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Interesting information.

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China - Peoples Republic of

Biofuels Annual

Biofuels Demand Expands, Supply Uncertain

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Report Highlights:

China is the world's fourth largest ethanol producer and consumer after the United States, Brazil, and the European Union. However, it remains unclear how China will meet ambitious ethanol and biodiesel production targets set in its 13th Five Year Plan announced on October 24, 2016. China aims to expand ethanol production through newly implemented processor subsidies and import restrictions. China also aims to reform its energy consumption profile to meet international climate change commitments and domestic air pollution targets.

Post:
Beijing

I. Executive Summary

China's biofuel policies have changed significantly from the previous report.

In 2017, overall forecast fuel use in China is nearly unchanged. Although fuel demand in China has expanded considerably over the past decade, overall fuel use has stagnated since 2015 on slowing economic growth, greater public transportation options, and increasing adoption of smaller passenger transportation. Expansion of the national passenger vehicle fleet has more than offset decreases in lower diesel demand from higher fuel quality and emissions standards and weaker demand for heavy truck transport. Future prospects for transportation fuel demand depend on the adoption of advanced fuel technologies for the national passenger and heavy truck fleet and macroeconomic factors.

China has launched pilot zones in 11 provinces and 40 municipalities, including Heilongjiang, Jilin, Liaoning, Inner Mongolia, Henan, Anhui, Shandong, Zhejiang, Guangzhou, Guangxi, Jiangsu, and Hainan for mandatory ethanol blended gasoline use. E10 adoption in areas without a blending mandate remains comparatively low.

The 13th FYP production targets exceed the ambition of 12th Five Year Plan (12th FYP) production targets, which were not fully achieved. The recently announced 13th FYP highlights significant gaps between current production capacities for ethanol and biodiesel production in China and production targets by 2020. On October 24, 2016, in its 13th FYP, the State Council announced ambitious goals to produce 6,335 million liters (5.0 million tons) of ethanol and 2,272 million liters (2.0 million tons) of biodiesel by 2020. The 13th FYP aims to double ethanol production and expand biodiesel production by more than four-times current volumes.

China's fuel ethanol production is forecast to continue growing on strong demand, plentiful feedstocks, and continued local and provincial government support.

2017 fuel ethanol imports are forecast to fall by nearly two-thirds to 300 million liters on higher applied duties for imported ethanol and growing domestic supplies. On December 19, 2016, China announced that the applied import duty for ethanol imports in 2017 will return to the WTO bound rate of 30 percent, a six-fold increase from the previously applied preferential rate of 5 percent.

2017 forecast fuel ethanol consumption is nearly unchanged. At this time, future ethanol consumption growth will depend on gasoline consumption growth and the number of additional provinces and municipalities mandating E10 ethanol-gasoline blends. In 2017, the blend rate for ethanol-gasoline is forecast at 2.5 percent, slightly lower by 0.1 percentage points from 2016, on relatively little change in fuel ethanol use and continued expansion in overall gasoline use. Over the past decade, there has been no long-term sustained growth in the blend rate.

China's biodiesel industry remains in its early stages of development and faces challenges throughout the value chain. 2017 biodiesel production is forecast at 500 million liters, unchanged from 2016 on

lower overall diesel demand, limited government support, and stagnant capital investment. In 2017, biodiesel imports are forecast to slow to a trickle, unchanged from 8 million liters on weak domestic demand.

2017 biodiesel consumption is forecast at 488 million liters, unchanged from 2016 on continued sluggish demand. Biodiesel demand is forecast to remain flat at 521 million liters on the slowing pace of economic expansion shrinking domestic production capacity, and declining truck kilometers-driven

2017 advanced biofuels production is forecast to reach 350 million liters, up nearly 100 million liters, or 40 percent, on expanded production capacity.

II. Policy and Programs

China's grain and biofuels policies and support programs have changed significantly from the previous report. For more details, please see GAIN reports CH13040, CH14038, CH15030, and CH16058.

Environmental Commitments Support Long-Term Ethanol Prospects

Biofuels are part of China's long-run strategic energy plan to help protect the environment, prevent energy shortages, and reduce dependence on imported energy. Blending biofuels into petroleum fuels will support recent Beijing's initiatives to improve fuel quality and economy standards and manage air pollution at the national level.

In late 2014, the Central Government approved a National Climate Change Plan (NCCP) that set emission and clean energy targets for 2020. The NCCP set a target of 130 billion cubic meters of biofuel consumption by 2020 (see Table 1).

In November 2015, the State Council released "The Energy Development Strategy Action Plan 2014-2020," which aims to cap energy consumption by 2020. The targets include a cap on annual primary energy consumption at 4.8 billion tons of standard coal-equivalent-consumption by 2020, and a goal of reaching 15 percent of non-fossil fuel-based energy usage in the country's primary energy mix.

In November 2016, China committed in the Paris Agreement within the United Nations Framework Convention on Climate Change (UNFCCC) to peak its growth in greenhouse gas emissions, including emissions from heavy trucks and passenger vehicles, by 2030.

Renewable Energy Gets a Boost Under the 13th FYP

In 2010, the government set ambitious targets for ethanol and biodiesel in its 12th FYP. The 12th FYP targeted production of 5,068 million liters (4.0 million tons) of fuel ethanol and 1,361 million liters (1.0 million tons) of biodiesel by 2015. However, production for both targets fell short in 2015. In 2015, ethanol production reached only 3,078 million liters (2.4 million tons), or less than two-thirds of the original 5,068 million liter (4.0 million ton) 12th FYP goal. Despite significant investments in research and development, government efforts to expand production of non-grain conventional fuel ethanol never materialized into commercial-scale projects (See Section VI).

The 12th FYP target for biodiesel was achieved one year early in 2014 partly due to a government crackdown on illegal use of used cooking oil feedstocks and rising petroleum crude oil prices. However, one year later, at the close of the 12th FYP, China's biodiesel production halved (See Section V).

On October 24, 2016, in its 13th FYP, the State Council announced even more ambitious goals to produce 6,335 million liters (5.0 million tons) of ethanol and 2,272 million liters (2.0 million tons) of biodiesel by 2020. The 13th FYP aims to double ethanol production and expand biodiesel production by more than four-times current volumes.

For non-grain and cellulosic ethanol, the 13th FYP also highlights significant gaps between current production capacities and production targets by 2020. Based on industry information, the government has unofficially set a target to produce 3,801 million liters of cellulosic and non-grain based ethanol by 2020. Current production volumes remain at less than 10 percent of these targets.

Table 1 - Biofuels Production Goals Raised Under the 13th FYP (2016-2020)

Classification	**Units**	**12th FYP**	**13th FYP**	**National Climate Change Plan (NCCP)**
Period		**2011-2016**	**2016-2020**	**2015 to 2020**
Liquid Biofuels	billion cubic meters	**4**	**7**	130
Ethanol	million tons	4	5	
Biodiesel	million tons	1	2	
Biomass Electricity	million kilowatts capacity	13	30	30
Biomass Gas	billion cubic meters	30	N/A	44
Solid Biomass for Fuel	million tons	10	N/A	50

Given lofty production targets in the 13th FYP, China must expand ethanol and biodiesel production capacity to reach its goals by 2020. For ethanol, investments to construct new facilities or raising capacity at existing facilities can conceivably double China's national production. However, for biodiesel, underlying economic fundamentals discourage large-scale efforts to expand production (See Section V).

Mandated E10 Blended Gasoline Area Expands

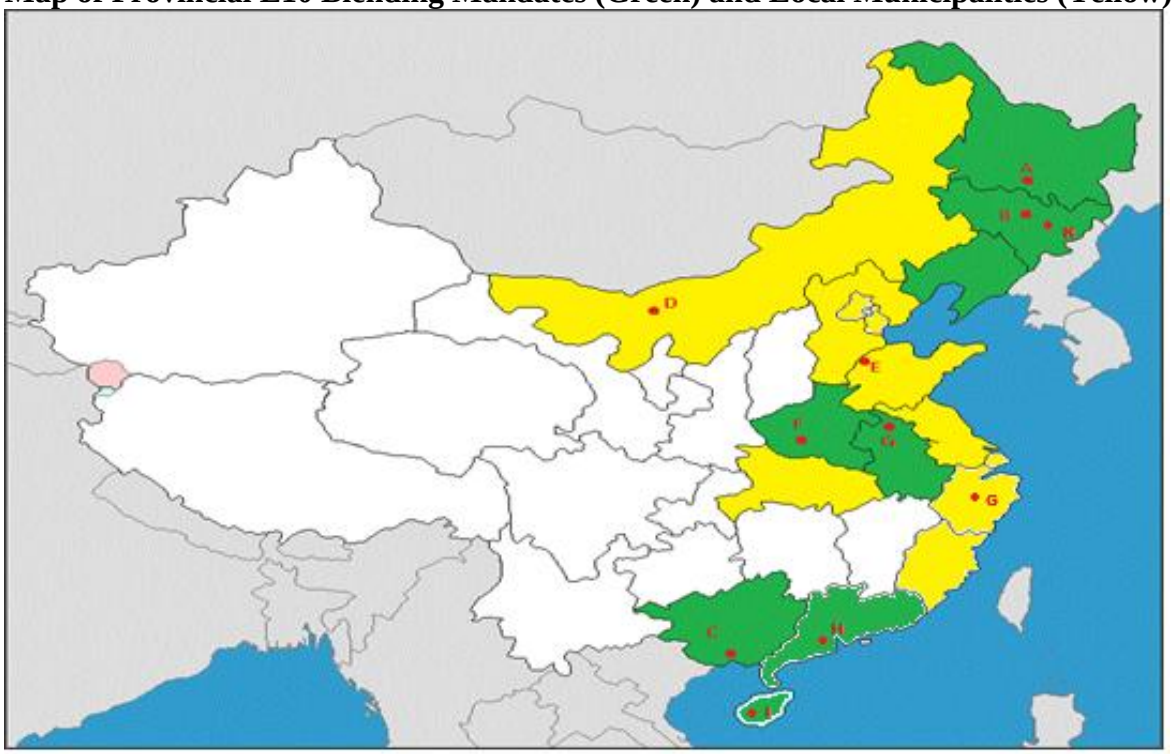
In 2016, Jiangsu and Hebei provinces and the city of Guangdong adopted an E10 blending mandate. China has launched pilot zones in 11 provinces and 40 municipalities, including Heilongjiang, Jilin, Liaoning, Inner Mongolia, Henan, Anhui, Shandong, Zhejiang, Guangzhou, Guangxi, and Hainan for mandatory ethanol blended gasoline use. Locations were selected due to proximity to grain production areas.

In areas with blending mandates, government regulations require state-owned petroleum companies to

purchase and blend a volumetric-mandate of 10 percent fuel ethanol into gasoline from designated plants. In practice, according to industry sources, the blending rate in these markets is closer to seven and 20 percent. E10 adoption in areas without a blending mandate remains comparatively low. There are no plans to increase blend rates beyond 10 percent.

A map of blend mandates and ethanol facilities in China below indicates the expansion of E10 blending mandates across Eastern China. Green-colored provinces indicate provinces enforcing E10 blending mandates. Yellow-colored provinces indicate provinces with local municipalities enforcing local E10 blending mandates. The red dots indicate licensed fuel ethanol facilities.

Map of Provincial E10 Blending Mandates (Green) and Local Municipalities (Yellow)



China's biofuel industry seeks strong policy incentives to improve market conditions for biofuels investment. The domestic industry is hopeful that E10 pilot programs will continue to expand into a national blending mandate. However, at this time, there are no proposals for a national blending mandate. At this time, future ethanol consumption growth will depend on gasoline consumption growth or an expansion of provinces mandating E10 ethanol-gasoline blends.

Biodiesel Blending Mandates See No Growth

Since 2010, Hainan province has maintained a trial program requiring a biodiesel-diesel blend rate of two to five percent. Industry sources report that when available biodiesel blend rates can reach as high as 20 percent.

Grain and Non-Grain Feedstocks Defined by China are Distinct

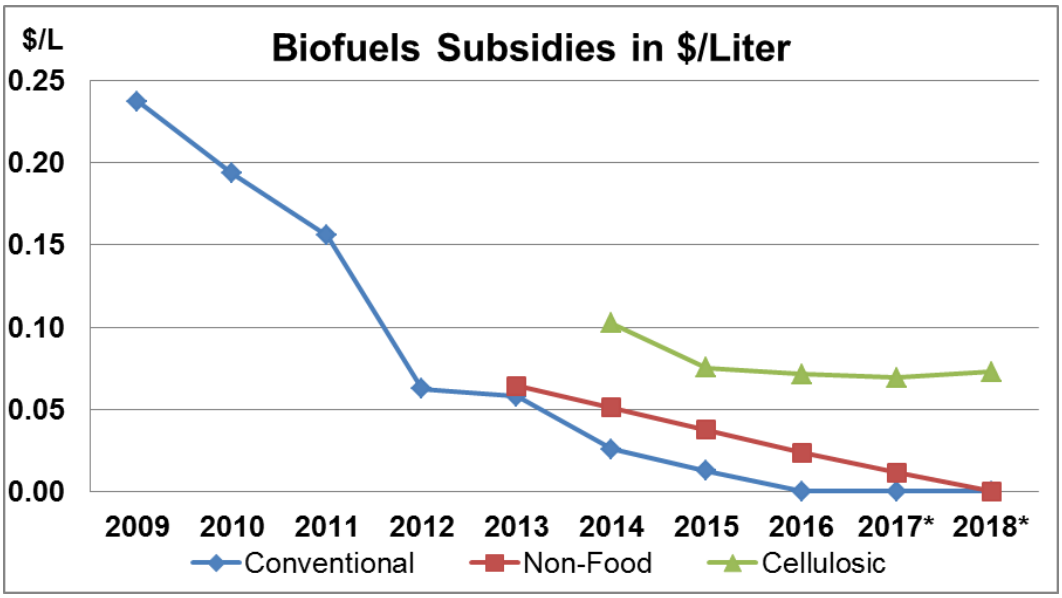
The definition of biofuels products by the Central Government as a grain or a non-grain feedstock determines the subsidy classification for different biofuels. Staple grain crops are defined as Generation 1.0 biofuels feedstocks. State Council policies and defined subsidy benefits historically discourage ethanol production using corn, wheat, and rice feedstocks. State policies prescribed that biofuel development (including fuel ethanol and biodiesel) should not compete for arable land designated for crops for human consumption. See GAIN report CH9059.

China promotes the development of ethanol production using non-food grain feedstocks. China's definition of "non-grain material feedstocks" is distinct. Sweet sorghum (stalks and grain), grain sorghum, cassava (tapioca), sugarcane (stalks and molasses), and sweet potatoes are defined as Generation 1.5 biofuels feedstocks. The Central Government interprets that the cultivation, processing, and production of biofuels using Generation 1.5 feedstocks does not compete with the production and processing of staple food crops. China defines corn cobbs, corn stover, forage sorghum, wood chips, and other "fiber material" biomass as Generation 2.0 feedstocks. The Central Government defines no policy or subsidy determination for synthetic ethanol production using petroleum, municipal waste, or biogas feedstocks.

Production Subsidies Gradually Phased Out

During a period of high corn prices in 2008, China restricted construction of new ethanol facilities. Central Government subsidies for conventional ethanol plants have been gradually phased out from RMB 2,000 per ton ($318) in 2009 to zero in 2016. Ethanol production subsidies using non-food grain feedstocks will become phased out by 2018.

Advanced cellulosic ethanol production subsidies are RMB 600 per ton ($0.07 per liter). The prospects for continued production subsidies in 2017 and 2018 remain uncertain as extensions or updates to the original subsidy program have not been announced at this time.



Source: Post calculations, Innovation Center for Energy and Transportation, and Pacific Exchange Rate

Service. *2017 and 2018 exchange rates are forecasts

Processor Subsidies Promote Disposal of Massive State Grain Administration Feedstocks

During a period of low corn prices and rapidly accumulating State Grain Administration inventories in 2016, China reversed its food security stance on biofuels. In March 2016, China's eliminated its long-standing temporary reserve program. The Central Government abandoned price support policies for all commodities, except wheat and rice. Furthermore, in Fall 2016, several provincial governments in Northeast China began offering processor subsidies to state-owned ethanol processors to dispose of old-crop inventories from the State Grain Administration at discounted rates. See GAIN report CH16058.

Fuel Quality Standards

On February 17, 2016, the CPC Central Committee and the State Council announced a new regulation entitled "Notice of Revised Fuel Quality Standards and Regulatory Enforcement," «发改委印发《关于进一步推进成品油质量升级及加强市场管理的通知》 to reduce vehicle exhaust emissions.

On January 1, 2016, gasoline for automobiles (including E10 ethanol- gasoline blends) must conform to revised Fuel Quality Standards defined as "China V" in 11 provinces and municipalities in Eastern China, including Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. On January 1, 2017, the revised standards will apply nationwide.

Table 2 - New Gasoline Quality Standards in China

Entering Force	Octane Rating	Sulphur Content (ppm)	China Standard	Biofuel Blends
December 2013 (11 Provinces)	92	10	V5 gasoline	E10 gasoline-ethanol
January 2017 (Nationwide)	92	10	V5 gasoline	E10 gasoline-ethanol

The China National Standard, or Guobiao (GB) Standard, is a set of mandatory standards regulated by the Standardization Administration of China (SAC). Each GB Standard has a GB number followed by the year when it was issued. The February 2016 Fuel Quality Standard revision does not affect the existing ethanol standard (GB 18351-2015). According to the 2015 GB standard, E10 gasoline-ethanol blends must meet Octane ratings of 95 or 97.

Table 3 - New Diesel Quality Standards in China

Entering Force	Cetane Rating	Sulphur Content (ppm)	China Standard	Biofuel Blends
January 1, 2015 (Nationwide)	49	50	China IV diesel	B5 biodiesel-diesel
January 1, 2017	51	10	China V diesel	B5 biodiesel-diesel

(Nationwide)				

On January 1, 2016, diesel for automobiles (including B5 biodiesel) must conform to revised Fuel Quality Standards defined as "China V Standard Ordinary Diesel Oil" in 11 eastern provinces. On January 1, 2017, the revised standards will apply nationwide.

The B5 biodiesel-diesel national standard (GB/T 20828-2015) remains the national fuel quality standard. However, industry-wide adoption of this standard has been inconsistent. In 2015, the biodiesel industry faced serious reports of low biodiesel quality. In South China, Petro China and Sinopec have ceased biodiesel procurement. Diesel end-users and distributors report that without clear policy guidance, financial assistance, and rulemaking standards, they are reluctant to invest in compliance measures for new fuel standards.

Fuel Economy Standards

In September 2004, China introduced its first fuel economy standards for light-duty passenger vehicles. In March 2013, the National Development Reform Commission (NDRC) and four other ministries introduced new average fuel consumption limits for passenger cars to 6.9 liters per 100 kilometers by 2015, and 5.0 liters by 2020.

To meet these goals, China has adopted restrictions for currently operated vehicles, new vehicle registrations, and tax rules that promote sales of vehicles with lower emissions. These measures are expected to change the composition of the national vehicle fleet to smaller, more efficient gasoline engines, as well as more advanced powertrain technologies, including electric, hybrid, and compressed natural gas engines.

In 2014, China's Ministry of Industry and Information Technology (MIIT) set new fuel economy standards for heavy-duty commercial vehicles (GB 30510-2014).

Value Added Tax (VAT) and Consumption Tax

Since 2002, China has subsidized and granted tax reductions or exemptions of VAT or consumption taxes to fuel ethanol and biodiesel producers.

In 2009, China's Ministry of Finance announced that by 2015, the government will remove its support on the VAT rebate and impose a five-percent consumption tax for grain-based ethanol production. China's Ministry of Finance implemented the rule in 2014. In 2015, VAT exemptions for grain-based fuel ethanol producers expired. VAT exemptions for ethanol producers using "non-grain" (Generation 1.5) and cellulosic feedstocks (Generation 2.0) continue.

On December 15, 2015, China's General Administration of Customs imposed a RMB 8 per liter ($1.16) consumption tax on fuel blends with less than 30% biodiesel content. All other biodiesel blends are exempt from the measure.

III. Gasoline and Diesel Markets

According to National Bureau of Statistics (NBS) estimates, China's economic growth has slowed significantly since 2014. In 2016, China's Gross Domestic Product (GDP) growth fell to 6.7 percent, down two percentage points from 2015. Actual GDP growth may even be lower than government figures.

Forecast overall fuel use in China is nearly unchanged in 2017. NBS estimates national fuel use at 320,453 million liters, up 3,721 million liters, or one percent from 2016. Although fuel demand in China has expanded considerably over the past decade, overall fuel use has stagnated since 2015 on slowing economic growth, greater public transportation options, and increasing adoption of smaller passenger transportation. Future prospects for transportation fuel demand depend on the adoption of advanced fuel technologies for the national passenger and heavy truck fleet and macroeconomic factors.

Table 4 - China Historical and Projected Fuel Consumption

Fuel Use History (Million Liters)											
Calendar Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Gasoline Total	65,591	70,833	74,562	80,911	84,289	96,705	97,123	105,013	123,481	133,360	140,153
Diesel Total	130,786	141,073	148,964	161,313	154,269	185,952	181,470	182,769	183,544	180,958	176,416
On-road	70,913	76,996	84,489	89,956	92,810	100,179	111,546	126,150	133,718	141,742	144,663
Gasoline and Diesel	**196,377**	**211,906**	**223,526**	**242,225**	**238,558**	**282,657**	**278,593**	**287,783**	**307,026**	**314,317**	**316,569**
Fuel Use Projections (Million Liters)											
Calendar Year	**2016 E**	**2017 F**	**2018 F**	**2019 F**	**2020 F**	**2021 F**	**2022 F**	**2023 F**	**2024 F**	**2025 F**	**2026 F**
Gasoline Total	146,740	153,637	160,858	168,418	176,334	180,037	183,817	187,678	191,619	195,643	199,751
Diesel Total	170,012	166,816	165,348	163,893	165,483	165,665	165,847	166,029	166,212	166,395	166,578
On-road	145,884	147,197	148,522	149,859	151,207	151,737	152,268	152,801	153,335	153,872	154,411
Gasoline and Diesel	**316,752**	**320,453**	**326,206**	**332,311**	**341,816**	**345,701**	**349,664**	**353,707**	**357,831**	**362,037**	**366,329**

Source: Post estimate

China crude oil import volume skyrocketed in 2016 with a daily import average volume of 7.63 million barrels per day. According to China's General Administration of Customs, crude oil imports in 2016 rose to 381 million tons, 13.6 percent higher than 2015.

Expansion of the national passenger vehicle fleet has more than offset decreases in lower diesel demand from higher fuel quality and emissions standards and weaker demand for heavy truck transport.

2017 gasoline consumption is forecast at 153,637 million liters, up 4.7 percent on continued expansion of the domestic passenger vehicle fleet. According to the China National Petroleum Company (CNPC) Research Center, in 2016, estimated gasoline consumption jumped to 146,740 million liters, up 4.7 percent from 2015. According to NBS estimates, in 2015 China's national gasoline consumption reached 140.15 million liters (see Table 6).

Meanwhile in 2016, diesel consumption dropped to 170 million liters, down by 4 million liters, or 3.6 percent from 2015. In 2015, diesel for transportation is estimated to account for about 83 percent of

total diesel use.

Vehicle and Fuel Use

Over the past few decades, a growing middle-class has propelled China to become the world's largest automobile market, overtaking the United States in 2008. The national fleet for passenger vehicles is expanding rapidly, while the national fleet for heavy trucks remains relatively stable. In 2014, the China Automotive Energy Research Center (CAERC) projected the national passenger vehicle market to grow to 550 million vehicles by 2050.

The China Association of Automobile Manufacturers forecasts that overall 2017 vehicle sales will grow to 29.7 million vehicles, up 5 percent from 2016, primarily driven by a 5 percent jump in passenger vehicle sales forecast at 25.7 million vehicles.

In 2015, NBS estimates that the national civilian vehicle fleet reached 172.3 million (including 9.6 million tri-wheel vehicles and low-speed trucks), up 11.5 percent from 2014. Among these vehicles, privately-owned passenger vehicles accounted for 144 million vehicles, up 14.4 percent from 2014.

Over the past decade, China has expanded its infrastructure tremendously. According to NBS, from 2005 to 2015, China's national road network grew by more than 40 percent and its national expressway network more than doubled. In 2015, total annual vehicle kilometers-driven fell to 1,047.4 billion kilometers-driven, down 5 percent from 2014 on relatively sluggish economic growth.

IV. Ethanol

Production

China is the world's fourth largest ethanol producer and consumer after the United States, Brazil, and the European Union.

Total ethanol production (potable beverage, fuel, and other industrial chemicals) in 2017 is forecast at 20,432 million liters, up 1,450 million liters or seven percent from 2016.

Based on available information, Post estimates that beverages and hard liquor account for 56 percent (10,098 million liters) of total ethanol production, industrial chemicals accounts for 26 percent (4,470 million liters), and fuel ethanol accounts for 16.6 percent (3,200 million liters).

Table 5 - China Ethanol Industry Production Mix

In Million Liters	2008	2009	2010	2011	2012	2013	2014	2015	2016 Estimated	2017 Forecast
Ethanol for fuel only	**2,257**	**2,466**	**2,479**	**2,566**	**2,858**	**2,934**	**2,951**	**3,078**	**3,155**	**3,550**
Ethanol - GEN I	*2,235*	*2,397*	*2,383*	*2,479*	*2,724*	*2,735*	*2,721*	*2,835*	*2,906*	*3,200*
Ethanol - GEN II	*23*	*68*	*96*	*87*	*134*	*199*	*230*	*243*	*249*	*350*
Ethanol for other Industrial Chemicals	**1,185**	**1,253**	**1,656**	**2,053**	**2,428**	**2,861**	**3,970**	**4,470**	**5,036**	**5,357**
Ethanol for beverage or other usage	**5,918**	**6,409**	**7,072**	**7,858**	**8,980**	**9,810**	**9,842**	**10,098**	**10,791**	**11,525**

All Ethanol Production - China	9,361	10,127	11,207	12,477	14,266	15,605	16,763	17,646	18,982	20,432

Source: Post estimates

Fuel Production

2017 fuel ethanol production is forecast at 3,550 million liters, up 12.6 percent from estimated 2016 production on strong demand, plentiful feedstocks, and continued government support.

2016 ethanol production is estimated at 3,155 million liters, up 77 million liters from 2015.

Policy changes have reversed the fortune of China's ethanol producers, driving production higher. The 13th Five Year Plan targets total ethanol production at 6,335 million liters by 2020. China's current production capacity utilization (see Section II) is around 25 percent. Some industry forecasts estimate that national production capacity may expand to 8,000 to 10,000 million liters in the next two to three years with continued strong demand and policy support.

The Central Government tightly controls ethanol production, blending, and distribution. There are a reported total of 115 ethanol producers nationwide using a variety of feedstocks such as grains (corn, wheat, and sorghum), tubers (cassava, yams, and sweet potatoes), molasses (sugarcane and sugarbeet), as well as synthetic ethanol feedstocks such as coal, municipal solid waste, sewage sludge, and acetic acid. Of these facilities, the government has granted 11 ethanol facilities production licenses and franchise rights for distribution in one or more designated provinces.

Corn is the major feedstock for ethanol production in China. Corn use for ethanol production yields several byproducts. Dry milling production yields dried distiller's grains with solubles (DDGS), corn oil, and, in some cases, germ and bran. Wet milling production yields corn gluten feed, corn fiber, and corn oil, which are fed to livestock. Crude corn oil may be processed for food use or biodiesel.

Wheat use for ethanol production is not supported by State Council policies due to food security concerns. However, industry sources report that wheat is used to produce undenatured ethanol for human consumption. Wet milling production yields wheat gluten, wheat bran, and wheat germ, which are fed to livestock or processed into food use.

Non-food grain feedstocks do not compete with food production and are considered advanced biofuels. In 2008, the NDRC commissioned the China International Project Consultancy Corporation to evaluate the feasibility of establishing non-grain ethanol processing facilities in Hubei, Hebei, Jiangsu, Jiangxi and Chongqing. The study concluded ethanol refining capacity processing yam, cassava, or sweet potatoes in these areas would not compete with food crops and would continue to support food security. Soon after, China constructed several starch-based cassava-to-ethanol plants. Today, cassava accounts for nearly one-third of China's state approved ethanol production capacity. However, actual production volumes are low as up to 80 percent of China's cassava feedstock supplies remain import dependent. Industry sources estimate that the production cost for cassava-based anhydrous ethanol averages RMB 5,300 per ton ($775). Yam, sweet potato, and cassava use for ethanol yield root fiber which is used to co-generate power.
Forage and sweet sorghum are attractive feedstocks due to their drought tolerance, ability to grow on marginal land with few inputs, and quick-growing characteristics. However, without sufficient road

infrastructure to accommodate field access and transport biomass residues and sugar-containing stalks in a timely manner, forage and sweet sorghum feedstocks for ethanol production will remain on the horizon. Sweet sorghum use for ethanol yields bagasse which is used to co-generate electrical power or in rare cases may be fed to livestock.

Molasses (from cane or beet sugar refineries) accounts for the remaining share of ethanol feedstocks due to limited volumes of sugarcane production in South China. Sugarcane use for ethanol yields bagasse which is used to co-generate electrical power or in rare cases fed to livestock. Sugar beet pulp is used as feed for livestock.

Table 6 – Chinese Ethanol Facilities (Licensing, Production, and Distribution)

Symbol	**Producer**	**Province, City**	**Approved Capacity**		**Feedstock**	**Ownership**
			Million Liters	1,000 MT		
A	China Resources Alcohol Company, Zhaodong	Heilongjiang, Zhaodong	570	450	Corn/Wheat/Rice	China National Cereals, Oils and Foodstuffs Corporation (COFCO)
B	Jilin Fuel Ethanol	Jilin, Jilin	887	700	Corn/Wheat	COFCO and China National Petroleum Co.
C	Guangxi COFCO Bio-energy	Guangxi, Beihai	507	400	Cassava	COFCO
D	ZTE Energy	Inner Mongolia	101	80	Sweet Sorghum	Zhongxin Telecommunication Enterprises (ZTE)
E	Shandong LongLive	Shandong, Qingdao	101	80	Corn Stover	Private
G	Henan Tianguan Alcohol Chemical Group Co.	Henan, Nanyang	634	600	Corn/Wheat/Cassava/Molasses/Sweet Potato	Shougang Group/ China Petroleum and Chemical Corp. (Sinopec)
F	COFCO Biochemical (Anhui)	Anhui, Bengbu	634	500	Corn/Cassava	COFCO
H	Guangdong Zhongneng Alcohol Co.	Guangzhou, Zhongneng	190	150	Molasses (Sugarcane)/Cassava	China State-Development and Investment Corporation
I	Hainan Yedao Group	Hainan	127	100	Cassava	COFCO
G	Zhejiang Zhoushan Fuel Ethanol Co.	Zhejiang	380	300	Cassava	Unknown
K	China Datang New Energy	Jilin	TBD	TBD	Under Development (State-Owned)	DaTang & DuPont
	Total	**Reported**	**4,067**	**3,210**		

Sources: Industry Sources.

Synthetic Ethanol Attracting Investment

2017 synthetic (fossil fuels-based) ethanol production capacity is forecast to expand to 1,104 million liters, up 253 million liters, from 2016.

SOEs and private investors continue to show interest in expanding synthetic ethanol production capacity. In 2015, the NDRC continued strict control of licensing for synthetic ethanol plants. Current synthetic ethanol production costs range around RMB 5,100 per ton ($745), comparatively price competitive to starch-based ethanol.

Table 7 Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
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	3,442	3,718	4,135	4,619	5,286	5,795	6,921	7,548	8,191	8,907
Fuel Production	2,257	2,466	2,479	2,566	2,858	2,934	2,951	3,078	3,155	3,550
>of which is cellulosic	23	68	96	87	134	199	230	243	249	350
Imports	0	0	4	5	15	0	27	477	890	350
Fuel Imports	0	0	3	5	3	0	14	468	853	300
Exports	108	108	156	43	45	40	33	25	33	12
Fuel Exports	8	16	12	8	7	2	1	1	1	1
Consumption	3,334	3,610	3,983	4,581	5,256	5,755	6,915	8,000	9,047	9,245
Fuel Consumption	2,249	2,450	2,470	2,563	2,854	2,932	2,964	3,545	4,007	3,849
Ending Stocks										
Fuel Ending Stocks										
Total BalanceCheck	0	0	0	0	0	0	0	0	0	0
Fuel BalanceCheck	0	0	0	0	0	0	0	0	0	0
Production Capacity										
Number of Refineries	4	5	5	5	6	6	7	7	9	11
Nameplate Capacity	2,300	2,500	2,500	2,600	3,000	3,000	3,200	3,200	3,600	4,200
Capacity Use (%)	98%	99%	99%	99%	95%	98%	92%	96%	88%	85%
Market Penetration (Million Liters)										
Fuel Ethanol	2,249	2,450	2,470	2,563	2,854	2,932	2,964	3,337	3,824	3,849
Gasoline	80,911	84,289	96,705	97,123	105,013	123,481	133,360	140,153	146,740	153,637
Blend Rate (%)	2.8%	2.9%	2.6%	2.6%	2.7%	2.4%	2.2%	2.4%	2.6%	2.5%

Source: Post estimates. Post has omitted fuel ethanol feedstock data which are currently under review. The 2017 Annual Biofuels report due July 2017 will include fuel ethanol feedstock updates.

Fuel Consumption

2017 fuel ethanol consumption is nearly unchanged. Post forecasts 2017 fuel ethanol use at 3,849 million liters, slightly up 25 million liters from 2016 estimates.

In 2017, the blend rate for ethanol-gasoline is forecast at 2.5 percent, slightly lower by 0.1 percentage points from 2016, on relatively little change in fuel ethanol use and continued expansion in overall gasoline use. Over the past decade, there has been no long-term sustained growth in the blend rate.

The government sets the price for ethanol at 91.1 percent of the wholesale price for 93 Octane-rated gasoline. Industry sources report that the fuel ethanol settlement price is RMB 2,656 per ton ($388).

Trade

In 2017, fuel ethanol imports are forecast to fall by nearly two-thirds to 300 million liters on higher applied duties for imported ethanol and growing domestic supplies.

2016 ethanol imports are estimated at 890 million liters, including 853 million liters of fuel ethanol on higher consumption and competitive prices.

Ethanol imports to China are highly regulated. Designated importers are licensed to import ethanol, distribute fuel, and operate retail fuel stations.

Starting in 2014, State-Owned Enterprises (SOEs)s imported small volumes to examine how supplementing domestic ethanol supplies with imports would change the domestic market dynamics. Since 2015, ethanol imports rapidly expanded on strong demand and policy support.

Import Tariffs on Ethanol

On December 19, 2016, China announced that on January 1, 2017, the applied import duty for U.S. denatured ethanol (HS: 220710) imports will return to the WTO bound rate of 30 percent, a six-fold increase from the previously applied preferential rate of 5 percent. The applied import duty for undenatured ethanol (HS: 220720) remains unchanged at 40 percent.

Table 8 - Tariff and Taxes on Ethanol (2009 to 2016)

HS#		Import Tariff Rate	VAT on Import	Consumption Import Tax	VAT Rebate on Exports
220710	Undenatured	40%	17%	5%	0%
220720	Denatured	5%	17%	5%	0%

Table 9 - Tariff and Taxes on Ethanol (Effective January 1, 2017)

HS#		Import Tariff Rate	VAT on Import	Consumption Import Tax	VAT Rebate on Exports

220710	Undenatured	40%	17%	5%	0%
220720	Denatured	30%	17%	5%	0%

Source: China General Administration of Customs, Import and Export Tariffs

In 2012, free trade agreements removed import tariffs for ethanol (undenatured and denatured) and biodiesel, originating from ten ASEAN countries plus Chile, Singapore, Vietnam, and Pakistan.

Table 10 - Imports of Ethanol, Denatured and Undenatured (HS: 220710 and HS:220720)

	2012	2013	2014	2015	2016
	---1,000s liters---				
United States		32	26,310	299,605	853,272
Pakistan	7,854	18	59	189,614	14,458
Brazil	-	-	-	167,748	4,885
Vietnam	4,995	-	-	20,357	3,744
Korea, South	6	3	7	8,700	9,814
South Africa	0	-	-	678	3,813
Russia	-	-	30	61	-
Japan	229	142	184	61	28
Germany	13	17	25	30	39
United Kingdom	4	22	1	24	26
Poland	-	-	-	11	-
Spain	2	4	6	8	6
Netherlands	8	9	8	6	3
China	38	5	2	2	2
Israel	49	1	0	2	-
France	1	2	1	1	27
Thailand	2,066	-	-	1	0
Other countries	13	20	84	0	24
Grand Total	**15,308**	**275**	**26,717**	**686,907**	**890,140**

Source: China General Administration of Customs data sourced from Global Trade Atlas, IHS, Inc. with Post estimates

Prior to the renewal of bound duty tariffs, imported ethanol was far cheaper than domestically produced ethanol. Restricting ethanol imports further supports the Central Government's efforts to de-stock massive temporary reserves of domestic corn supplies.

In 2015, the average price for domestic ethanol was RMB 5,121 per metric ton ($787), whereas the average CIF price for imported ethanol was around $595 per ton. Based on industry information, imported ethanol was primarily used for fuel.

China Actively Manages VATs Applied to Exports of Ethanol

China's Ministry of Finance uses fiscal instruments to actively manage its grain-processing sector and exports of processed grain products. During periods of high grain prices, China fully applies a 13-

percent VAT on exports without rebates. In 2007, to discourage the expansion of China's grain-processing sector, the government eliminated a 13-percent VAT rebate on ethanol exports, substantially cutting profits for exporters.

During periods of relatively low grain prices, or when government stocks are high, the Ministry of Finance uses rebates to eliminate or partly offset a 13-percent VAT on ethanol exports. In 2009, the government announced a five-percent VAT rebate for ethanol exports. On August 25, 2016, the Ministry of Finance announced that a 13-percent VAT rebate on ethanol exports and 9 other processed corn products would be reinstated, encouraging ethanol exports, starting on September 1, 2016. On January 1, 2017, the 13-percent VAT rebate period lapsed (See Tables 8 and 9).

Even with several ethanol production support programs, China exports small volumes of ethanol. From 2012 to 2016, China exported on average about 33,000 liters of ethanol per year. In 2016, China exported 33,700 liters of ethanol, primarily to nearby markets.

Table 11 - Exports of Ethanol, Denatured and Undenatured (HS: 220710 and HS:220720)

	---1,000s liters---				
	2012	2013	2014	2015	2016
Korea, North	27,187	20,915	13,606	9,880	13,588
Philippines	-	3,649	2,067	6,132	10,307
Taiwan	7,365	8,027	6,125	3,768	2,298
Japan	8,529	5,101	6,834	2,902	4,130
India	964	984	1,088	973	649
Macau	643	766	759	746	760
Papua New Guinea	144	160	489	462	128
Korea, South	-	41	1,276	189	1,455
Hong Kong	65	89	105	98	103
Ethiopia	-	-	29	37	-
Vietnam	16	19	11	16	26
Other Countries	789	194	369	27	240
Grand Total	**45,702**	**39,945**	**32,757**	**25,230**	**33,684**

Source: China General Administration of Customs data sourced from Global Trade Atlas, IHS, Inc. with Post estimates

Stocks

See Section VIII.

V. Biodiesel

China's biodiesel industry remains in its early stages of development and faces challenges throughout the value chain. In 2015 and 2016, the market competitiveness for China's biodiesel production

diminished as international crude prices plummeted, overall domestic demand for diesel fell, and quality issues plagued the domestic industry. A lack of handling standards for biodiesel feedstock and production processes led to a market decline to nearly one-quarter of its former size.

The 13th Five Year Plan includes an ambitious goal to produce 2,272 million liters of biodiesel by 2020. Previous support policies for biodiesel industry in China energy market have been proven ineffective.

Fuel Production

2017 biodiesel production is forecast at 500 million liters, unchanged from 2016 on lower overall diesel demand, limited government support, and stagnant capital investment.

2016 biodiesel production fell to 500 million liters, down 45 million liters from 2015, on lower overall diesel demand.

The Chinese Academy of Sciences reports that national biodiesel capacity in China is approximately 3.0 to 3.5 million tons (3,408 to 3,976 million liters). Industry sources estimate biodiesel production capacity in 2016 at 2,370 million liters, less than 15 percent of total capacity. Today, China has 26 operating biodiesel plants, down five from 2015, and less than one-third of the 84 facilities operating during the industry's heyday in 2008.

In China, used cooking oil (UCO) is the primary feedstock for biodiesel production. In 2013, researchers at Tsinghua University estimated that China is the world's leading producer of waste oil, producing 13.74 million tons of waste oil in 2010. However, UCO remains an unreliable source for many of China's biodiesel processors. The domestic industry continues to face challenges to source quality inputs.

Biodiesel production using UCO feedstock yields two primary co-products, glycerine and fatty acids, which may be further processed into industrial chemicals.

Table 12 - Biodiesel (Million Liters)

Calendar Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Beginning Stocks	0	0	0	0	0	0	0	0	0	0
Production	534	591	568	738	909	1,079	1,133	545	500	500
Imports	0	0	0	0	49	895	1028	34	8	8
Exports	0	0	0	0	0	0	29	21	20	20
Consumption	534	591	568	738	958	1974	2132	558	488	488
Ending Stocks	0	0	0	0	0	0	0	0	0	0
BalanceCheck	0	0	0	0	0	0	0	0	0	0
Production Capacity										
Number of Biorefineries	84	62	45	49	52	53	53	31	30	28
Nameplate Capacity	3,351	2,670	2,556	3,400	3,600	4,000	4,000	2,431	2,372	2,680
Capacity Use (%)	15.9	22.1	22.2%	21.7%	25.3%	27.0%	28.3%	22.4%	21.1%	18.7%

	%	%								
Market Penetration (Million Liters)										
Biodiesel, on-road use	160	177	170	221	270	1,116	1,249	143	133	133
Diesel, on-road use	89,956	92,810	100,179	111,546	126,150	133,718	141,742	144,663	145,884	147,197
Blend Rate (%)	0.2%	0.2%	0.2%	0.2%	0.2%	0.8%	0.9%	0.1%	0.1%	0.1%
Diesel, total use	161,313	154,269	185,952	181,470	182,769	183,544	180,958	176,416	170,012	166,816

Sources: Post estimates. Post has omitted biodiesel feedstock data which are currently under review. The 2017 Annual Biofuels report due July 2017 will include biodiesel feedstock updates.

Fuel Consumption

2017 biodiesel consumption is forecast at 488 million liters, unchanged from 2016, on continued sluggish demand.

In China, biodiesel demand is entirely discretionary. Unlike ethanol, the Chinese biodiesel sector is not supported by a broad number of local and provincial blending mandates. Additionally, an RMB 8-per-liter consumption tax imposed in December 2015 further discourages biodiesel use.

The industrial sector accounts for 54 percent of total biodiesel use in 2016. Agricultural machinery and fishing vessels accounted for 18 percent of total use. The on-road transport sector accounts for about 28 percent of biodiesel use. However, in relative terms, biodiesel accounts for just 0.1 percent of total on-road diesel use.

Biodiesel demand peaked in 2013 and early 2014 during a period of record high international crude prices. State-owned petroleum refiners blended lower-priced biodiesel with high-priced petroleum-based diesel to lower production costs and raise production output.

In June 2014, international crude oil prices collapsed and petroleum-refined diesel prices plummeted. In response, China National Petroleum Company and Sinopec, which control over 90 percent of retail fueling stations in China, sharply lowered their biodiesel use.

Today, the two leading national fuel distributors offer biodiesel at a limited number of their fueling stations. The national market for biodiesel has collapsed to a small number of regional brokers or direct marketers who service transportation fleets and farmers.

Trade

In 2017, biodiesel imports are forecast to slow to a trickle, unchanged from 8 million liters on weak domestic demand.

2016 biodiesel B100 imports are estimated at 8 million liters, down 26 million liters on lower demand from industry.

Import Tariffs on Biodiesel

The applied import duty for biodiesel (HS: 382600) remains unchanged at 6.5 percent.

Table 13 - Tariff and Taxes on Biodiesel (2009 to 2017)					
HS#		Import Tariff Rate	VAT on Import	Consumption Import Tax	VAT Rebate on Exports
271020	Petroleum and biodiesel mixtures	20%	17%	5%	0%
382600	Biodiesel and mixtures	6.5%	17%	5%	0%

Source: China General Administration of Customs, Import and Export Tariffs

Free trade agreements with ten ASEAN countries plus Chile, Singapore, Vietnam, and Pakistan signed in 2012 removed import tariffs for and biodiesel.

Between 2012 and 2014, China imported significant volumes of crude palm oil (CPO)-based biodiesel from Indonesia and Malaysia. However, following the collapse of international crude prices in June 2014, imports of CPO-based biodiesel fell sharply as the arbitrage opportunity between Southeast Asian CPO-based biodiesel and diesel evaporated. As long as international crude oil prices continue to remain relatively low, the economics to profitably trade biodiesel imports to China will remain unfavorable.

Table 13 - Imports of Pure Biodiesel and Biodiesel Blends Above B30 (HS: 382600), B100-equivalent					
	2012	**2013**	**2014**	**2015**	**2016**
	---million liters---				
Indonesia	20	156	893	11	-
Hong Kong	0		9	18	2
Malaysia	-	2	38	4	5
Singapore	-	1	12	-	-
France	-	-	0	0	1
United States	-	0	0	0	0
Other Countries	-	-	-	-	-
Grand Total	**20**	**159**	**982**	**33**	**8**

Source: China General Administration of Customs data sourced from Global Trade Atlas, IHS, Inc. with Post estimates

Table 14 – Imports of Petroleum Oils Containing Up to 30% Biodiesel (HS: 271020), B100-equivalent					
	2012	**2013**	**2014**	**2015**	**2016**
	---million liters---				

Malaysia	-	1,573	156	-	-
Thailand	-	956	0	-	-
Indonesia	90	414	42	-	-
Singapore	38	261	-	-	-
United States	0	0	0	-	-
Other Countries	0	-	-	-	-
Grand Total	**128**	**3,204**	**198**	**0**	**0**

Source: China General Administration of Customs data sourced from Global Trade Atlas, IHS, Inc. with Post estimates

Table 15 – Imports of Total B100-equivalent (HS: 382600 and HS: 271020)					
	2012	**2013**	**2014**	**2015**	**2016**
	---million liters---				
Indonesia	112	588,414	1,038,086	12,688	-
Malaysia	-	1,574,917	197,958	4,894	5,658
Hong Kong	17	2	43,600	19,549	2,231
Singapore	38,241	262,197	13,050	0	-
Korea, South	3	11	112	146	51
Netherlands	0	21	107	0	-
United States	13	101	81	52	20
Italy	-	-	73	31	-
Germany	5	21	62	15	2
Spain	-	0	56	72	1
France	0	1	39	151	510
United Kingdom	0	0	28	2	-
Taiwan	17	24	28	46	4
Japan	15	18	16	22	30
Sweden	0	-	8	-	0
Thailand	-	955,952	2	-	-
Other Countries	-	1	1	1	2
Grand Total	**150,127**	**3,381,680**	**1,293,308**	**37,670**	**8,507**

Source: China General Administration of Customs data sourced from Global Trade Atlas, IHS, Inc. with Post estimates

Stocks

See Section VIII.

VI. Advanced Biofuels

2017 advanced biofuels production is forecast to reach 350 million liters, up nearly 100 million liters, or 40 percent, from 2016 on expanded production capacity.

Based on industry information, the government has unofficially set a target to produce 3,801 million liters of cellulosic and non-grain based ethanol by 2020.

Post estimates 2016 cellulosic ethanol production at 250 million liters, up 7 million liters, or 3 percent from 2015. In 2016, corn cob use rose sharply to 400,000 tons, up 54 percent from 2015 due to improved technology for non-grain starch processing and government support.

Globally, considerable challenges persist with the commercialization of cellulosic ethanol. Despite years of high expectations, China's cellulosic ethanol projects also remain in the pilot stages of development. Government agencies (National Energy Agency, NDRC, and Ministry of Finance) have invested significant resources to promote the development of cellulosic technology by China's top universities. Past government funding and policy support for cellulosic ethanol market development was limited to SOEs.

However, starting in 2015, the government opened market development resources to private industry, offering subsidies and partnerships with SOEs. The new policy spurred several multinational biofuels leaders, such as Novozymes, DuPont, and LanzaTech to partner with Chinese state-owned companies and invest hundreds of millions of dollars to further develop and commercialize technologies. Advanced cellulosic ethanol productions are just now shifting from demonstration-stage to commercial-scale projects.

Table 16 –Cellulosic Ethanol Investments in China

Company Name	**Estimated Capacity**	**Province**	**Ownership**	**Status**
	--1,000 tons--			
Guangdong Zhongneng Alcohol Co.	30	Guangdong	SDIC (SOE)	Under Development
Henan Tianguan Group Tianjin Biofuel Co.	20	Tianjin	Shougang Group/ Sinopec	Under Development
Henan Tianguan Group Hubei Biofuel Co.	15	Hubei	Shougang Group/ Sinopec	Under Development
China Datang New Energy	10	Jilin	DaTang & DuPont (Private)	Under Development
Zhejiang Zhoushan Fuel Ethanol Co	TBD	Zhejiang	State-Owned	Under Development
Hainan Yedao Group	TBD	Hainan	COFCO (SOE)	Under Development
Shangdong Long Live	TBD	Shandong	Private	Under Development

Sources: Industry sources

VII. Biomass for Heat and Power

In 2007, the Ministry of Agriculture and the State Forestry Administration reported that China produces an estimated total of 60.5 billion tons of plant-based biomass annually.

Several private initiatives have been proposed to develop direct-burn biomass power generation projects focused on either specific sorghum varieties or tapping plentiful corn, rice, and wheat residues from row crop production. They remain in the initial planning stages of development.

Traditionally, Chinese farmers burn crop residues at the end of the growing season causing significant air pollution. Direct-burn projects aim to offer economic incentives to growers to collect and market their farm residues for efficient power generation and large-scale incineration.

Biomass development in China remains limited due to challenges collecting and distributing bulky farm residues. Further market expansion will require improved road infrastructure at the provincial-level and capital investment for field access and equipment at the farm-level.

VIII. Notes on Statistical Data

Policy

The variance between official volumetric blending rates where mandated and actual blend rates is difficult to measure and there appear to be no reliable sources at this time.

It is unclear at this time if blending rates for biodiesel are enforced inconsistently, or if blending rates for biodiesel are not implemented at this time.

The Chinese government initially announced subsidies for cellulosic ethanol production for a defined period. However, the termination or renewal of cellulosic ethanol production subsidies remains unclear.

Gasoline and Biodiesel Markets

Official Chinese statistics for economic growth are subject to interpretation.

Chinese national forecasts for 2017 and 2016 estimates for gasoline use are unavailable. Instead, China National Petroleum Company (CNPC) Research Center statistics were cited. Chinese National Bureau of Statistics estimates were used for historical data from 2005 to 2015.

China does not publish automobile sales forecasts. Instead, China Association of Automobile Manufacturers data was used.

2016 national road network statistics are not available from the National Bureau of Statistics.

2016 annual kilometers-driven are not available from the National Bureau of Statistics.

Ethanol

Official ethanol statistics are not broken into beverage and industrial production, making it difficult to determine the exact mix.

Post has omitted fuel ethanol feedstock data which are currently under review. The 2017 Annual Biofuels report due July 2017 will include fuel ethanol feedstock updates.

There is not a reliable source for estimates of non-food grain feedstock fuel ethanol production, or a method to calculate an imputed value for this statistic at this time.

Synthetic ethanol production statistics for overall production capacity in operation and current production volumes are not available at this time.

The conversion ratio used for ethanol by mass to volumetric units is 1,267 liters per metric ton of ethanol.

The share of E10 gasoline consumption in China is difficult to measure without official gasoline consumption data for E10 or other ethanol-gasoline blends.

There is no reliable source for a national and regional fuel ethanol price series at this time.

There are no reliable sources for ethanol inventories in China at this time.

Biodiesel

There is no data to support commercially significant operations processing vegetable oil, animal fats, or advanced biodiesel feedstocks into biodiesel at this time.

Post has omitted biodiesel feedstock data which are currently under review. The 2017 Annual Biofuels report due July 2017 will include biodiesel feedstock updates

The conversion ratio used for biodiesel by mass to volumetric units is 1,136 liters per metric ton of ethanol.

The share of B5 diesel consumption in China is difficult to measure without official diesel consumption data for B5 or other biodiesel-diesel blends.

There are no reliable sources for biodiesel inventories in China at this time.

Advanced Biofuels

It is unclear if China primarily uses corn stover or corn cobs for cellulosic ethanol research and commercial production at select plants.

Biomass for Heat and Power

Several anecdotal reports and industry sources have discussed ongoing efforts to develop direct-burn biomass power generation in China. However, at this time, there are not investment estimates or publicly announced projects at this time. Therefore, data for biomass heat and power is not available at this time.