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Status and progress of fuel ethanol in China

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Nutrition and Healthy Research Institute, COFCO

Beijing, Oct 23rd, 2018

Overview of COFCO



Over **69** years

Founded in 1949

25 years

Consecutively ranked
among the Fortune Global
500 companies
(Ranks 122 in 2018)

- China National Cereals, Oils and Foodstuffs Corporation (COFCO) , guided by its integrated value chain, COFCO is a leading supplier of agri-products with an annual business volume of 150 million tons of commodities in the world. Meanwhile, COFCO ranks the top in its total asset and the third in its total revenue in agri-industry all over the world.
- COFCO is the leader in grain and oil products in China and creates a wholly-new business model to build a fully-integrated value chain covering all links from the farmland to the dining table.
- One of the 53 Large state owned key enterprises.
- To create lasting true value for customers, shareholders and employees.

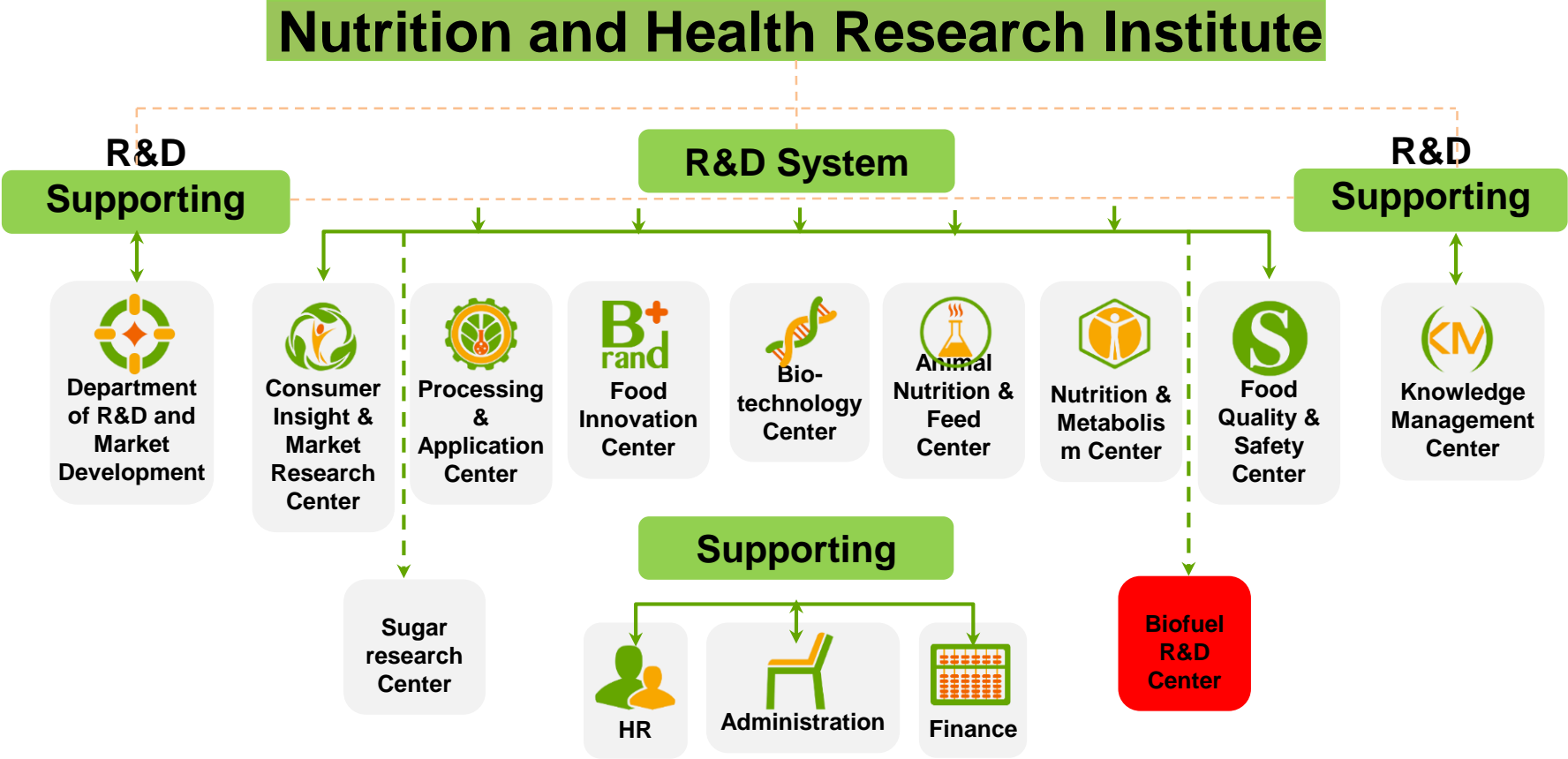


Ethanol production and R&D of COFCO



中粮国际 COFCO International	中粮贸易 COFCO Trading	中粮油脂 COFCO Oils & Oilseeds	中粮粮谷 COFCO Grains & Cereals	中粮生化 COFCO Biochemical
中粮饲料 COFCO Feed	中粮糖业 COFCO Sugar	中国纺织 Chinatex	中粮工科 COFCO Engineering & Technology	中粮酒业 COFCO Wines and Spirits
中可饮料 COFCO Coca-Cola Beverage	中粮肉食 COFCO Meat	中国茶叶 China Tea	蒙牛乳业 Mengniu Dairy	我买网 Womai.com
中粮包装 CPMC Holdings	中粮资本 COFCO Capital	中粮置地 COFCO Land	中粮营养健康研究院 COFCO Nutrition & Health Research Institute	

Nutrition and Health Research Institute



Agenda



- Features and benefits of biofuel ethanol
- Status of fuel ethanol production globally
- Technological route of biofuel ethanol production
- Summary

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1.1 Biofuel ethanol

--- a high efficient, renewable and clean energy

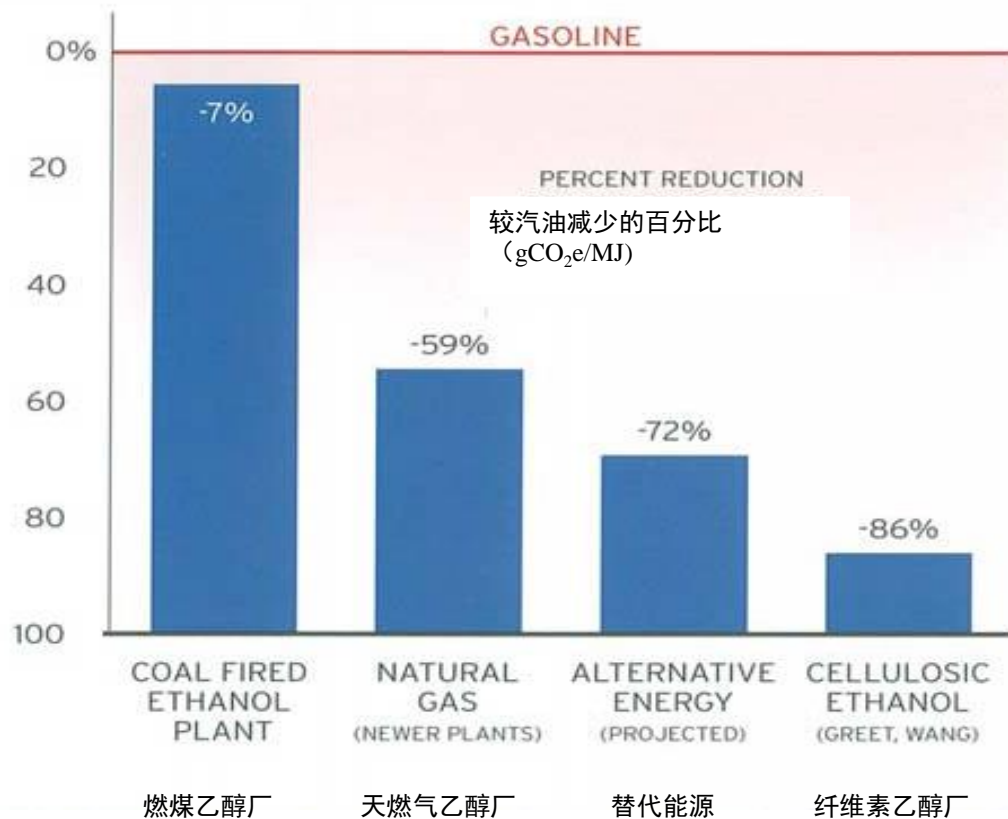


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- Good replacement of fossil fuel.
- Be able to mix with gasoline at any ratio.

1.2 Fuel ethanol's benefits on environmental protection



Benefits of ethanol gasoline:

- Increasing olefins and aromatics in gasoline.
- Decreasing toxic (ex. benzene and 1, 3-butadiene) and PM2.5.
- Decreasing CO₂ and greenhouse gas.

1.3 Fuel Ethanol's benefit on agriculture and energy safety



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- Agriculture
 - The total yield and consumption of fuel ethanol has been up to 20 million tons since 2000 in China.
 - More than 60 million tons grains has been consumed, which promoted agriculture production significantly.
 - More than 15 million tons of non-digestive corn, rice, wheat , etc was used accompanied by the 12.4 million tons by-product of high-protein feed. It improved grain sales and employ 50 thousand of people, which directly benefited 5 million agricultural population.
- Energy safety
 - In 2014, the apparent gasoline consumption in China has reached 100 million tons. Considering the increase of natural gas, electric and other new energy cars in the coming years, the growth of gasoline consumption will slow down, The gasoline consumption in 2020 will be about 150 million tons, according to annual increment of 7% .
 - The production of **E10** ethanol gasoline needs about 15 million ton of fuel ethanol, whose output value is about 150 billion Yuan. The import of crude oil would reduce 24 million tons, which **reduce oil external dependency 2% to 58.8%**.

Agenda

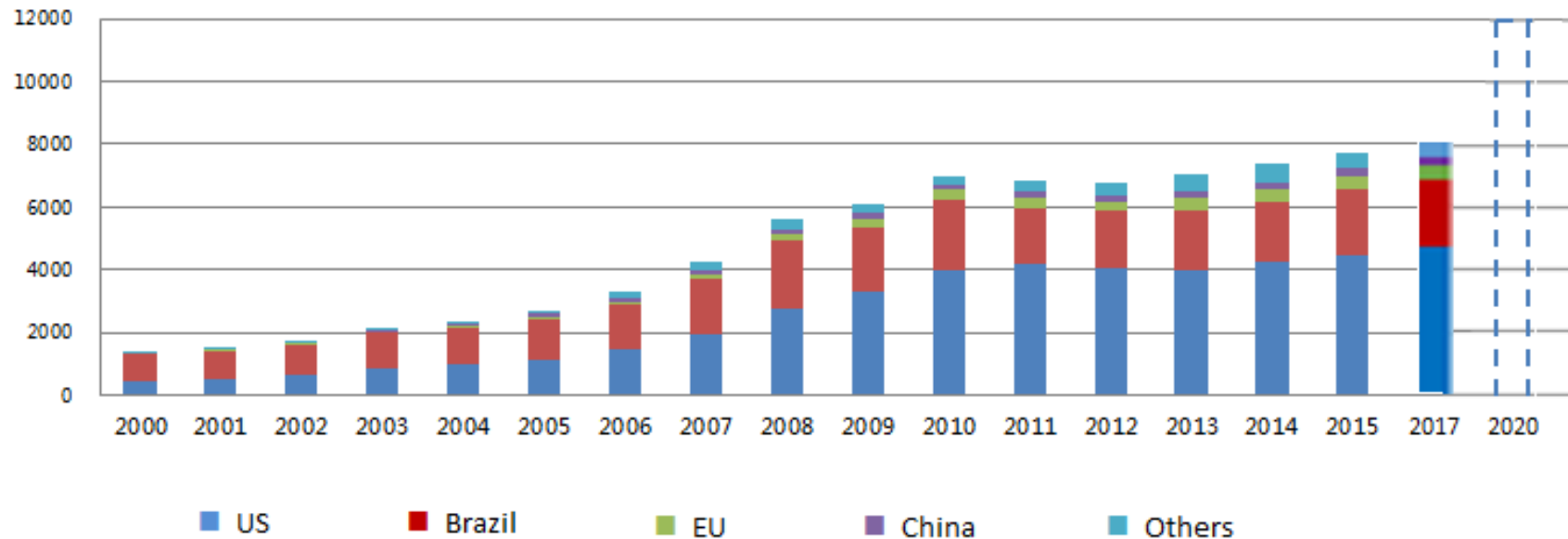


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2.1 Global fuel ethanol production and consumption

Global fuel ethanol yield, 10k ton



- USA: In order to promote the development of agriculture, especially corn industry, The USA government began to promote fuel ethanol in the 1980s. A series of legal principles on finance and taxation were issued to support the development of fuel ethanol.
- Brazil: The fuel ethanol industry started since the two oil crises in the 1970s, which also stimulated sugar cane cultivation and sugar industry at the time of the downturn of sugar price.

2.1 Global fuel ethanol production and consumption



Fuel ethanol yield in 2017

Country	Yield/10000 ton	Ratio, %
USA	4,718	57.7
Brazil	2,108	27.6
EU	423	5.4
China	261	3.2
Canada	134	1.7
Thailand	118	1.3
Argentina	93	0.8
India	83	0.8
Others	139	1.5
Total	8,078	100.0

Source: RFA

Consumption of fuel in 2017

Country/area	Fuel ethanol, Billion liter/M ton	Gaslion, Billion liter/M ton	Ratio of ethanol/%
USA	54.9/43.4	577.6/439	9.5
Brazil	28.8/22.8	59/44.25	48.8
EU	5.2/4.1	100/75	5.2
China	3.08/2.4	145/108	2.1

Source: EIA, RFA, USDA, UNICA

Including
fuel ethanol

The gap will be
~9M tons if E10 is
mandatory around
China.

- USA is the No. 1 on both yield and consumption of fuel ethanol.
- Brazil has the highest ratio of fuel ethanol addition in gasoline, ~50%.
- China has the biggest potential of fuel ethanol consumption.

2.2 Fuel ethanol production and development in China



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- Since 2002, fuel ethanol started to be added in gasoline in China.
- In 2016, annual consumption **around 2.5million tons**, and the material change to non-grain.



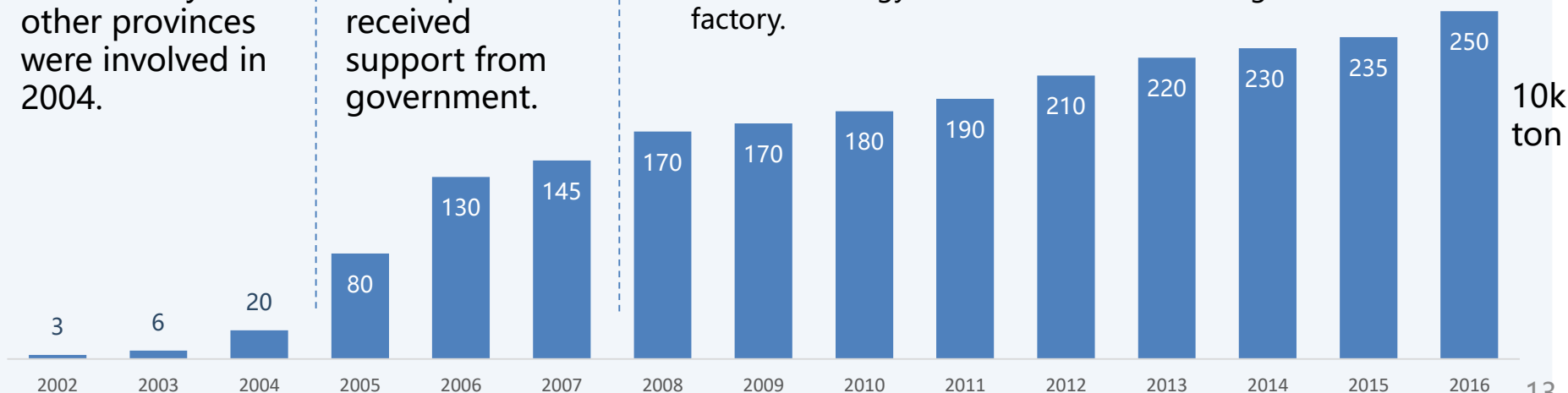
In 2002, ethanol gasoline was promoted in Heilongjiang and Henan mandatorily. 5 other provinces were involved in 2004.



In 2007, advanced non-grain fuel ethanol was initiated to develop and received support from government.



In 2008, COFCO built the first non-grain, 2million tons cassava fuel ethanol factory in Guangxi.
In 2012, Henan Tianguan built its first 10k-ton cellulosic fuel ethanol pilot program.
In 2013, Shandong Longlive built its 50k-ton corn cob fuel ethanol production line.
In 2014, Zonergy built its 30k-ton sweet sorghum fuel ethanol factory.



2.3 Vision of fuel ethanol in China

By 2020—

Ethanol gasoline will be promoted throughout China. Fuel ethanol production will be enlarged by 5-6 times on the base of present scale.

A commercial demonstration of cellulosic fuel ethanol plant will be constructed at the capacity of 50,000 ton/y.

By 2025-

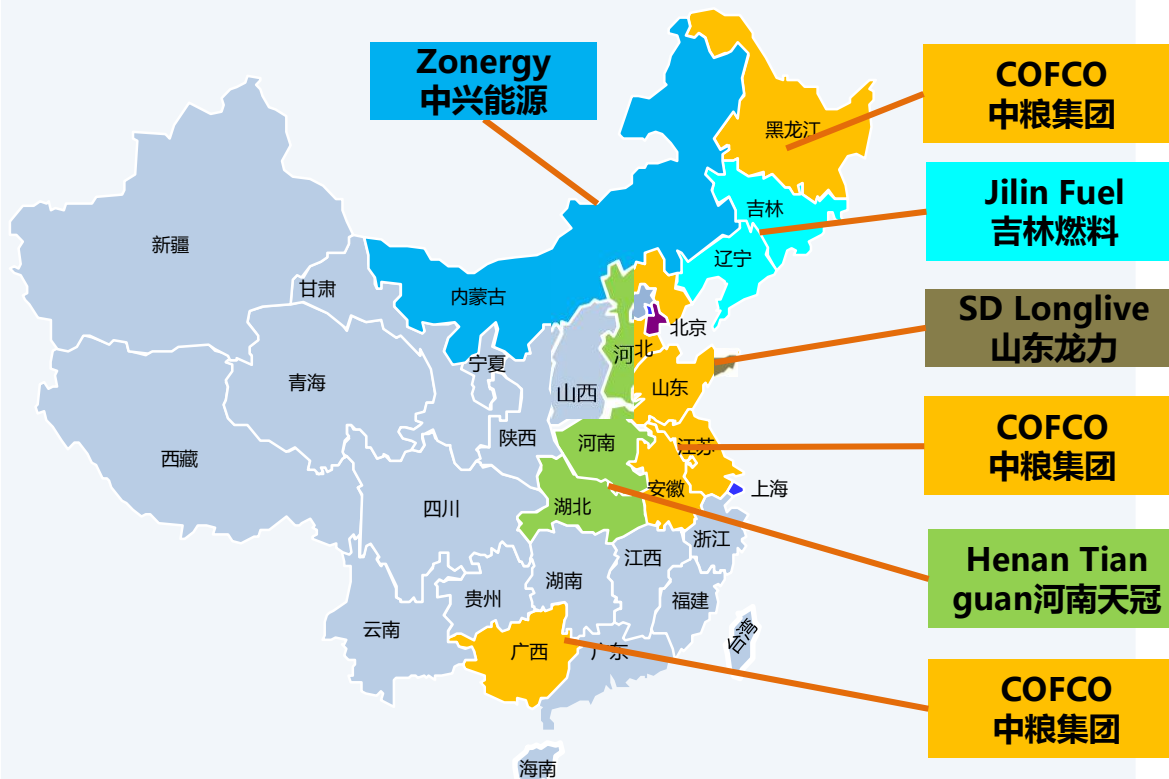
Efforts will be made to realize large-scale production of cellulosic fuel ethanol. The overall development of advanced biological liquid fuel technologies, equipment and the industry will reach an international advanced level, and an improved market-oriented operating mechanism will be established.



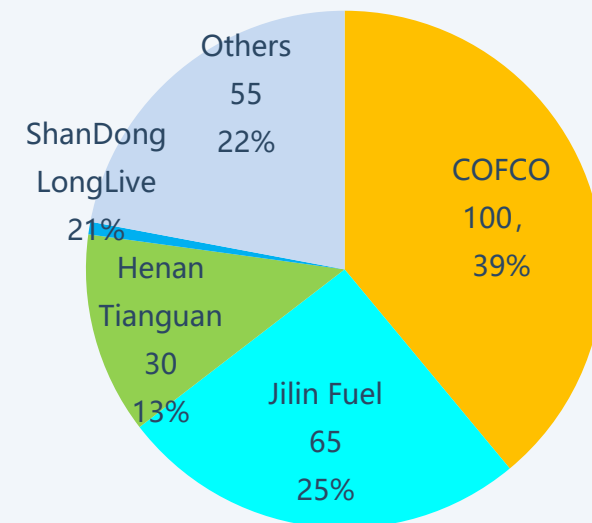
2.4 Fuel ethanol market area and suppliers in China

- Ethanol gasoline has been popularized in 12 provincial areas, which is supplied by 7 companies. COFCO is the largest fuel ethanol producer in China.

Geographic supply



Marketing share (10k tons)



2.5 COFCO --- the leader of China fuel ethanol industry



- COFCO is **the largest** fuel ethanol production enterprise, owning three holding enterprises and one equity participation enterprise
- COFCO is **the earliest** fuel ethanol production enterprise, owning the first corn-based, cassava-based and cellulose-based fuel ethanol plant.



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3.1 Technological route of biofuel ethanol production

G1

Corn
Wheat
Rice
Cassva

Smash and
pretreatment

Liquification

Saccharificati
on and
fermentation

Ethanol
refining

Residues and
liquid waste
treatment

Corn fuel ethanol process: dry process, wet process and Chinese semidry process

G1.5

Sweet
Sorghum
Sugar cane

Squeezing
and
Pretreatment

Sugar juice

Fermentation

Ethanol
refining

Residues and
liquid waste
treatment

G2

Corn stover
Wheat straw
Bagasse

Pretreatment

Hydrolysis

Fermentation

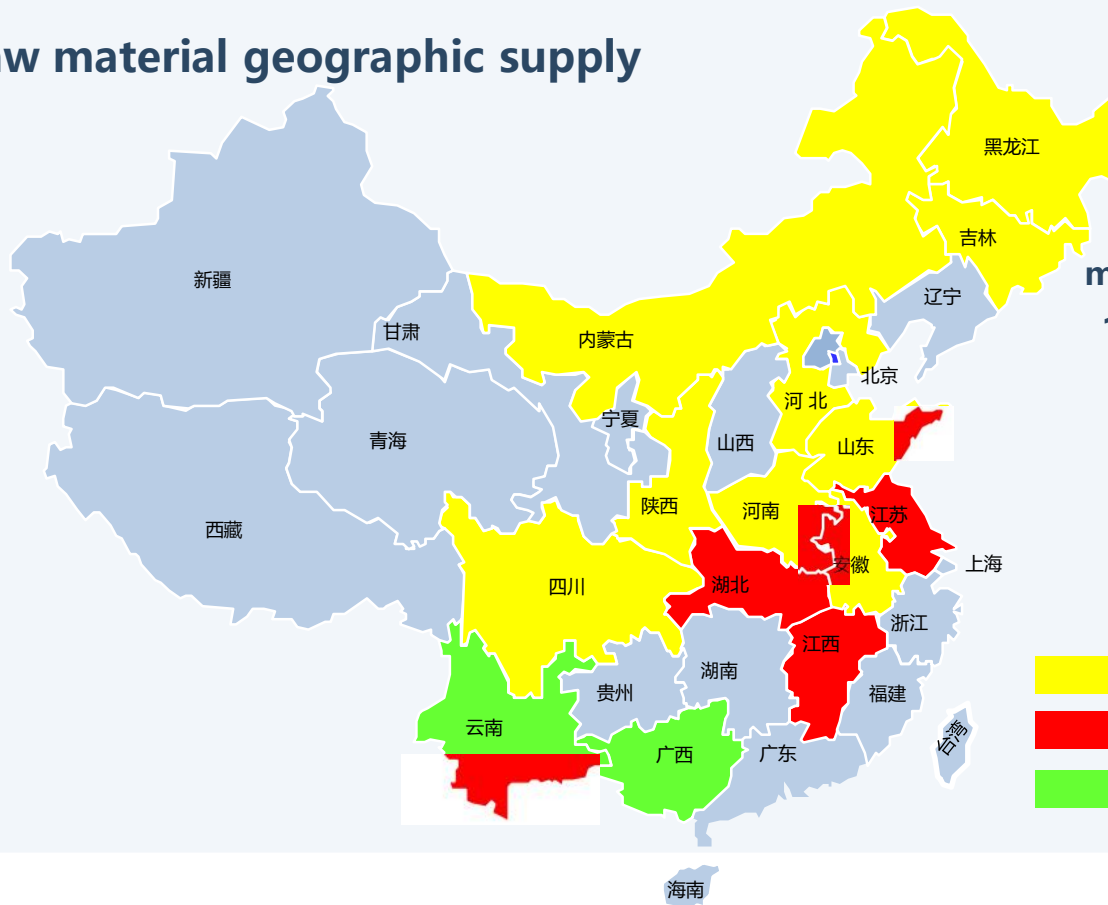
Ethanol
refining

Residues and
liquid waste
treatment

3.2 Diversified Development in Raw Materials of China Ethanol Industry

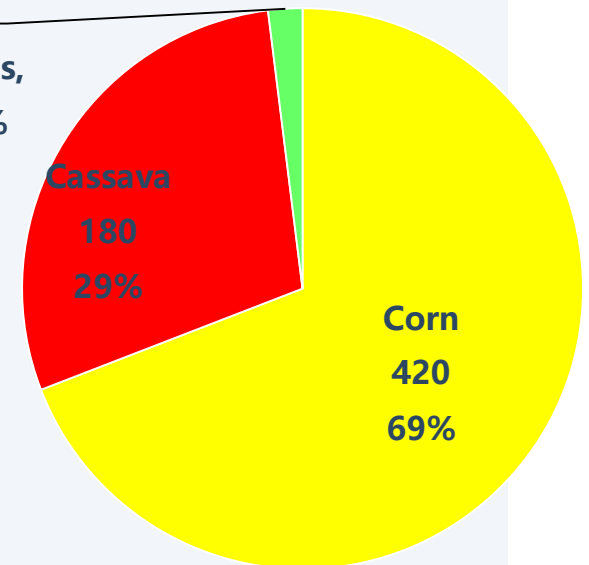
- The raw material of China ethanol industry include corn, cassava, molasses, overdue wheat and overdue rice.

Raw material geographic supply



2016 ethanol raw materials
(convert into ethanol, 10k tons)

2016,
molasses,
10, 2%



3.3 COFCO R&D on fuel ethanol

- Based on the existing cellulosic ethanol demonstration plant, COFCO will further explore the feasible route for the industrial production of cellulosic ethanol and build a plant of 50k tons cellulosic ethanol.

Corn ethanol

4million tons



Cassava ethanol

0.2million tons



Cellulosic ethanol

**Several 50k tons
demonstration plant**



3.4 Technology development of cellulosic ethanol in COFCO



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- A leading sugar platform based on lignocellulose has been built up after R&D for more than 8 years and the industrialization of cellulose ethanol has been on processing.
- A series of technical problems have been solved, such as feedstock storage and transportation, pretreatment, hydrolysis, C5/C6 co-formation, wastewater treatment, etc. The technical package of 50,000 ton cellulose ethanol per year has been finished and over 50 patents have been submitted or authorized.
- The relevant cellulose technology, such as organic acids (malic acid and lactic acid) and amino acid (lysine), has also been developed.



国产化预处理设备
Localization of pretreatment facility



3.4 Biofuel R&D center of NHRI COFCO



Pretreatment

Fermentation

Strain development

Analysis



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- There are good opportunities for biofuel ethanol development in China.
- Cellulosic ethanol has big potential, but also great challenge on technology development.
- Sugar platform is the future direction.

Thanks

