
Note: *aspirational and voluntary goal

The Philippines initially set higher eventual blend targets for biodiesel and fuel ethanol, but the mandated blends have remained at B2 and E10 since 2009 and 2012, respectively and higher blend targets initially set have not been met to date. In 2020, the DOE initiated studies to increase the biodiesel blend mandate from B3 to B20 and the fuel ethanol blend mandate from E15 to E20, and has coordinated with ASEAN-counterparts, particularly Indonesia and Malaysia, on test protocols for higher biodiesel blends. The SRA together with the University of the Philippines Los Baños (UPLB), and Ethanol

Producers Association of the Philippines (EPAP) conducted discussions in the development of a draft test protocol for E15 and E20. To date, there is no immediate plan to increase the fuel ethanol blend, which remains stagnant at E10. The long-term pathway to E20 blending will likely be through voluntary blending, not mandated, and only if the vehicle fleet can be transitioned to the higher blend without engine damage, pricing at the pump incentivizes buyers, and efficient distribution is realized.

***Initiatives for Higher Ethanol Blends*.** The DOE Secretary had released instructions to prepare the standards for E15 and E20 in early 2020, but these were put on hold due to COVID-19. In April 2022, DOE's Technical Committee on Petroleum Products and Additives (TCPPA) started preparatory coordination with oil companies and local car manufacturers on the formulation of the PNS for higher fuel ethanol blends of E15 and E20. Once the PNS are issued, engine tests using E15 and E20 will also be conducted on new and in-use vehicles. DOE, SRA, EPAP and UPLB conducted initial meetings to study engine performance and emission testing at higher ethanol blends in non-flex fuel vehicles in the Philippines. Since the Philippines transport sector has limited availability of flex fuel engines, there is a need for science-based studies using typical non-flex fuel vehicles at higher bioethanol blends. Most of the vehicle fleet especially those in the provinces are old and there is nothing incentivizing a faster turnover of the vehicle fleet. The DOE is set to increase the biodiesel blend to B3 or B5, whichever will be agreed upon by the NBB. Recently, the DOE revised the biofuels roadmap posted on its website simplifying the 2020-2040 targets. The blend target for B5 is set for 2022 and E20 beyond 2025.

Figure 1. Philippine Biofuels Roadmap, 2020-2040



Source: DOE

Financial Supports for Biofuel Producers

To encourage investments, the government provides biofuels producers income tax breaks for the first seven years of operation, special realty tax rates on equipment and machineries, duty-free importation of equipment and machineries, zero-rated value added tax on purchases of goods and equipment, and zero percent value added tax rate on sale of bioethanol fuel, as stated in RE Law of 2008.

The Board of Investments (BOI) extended zero-VAT Rating to the sale of raw materials used in biofuels production under the National Internal Revenue Code, as amended by the Expanded VAT Reform Law of 2006, in accordance with the Omnibus Investment Code of 1987 (Executive Order No. 226). BOI also provides incentives to registered biofuels manufacturers under the CREATE Act and IRR and the 2020 Investment Priorities Plan which identifies projects under the Renewable Energy Act as among the mandatory inclusions.

The Biofuels Act contains several incentives detailed in Section 6 such as: tax exemptions for the biofuel component of the blended gasoline and diesel, and exemptions from wastewater charges imposed under Section 13 of the Philippine Clean Water Act for water effluents from biofuels production.

In accordance with Section 17B of the Biofuels Act, the Social Amelioration and Welfare Program (SAWP) has been institutionalized wherein biofuel producers contribute a corresponding "lien" per liter of biodiesel and bioethanol produced and sold. Currently, the Department of Labor and Employment (DOLE) imposed a lien of PhP 0.05 per liter of CME-based biodiesel, PhP0.19 per liter of sugarcane-based bioethanol, and PhP0.07 per liter of molasses-based bioethanol. Under the SAWP, qualified biofuel workers can take advantage of various assistance, such as for livelihood, training, education, social protection and welfare, and emergencies. The revised guidelines on the implementation on SAWP for biodiesel workers was issued June 3, 2021, while the revised SAWP for ethanol was issued in January 22, 2021, both with increasing social protection and benefits to workers.

SRA requires bioethanol producers to pay a monitoring fee and liens for bioethanol research, development, and extension (BRDE). SRA's Sugar Order No. 5 in 2016, amended in 2019 authorized the collection of a monitoring fee of PhP0.05 ($0.001) per liter of fuel ethanol produced and a BRDE lien of PhP0.10 per liter of fuel ethanol. The BRDE lien collected is set aside by the SRA in a trust fund for the purpose of funding research and development (R&D) and extension projects for the fuel ethanol industry. All project proposals endorsed by the EPAP to SRA shall be accompanied by a Sugar Board Resolution. The EPAP and SRA then enter into a memorandum of agreement (MOA) on the terms and conditions for the utilization of the BRDE liens, accompanied with project proposals, work plans and other requirements pursuant to the Commission on Audit rules and regulations.

Environmental Sustainability and Certification

Among the primordial objectives of the Biofuels Act are: a) develop and utilize indigenous renewable and sustainably-sourced clean energy sources to reduce dependence on imported oil; b) mitigate toxic and GHG emissions; and c) ensure the availability of alternative and renewable clean energy without any detriment to the natural ecosystem, biodiversity and food reserves of the country. There are efforts by the Philippine government to comply with its international commitment to reduce GHG emissions through RE. The Philippine government looks into the realization of the sustainable development goals, wherein economic progress supports the protection of the environment and the health and safety of the people. The DOE-Energy Policy and Planning Bureau (EPPB) continues to monitor the GHG avoidance contribution of the actual local consumption of biofuels in the country. To date, there is no third-party certification and GHG values are released by the DOE-EPPB.

Table 4. Biofuels GHG Avoidance

Year	Bioethanol (KTCO2e)	Biodiesel (KTCO2e)
2016	499.59	551.98
2017	516.61	516.05
2018	668.81	520.39
2019	782.92	551.53
2020	609.38	406.75
2021	788.81	484.74

Source: DOE-EPPB

Life Cycle Assessments. In 2019, UPLB completed a study on "Life Cycle Assessment in terms of Carbon Debt and Payback Analyses, Carbon Savings and Energetics Studies of Biodiesel Production from Coconut Oil in the Philippines." The study calculated carbon intensity of Philippine biodiesel from crude coconut oil and refined coconut oil at 32.8 gCO2e/MJ and 31.5 gCO2e/MJ, respectively. However, under the current B2 blending requirement, this only results in a GHG reduction of 1.2-1.3 percent, though this factor would grow to 12.6-12.9 percent under a B20 scenario as earlier envisioned by DOE.

UPLB also conducted a life cycle assessment of fuel ethanol production, considering 10 out of 12 bioethanol distilleries during Marketing Year (MY) 2019-2020 (September to August). The study calculated the Philippines' overall ethanol carbon intensity at 46.8 gCO2e/MJ, albeit wide ranging from 37 to 89 percent GHG reduction, depending on the ethanol plant observed. The study further estimated the adoption of an E20 mandate as earlier envisioned by DOE would result in four million tons of annual GHG savings by 2030.

The Biofuels Act does not provide the Department of Environment and Natural Resources (DENR) any specific responsibilities for its implementation. The production of biofuels, however, has possible effects on water discharges and effluents, which may be a source of water pollution. The Biofuels Act exempts biofuel investors from wastewater fees but not from the obligation to secure a discharge permit. Under the Philippine Clean Water Act, the DENR requires facilities discharging regulated effluents to secure a permit to discharge (Section 14). While biofuels plants are exempted from the discharge fees, they must conform to guidelines issued pursuant to the Clean Water Act, subject to the monitoring and evaluation

of the DENR. The implementation of the Biofuels Act is linked to the provisions and in accordance with the objective of the Philippine Clean Air Act to develop and utilize cleaner alternative fuels. Manufacturers must comply with the standards to ensure its effectiveness when use as a blend.

There are no sustainability requirements for soil management or land use. The Philippines has no comprehensive land-use policy regarding the cultivation of energy crops such as sugarcane for bioethanol or coconut for biodiesel. While the DA and DAR are mandated to determine the lands suitable to feedstock production, land use is largely determined by the local governments through ordinances, if any. SRA monitors the sugarcane used for fuel ethanol production but there are no national standards or guidelines on how decisions are made on whether farmland is to be used for biofuel or food production.

On April 15, 2022, the Electric Vehicle Industry Development Act (EVIDA) lapsed into law without being approved or vetoed by the Philippine President. EVIDA was published in the online Official Gazette on April 16, 2022, and took effect within 15 days. EVIDA is in line with the country's policy to ensure its energy security and independence by reducing reliance on imported fuel for the transportation sector. The IRR is being developed and it will take time before its full implementation.

Operation of the Domestic-Imported Fuel Ethanol Allocation System and Diversion Prevention

By law, during the first four years of Biofuels Act implementation, in the event of supply shortage of locally produced fuel ethanol oil companies were allowed to import bioethanol and benefitted from a reduced tariff, but only to the extent of the shortage as determined by the NBB (Section 5 and 6 of the IRR, RA 9367). Due to insufficient feedstocks for bioethanol, NBB still allows importation of fuel ethanol to comply with the mandated E10 blend requirement. The DOE promulgates the import guidelines DOE DC 2011-12-0013 requiring oil companies to purchase the entire monthly allocation of local fuel ethanol before they can import. The bioethanol producers submit their committed volumes available for lifting/delivery to the DOE- Renewable Energy Management Bureau (REMB) on the first day of the allocating month, which is one quarter ahead of the delivery month. DOE-REMB endorses the consolidated monthly committed volumes for any given quarter to OIMB. The OIMB calculates and circulates the respective local monthly allocation (LMA) of each oil company on the 10th day of each allocating month based on the average market share. The LMA issuance serves as the regulatory mechanism for the exhaustion of local bioethanol. While imported ethanol fills in the supply gap, it is calculated based on gasoline demand.

The quota allocation system ensures that imports do not displace locally produced fuel ethanol. DOE DC 2015-06-0007 provided the revised guidelines on the utilization of locally-produced fuel ethanol, which amended DC 2011-12-0013. The revised DC omitted the notice of allowable fuel ethanol importation (NABI) and issue special exemption for E10 blending to RON 97, 98, and above. Oil companies can only import fuel ethanol equivalent to the shortage, that is, total requirement less LMA.

The Bureau of Internal Revenue (BIR) issued Revenue Regulations No. 8-2006 prescribing the implementing guidelines on the taxation and monitoring of the raw materials used and the fuel ethanol-blended gasoline produced under the fuel bioethanol program of the DOE. Imported fuel ethanol must be denatured with two percent gasoline in accordance with the formula prescribed under these regulations. This practice prevents the diversion of imported bioethanol to other usage other than fuel, i.e., potable alcohol. The denaturing of imported fuel ethanol must be conducted in the presence of authorized representative of the oil industry participant, DOE, BIR and Bureau of Customs (BOC) within 48 hours immediately after completion of the unloading of the fuel ethanol from the foreign vessel and transfer thereof to the Customs-bonded storage tank. The REMB conducts monitoring and sampling activities to ensure compliance to the PNS – quarterly for biodiesel and semestral for bioethanol producers.

EPAP requested for the reinstatement of the net allowable bioethanol import (NABI) as stated in DC 2011-12-0013, which was omitted in the amended version DC 2015-07-0007 or the revised guidelines on the utilization of locally produced bioethanol in the production of e-gasoline. The DOE issued DC 2021-06-0014 or the revised circular for the accreditation and submission of notices and reports of the Philippine downstream oil industry (DOI) pursuant to Biofuels Act. The circular reinforces the DOE's mandate to strictly monitor the DOI. Additional information can be accessed here.

Import Duties

The HS Codes for ethanol (excluding beverage ethanol) are 2207.10 and 2207.20. Currently, there is no import tariff on ethanol as tariffs fell to zero in 2016 (ASEAN) and 2020 (Most Favored Nation). A duty of 1 percent duty is paid on imported ethanol destined for gasoline blending that the oil companies pay. Biodiesel is harmonized under HS Code 3826.00 (pure biodiesel and biodiesel blends down but not including 30 percent while petroleum oils containing 1-30 percent biodiesel by volume use HS Code 2710.20.

III. Ethanol

Table 6. Fuel Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022f**
Beginning Stocks	na	na	na	na	na	na	25	14	14	10
Fuel Begin Stocks	na	na	na	na	na	na	25	14	14	10
Production	na	na	na	na	na	na	375	344	409	410
Fuel Production	72	115	168	230	235	297	346	280	355	360
Imports	na	na	na	339	322	347	341	322	385	480
Fuel Imports	297	339	311	260	276	285	257	241	225	300
Exports	0	0	0	0	0	0	0	2	4	4
Fuel Exports	0	0	0	0	0	0	0	0	0	0
Consumption	na	na	na	na	na	na	727	664	794	886
Fuel Consumption	369	454	479	490	511	557	614	521	584	660
Ending Stocks	na	na	na	na	na	25	14	14	10	10
Fuel Ending Stocks	na	na	na	na	na	25	14	14	10	10
Refineries Producing Fuel Ethanol (Million Liters)										
Number of Refineries	4	7	8	10	10	12	12	12	13	13
Nameplate Capacity	133	207	222	282	282	381	381	381	426	426
Capacity Use (%)	54.1%	55.6%	75.7%	81.6%	83.3%	78.0%	90.8%	73.5%	83.3%	84.5%
Co-product Production (1,000 MT)										
Bagasse	150	150	45	17	12	3	88	150	102	120
Feedstock Use for Fuel Ethanol (1,000 MT)										
Sugarcane	500	500	150	55	40	200	190	502	340	350
Molasses	155	340	650	930	950	1,080	1,240	1,076	1,340	1,350
Sugar	10	5	0	0	0	0	0	0	0	0
Market Penetration (Million Liters)										
Fuel Ethanol Use	369	454	479	490	511	557	614	521	584	660
Gasoline Pool 1/	4,358	4,505	5,174	5,692	6,199	6,441	6,973	5,636	6,757	6,775
Blend Rate (%)	8.5%	10.1%	9.3%	8.6%	8.2%	8.6%	8.8%	9.2%	8.6%	9.7%

Note:
na-Neither government nor industry sources can provide stocks and production data for 2013 to 2018. f = forecast.
1/= Covers gasoline and all biocomponents (biofuels) like ethanol
Conversion: 1MT of molasses = 246 liters of ethanol, 1MT of sugarcane = 80 liters of ethanol (ave.)
Source: DOE, SRA, Bureau of Customs, with Post estimates for 2022 using IEA data as reference

Consumption

The demand for fuel ethanol is a function of the actual blend and gasoline pool size. Post forecasts a 13 percent growth in consumption to 660 million liters in 2022 attributed to continuous economic growth as the Philippines recovers from the COVID-19 pandemic. The plan to have full face to face classes in schools in August 2022 will drive the fuel demand despite the current high prices. The expected growth relates to the forecast of the International Energy Agency (IEA) though the Philippine DOE released a more optimistic outlook starting with a high forecast in 2022. The total consumption of fuel ethanol reached 584 million liters in 2021 due to growth in gasoline demand to 6.8 billion liters during the year, returning to the pre-pandemic consumption level.

Over time, imported fuel ethanol is expected to cover a growing portion of total consumption because local production is expected to face continued feedstock supply constraints. Imports supplied most of domestic demand in the early years of the fuel ethanol program. With the expansion of domestic production capacity, the industry was able to reach up to 50 percent of domestic demand by 2016. Since then, the ability of the domestic industry to supply demand has stagnated at near 50 percent, with imports covering the remaining 50 percent of the E10 mandate. With the projected increase in imports in 2022, the average blend rate is expected to reach 9.7 percent. The DOE released the bioethanol demand outlook below keeping the blend at E10 until 2026, with demand growing at about six percent annually.

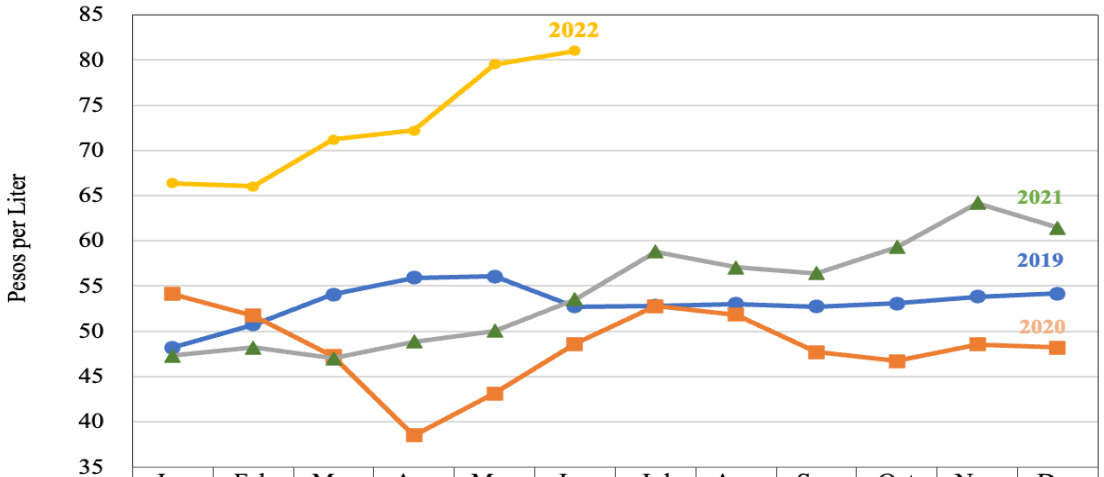
Table 7. Bioethanol Demand Outlook

Year	Gasoline Demand (in million liters)	Bioethanol Blend (Target)	Supply Requirement (in million liters)
2022	7,652	10%	765
2023	8,108	10%	811
2024	8,639	10%	864
2025	9,150	10%	915
2026	9,697	10%	970

Source: DOE-OIMB

Prices. In the past three years, the lowest gasoline prices were seen in April 2020 when the Philippines imposed a series of lockdowns due to COVID-19. In 2022, crude oil prices have risen due to global supply/demand imbalances aggravated by the conflict between Russia and Ukraine that has unsettled markets. The Philippines experienced and continues to experience sudden increases in at-the-pump prices of fossil fuel. Independent oil producers proposed the suspension of the Biofuels Act. EPAP opposed the proposal and is pushing to raise the blend to E15/E20 to reduce gasoline prices and GHG emissions.

Figure 2. Monthly Gasoline Prices, 2019-2022



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	48.17	50.75	54.09	55.89	56.05	52.74	52.83	53.00	52.73	53.05	53.84	54.19
2020	54.14	51.71	47.25	38.50	43.12	48.60	52.75	51.85	47.67	46.71	48.54	48.19
2021	47.30	48.18	46.98	48.86	50.05	53.54	58.80	57.05	56.40	59.30	64.16	61.44
2022	66.36	66.02	71.20	72.19	79.49	81.02						

Note: June 2022 (1st week average)
Source of data: DOE-OIMB

EPAP acknowledges that domestic ethanol is expensive, and that oil companies have benefitted from cheaper imported fuel ethanol, which drives down the retail price of gasoline. The current high gas prices make it cheaper to use bioethanol.

Based on prevailing prices as of first week of June 2022, domestic fuel ethanol was priced at PhP 69.79 per liter while imported fuel ethanol costs PhP 48.66 per liter. With the average June price of domestic and imported gasoline, E10 gasoline decreased the pump price by PhP 4.86 per liter versus pure imported gasoline.

Economic Impacts of Higher Blend Rates. Had the Philippines maintained its earlier timeline to move to higher blends of E15 and E20, using current prices, it would have decreased the gasoline pump price by 2.2 percent and 4.4 percent, respectively, resulting in average annual savings equivalent to PhP 11.8 billion ($225 million) and PhP 23.6 billion ($450 million). This environment, however, would have also facilitated an opportunity to share a portion of gained consumer welfare with local fuel ethanol producers via higher prices for locally produced fuel ethanol, which in turn, would have encouraged local producers to maximize production.

Table 8. Pump Price Impacts of Higher Blend Rates			
Blend	Pump Price E10-Equivalent	Consumer Welfare	Equivalent Peso Value (PhP Million)
E15	0.9777	.0223	11,785
E20	0.9555	.0445	23,571

Note: Gasoline – PhP81/liter (average first week of June 2022)
Bioethanol Reference Price (June 1, 2022) – PhP69.79/liter
Imported Ethanol (June 1, 2022) - $0.772/liter + 20% = Landed Subic – PhP48.55/liter
Forex (June 1, 2022) - $1:PhP52.41 (Source: Bangko Sentral and Pilipinas)

Production

Post forecasts fuel ethanol production in 2022 to reach 360 million liters, a slow growth of 1.4 percent is due to feedstock problems. Competitiveness of the local sugarcane industry to provide the needed feedstock remain a challenge. From the Sugar Annual Report 2022, Post expects raw sugar production to decline year-over-year by 2 million metric tons (MT), with cane production expected to be about 23 million MT. As in past recent years, feedstock supply will be limited for fuel ethanol production, requiring imports to cover growth in fuel consumption. Since the implementation of the Biofuels Act in 2007, investments in distilleries contributed to industry growth.

Table 9. Bioethanol Production Milestones					
Year	Number of Distilleries	Annual Rated Capacity (million liters)	Annual Production (million liters)	Capacity Utilization (%)	Annual Blend Rate (%)
2008	1	Na	0.97	Na	Na
2009	2	39.00	23.23	59.6	2.3
2010	3	69.00	10.17	14.7	3.8
2011	3	69.00	4.14	6.0	5.6
2012	4	123.00	34.54	28.1	6.9
2013	4	123.00	71.54	58.2	8.5
2014	7	207.12	114.86	55.5	10.1
2015	8	222.12	167.87	75.6	9.3
2016	10	282.12	230.18	81.6	8.6
2017	10	282.12	234.65	83.2	8.2
2018	12	380.50	296.54	77.9	8.6
2019	12	380.50	346.14	91.0	8.8
2020	12	380.50	279.58	73.5	8.8
2021	13	425.50	354.60	83.3	8.6
2022*	13	425.50	350.00	82.3	9.7

Source of basic data: DOE and SRA

Currently, the main feedstocks are sugarcane-based materials, i.e., molasses and sugarcane juice. While 80 percent of total molasses in the country is used for ethanol production, supply is still not sufficient. The industry looks at corn and other potential feedstock, i.e. sweet sorghum, cassava, nipa and sweet potato, but these are still in the research stage and will take time to produce alternative to sugarcane commercially for bioethanol processing, if they can achieve success at all. The DOE has recent projects on biofuels on nipa sap as feedstock and cellulosic ethanol production technology. Corn as feedstock poses problems because of the food versus fuel dilemma. Corn is also not included in the list of crops in the guidelines governing biofuels feedstock production (DOE JAO No. 2008-1). Corn can be allowed if from newly opened corn areas but not from existing corn production areas, thereby avoiding conflict with food security issues. To use corn, existing bioethanol plants need to invest on the corn feedstock line which required a difference processing technology. Current ethanol plants are only equipped to process molasses and sugarcane juice. One producer has signaled interest to look into corn ethanol production. Brazil is the only country that has successfully developed dual cane-corn commercial plants at scale now operational in recent years.

There is no immediate solution to insufficient feedstock. The Philippines will continue to use molasses and sugarcane. The high demand for molasses had driven up its price in previous years from the normal longer-term average of PhP 4,000/MT ($80/MT) in the previous years. Sugarcane planters are benefiting from the high molasses prices, but this has resulted in high bioethanol prices. The SRA releases the Bioethanol Reference Price twice a month as benchmark for the price negotiations of oil companies and bioethanol producers to establish a level playing field.

Table 10. Molasses Price and BRP

Marketing Year	Molasses Price (PhP/MT	Sugar Composite Price (PhP/Lkg)	Bioethanol Reference Price (PhP/Li)
2016-2017	8,543.92	1,429.89	53.68
2017-2018	6,363.96	1,440.47	50.96
2018-2019	9,693.99	1,532.32	57.40
2019-2020	11,828.02	1,483.87	61.07
2020-2021	9,352.00	1,500.00	57.07

Source: SRA

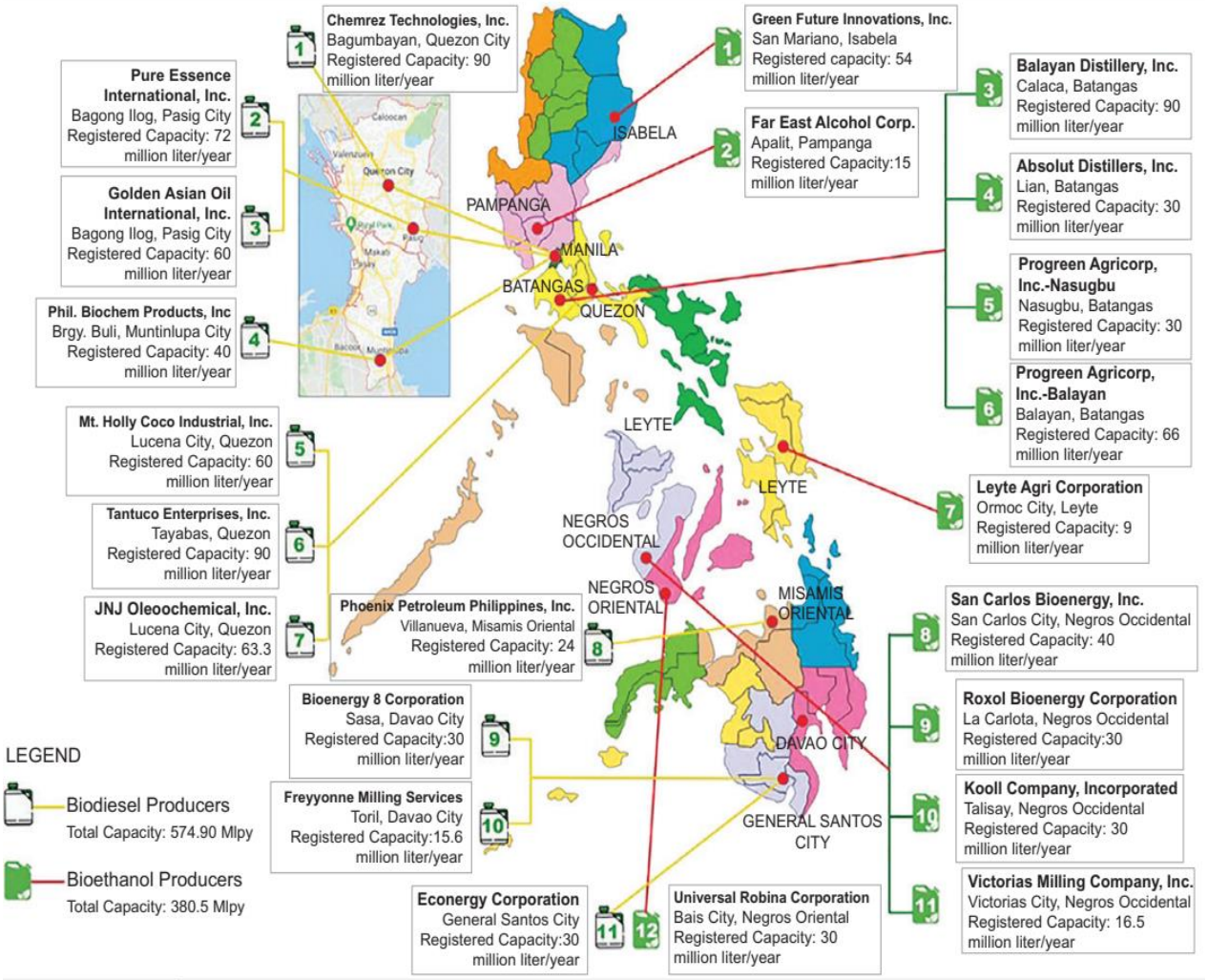
By law, imported molasses for use as a biofuel feedstock is not allowed. The EPAP proposed to temporarily allow importation of molasses to maximize plant capacity given current high fuel prices. The DOE declined such a proposal in 2020 with sugar planters, millers and the SRA also opposed during the stakeholders' consultations in August 2021. EPAP also discussed the proposal with the Philippine Senate but received no decision. EPAP hopes the new government will back such a proposal for the development of the biofuels industry.

Meanwhile, imported molasses is allowed as feedstock in the production of denatured alcohol for industrial use. Production increased by 16 percent in 2021 with almost 700 million liters related to the COVID-19 pandemic. A number of distilleries shifted a portion of their capacity to alcohol disinfectant or rubbing alcohol producing a monthly average of about 60 million liters.

There are 13 accredited bioethanol producers in the Philippines, with a total production capacity of 425.5 million liters per year (MLPY) in 2021. Additional capacity of 38 million liters is expected by the end of 2022. The current capacity utilization is equivalent to about 80 percent of the volume requirement for the E10 mandate.

The overcapacity of fuel ethanol plants compared to the local feedstock available is a result of the unexpected shift of seven potable alcohol producers to fuel ethanol following the implementation of a 22 percent excise tax on potable alcohol.

Figure 3. Philippine Biofuels Producers



Source: PEP 2018-2040

Trade

Fuel oil companies can import bioethanol only if domestic production cannot meet demand created by the mandate which has been the case from the very earliest days of the fuel ethanol program. The NBB determines the volume and allocates among fuel oil companies to comply with the mandated the blend. Imports were almost entirely sourced from the United States now several years ongoing although there were a few years earlier which Thailand was a key supplier. Total fuel ethanol imports in 2022 will accelerate to 300 million liters due to the expected increase in consumption. Local ethanol remains the priority but imported will continue to cover around 50 percent of the needed supply for gasoline for the E10 blending.

Table 11. Fuel Ethanol Imports (Million Liters)						
Source	2016	2017	2018	2019	2020	2021
Australia	17	4				
South Korea	2	6		6	4	
USA	241	263	285	251	237	217
Vietnam		3				
Brazil						7
Singapore						1
Total	260	276	285	257	241	225

Source: SRA and DOE
(HS Codes 2207.10 and 2207.20)

As of May 2022, there are 22 accredited importers of bioethanol composed of the top fuel oil companies (Petron, Shell, Chevron) and fuel traders who supply small players.

Table 12. Accredited Downstream Oil Industry Biofuel Participants	
1. Goldenshare Commerce & Trading, Inc.	12. Petron Corporation
2. Pilipinas Shell Petroleum Coporation	13. Unioil Petroleum Philippines, Inc.
3. Marubeni Philippines Corporation	14. Seaoil Philippines, Inc.
4. Sea Marine Subic Worthy Services and Trading Corporation	15. Warbucks Industries Coporation
	16. Noble 1 Petroleum Corporation
5. PTT Philippines Corporation	17. ERA 1 Petroleum Corporation
6. Filoil Logistics Corporation	18. Warbucks Southern Corporation
7. Jetti Petroleum Inc.	19. Bei Hai Import/Export Inc.
8. Micro Dragon Petroleum, Inc,	20. High Glory Subic International Logistics, Inc.
9. Trafigura Philippines Inc.	
10. Vmaximus Subic FreePort Corp.	21. APEX Petroleum OPC
11. Chevron Philippines, Inc.	22. Northonmark Industries Corp.

Ethanol for Non-Fuel Use (Disinfectant)

The DOE allowed the bioethanol producers to repurpose their production processes from fuel use to medical use. Five bioethanol producers went into production of medical grade alcohol or rubbing alcohol to increase the country's supply of the needed alcohol due to COVID-19. The Philippine Food and Drug Administration (FDA) issued interim guidelines for the provisional licenses to operate and certificates of product notifications for all rubbing alcohol through FDA Memorandum Circular 2020-001. In 2020, about 64 million liters of rubbing alcohol were produced by bioethanol producers: Victorias, Progreen (Balayan and Nasugbu), Kooll Company, and Far East Alcohol. According to EPAP, ethanol producers donated about 1.5 million liters to hospitals, government offices, local government units, and schools as part of the producers' corporate social responsibility.

IV. Biodiesel

Table 13. BIODIESEL (Million Liters)

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Beginning Stocks	18	20	29	32	41	57	71	95	122	129
Production	155	172	204	227	220	220	242	188	198	248
Imports	0	0	0	0	0	0	0	0	0	0
Exports	0	0	0	0	0	0	0	0	0	0
Consumption	153	163	201	218	204	206	218	161	191	250
Ending Stocks	20	29	32	41	57	71	95	122	129	127
Production Capacity (Million Liters)										
Number of Biorefineries	9	11	11	11	11	11	12	13	13	13
Nameplate Capacity	393	585	585	575	575	575	608	708	708	708
Capacity Use (%)	39.4%	29.4%	34.9%	39.5%	38.3%	38.3%	39.8%	26.6%	28.0%	35.0%
Feedstock Use (1,000 MT)										
Coconut Oil	142	158	187	208	202	202	222	172	182	228
Market Penetration (Million Liters)										
Biodiesel, on-road use	153	163	201	218	204	206	218	161	191	250
Diesel Pool, on-road use 1/	6,187	6,579	7,334	7,701	8,086	8,200	8,413	6,440	7,460	8,300
Blend Rate (%)	2.5%	2.5%	2.7%	2.8%	2.5%	2.5%	2.6%	2.5%	2.6%	3.0%
Diesel Pool, total 1/	7,394	7,778	8,793	9,535	10,159	11,207	11,534	9,060	9,980	11,175

Note:
1/ Fuel pools are defined as fossil fuels plus all "bio-components" (biofuels) blended with fossil diesel.
f-forecast; diesel use includes biodiesel
Feedstock biodiesel conversion: 1 MT of coconut oil yields 1,090 liters of biodiesel
Source: DOE, with Post estimates for 2022 referencing to IEA data

Consumption

Consumption will accelerate in 2022 if the biodiesel blend mandate will increase from B2 to B5 and the fuel pool increases as forecast. Post forecasts biodiesel consumption to reach 250 million liters in 2022, 31 percent higher than in 2021. The Philippines Biodiesel Association (TPBA) advocates for gradual increase from B2 to B3 to B5 considering that domestic production can supply the needed requirement for an increase to higher blend. The DOE awaits the NBB endorsement to increase the blend mandate.

Consumption grew by 19 percent in 2021 due to rising economic activity, which significantly increased transport demand for fuel. The DOE-OIMB estimated the biodiesel demand for the next five years, increasing the blend target to five percent in 2022 growing at about five percent annually.

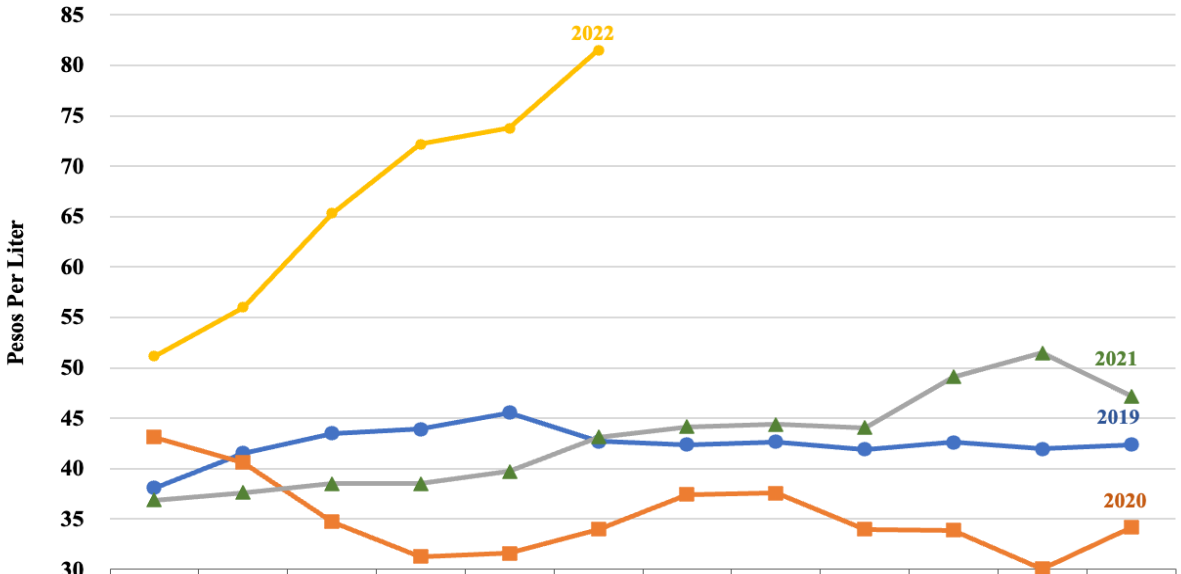
Table 14. Biodiesel Demand Outlook

Year	Diesel Demand (in million liters)*	Biodiesel Blend (Target)**	Supply Requirement (in million liters)
2022	12,894	5%	645
2023	13,650	5%	683
2024	14,342	5%	717
2025	14,907	5%	745
2026	15,543	5%	777

Note: * DOE-OIMB Estimates
**Proposed target
Source: DOE

Prices. Diesel is sold at retail stations for on-road and off-road use, including agricultural use (e.g. tractor fuel). Large mining companies maintain their own fuel depots on-site for their equipment, sourcing their supply directly from fuel companies.

Figure 4. Monthly Prices of Diesel, 2018-2022



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2019	38.11	41.53	43.50	43.91	45.55	42.70	42.40	42.68	41.89	42.60	41.96	42.38
2020	43.11	40.63	34.72	31.29	31.61	33.98	37.44	37.56	33.99	33.91	30.09	34.17
2021	36.87	37.63	38.52	38.50	39.74	43.14	44.14	44.38	44.04	49.09	51.47	47.16
2022	51.15	55.99	65.33	72.19	73.76	81.52						

Note: June 2022 (1st week average)
Source: DOE-OIMB

Over the years, examining the trends and gaps in prices between biodiesel and fossil diesel prices suggests raising the blend higher from B2 would lead to even higher diesel fuel cost. Through the years, biodiesel prices in the Philippines remain higher and even almost double the price of fossil diesel. This price effect (which is relatively very small on low-blended biodiesel-diesel blends), however, the PCA still pushes for the increase in the biodiesel blend in support of the livelihood of around 2.5 million coconut farmers. An evaluation of the effects in the coconut oil industry, however, and a calculation of diesel price increases need to be studied. That said, at low-blends, any price increase in the blended fuel over pure fossil diesel is largely 'washed-out' by the wide swings in oil and fossil diesel prices on the international market seen year after year. **By law, importation of biodiesel is not allowed, which could be the solution to manage the increase in diesel pump prices.** In June 2022, diesel became more expensive than gasoline.

Table 15. Prices of Diesel, CME and CNO			
Year	Diesel Price (a) (PhP/Li)	Biodiesel (CME) Price Range (b) (PhP/Li)	Crude CNO Local Price (c) (PhP/Kg)
2011	43.94	57 – 106	78.25
2012	43.67	30 – 88	48.15
2013	41.93	29 – 60	39.73
2014	41.04	38 – 75	61.98
2015	27.46	43 – 72	55.25
2016	25.43	45 – 85	74.45
2017	31.78	45 – 92	90.41
2018	42.70	40 – 91	79.97
2019	42.13	35 – 70	51.73
2020	35.16	35 – 75	49.19
2021	42.89(b)	58 – 90	97.16

Source: (a) ADB Key Indicators Database Philippines, Row 206
(b) DOE
(c) United Coconut Association of the Philippines

Production

Should the government mandate B5, the available biodiesel plant capacity is more than enough to supply the B5 requirement. However, while coconut production is abundant in the Philippines, the bulk of coconut oil goes to traditional exports, leaving bioethanol producers with feedstock issues. Post forecasts a growth of 25 percent in biodiesel production to 248 million liters in anticipation of the increase in the blending rate from B2 to B5 in 2022. While DOE affirms that the increase in blending will happen in 2022, considering that is it already the middle of the year, the volume uptake will take effect no sooner than the third or fourth quarter of 2022.

There are 13 accredited biodiesel producers, with total production capacity of 707.9 MLPY, equivalent to about 342 percent of volume requirements for the B2 mandate. The overcapacity in serving the B2 blend is a result of the over expansion of the industry in anticipation of the shift to B5 as guided by the PEP. Additional capacity of 150 million liters is expected by end of 2022. The actual production of 198 million liters in 2021 was only 28 percent of the registered capacity. The capacity utilization will rise to 35 percent if the increase in blend is mandated.

Increasing the biofuels blend requires constant development of locally produced feedstock sources to ensure adequate supply. Aside from finding promising feedstock, the DOE remains committed to the implementation of the Biofuels Roadmap and to working closely with other government agencies, academic institutions, industry stakeholders and international counterparts/organizations on the conduct of various R&D activities and demonstration projects using alternative feedstock such as jatropha, used cooking oil, microalgae, and rubber seed oil for biodiesel.

Research and development of biofuel production and utilization is one of the responsibilities of the Department of Science and Technology (DOST), which is also tasked with publishing and promoting related technologies developed locally and abroad. Its recent project is called Biomass as Green Energy Source. The DOST- Industrial Technology and Development Institute (DOST-ITDI) completed in December 2019 the study entitled Characterization/Performance Testing of the Biodiesel/Diesel Blends from Combined Feedstock of Various Vegetable and Used Cooking Oils. Biodiesel was produced from various feedstocks, namely: refined palm oil, used cooking oil, and rubber seed oil through optimized processes developed by DOST-ITDI. Four combinations of the biodiesel from four plant oils, coconut (CME), palm (POME), used cooking oil (UCOME) and rubber seed oil (RSOME) were used. Results of the analyses showed methyl esters from palm oil, used cooking oil, and rubber seed oil can be blended with CME for use as fuel additive to petroleum diesel at the given blending ratio both for binary and tertiary blends.

Trade

No trade is allowed under the Biofuels Act, although imported palm-oil biodiesel could offset the expected price increase of a higher blend mandate through lower-cost imported biodiesel.

V. Advanced Biofuels

The DOST-Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD) conducts R&D on biofuels in collaboration with other institutions such as DOE, DA, PCAARRD, and academia, particularly the UPLB and UP Visayas. PCIEERD, conducted research as follows:

1. Bio-oil production from agricultural waste (2014-2020). Pyrolysis was conducted on corn stover using a prefabricated reactor. Optimum conditions on temperature, time, and catalyst have yielded corresponding improvements in bio-oil and char yields. Recommendations for further studies include scaling up of equipment and facilities to support bio-oil production from other agricultural waste sources, working on higher pyrolysis temperature, and economic analysis to determine cost efficiency of the bio-oil and char.
   Fuel ethanol production from lignocellulosic feedstock (2009-2014) was carried out by UPLB to determine possible candidates for feedstock, evaluation, and optimization of pre-treatment methods, development of micro-organisms capable of utilizing lignocellulosic hydrolysates, and optimization of saccharification, fermentation, and purification processes for the ethanol production. Further R&D is required to improve the yield.

Sustainable (bio-based) Aviation Fuel (SAF) is not produced or used on flights in the Philippines. Currently, there are no reports of planned investments in SAF and renewable biodiesel.

To date, the Philippines has had little success in bringing advanced biofuels solutions to market but offers opportunities for (1) scientific exchanges, and (2) commercial opportunities for U.S. and European companies seeking to set up joint ventures with proven advanced biofuel technologies.

The Philippines focuses on finding new feedstock to produce more biofuels. The National Bioenergy Research and Innovation Center (NBERIC) was established in 2018 to realize research and development projects in bioenergy. NBERIC collaborates with various institutions on bioethanol R&D to maximize the NBERIC facility located at the Mariano Marcos State University in Batac, Ilocos Norte in northern Philippines. The USAID-Science, Technology, Research and Innovation for Development (STRIDE) have been instrumental in the establishment of NBERIC. The United States continues to collaborate in R&D efforts in bioethanol.

Attachments:

No Attachments