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Report Highlights:

China’s biofuels policies continue to wane as a priority for the People’s Republic of China (PRC) and investment in the sector has declined. Post estimates China’s 2022 ethanol blend rate at 1.8 percent, down from 2021 and well below the peak blend rate of 2.8 percent eleven years ago. Fuel ethanol consumption in 2022 is estimated at 3.8 billion liters, down 164 million liters from 2021 due to regional Covid-19 lockdowns resulting in less gasoline consumption in existing E10 pilot areas. Ethanol production in 2022 is forecast to increase to 3.8 billion liters, up 383 million liters from the previous year due to a period of profitability early in the year and limited imports. China’s 2022 biodiesel production is forecast at 2.4 billion liters, up by more than 32 percent from 2021 due to a surge in export demand, well above previous records almost entirely to the EU. Domestic biodiesel blending rates remain limited with no mandates beyond one municipal B5 program.

THIS REPORT CONTAINS ASSESSMENTS OF COMMODITY AND TRADE ISSUES MADE BY USDA STAFF AND NOT NECESSARILY STATEMENTS OF OFFICIAL U.S. GOVERNMENT POLICY

ACRONYMS

CAS	Chinese Academy of Sciences
CEF	Carbon Emission Footprint
ETS	Carbon Emissions Trading System
CAAM	China Association of Automobile Manufacturers
COFCO	China National Cereals, Oils and Foodstuffs Corporation
CNOOC	China National Offshore Oil Company
CNPC	China National Petroleum Corp
PetroChina	China National Petroleum Corp, Publicly listed-arm
Chinaoil	China National United Oil Corp, CNPC Trading-arm
Sinopec	China Petroleum and Chemical Corporation
Unipec	China Petroleum and Chemical Corporation, Trading-arm
CPPCC	Chinese People's Political Consultative Conference
DDGs	Dried Distiller's Grains with Solubles
EV	Electric Vehicle
ETBE	Ethyl Tert-Butyl Ether
FYP	Five-Year Plan
GACC	General Administration of Customs of the People's Republic of China
GHG	Greenhouse Gas
HDRD	Hydrogenation-derived Renewable Diesel
MTBE	Methyl tert-butyl ether
MEE	Ministry of Ecology and Environment
MEP	Ministry of Environmental Protection
MOF	Ministry of Finance
MPS	Ministry of Public Security
NDRC	National Development and Reform Commission
NEA	National Energy Administration
NPC	National People's Congress
NEV	New Energy Vehicles
PM	Particulate Matter
RMB	Renminbi
SCTC	State Council Tariff Committee
UCO	Used Cooking Oil

I. Executive Summary:

China's biofuel program has always been driven by plentifully available corn stocks and a means to reduce excess old stocks - air quality and environmental or climate change goals have always been secondary. In 2022, domestic corn-based ethanol producers struggle to be profitable with high corn prices and strict Covid-19 control measures, even as gasoline prices in China have risen by 30 percent in the last year. China's high tariffs and rising international shipping costs make ethanol imports unviable. At the same time, enforcement of China's E10 blending mandate remains weak, further dampening any incentive to import. The PRC did not enact any significant polices or supports over the past year to assist or develop the ethanol industry, another indication government priorities have shifted away from biofuels development.

In late 2020 President Xi made an international commitment to peak carbon dioxide emissions by 2030, but biofuels were noticeably absent as a directive or tool to meet these targets. The policy-driven directives made by the PRC also allowed the country's biofuels sector to be partially isolated from the global market and less responsive to market forces.

It is rumored that the PRC may move unofficially to an E5 mandate in the coming years, but the government insists E10 remains in force. While E10 remains the official policy, actual blend rates vary and are often significantly lower even in locations with an E10 program. Moreover, several provinces have yet to establish a program and are unlikely to ever establish one without surplus feedstock to support a local industry. The PRC declared in 2017 that it would establish a nationwide E10 mandate by 2020. The goal was unofficially suspended in late 2020 and ethanol blend rates in pilot areas have since declined. High corn prices pushed up the cost of fuel ethanol production while ethanol price gains were held in check using a formula tied to gasoline prices, forcing the provinces and cities which had announced E10 expansion plans in 2019 to scale back implementation. The PRC has reportedly delegated E10 blending goals and decision-making authority to provincial governments while requiring existing E10 pilot areas to continue to blend at E10.

Fuel ethanol consumption in 2022 is estimated at 3.8 billion liters, down 164 million liters from 2021 due to regional Covid-19 lockdowns resulting in less gasoline consumption in existing E10 pilot areas. Production is forecast to increase to 3.8 billion liters, up 383 million liters from 2021 due to a period of profitability early in the year. Fuel ethanol imports are forecast at 5 million liters, mostly from the United States. With higher domestic production due to reduced feedstock prices early in the year, China will rely on domestic production to meet market demand in 2022.

The export of used cooking oil (UCO)-based biodiesel saw an increase in the first half of 2022, as robust demand from the European Union (EU) spurred biodiesel producers to increase production[1]. China's fatty acid methyl esters (FAME) biodiesel producers have a relatively stable production capacity at 2.4 billion liters per year. Export-oriented hydrogenation-derived renewable diesel (HDRD) plants saw notable expansion in the last two years, with a combined capacity of close to 2.3 billion liters by the end of 2022 and an additional 3.4 billion liters per year capacity planned. China's 2022 biodiesel production is forecast at 2.4 billion liters, up by over 32 percent from 2021 due to a surge in exports, well above previous records, almost entirely to the EU. From January to June 2022, China's biodiesel exports rose 60 percent year-on-year. The vast majority is shipped to the Netherlands and Belgium. With no national or provincial biodiesel blend mandates, demand for domestic use and imports is

[1]Due to uncertainty in HS codes used for HDRD, it is possible some product traded under the biodiesel code in Chapter 38 could be HDRD that should be reported in Chapter 27.

discretionary (except for Shanghai's city mandate) and thus hinges on the price spread between palm oil (feedstock used to make the generally lowest cost biodiesel from Indonesia and Malaysia) and diesel. Lacking any significant support, plants remain small with localized and limited sales. Post estimates a 0.2 percent biodiesel blend rate in 2022, similar to the previous two years. There have been no appreciable changes since biodiesel emerged in China two decades ago.

II. Policy and Programs

Past government policies state biofuels are part of the PRC's long-term strategic plan to protect the environment, conserve resources, and reduce dependence on imported energy. However, no new biofuel policies were announced in the last half of 2021 or the first half of 2022. Ethanol is the only biofuel that has received any attention from policy makers with ambitious emissions targets. China's ethanol programs also support national initiatives to manage air pollution. Support for biodiesel (mandates, producer subsidies, and pricing policy) which lowers air toxins compared to fossil diesel, remains noticeably absent and is left out of policy conversations. Sustainable aviation fuel (SAF) is still in its infancy and there have yet to be serious conversations around support policies. For more details, see GAIN reports CH19047 and CH2020-0105.

Renewable Energy and Greenhouse Gas (GHG) Emissions

Carbon Peak before 2030
At the Climate Ambition Summit in December 2020, President Xi committed the PRC to lower its carbon dioxide emissions per unit of GDP by over 65 percent from its 2005 level and will increase the share of non-fossil fuels in primary energy consumption to 25 percent by 2030 to meet the goal of peak carbon dioxide emissions by 2030.

The PRC launched an emissions trading system (ETS) on July 16, 2021. Carbon emissions by companies covered in the first batch of trading are estimated to exceed 4 billion tons per year, or roughly 12 percent of global CO2 emissions, making it the world's largest market in terms of the amount of greenhouse gas emissions due to heavy use of coal. The first compliance period of the national ETS was completed on December 31, 2021. It spanned 114 trading days, with a cumulative trading volume of 179 million tons of carbon allowances and a cumulative turnover of $1.1 billion (RMB 7.7 billion). Ethanol could stand to benefit from the carbon trade system as a carbon emission reducer if the China Certified Emission Reductions (CCER) approves biofuel ethanol for carbon trade. Ethanol would then hold additional value on the carbon market. This will support ethanol producers and makes use of ethanol-blended gasoline more economical over pure gasoline.

For information on the PRC's CO2 and energy intensity reduction goals as well as the Energy Development Strategy Action Plan published in November 2015, the Blue Sky Protection Plan issued in July 2018, and China's Vehicle Emissions Standards, please see the 2021 and 2020 Annual Biofuels Reports.

Fuel Ethanol Policy Framework and Mandates

PRC law restricts fuel ethanol processing to licensed facilities that produce and supply fuel ethanol to national refiners and fuel marketing companies. Provincial Development and Reform Commissions (DRCs) are responsible for the distribution of licenses for fuel production, refining, and marketing. (See Section III. Ethanol Production).

In February 2022, the State Council released its annual policy guidelines on agriculture and rural development known as the "Number 1 Document" which stipulated that officials "strictly control the corn-based fuel ethanol processing industry." This likely indicates that corn-based ethanol production will remain at current capacity for the foreseeable future. In June 2022, the NDRC led nine ministries to publish the "14th Five-Year-Plan for Renewable Energy." The Plan calls for the development of non-grain biofuel ethanol such as cellulosic biofuel (a

long-standing announced goal that has led to no large-scale commercial industry), and encourages demonstration pilots of alcohol, electricity, gas, and fertilizer production. The Plan also encourages promotion of clean liquid fuels such as fuel ethanol and biodiesel (a rather empty statement and nothing new).

On May 10, 2022, NDRC and MOFCOM jointly released the 2022 Catalogue of Encouraged Foreign Investment in Industries, which includes fuel ethanol development and production. However, the catalogue specifically discourages foreign investment in grain-based ethanol production. This is a further signal that investments in expanding China's corn (or other grain) based ethanol production capacity in the short to near-term is unlikely.

In 2017, PRC government messaging called for the moderate development of grain-based fuel ethanol and an E10 mandate which shifted in 2020 to the "strict control of the expansion of fuel ethanol processing capacity." This is reminiscent of earlier period of reduced surpluses and high corn prices in 2008, following a corn ethanol expansion phase, when China restricted construction of new ethanol facilities. In 2022, the messaging was repeated, "to strictly control the corn-based fuel ethanol processing industry." This shift from 2017 to 2020 and reinforced in 2022 illustrates the gradual transition away from the original first-ever push for E10 nationwide. That said, the PRC will maintain E10 mandates in provinces and municipalities that have fully or partially adopted E10, while quietly postponing (and likely eventually dropping altogether) any expansions of nationwide E10.

E10 Production Estimate for 2022
Post forecasts China to produce 3.8 billion liters of fuel ethanol and consume the same amount in 2022, slightly lower than 2021 consumption levels. Domestic production will keep the blend rate at or slightly below 2021 levels as there will be less blending in some areas, high feedstock prices, and limited imports which are constrained by high import tariffs and rising shipping costs.

If China had fully implemented a national E10 blending program by 2020, based on the International Energy Agency (IEA) and China's National Energy Administration (NEA) figures, China would have consumed about 19 billion liters of fuel ethanol in 2020, or five times greater than actual consumption that year. Even if all existing approved fuel ethanol projects begin operation in 2022, the total output would only allow an E4 blend rate. However, this assumes China's corn stocks could support the expansion and remain stable over the long term which appear unlikely given water scarcity and climate change impacts, or that China commits to a long-term corn import program. The assumption here is that cellulosic ethanol will never achieve cost breakthroughs needed to realize large-scale commercial production that would make a meaningful and growing contribution to overall supply.

Phased Adoption and Actual Implementation of E10 Varies by City and Province
Beginning in 2006 and until recent years, China expanded in a piecemeal fashion the number of cities and provinces adopting E10 blending mandates. Actual rates of fuel ethanol blended into gasoline vary over time and by city and province, but often fall below local mandates due to varying levels of enforcement. The level of implementation often reflects the volume of ethanol produced regionally which fluctuates based on corn and gasoline prices and feedstock availability.

For more historical information on blend mandates, please see the 2020 Biofuels Report.

Government Financial Support for Ethanol Production
Past PRC government subsidies for fuel ethanol production supported both feedstocks and production inputs to make the industry viable. Starting in 2009, central government production subsidies for grain-based conventional ethanol were as high as $0.25/liter but were eliminated in 2016. From 2016 to 2018, provinces in Northeast China

offered corn processors and ethanol facilities generous subsidies (See GAIN report CH9059 and Annex 1). Provincial authorities have not renewed processing subsidies since 2019 as government commitment to supporting the biofuels industry has waned with corn stocks depleted (See GAIN report CH16058). The advanced cellulosic ethanol production subsidy was set at is $0.07 per liter (600 RMB per ton) in 2018 and there have been no additional announcements or updates to the original subsidy program. Such a low subsidy remains ineffective in building an industry. Support for corn is unlikely to be reintroduced unless concerns over feedstock supply reverse at some future date.

Import Tariffs

Tariffs on ethanol remain unchanged in 2022.

Denatured Ethanol (HS 220720) (ethanol used as fuel falls under this code in China import stats)

On January 1, 2017, the tentative tariff rate for denatured ethanol (HS 22072000) rose from 5 percent to the World Trade Organization (WTO) Most-Favored Nation (MFN) bound rate of 30 percent. Subsequently, on April 2, 2018, China levied an additional 15-percent retaliatory tariff on U.S.-origin denatured ethanol in response to the U.S. 232 Action, raising the tariff from 30 percent to 45 percent. Later, on July 6, 2018, China imposed an additional 25-percent retaliatory tariff on imports of U.S. denatured ethanol in response to the U.S. 301 Action, raising the effective tariff to 70 percent. (See GAIN reports CH18017 and CH18018).

Undenatured Ethanol (HS 220710)

MFN tariff rates on undenatured ethanol were raised to 40 percent on January 1, 2017. On August 3, 2018, MOFCOM announced a retaliatory tariff on U.S.-origin undenatured ethanol, raising the tariff by 25 percent from 40 to 65 percent. (See GAIN report CH18047).

Table 1. China: Import Tariffs on Ethanol

HS Code		MFN	232 Retaliation	301 Retaliation
22072000	Ethyl Alcohol & Other Spirits, Denatured of Any Strength	30%	15%	25%
22071000	Undenatured Ethyl Alcohol, Of Alcohol V. ≥80%	40%	-	25%

Source: PRC Ministry of Finance

On February 18, 2020, China announced a new round of tariff exclusions for U.S. agricultural commodities impacted by the retaliatory Section 301-tariffs. Denatured ethanol (HS Code: 22072000) is included in the list with the announcement effectively lowering the duty on U.S. fuel ethanol from 70 percent back to 45 percent for those importers who apply for the exclusion. Tariff exclusions are approved for individual importers and will not automatically extend to all importers. Undenatured ethanol (HS Code: 22071000) is not on the list, but eligible importers can also apply for an exclusion on the Section 301 retaliatory tariffs for this product. The application process through China's Ministry of Finance (MOF) website opened on March 2, 2020. See Post's February 26, 2020 report "China Announces a New Round of Tariff Exclusions" for more information.

Biodiesel (HS382600) and Petroleum Oils Containing Biodiesel (HS27102000)

On August 23, 2018, China imposed an additional 25 percent tariff on U.S.-origin petroleum oils containing 1 to 30 percent biodiesel (HS27102000, Petroleum oils containing up to 30 percent biodiesel by volume) by volume, which effectively raised the tariff from 6 to 31 percent. At the same time, the duty for U.S.-

origin biodiesel-blended petroleum containing more than 30 and up 99 percent biodiesel by volume as well as pure (B100) biodiesel was raised from 6.5 to 31.5 percent (HS38260000). See GAIN report CH18034.

For more historical information on China's biofuel policies, please see the 2020 Biofuels Annual and 2021 Biofuels Annual Reports.

III. Ethanol

Overview

China is the world's fourth largest fuel ethanol producer after the United States, Brazil, and the EU but its fuel ethanol market has remained insular throughout its 20-year history with the exception of a few recent years. Imports were effectively banned until 2015 even though imports duties were held well below MFN rates, and China has never produced an exportable surplus. Since additional duties on U.S.-origin imports were implemented in early 2018, China's fuel ethanol market retreated from the global marketplace.

China produces a broad variety of ethanol products at a commercial scale covering potable alcohol, medical grade, and other industrial chemicals, in addition to fuel ethanol. Unlike other major ethanol producing countries, China's major end use market is non-fuel industrial chemicals.

Fuel Ethanol Consumption

In 2022, fuel ethanol consumption is estimated at 3.8 billion liters, down 164 million liters from 2021 resulting in a 2022 national average fuel ethanol blend rate estimated at 1.8 percent. While only slightly lower than the 2021 blend rate, it is significantly lower than the 2.8 percent peak blend rate achieved eleven years ago. This is in part attributed to continued Covid-19 lockdowns in various locations which completely halted fuel ethanol production and transportation in Northeast provinces for several months during the first half of 2022. Fuel ethanol demand is expected to increase in the second half of 2022 as gasoline prices continue to climb. Although the NDRC has reportedly increased attention on localities with existing E10 pilots to meet their full blend mandate, there is a common understanding that E10 expansion has been halted.

Wavering polices and high feedstock prices continue to limit fuel ethanol consumption. On the one hand, the State Council called for controlling the expansion of fuel ethanol processing capacity in 2020, while on the other, the NEA in early 2021 urged local governments and companies to support the development of liquid biofuels, work to regulate ethanol gasoline promotion, and urged gasoline companies to sell liquid biofuel in line with existing regulations. These guidelines from both the State Council and the NEA had little effect on biofuel consumption and were not enough to meet previous targets.

Note: China does not produce ethanol derived ETBE in commercial volumes. Fuel blends incorporating ETBE require additional processing and have not been adopted in China. Fossil fuel derived MTBE is the alternative oxygenate used across much of China along with methanol in certain areas.

Table 2. China: Ethanol Production, Supply, and Distribution

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Beginning Stocks	0	0	0	0	0	0	0	0	0	0
Fuel Begin Stocks	0	0	0	0	0	0	0	0	0	0
Production	5,795	6,921	7,868	8,071	9,211	9,770	10,740	10,830	10,580	11,850
Fuel Production	2,934	2,951	2,914	2,534	3,041	2,914	4,339	3,801	3,421	3,804
>of which fossil-based synthetic	0	0	0	0	0	0	0	30	30	40
>of which biobased	2,934	2,951	2,914	2,534	3,041	2,914	4,339	3,771	3,391	3,764
>of which biobased cellulosic	25	25	38	40	30	20	0	0	0	0
Imports	0	27	687	890	24	1,035	104	69	824	10
Fuel Imports	0	26	477	871	8	759	0	63	550	5
Exports	40	33	25	34	135	79	21	367	13	10
Fuel Exports	2	2	0	1	3	35	7	21	0	2
Consumption	5,755	6,915	8,530	8,927	9,100	10,726	10,823	10,532	11,391	11,850
Fuel Consumption	2,932	2,975	3,391	3,404	3,046	3,638	4,332	3,843	3,971	3,807
Ending Stocks										
Fuel Ending Stocks										
Refineries Producing First Generation, Bio-based Fuel Ethanol (Million Liters) 1/										
Number of Refineries	6	7	7	10	11	12	14	20	22	22
Nameplate Capacity	3,000	3,200	3,200	3,600	4,200	5,000	5,257	6,578	7,720	7,720
Capacity Use (%)	97%	91%	90%	69%	72%	58%	83%	57%	44%	49%
Refineries Producting Cellulosic Fuel Ethanol (Million Liters) 2/										
Number of Refineries	1	3	3	1	1	1	1	1	1	1
Nameplate Capacity	50	129	129	65	65	65	65	65	65	65
Capacity Use (%)	50%	19%	29%	62%	46%	31%	0%	0%	0%	0%
Co-product Production (1,000 MT)										
DDGs	1,652	1,661	1,640	1,427	1,598	1,536	2,796	2,436	2,279	2,471
Feedstock Use for Fuel Ethanol (1,000 MT)										
Corn Kernals	5,277	5,308	5,241	4,558	5,105	4,542	6,763	5,426	4,229	4,694
Rice Kernals						364	2,170	2,357	3,052	3,199
Cassava (dried chips)	2,203	2,215	2,188	1,902	2,283	2,188	1,303	1,132	1,018	1,469
Wheat	na	na	na	na	387	371	552	480	173	96
Celluloic Biomass	na	na	na	na	na	na	na	na	na	na
Fossil Fuels/Waste Gas	na	na	na	na	na	na	na	na	na	na
Market Penetration (Million Liters)										
Fuel Ethanol Use	2,932	2,975	3,391	3,404	3,046	3,638	4,332	3,843	3,971	3,807
Gasoline Pool 3/	130,017	135,837	157,490	164,502	170,477	182,197	193,853	191,631	211,207	209,357
Blend Rate (%)	2.3%	2.2%	2.2%	2.1%	1.8%	2.0%	2.2%	2.0%	1.9%	1.8%

Notes: f = forecast
Corn kernels: 1 MT = 402 (before 2014) to 417 liters (after 2014)
Rice: 1 MT = 400 liters
Wheat kernels: 1 MT = 393 liters
Sorghum (Sweet) 1 MT = 430 (used in 2014 Baseline)
Cassava (fresh root): 1 MT = 143 to 150 liters (25 to 35% starch content)
Cassava (dried chips): 1 MT = 333 to 400 liters (15 to 65% starch content)
Sources: Post estimates and industry sources

Fuel Ethanol Production

China's 2022 fuel ethanol production is forecast to increase to 3.8 billion liters, up 383 million liters from the previous year. Fuel ethanol prices are fixed at 91.1 percent of the retail gasoline price, which is set by the NDRC according to a basket of global benchmark crude prices. As the Brent crude oil prices rebounded to US$75/barrel in the first half of 2021, the international oil price returned to levels in place at the beginning of 2020 and continued to soar over the past year reaching peaks near US$130/barrel. Chinese fuel ethanol prices have risen with gasoline with no change in the pricing mechanism, while corn prices have decreased from their peak by 10 percent in the first half of 2022. Profitability increased to $12 (RMB 80) per ton in the first half of 2022 from negative $108 (RMB -716) per ton during the same period in 2021. Fuel ethanol plants continued to use old stock paddy rice as feedstock to protect margins. The fuel ethanol plant operational rate is estimated to increase to 49 percent in 2022, 5 percent higher compared to the previous year. With increasing international and domestic gasoline prices and the recent trend of decreasing domestic corn prices, fuel ethanol profitability has potential to improve even more in the second half of 2022.

Industry sources report no new facilities began production in 2022. The total production capacity is forecast to remain at 7.7 billion liters. Industry sources report that China's fuel ethanol production was over 80 percent grain-based (i.e., corn, wheat, and rice) in 2022 and 10 percent cassava or sugarcane-based. From 2018 to 2020, essentially all fuel ethanol expansion was attributed to higher production from China's 8 major grain-based ethanol production facilities. Ethanol was transported to consumption areas via truck (87 percent), boat (8 percent) and rail (5 percent).

Table 3. China: Production Capacity of China's Fuel Ethanol Licensed producers (2022 estimates)

	Producers	**Production Capacity**	**Feedstock**
1	SDIC Jilin Alcohol	887 million liters	Corn
2	Henan Tianguan	887 million liters	Wheat, Corn, Cassava
3	COFCO Biochemical (Anhui)	798 million liters	Corn, Cassava
4	COFCO Bioenergy (Zhaodong)	507 million liters	Corn, Cellulosic
5	SDIC (Zhanjiang)	190 million liters	Cassava
6	Shandong Longlive	65 million liters	Cellulosic
7	COFCO Bioenergy (Guangxi)	253 million liters	Cassava
8	Zonergy (Inner Mongolia)	38 million liters	Sweet Sorghum
9	SDIC (Tieling)	380 million liters	Corn
10	Liaoyuan Jufeng Biochemical	380 million liters	Corn
11	Jilin Boda Biochemistry	507 million liters	Corn
12	Jiangsu Lianhai Biotechnology	152 million liters	Corn
13	Shandong Fu'en Biochemical	152 million liters	Cassava
14	Jiangxi Yufan	127 million liters	Cassava
15	Shougang Lanza Tech	58 million liters	Coal, Waste Residues, Industrial Flue Gases
16	SDIC (Hailun)	380 million liters	Corn
17	Wanli Runda (Baoqing)	380 million liters	Corn
18	Hongzhan (Nehe)	380 million liters	Corn
19	Hongzhan (Huanan)	380 million liters	Corn
20	Ningxia Shougang Lanza Jiyuan	57 million liters	Coal, Waste Residues, Industrial Flue Gases
21	Hongzhan (Bayan)	380 million liters	Corn
22	SDIC (Jidong)	380 million liters	Corn
	TOTAL	**7,720 million liters**	

Source: Post Industry Sources

Industry sources report that sugar and molasses- ethanol producers continue to struggle with low margins due to limited supplies of sugarcane and record high molasses prices. Cassava ethanol (for fuel and other industrial use) production capacity is forecast at 2.82 MMT in 2022, mainly in Shandong, Anhui, and Jiangsu, as a result of relatively low cassava prices compared to corn. China's cassava imports are projected to increase by 50 percent this year but imported raw cassava prices and shipping fees continue to rise and limit cassava-based ethanol production.

Synthetic ethanol production will remain unchanged in 2022. In September 2020, a project signing ceremony was held for the first syngas-based fuel ethanol plant in Guizhou. Once operational, the plant is expected to produce 76 million liters (60,000 tons) of fuel ethanol per year but has not yet come to fruition.

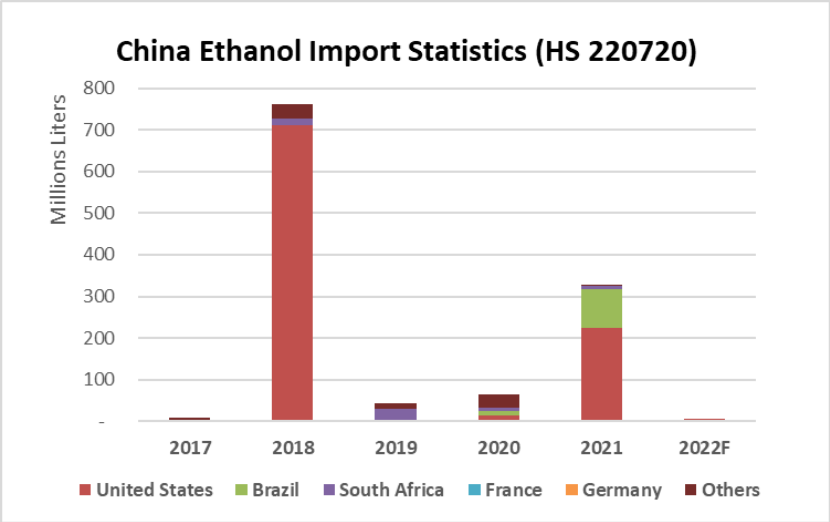
Trade

China's 2022 fuel ethanol imports are forecast at 5 million liters (6,335 tons), down drastically from 2021. With domestic corn prices increasing and production increasing, China may soon have to turn to imports to meet domestic demand for the remainder of 2022. From January to June 2022, trade data indicates China imported 56,468 liters of denatured ethanol, mainly from the United States and France. China's 2022 fuel and other industrial chemical ethanol exports are forecast at 2 million liters. In the first six months of 2022, China exported 1.3 million liters of denatured ethanol predominantly to India and Taiwan, more than double than the same period the previous year. However, exports are expected to level off for the remainder of the year.

Looking at the recent history of China's denatured ethanol (220720) imports, Post notes the following:

Nearly all imports originate from the United States since 2016 and were used as fuel ethanol. China first allowed some test shipments of U.S. fuel quality ethanol in 2015 which turned into commercial trade in 2016 at the tariff rate of 5 percent. Starting January 1, 2017, China increased tariffs on all fuel (denatured) ethanol to the WTO MFN bound rate of 30 percent and trade was shut off from January to October 2017. Trade resumed in November 2017 as U.S. ethanol prices reached a 12-year low and continued thru March 2018. Retaliatory tariffs on U.S. fuel ethanol were imposed in April 2018 which raised the duty to 45 percent and choked off all trade. Three months later, duties on U.S. products were raised further to 70 percent. In the second half of 2018, media reports chronicled how Malaysia and Indonesia shipped large volumes of ethanol to China, taking advantage of duty-free market access for ASEAN members. After two years, Chinese fuel ethanol imports from the United States picked up in late 2020 when U.S. ethanol prices fell. The purchases were all price-based on sporadic openings in the arbitrage window. Post analysis and industry sources suggest the PRC's political will and endorsement is necessary to see significant purchases of U.S. ethanol, regardless of tariff level. The PRC reportedly waived import tariffs for an unknown volume of U.S. ethanol in 2021. Industry members believe the tariff waiver was a limited action and not a significant development or endorsement for greater imports of U.S. ethanol. There are few imports expected for the remainder of 2022.

Chart 1. China: Ethanol Import Statistics



Sources: Trade Data Monitor, General Administration of China Customs, and Post estimates
Note: News reports indicate that shipment from Indonesia and Malaysia in 2018 were US-origin product.

IV. Biodiesel / Renewable Diesel

Overview

The PRC's commitment to peak carbon emissions is driving and creating new prospects for expanded biodiesel use and production. Previously, there was little will to mandate or provide support other than attempts to ban the reuse of cooking oil in food preparation. Based on fuel use, a modest B5 nationwide mandate for on-road use alone would currently require 7.05 billion liters of B100 biodiesel (See Table 4 below). China is the third largest user of on-road diesel following the EU and the United States. Beyond on-road use, the potential for biodiesel (and renewable diesel) is greater still, as China's off-road diesel applications include inland fisheries, construction, agriculture and even limited stationary power. However, with inadequate policy support, nationwide consumption remains limited to only discretionary use and ranges annually from 500 million liters to 2.1 billion liters over the past decade largely due to changes in imports of palm oil-based biodiesel.

In June 2022, the NDRC led nine ministries to publish the "14th Five-Year-Plan for Renewable Energy". The Plan called to support research and development and promote the use of advanced technology and equipment in biodiesel and jet fuel. In addition, the Plan continues to promote the use of clean liquid fuels such as fuel ethanol and biodiesel. However, no detailed implementing measures or support were announced following the release of the Plan.

Expansion of China's biodiesel production remains limited for the foreseeable future with ineffective tax breaks and no other incentives, blending mandates, or punitive carbon taxes on fossil fuels. In addition, a nationwide supply chain would need to be built up as UCO is the only feedstock available in large volumes. Any periodic expansions in biodiesel production, imports, and consumption are followed by collapses when the spread between palm oil (generally the cheapest biodiesel feedstock traded internationally) and fossil fuel diesel narrows, and the price of unsupported biodiesel drops below that of fossil diesel.

In contrast, China's exports of biodiesel will once again grow in 2022, driven by demand for waste-based biofuels in Europe which benefit from EU double-counting provisions.

Table 4. China: Biodiesel Production, Supply, and Distribution

Biodiesel (Million Liters)										
Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022f
Beginning Stocks		0	0	0	0	0	0	0	0	0
Production	1,079	1,133	787	909	1,043	834	939	1,455	1,835	2,430
Imports	895	1,028	33	8	18	853	953	102	204	295
Exports		43	27	76	194	357	752	1,035	1,475	2,125
Consumption	1,974	2,118	793	841	867	1,330	1,140	522	564	600
Ending Stocks										
Production Capacity (Million Liters)										
Number of Biorefineries	53	53	53	48	46	44	40	42	44	46
Nameplate Capacity	4,000	4,000	4,000	2,680	2,680	2,680	2,680	2,726	2,800	4,700
Capacity Use (%)	27.0%	28.3%	19.7%	33.9%	38.9%	31.1%	35.0%	53.4%	65.5%	51.7%
Feedstock Use (1,000 MT)										
UCO	1,055	1,108	771	891	1,022	816	918	1,426	1,798	2,381
Market Penetration (Million Liters)										
Biodiesel, on-road use	324	340	236	273	313	410	430	250	260	276
Diesel Pool , on-road use	133,383	133,365	134,375	130,564	130,538	126,898	135,370	136,149	141,000	139,828
Blend Rate (%)	0.2%	0.3%	0.2%	0.2%	0.2%	0.3%	0.3%	0.2%	0.2%	0.2%
Diesel Pool, total 1/										

Note: Fuel pools are defined as fossil fuels plus all "bio-components" (biofuels) blended with fossil diesel.
f = forecast; All PSD data are B100 or B100-equivalent (see statistical info section of Reporting Instructions).
Used cooking oil (UCO):1 MT = 1,043 liters of UCOME (UCO methyl ester)
Source: Post and Industry sources

Consumption

China's 2022 biodiesel consumption is estimated at 600 million liters, slightly higher than 2021, but 50 percent below 2019 levels and 40 percent below 2018. This is attributed to China's demand drop off from October through December 2019 when the price of biodiesel was competitive with fossil diesel and is essentially absent in 2020 and 2021. In contrast to most other countries, biodiesel in China is mainly used for electric power generation, fishing vessels, and farm equipment. Post contacts report that on-road transport accounts for over one-third of total biodiesel demand. UCO is the main feedstock for China's biodiesel production. In 2010, NDRC launched a UCO reutilization and disposal pilot program and over 100 pilot cities were identified. However, these cities still lack the biodiesel producers to seamlessly receive the collected UCO.

Shanghai remains the only local authority with or moving toward a biodiesel program. In 2021, Shanghai revised the *Administrative Measures on Promoting and Using Gutter Oil to Produce Biodiesel* which took effect March 1 and lasts for two years. Shanghai is still the only municipality or province committing support to create a biodiesel market. The Shanghai government subsidizes biodiesel blenders based on the amount of biodiesel sold to gasoline stations. The government also subsidizes producers when diesel prices drop below U.S. $902 (RMB 6,000) per ton. The city published the industry Standard of *B10 Diesel produced by UCO* in 2021. In January 2021, Hainan provincial officials proposed resuming the B5 mandate the province adopted 10 years ago but officials have yet to take action.

In October 2017, Sinopec Shanghai began offering B5 diesel at a $0.05 per liter (RMB 0.3) discount to regular diesel as part of a pilot program. The Shanghai program aims to buck a historical precedent where previous efforts to adopt local and provincial biodiesel blending mandates failed. Shanghai produces about 40,000 tons of UCO each year. There are 18 designated companies collecting UCO daily. Shanghai currently has three blending centers with annual distribution capacity of B5 diesel of 600,000+ tons (equivalent to 30,000 tons or 34 million liters of B100 biodiesel) to 300+ gas stations, which accounts for half of Sinopec Shanghai's total gas stations in the city.

Production

China's 2022 biodiesel production is forecast at 2.4 billion liters, up by over 32 percent from 2021 due to strong exports. Beginning in 2020, China's production yearly capacity of fatty acid methyl esters (FAME) grew to 2.6 billion liters. These facilities are located mainly in Shandong, Guangdong, Shaanxi, and Jiangsu. Hydrogenation-derived Renewable Diesel (HDRD) plants have a combined annual capacity of 2.3 billion liters with an additional 3.4 billion liters capacity planned. Nearly all plants are export-oriented to take advantage of EU tax policies.

China's biodiesel production capacity expanded rapidly over the past year as biodiesel prices increased from U.S.$ 1,053 (RMB 7,000) per ton to more than U.S.$ 1,654 (RMB 11,000) per ton due to strong export demand. Contacts report that since 2021, biodiesel production profits averaged U.S.$ 132 (RMB 880) per ton, up 75 percent. Zhuoyue New Energy is the leading FAME biodiesel producer, with a new 114 million liters per year production line that will start production in October 2022. The company plans to expand capacity to 852 million liters (including more than 114 million liters of HDRD capacity) from the current 454 million liters in 3-5 years. Zhejiang Jia'ao also plans to expand capacity to 398 million liters from current capacity of 171 million liters. China's only publicly traded company, Beiqing Huanneng which focuses on UCO business, also plans to build 795 million liters (including 454 million liters of HDRD and 341 million liters of FAME) of biodiesel production capacity, on top of their existing UCO business. Availability of UCO may limit biodiesel production as China's UCO export rebate polices incentive UCO exports.

Table 5. China: Major Biodiesel Producers

	Producer	**Production Capacity**
FAME (Fatty Acid Methyl Esters)	Zhuoyue New Energy	454 million liters
	Hebei Jingu Group	284 million liters
	Bimei New Energy	114 million liters
	Tangshan Jinhai Biodiesel	68 million liters
	Hebei Longhai Biofuel	68 million liters
	Shandong Fenghui	68 million liters
	Zhejiang Jia'ao Environment Protection	171 million liters
	Zhejiang Dongjiang Energy Technology	57 million liters
	Jingzhou Dadi Biotechnology	57 million liters
	Shanghai Zhongqi Environment Protection	41 million liters
HDRD (Hydrogenation-derived Renewable Diesel)	Beijing Sanju Environmental Protection	613 million liters
	Jiangsu's Yangzhou Jianyuan Biotechnology	159 million liters
	Shijiangzhuang Changyou Bioenergy	227 million liters
	Zhangjiagang Eco Biochemical Technology	284 million liters

Source: Post Industry Contacts

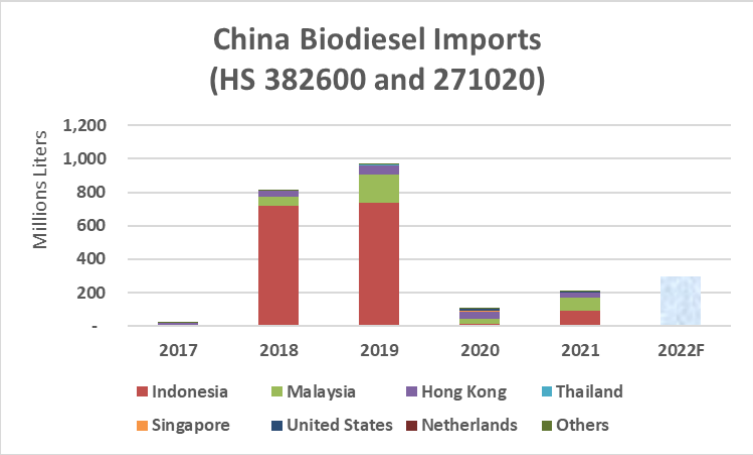
Trade

Biodiesel imports in 2022 are estimated at 295 million liters, unchanged from the previous year. As in the past, industry sources report that more than 90 percent of imports are palm oil biodiesel from Indonesia and Malaysia.

Biodiesel exports will surge in 2022, almost entirely to the EU, due to the double-counting provisions for UCO-based biofuels of the EU's Renewable Energy Directive (REDII) and support by a 70 percent VAT rebate. Average biodiesel prices reached U.S.$1,654 (RMB 11,000) per ton in early 2022, up over 30 percent year-on-year, with even higher prices for HDRD. Current biodiesel prices are no longer affordable on the domestic market, but exports remain competitive to Europe. From January to June 2022, China's biodiesel exports rose 60 percent year-on-year. The vast majority is shipped to the Netherlands and Belgium. Despite the export expansion, China's exports only account for 3-5 percent of the EU's biodiesel/HDRD renewable diesel demand.

Note: This estimate is based on trade reported under the Chapter 38 Chapter code though it is unclear if some or all of China's HDRD exports to Europe fall under the designated Chapter 38 code for biodiesel or if they fall under Chapter 27. Some of this product, when misclassified, could be HDRD since sales of HDRD to Europe have been documented by market analysts. HDRD cannot be accurately tracked at this time due to code uncertainties which will be investigated further.

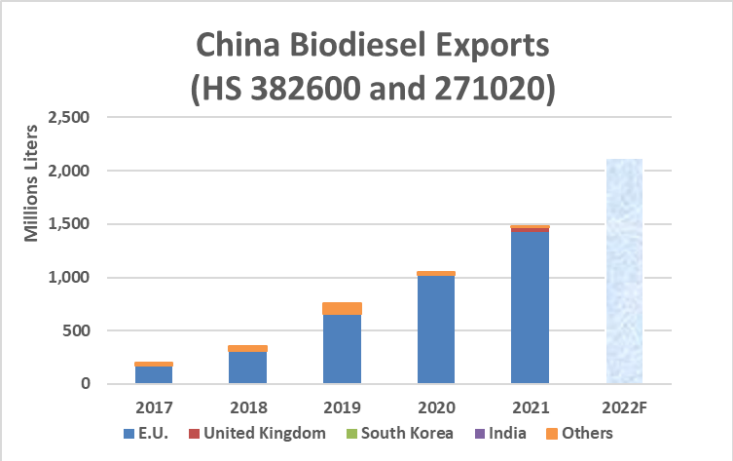
Chart 2. China: Biodiesel Imports



Sources: Trade Data Monitoring and General Administration of China Customs

At a 2022 national biodiesel industry conference, industry representatives concluded that the Covid-19 pandemic had little impact on China's biodiesel industry as exports remain robust, reaching more than 1 billion liters in 2020. At the same conference, leading biodiesel producers reported they will "join hands" to report to supervising government authorities that the tax policy on biodiesel exports is unreasonable as UCO is the feedstock for biodiesel and the PRC no longer has a tax refund for biodiesel exports. In addition to strong biodiesel exports, Post expects China will also export more than 1.7 billion liters of UCO in 2022.

Chart 3. China: Biodiesel Exports

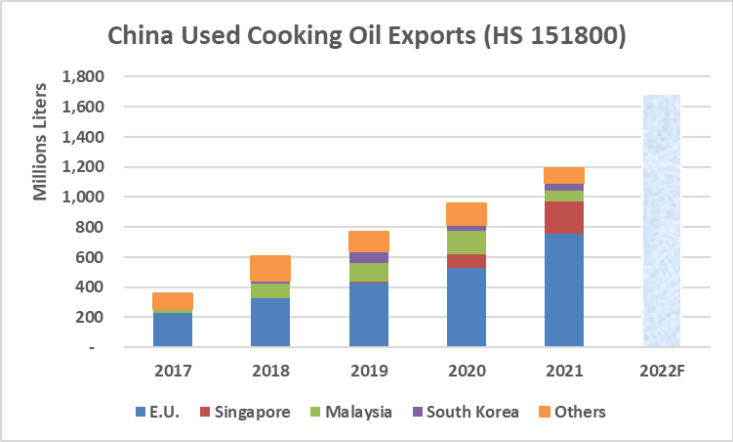


Sources: Trade Data Monitoring and General Administration of China Customs

Note: All product trade under HS 3826.00 is assumed to be pure B100 biodiesel; All product under HS 271020 as petroleum oil, containing biodiesel up to 30 percent, is assumed to contain on average 10 percent biodiesel by volume, converted and reported as B100 equivalent.

Due to uncertainty in trade codes used for HDRD, it is possible some of the product traded under the biodiesel code in chapter 38 could be HDRD that should be reported under Chapter 27 (according to NesteOil). The accurate tracking of HDRD will be investigated.

Chart 4. China: Using Cooking Oil (UCO) Exports



Sources: Trade Data Monitoring and General Administration of China Customs
Note: Used cooking oil (UCO): 1 MT = 1,043 liters of UCOME (UCO methyl ester)

V. Advanced Biofuels

Fuel ethanol in China is produced predominately from corn through conventional fermentation. However, the biofuels industry is investing resources to transition to advanced biofuels such as cellulosic bioethanol as well as coal and industrial flue gas-based synthetic ethanol though actual production remains virtually non-existent.

Over the past year, cellulosic ethanol production has become the priority for any potential policy support though advances have stalled. Although China began cellulosic ethanol trials well over a decade ago, no projects achieved commercial scale. Industry sources report almost all existing cellulosic ethanol projects are either a) announced but have not begun construction or production or, b) have suspended production. Major state-owned fuel ethanol producers such as COFCO and SDIC reportedly are upgrading old or developing new plants to meet policy goals, but sources suggest that the firms are unlikely to do so without substantial government financial subsidies.

Several cellulosic ethanol developments were announced over the last two years, but little has become a reality. In late 2021, Hebei Yigao Biofuel company reportedly successfully operating the first trial of their 240,000 tons per year biomass comprehensive use project. The project produced qualified ethanol on November 14 after successful enzyme decomposition and fermentation. The project is designed to produce 25,000 tons of biofuel, 27,000 tons of other byproducts. In addition, two more cellulosic fuel ethanol projects with 558 million liter capacity are reportedly seeking investors in Jilin province. Also in 2021, NCPC Jilin Company's research institutes reported a breakthrough in their "10,000-ton scale cellulosic fuel ethanol whole-set technology development." To date, the project finished accreditation for the enzyme technology and filed for four national patents.

The only existing cellulosic fuel ethanol plant in China was delisted from the stock market in July 2020. According to industry contacts, the company's challenges limit any real growth in cellulosic ethanol production in the near future without any targeted, significant government support policies.

Cellulosic Ethanol

China's biofuel policy defines second generation biofuels as those made from cellulosic biomass and algae. While cellulosic ethanol has been mentioned in various government planning documents and policies as early as 2011, including a goal to a build yearly capacity of more than 760 million liters (600,000 tons) by 2020, little has materialized.

Cellulosic ethanol projects in China repeatedly fail to meet expectations and timelines for commercialization. Cellulosic ethanol plants face logistical challenges to supply reliable volumes of feedstock at low cost and are far more expensive than conventional ethanol plants to build and operate. China's cellulosic ethanol industry faces

similar challenges found elsewhere, including sourcing consistent high volumes of feed stock bales of stalks, straw, or stover, and optimizing enzymes to convert cellulosic material into energy.

Bio-energy is commonly cited as a preferred option for the disposal of large volumes of crop residues in China in order to reduce field burning under uncontrolled conditions that result in wide spread air particulate matter pollution. China's estimated national crop straw and stalks resources are between 800 million tons and 1.1 billion tons. Each ton of corn produced yields around 1.1 tons of corn stalk residue, some of which is left in the field for erosion control and soil health.

Farmers customarily burn crop residue in the fields or bundle the residue to use as winter heating fuel. Since 1999, local authorities have announced strong enforcement measures to lower particulate matter emissions and curb the practice. In 2017, the MOF offered subsidies as high as $1.5 million to $3.0 million (RMB 10 to 20 million) for each city and county pilot project to utilize straw as an energy feedstock. Qualified projects include procurement of stalk processing equipment, such as balers, bioenergy power generation, and construction of crop residue purchase points to receive, grade, store, and market it. Farmers face cash penalties and detention if they fail to comply with burning rules. However, the economic cost of gathering and transporting biomass for cellulosic processing exceeds the subsidy value offered by local authorities. A recent economic study reported that crop residue collection is limited by low economies of scale, lack of public awareness, and limited access to equipment.

Table 6. China: Suspended or Planned Cellulosic Ethanol Production Capacity (2022 estimates)

Producers	**Production Capacity**	**Status**
COFCO Biochemical (Zhaodong)	6.3 million liters	Announced in 2006
Jinan Shengquan	25 million liters	Announced in 2012
Shendong Zesheng	25 million liters	Announced in 2012
Xin Tianlong (Jilin's Siping)	n/a	Announced in 2015
Meijie Guozhen (Anhui's Fuyang)	230 million liters	Announced in 2017
Shandong Longlive	65 million liters	Production suspended
SDIC Jilin Alcohol	101 million liters	Planned
COFCO Biochemical (Anhui's Bengfu)	127 million liters	Planned
SDIC Hailun	38 million liters	Planned
Hebei Yigao	304 million liters	In Trial
Source: Post Industry Sources		

Sustainable Aviation Fuel (SAF)

China's SAF industry development is led by China Petroleum & Chemical Corporation (Sinopec). The company started SAF technology research in 2009. The first test flight using SAF was successfully completed in Shanghai in 2013. The first passenger flight Hainan Airline's HU7604 using SAF in a Boeing 737-800 successfully finished a 2.5 hour fight from Shanghai to Beijing in 2015. The first international passenger flight, Hainan Airline's HU497 using SAF on a Boeing 787, successfully landed in Chicago in 2017. Sinopec Zhenhai Refinery established China's first SAF commercial production facilities in 2020. The company's HEFA (Hydroprocessed Esters and Fatty Acids) products passed Roundtable on Sustainable Biomaterials (RSB)'s certification in 2022. On June 28, 2022, Sinopec Zhenhai Refinery produced the first test batch of SAF products.

Synthetic Fuel Ethanol

China's efforts to reduce air particulate matter and other fossil fuel toxins include projects to convert coal and industrial waste gas into synthetic ethanol. At the same time, China's adoption of more stringent environmental standards further constrains expansion of existing coal-to-syngas-to-ethanol processing facilities.

In 2019, several non-fuel, industrial chemical ethanol producers in Jiangsu province that use coal and synthetic gasification technology ceased operations in the wake of weakening demand for industrial chemicals, and the implementation new environmental and safety requirements. Currently, one 58-million-liter-per year fuel ethanol facility in Hebei is operational and another 57-million-liter-per-year production line, the Ningxia Shougang Lanza Jiyuan started production in May 2021. In September 2020, the first syngas-based fuel ethanol plant project in Guizhou held a signing ceremony. Once operational, the plant will produce 76 million liters (60,000 tons) of fuel ethanol per year. While the PRC press and industry contacts still report that China's Syngas ethanol production capacity is expected to reach 2.5 billion liters by the end of 2022, little progress has been made and Post does not expect this to be achievable within this timeframe.

Annex

China's Long March Towards National Biofuel Market Development: Production/Consumption Targets and Feedstock Priorities.

10th FYP (2001-2005) – Corn Surplus Period
China implemented a fuel ethanol program, one of the world's earliest, starting in the early 2000's to create additional demand for then abundant grain supplies. In MY1998/99, USDA ending stocks estimates for China reached record highs at 123.8 million tons. During these early years, the vast majority of domestic ethanol production relied on existing corn surpluses and was in essence a con disposal program. Beginning in 2005, as global grain prices soared, China began its initial promotion of nongrain, conventional fuel ethanol production known as Generation 1.5 ethanol.

11th FYP (2006-2010) – Corn Surplus Moderated
China's 11th Five-Year Plan (2006-2011) was the first targeting the production of biofuel from non-grain materials, including sweet sorghum, potatoes, and cassava root for ethanol, and jatropha trees for biodiesel.

Beginning in 2006, 11 provinces (Heilongjiang, Henan, Jilin, Liaoning, Anhui, Guangxi, Hebei, Shandong, Jiangsu, Inner Mongolia and Hubei) were selected as pilot zones for fuel ethanol production and 'mandatory' E10 blend use. Many fuel retailers argued in courts and protested against state-owned petroleum giants that China's implementation of biofuels blending targets restrict their ability to respond to market prices, undercutting their profitability and the long-term sustainability of their businesses. As a result of these concerns, some provinces with blending requirements do not fully enforce province-wide E10 blending. Many provinces remain with no blend mandate and use MTBE instead (then and today) since they have no major corn growing areas nd thus little economic interest in an ethanol program.

In August 2007, NDRC published a "Mid- to Long-term Renewable Energy Development Plan" that targets annual fuel ethanol use to exceed 12.670 billion liters by 2020, effectively expanding production by five-fold from 2017 to 2020.

During a period of high corn prices in 2008, China restricted construction of new ethanol facilities. Starting in 2010, phase out of PRC government subsidies for conventional ethanol plants began, falling from $0.03 per Liter (RMB 2,000 per ton) in 2009 to zero in 2016. Ethanol production subsidies using non-food grain feedstocks to produce conventional ethanol were also phased out by 2018. Afterwards, China limited the growth of corn use for fuel ethanol when rising domestic grain prices triggered food price concerns. During this same period, China became a net corn importer.

12th FYP (2011-2015) – Corn Surplus Period
In 2010, the government set ambitious targets for ethanol and biodiesel in its 12th FYP, including a goal of producing 5.068 billion liters of fuel ethanol and 1.136 billion liters of biodiesel by 2015.

Despite significant investments in research and development, government efforts to expand production of non-grain conventional fuel ethanol never materialized into commercial-scale projects.

The 12th FYP goal for biodiesel was met early in 2014. However, both biofuel production targets fell short in 2015. In 2015, fuel ethanol production reached just 2.9 billion liters, or less than two-thirds of the original 5.1 billion liter 12th FYP goal.

13th FYP (2016-2020) – Corn Stocks Drawdown

On October 24, 2016, China's State Council announced its 13th FYP goal to produce 5.1 billion liters of ethanol and 2.3 billion liters of biodiesel by 2020. While the goal requires ethanol production to rise four-fold from 2016 levels, underlying economic fundamentals and the lack of national or provincial government support undermined large-scale efforts to expand production.

Government policies introduced in 2016 paved the way for a fuel ethanol industry revival through the elimination of the temporary reserve policy for corn; reinstatement of the VAT refund on ethanol products added further support. Industry sources reported at the time that China's provincial corn processing subsidies and a nationwide effort to expand E10 effectively supported margins for ethanol producers.

On September 13, 2017, NDRC, NEA, Ministry of Finance (MOF) and 12 other ministries jointly announced a plan to expand ethanol production and promotion for transportation fuel. This included a nationwide target of 10-percent ethanol blending into gasoline fuel by 2020, and a proposed shift to commercial-scale cellulosic ethanol by 2025. To date, the PRC has not proposed an updated volumetric target for commercial-scale cellulosic ethanol production. On August 22, 2018, Chinese Premier Li Keqiang addressed China's State Council, and reiterated the central government's commitment to expand ethanol use nationwide.

In December 2019, media reported that China will suspend the expansion of its E10 mandate, essentially confining it to regions where it had already been introduced as corn stocks were too low and ethanol production capacity too small to implement E10 properly nationwide. The expressed use of imports as a vehicle to advance the E10 goal remained off the table.

14th FYP (2021-2025) – Corn Stocks Drawdown

The outline of the 14th FYP for Economic and Social Development (2021-2025), published in March 2021, sets an 18 percent reduction target for "CO2 intensity" and 13.5 percent reduction target for "energy intensity" from 2021 to 2025. The Plan requires "strengthening the management of urban air quality compliance, promoting coordinated control of fine particulate matter (PM 2.5) and ozone (O3), reducing the PM2.5 concentration of cities at prefecture-level and above by 10 percent, effectively curb the increasing trend of O3 concentration" and "basically eliminate heavily polluted weather", which researchers estimate it will require a 70–80 percent reduction in pollution emissions in northern China by 2025. The degree to which the use of biofuels is not expected to realistically contribute to progress on these goals, if existing policy does not radically change.

Attachments:

No Attachments