



Part 1

Business Operation

(1) Policy and Business Overview

Thai Agro Energy Public Company Limited engages in production and distribution of ethanol with 99.5 percent purity by volume. Produced for use as fuel, this ethanol has a molecular formula of C_2H_5OH with a boiling point at approximately 78 degree Celsius. This colourless and transparent product is flammable and is used as fuel due to its high octane rating. The product is denatured before being sold to oil companies under Section 7 of the Petroleum Trading Act B.E. 2543 as a substance to be blended with gasoline at the ratios of 10, 20, and 85 per cent, resulting in E10, E20, and E85 gasohol respectively. These gasoline substitutes help to reduce the country's import burden of fuel and MTBE (Methyl Tertiary Butyl Ether), an additive to boost octane in gasoline. Reduction of air pollution leading to a better environment is another benefit resulting from using gasohol.

The manufacturing technology being used at present came under license from a French company, Maguin Interis. The plant consists of two production lines with a combine capacity at 365,000 litres per day. Based on 330 production days per annum, the total annual production output of the plant is 120.75 million litres. Details of two production lines are given as follows.

Item	Line 1	Line 2
Raw material	Molasses	Molasses or cassava
Installed capacity	165,000 litres/day	200,000 litres/day
Commencement	31 st January 2005	2 nd April 2012

The Company received investment promotion certificates from the Board of Investment of Thailand; they are certificate no 1760(2)/2546 dated December 26, 2003 for Production line 1 and, certificate no. 2078(9)/2551 dated November 19, 2008 for Production line 2. Privileges granted by BOI include:

(1) Exemption from corporate income tax on profit generated by promoted activities and exemption from income tax on dividends distributed by the company are granted for a period of 8 years starting from the first day the company generates income. Privileges granted to Production line 1 expired on January 30, 2013, while that of Production line 2 shall expire on April 1, 2020.

(2) Permission to deduct annual loss, incurred from operation during the period of corporate income tax exemption, from annual profit incurred after the income tax exemption period for another 5 years from the date the privilege period expires.

(3) Exemption from import duty on raw materials and other essential materials imported for production of export products. This incentive lasts for one year from the date of first importation of such materials.

(4) Exemption from import duty on machinery as approved by the BOI.



Policy and Business Goal

Vision

“To be the leader in the development of alternative energy for a clean environment and quality society.”

Mission

We are dedicated to manufacturing and encouraging the use of ethanol as an alternative energy source through cooperation with government agencies, educational institutes, and other private enterprises. These motivations to undertake ethanol fuel development are pursued under good governance management for the benefit of the corporation, shareholders, business alliances and stakeholders.

Quality policy

Thai Agro Energy Plc. is determined to produce and distribute fuel ethanol that conforms to internationally-recognized quality standards. The Company aims to build confidence and satisfaction in the products and services among customers by adhering to three main principles:

- (1) Consistent development and improvement of the production process
- (2) Stringent inspection of the quality of raw materials, chemical substances, and water, as well as product quality, at every stage of the production process, as required by ISO 9001/2015
- (3) Creating awareness and being attentive to the needs of customers
by acting swiftly, responsibly and sincerely

Corporate Social Responsibility: CSR

The Company is committed to management and business operations with responsibility to society and stakeholders, including shareholders, customers, suppliers, employees, community, and other social peers. The Company's good governance policy has been carried out through campaigns and encouragements for the staff members to take part in communal activities which focus on sustainable improvement in quality of life among employees, and other members in community and surrounding society. Practical guidelines were designed for four CSR tasks:

(1) Environment

The Company is determined to operate its business in an environmentally responsible manner through the following performances:

- Monitoring and compliance with laws and regulations related to the environment
- Development and improvement of the production process and waste management system as a scheme to eliminate pollution affecting the environment and to upgrade its standard to ISO 14000/2015
- Raising awareness among employees at all levels of the responsibility to protect the environment both inside and outside the plant



- Manipulation of action plans, implementation, and ongoing monitoring and assessment
- Improvement of the factory's working areas and its landscape as an ambition towards becoming a Green Plant

(2) Safety and occupational health

Employees' safety and occupational health is under the Company's basic responsibility and considered an important factor for the success and growth of the corporation. Thai Agro Energy Plc. has set a policy with the following practical rules:

- Abide to laws and regulations related to the Safety and Occupational Health measure
- Limit and control the risk of unsafe working
- Manipulate employee training on accident prevention and mitigation, on regular basis
- Set a Safety, Occupational Health, and Environment committee to work on planning, monitoring, and evaluation.

(3) Resources preservation

Considering that resources consumption is important to the business operation, the Company has launched strategies on resources management which include:

(a) Energy conservation

- Utilize bio-gas conveyed from waste water treatment system to replace furnace oil
- Reduce electricity consumption by using highly efficient and energy saving equipment
- Apply the Energy Audit scheme to achieve the highest efficiency in electricity consumption management
- Offer training courses to build understanding and awareness among the employees towards energy saving in all the factory's functions.

(b) Water resources and waste water treatment

- Check the raw water treatment and devices in the pipeline systems on schedule to prevent water loss from leaking and malfunctioning equipment
- Recycle water from the treatment system to use in ethanol production process
- Examine water quality on regular basis to prevent any defect that may affect the ethanol product



- No discharge of wastewater from the treatment system into the area outside the plant as regulated in the Zero Discharge measure
- Encourage the water saving plan in both consumption and working application usage

(c) Air pollution elimination

- Improve efficiency in the bio-gas production system on regular basis to prevent leakage
- Examine the fuel combustion system on schedule to control quality of the air emitting from the factory's chimneys in accordance with the standard set by Department of Industrial Works
- Check air quality every six month.

(4) Society

"Society" is the key element for the Company to sustain and grow steadily. Beginning from the small society of our corporation, where employees play the key role in strengthening the capacity and competitiveness, our social responsibility works into larger community, and society as a whole. Our CSR activities were created to reach various levels in the society:

(a) Organization level

- Improve skills of staff members at all levels and build corporate cognition to develop Competence Management
- Stimulate employees to express their opinions on the organization
- Encourage all to join community development projects

(b) Community level

- Preserve environment and resources
- Promote and improve quality of life
- Promote education and learning development among youths in community
- Support cultural learning and moral principles as a foundation for youths to develop their quality of life

(c) National level

- Support activities involving environmental preservation
- Promote development of learning, awareness, and responsibility among youths



Anti-corruption policy

With a strong determination to oppose all forms of corruption, the Board of Directors has set an anti-corruption policy for executive directors, management, and employees at all levels to be aware of corruption hazard. The policy also aims to create the value of correctness and to raise confidence among stakeholders, as well as to encourage the enterprise's sustainable development in the long term.

The Company forbids directors, management, and employees at all levels to actuate or accept all forms of corruption in both direct and indirect manner. The anti-corruption policy applies to all of the Company's business operations located in the country and abroad, and to all relating working units. Performance inspections and reviews are conducted on regular basis. Guidelines and requirements are regularly reviewed, as well, to be conformed with business transformation, and relevant regulatory and legal provisions. The anti-corruption policy contains the following details:

- (1) Directors, management, and employees at all levels must adhere to this anti-corruption policy and other business ethics. One must not get involved with corruption whether directly or indirectly.
- (2) Employees at all levels should not neglect or ignore any action that leads to corruption which involves the company. They should inform the matter to department heads or persons in charge and cooperate in the investigation. If in doubt, one must consult their boss or persons in charge of business code of conduct supervision through various defined channels.
- (3) The Company will ensure fairness and protect employees who report corruption related to the Company. Measures to protect the complainants or others who cooperate in reporting corruption are defined in the regulations and guidelines for stakeholders to submit clues or complaints.
- (4) Considered violating business ethics, one who commits corruption must be considered to get disciplinary punishment as defined in the company's regulations. Besides, punishment by law might be applied if the deed is illegal.
- (5) The Company is aware of the importance in dissemination of knowledge and understanding about the anti-corruption policy among other individuals whose works are associated with the Company.

In summary, the guidelines to effectively carry out the Company's anti-corruption policy include:

- (1) Anti-corruption procedures are designed to cover the whole process of human resources management, from recruitment to promotion, training, assessment and to rewarding. Heads or supervisors at all levels must communicate with employees for good understanding about business activities under their responsibility. Monitoring must be conducted efficiently and effectively.
- (2) Operations with a high risk of corruption must be undertaken by directors, management, and employees at all levels with special care, in the following particular manners:



- (2.1) Do not offer to pay compensation or bribery, or demand/agree to accept all forms of graft from individuals or other agencies whether directly or indirectly as a means to return benefits to each other for fraud synergy or with expectation for benefits related to the company's operation.
- (2.2) Receiving or giving donations or sponsoring activities must be transparent and lawful to ensure that the donations and support have not been used as a pretext for bribes.
- (2.3) It is prohibited to accept or offer bribes in all business operations. The company operates and deals with government agencies in a strictly transparent, honest, and legitimate manner.

Investment in subsidiaries and associated companies

Having a policy to invest in its subsidiaries or associates of which operations are the same or similar to those of the Company, Thai Agro Energy Plc. views that the support given to these enterprises will enhance the Company's turnover or profit. Working as a synergy can empower the core business and expand the Company's capacity to become more comprehensive.

However, the investment in subsidiaries and associated companies are under the control and monitoring of the audit committee. To supervise these affiliates, Thai Agro Energy Plc. sends directors or selected executives with appropriate qualifications and experience to represent the company in the administration. Representatives of the parent company play a key role in policy-making and control the business operations of such subsidiaries and associated companies (if any).

To prevent conflict of interest which is a usual probability in competing businesses, the meeting of the Board of Directors of Lanna Resources Public Company Limited, the major shareholder of Thai Agro Energy Plc., approved for the entire operations relating to bio fuel business to be arisen under the group in the future will be conducted through Thai Agro Energy.

Changes and key developments

Background

Ethanol fuel produced by Thai Agro Energy is used to blend with gasoline to produce another form of energy known as gasohol. Gasohol production in Thailand was originated by a royal project initiated by His Majesty King Bhumibol in 1985 when HM launched the Study Project on Gasohol Production for an Alternative Energy by producing ethanol from sugar cane. Later on, with the awakening of the new alternative energy, enterprises in both public and private sectors participated in the development and test of ethanol with engines.

The use of gasohol had not been widespread until the world oil prices rose significantly in 2003. The government has turned to push the production and use of the alternative energy strategically. Ethanol manufacture has been promoted, as well, as it is the major mixture in gasohol production.

Foreseeing growth opportunities in ethanol business, the Company's existing shareholders decided to establish Thai Agro Energy Co., Ltd. on 25 October 2001, with an initial capital of 10 million baht, as a manufacturer and distributor of ethanol used as fuel. Permission to



set up a production facility for ethanol fuel was granted by the National Ethanol Committee through the approval of the National Energy Policy No. 2/2545 held on 8 July 2002.

On 18 June 2003, Lanna Resources Plc (LANNA) purchased common shares and has become the major shareholder of the ethanol company. Presently, LANNA hold 75 per cent of the shares already sold making Thai Agro Energy a subsidiary of LANNA.

Recognized the first licensed ethanol producer in Thailand, Thai Agro Energy was certified a fuel trader under Section 10 of the Fuel Trade Act B.E. 2543 on 29 April 2005. The Company became public and changed its name to Thai Agro Energy Public Company Limited on 18 October 2007.

Significant milestones

2003
<ul style="list-style-type: none"> ▪ The Company increased its registered capital by 255 million baht: From 10 million at the initial, the new capital grew to 265 million baht by issuance of the new 25.5 million ordinary shares at par value of 10 baht per share offered to existing shareholders. The new fund helped make business expansion possible with sufficient working capital. In this effort LANNA invested in buying 19,875,000 shares making it major shareholder holding 75% of the already sold shares. The Company, since then, has become LANNA's subsidiary. ▪ The Company received a business license for production and distribution of ethanol from Department of Industry on 22 September 2003. ▪ December 26, 2013, the company received BOI promotional certification for the Production Line 1 from the Board of Investment (BOI).
2004
<ul style="list-style-type: none"> ▪ Completion of the construction of the ethanol production plant (Production Line 1: production of ethanol using molasses)
2005
<ul style="list-style-type: none"> ▪ January 31, 2005, the Company began production and distribution of ethanol from Line 1 for the first time. ▪ The Company became licensed fuel trader under Section 10 of the Fuel Trade Act B.E. 2000 for the distribution of ethanol for use as fuel. From Department of Energy Business.
2006
<ul style="list-style-type: none"> ▪ LANNA purchased 200,000 common shares from the company's existing shareholders making the company's share number increase from 19,875,000 shares to 20,075,000, shares accounting for 75.75 percent of the shares sold. ▪ In January 2006, the Company began using bio gas produced from the well no. 1



which is equipped with Anaerobic Baffled Reactor (ABR) technology.

- March 31, 2006, the company was authorized by Excise Department to produce and distribute ethanol with alcohol purity not less than 99.5 directly only to the fuel vendors. The production capacity then was 150,000 liters/day
- The Company increased its registered capital by 106 million baht: From 265 million, the capital grew to 371 million baht. The issuance of new 10.60 million ordinary shares at par value of 10 baht per share offered to the existing shareholders was completed, resulting in new fund to expand the business and use as working capital.

2007

- The Company increased its registered capital by 79.50 million baht: From 371 million, the capital grew to 450.50 million baht. The issuance of new 7.95 million ordinary shares at par value of 10 baht per share offered to the existing shareholders was completed, resulting in new fund to expand the business and use as working capital.
- The Company increased its registered capital by 149.50 million baht: From 450.50 million, the capital grew to 600 million baht. The issuance of new 14.95 million ordinary shares at par value of 10 baht per share offered to the existing shareholders was completed, resulting in new fund to expand the business and use as working capital.
- October 18, 2007 the Company transformed to a public company and changed its name to Thai Agro Energy Public Company Limited. Registration to change the par value from 10 to one baht per share was done.
- December 25, 2007, the Company was authorized by the Excise Department to be able to export ethanol.

2008

- November 19, 2018 the Company received BOI promotion certification for the Production Line 2 from the Board of Investment (BOI).

2009

- June 30, 2009 the Company was accredited ISO 9001:2008 and ISO 14001:2004 from UKAS, England, and Thailand's NAC under the authorization of SGS (Thailand).

2010

- The Company commenced the construction of Line 2 production facility, enabling the Company to produce ethanol from molasses and cassava and to increase the production capacity by 200,000 liters/day or 66.00 million liters/year (calculated from number of days taken in the production which is equivalent to 330 days/year).

**2011**

- In January 2011, the Company commenced a test-run of the Line 2's cassava-based ethanol production machinery.
- In May 2011, the Company began using bio gas produced from well no 2, equipped with up flow Anaerobic Sludge Blanket (UASB) technology.
- The company increased its registered capital by 200 million baht: From 600 million, the capital grew to 800 million baht. The issuance of new 200 million ordinary shares at par value of 1 baht per share offered to the existing shareholders was completed, resulting in new fund to expand the business and use as working capital.
- July 22, 2011, the company was authorized by Excise Department to expand the production capacity of ethanol for use as fuel from 150,000 liters/day to 350,000 liters/day.
- 3rd quarter of 2011, the Company improved the Production Line 2 to facilitate the production of ethanol from molasses.

2012

- In March 2012, the Company began using bio gas produced from well no. 3, equipped with Modified Covered Lagoon (MCL) technology.
- April 2, 2012, the Company was able to produce and distribute molasses-based ethanol from Production Line 2 for the first time.

2013

- In September 2013, the Company increased its registered capital by 200 million baht: From the existing 800 million, the capital grew to 1,000 million baht, with the par value of 1 baht.

2014

- In June 2014, The Capital was increased following the new registration at Department of Business Development, Ministry of Commerce. From the existing 800 million shares at the par value of 1 baht, accounting to 800 million baht; the new registered capital grew to 1,000 million shares at the par value 1 baht, accounting to 1,000 million baht. The new lot of ordinary shares resumed trading on the Stock Exchange of Thailand for the first time.

2015

- The Company began using raw sugar to produce ethanol in Production Line 2. Following the launch of raw material diversification plan, using raw sugar and molasses as raw materials for ethanol production enables the company to save production cost greatly.
- In June 2015, the Company invested in the installation of Bio-Scrubber to eliminate



hydrogen sulfide (H ₂ S), the gas existing in bio-gas using as fuel for the production of steam and electricity. The new facility helps reduce the amount of SO _x residing in the Flue Gas, releasing from the boiler funnels. The practice can prevent air pollution that may harm the community around the factory.
2016
<ul style="list-style-type: none"> In November, 2016 the Company started Phase 2 of Hydrogen Sulfide Removal (H₂S) project in the Biogas (Bio-Scrubber) to increase the efficiency of air pollution prevention.
2017
<ul style="list-style-type: none"> March 10, 2017 The Company was certified as a member of Thailand's Private Sector Collective Action Coalition Against Corruption: CAC. The Certificate is valid for 3 years from the date of approval.
2018
<ul style="list-style-type: none"> March 14, 2018 The Company is now proceed with the construction of the EVAPORATOR SYSTEM FOR BIO METHANATED SPENT WASH 3,000 M3/DAY which was expected to complete in the first quarter of 2019. The Evaporator condensate is a source of re-use water. Condensate recovery can reduce process water used in Ethanol production and excess electricity generated from the evaporation plant will be used in Ethanol production and there will be a by-product from evaporation process which is Potassium Humate around 50,000 metric tons per year. June 30, 2018 The Company has been received Quality Management System certification ISO 9001:2015 and Environmental Management System certification ISO 14001:2015 from UKAS, United Kingdom and NAC, Thailand which is certified by SGS (Thailand) Co.,Ltd.

(2) Nature of Business

Revenue Structure

Type of income	2016		2017		2018	
	Million baht	Per cent	Million baht	Per cent	Million baht	Percent
Revenue from sales - Denatured ethanol ⁽¹⁾	2,415.07	99.86	2,470.52	99.91	2,696.07	99.93
Total revenue from sales	2,415.07	99.86	2,470.52	99.91	2,696.07	99.93
Other revenues ⁽²⁾	3.28	0.14	2.24	0.09	1.78	0.07
Total revenue	2,418.35	100.00	2,472.76	100.00	2,697.85	100.00

Remarks: (1) Revenue from the sale of denatured ethanol was generated by the sale of ethanol in the ratio of 99.5%, together with gasoline/gasohol in the ratio of 0.5%, according to the Excise Department's regulations for the distribution of ethanol used as fuel.

(2) Other revenues include revenues from the sales of fusel oil, asset, and interest income.

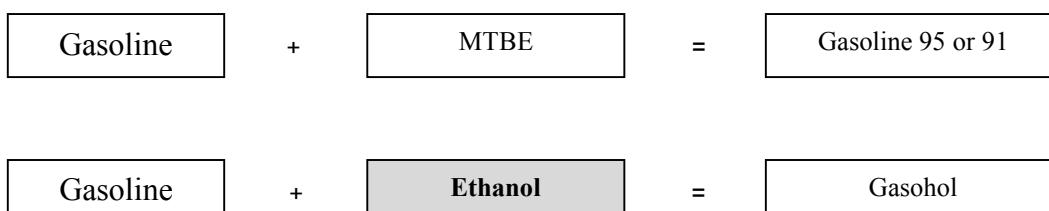


Product feature

(1) Ethanol

Ethanol is the Company's main product. Also known as ethyl alcohol, ethanol is a form of alcohol obtained from the processing of agricultural crops that contain starch and sugar. Molasses, cassava, and corn are the major raw materials in the production of ethanol. Biodegradation and fermentation process are applied to convert starch into sugar. The outcome will be distilled until it has a purity of 99.5% by volume.

Ethanol has C_2H_5OH as its molecular formula. Its boiling point is 78 degree Celsius. This flammable, colorless transparent liquid is known as a fuel with higher octane rating as it contains 35% oxygen and can replace MTBE (Methyl Tertiary Butyl Ether), an additive to boost octane in gasoline. As MTBE causes carbon monoxide and leaves residues that can contaminate the groundwater, ethanol can be a good substitution when blending with gasoline in an appropriate ratio to produce the clean gasohol fuel. Completely burned, gasohol helps to reduce air pollution. It can reduce the amount of hydrocarbons, carbon monoxide (CO), and carbon dioxide (CO₂), the main factor that contribute to the greenhouse effect. Black smoke, aromatic compounds and benzene compounds can be minimized as well for the benefit of the environment.

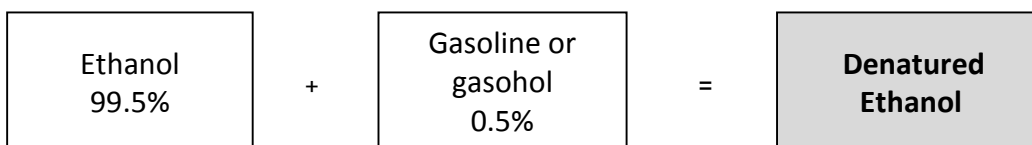


Ethanol production process at Thai Agro Energy is divided into two production lines:

	Production Line 1	Production Line 2
Raw materials	Molasses	Molasses or cassava
Installed capacity	165,000 liters/day	200,000 liters/day
Commencement	31 st January 2005	2 nd April 2012

Regulated by Excise Department, the Company can trade only denatured ethanol which is the ethanol to be used in the gasoline mixture in the process to produce gasohol, with conversion formulas determined by the department (as defined by the announcement of Department of Energy Business on Specification of Denatured Ethanol B.E. 2548).

The Company had used ethanol and gasoline 91 in the mixture to produce denatured ethanol until the bereavement of this gasoline type in the Thai market. To this end, the company now use gasohol 91 in the mixture. The company uses 0.5% gasoline or gasohol to mix with 99.5% ethanol in the production of denatured ethanol for sale to customers.





The denatured ethanol produced and distributed by Thai Agro Energy is a quality product according to the standards set by the Department of Energy Business. The Company's quality control department examines the quality of ethanol production on a daily basis.

Recognized the first licensed ethanol producer in Thailand, Thai Agro Energy was certified a fuel trader under Section 10 of the Fuel Trade Act B.E. 2543 on 29 April 2005. Section 10 covers the fuel traders whose commercial volumes of each oil type or a combination of all kinds of oil per year are less than to 100,000 metric tons (approximately 120 million liters).

Promoted by the Board of Investment, the company has enjoyed several incentives. According to Investment Promotion Act B.E. 2520, the incentives include:

Facts	Production Line 1	Production Line 2
Investment promotion certificate no	1760(2)/2546	2078(9)/2551
Promoted product	Pure alcohol	Pure alcohol
Production volumes exempted from tax	54,750,000 litres (working time 24 hrs./day : 365 days/year)	66,000,000 litres (working time 24 hrs./day : 330 days/year)
Commencement of revenue	31 st January 2005	2 nd April 2012
Expiry dates of benefits received.	30 th January 2013	1 st April 2020
Tax incentives		
1. Corporate income tax exemption for profits generated from the promoted operations. Able to exclude dividends, received from the operations that are exempted from corporate income tax, from the tax calculation throughout the duration of the corporate income tax exemption.	8 years from the date on which the revenue can be earned from the promoted operations (Expired 30 th January 2013)	8 years from the date on which the revenue can be earned from the promoted operations
2. Permission for the annual loss, incurred during the income tax exemption period, to be deducted from the net profit risen after the expiry of the tax exemption term.	5 years after the expiry date of the tax exemption period.	5 years after the expiry date of the tax exemption period.
3. Exemption from import duty on raw and other essential materials procured from abroad for production of export products:	1 year from the date of first import	1 year from the date of first import
4. Exemption from import duty on machinery following the BOI's approval	✓	✓

Besides, The Company has been certified Quality Management System ISO 9001:2015 and Environmental Management System ISO 14001: 2015 certifications from SGS (Thailand) Limited. This is a solid proof to indicate that the Company is seriously aware of the environment issue. Fully equipped with good environmental management system and facilities to control the production process, the company has implemented plans to reduce or prevent any clearly-seen environmental impact to meet the standards set.



(2) Raw materials and by-products

Apart from the key ethanol product, the Company benefits from Fusel Oil, a by-product derived from ethanol distillation. Fusel oil contains many forms of alcohol. After isolation of alcohol by distillation, the material is forwarded through a purification process to produce fusel alcohol, the type that is used as solvent in various industries, including perfume, resins, plastics, lacquers, and inks. Fusel oil derived from the company's production process accounts around 200 litres per day.

Marketing and competitiveness

(A) Competitive strategy

(1) Product quality

According to the policy, the Company focuses on manufacturing the premium-quality ethanol to meet the customer's requirement. Recognizing the importance of regular quality checking, the Company has applied a QC procedure throughout the production process, from the beginning of selection and quality check of raw materials, especially molasses which is the major raw mat. The Company embraces the French MAGUIN INTERIS technology to use in both production lines. Apart from the technology recognized among the ethanol producers worldwide, the facility is also equipped with modern and accurate distributed control system.

Monitoring and quality control of ethanol is carried out at all stages from the start until the final step prior to delivery to the customers. All procedures are stringent to ensure the ethanol is produced with quality standards. Presently, the Company is capable to produce ethanol with the purity up to 99.8% by volume, a higher quality standard than what is set by Department of Energy Business.

(2) Efficient cost management

The Company gives priority to cost management. Cost is considered the main factor to affect the ability to make profits and competitiveness. Several measures have been implemented, including the use of biogas as the main fuel to produce steam in the production of ethanol. Biogas is generated from the wastewater treatment process, resulting from the production of ethanol. The Company has used biogas to replace furnace oil. Since the termination of the costly furnace oil usage in 2013, And in year 2015, the Company built a biogas power generation system 3 megawatts of capacity to be used within the factory and production process enabling the Company to save on electricity costs. The production technology is wholly automatic with a computer-controlled system enabling the company to minimize the employee number in the production line. This is much help to reduce the labor cost. As the Production Line 2 was designed to use both molasses and processed cassava, the company has flexibility in managing manufacture costs to achieve the highest efficiency. Once the price of a certain raw mat tends to rise, the Company can shift to use the other choice in the production of ethanol.

(3) Reliable delivery service

On time delivery is another important factor for customers to make a decision to choose a product. Buyers usually accept denatured ethanol that is specified the quantity and the timing of delivery clearly. Inability to deliver products as specified leads to defamation of a company and mistrust among customers.



Delivery on time, then, is the main company's policy as a factor to create satisfaction and reliability among customers. The performance results in continuous calls for our services from customers.

(4) Maintaining good relationship with customers

The Company is the first ethanol producer granted a fuel trader certificate under Section 10 of Fuel Trade Act B.E. 2543, resulting in a large group of customers who are doing business with us for a long time. The company is dedicated to maintaining good relationship with customers successively to give them confidence and trust in the process of production and the efficient services of the company.

We work with customers to plan ethanol delivery in advance, in both terms of product volumes and delivery time to ensure them of accurate and punctual performance. We use all information obtained from customers in our production planning and procurement of raw materials for maximum performance. So that the delivery of ethanol can be completed with the quantity, quality, and time that meet the customer's needs.

(B) Nature of customers

The Company distributes denatured ethanol to mix with gasoline in various ratios to produce gasohol. The Company's major customers are fuel trading companies under Section 7 of the Fuel Trade Act B.E. 2543. Most of them are well-known Thai fuel traders. The Company makes ethanol agreements that are valid for 3-12 months, depending on each customer. The agreements specify the exact quantity and delivery date of denatured ethanol. Prices are determined on a quarterly basis.

(C) Pricing policy

The Committee on Energy Policy Administration (EPA) has agreed to base the reference price of ethanol on the lowest price between the price the producers report to the Excise Department and the price of the fuel traders under Section 7 report to Energy Policy and Planning Office (EPPO). The pricing formula has been effective since December 2015.

The Company uses the Cost plus Margin technique in its pricing policy. Apart from the ethanol reference price notified by the EPA, the Company takes other factors into consideration to denatured ethanol pricing. Key factors taken into consideration include prices for raw materials, supply and demand in the market and overall competitive conditions in both domestic and foreign markets.

(D) Sales and distribution channels

According to requirements set by the Excise Department and specified in licenses to produce and sell ethanol fuel, the Company must only use the ethanol it produces as an additive in fuel production or directly sell to oil traders. The Company is also required to transform ethanol into denatured ethanol before the product leaves the factory. Moreover, the transformation must conform to the formula set by the Excise Department (0.5% transforming substance—gasoline or gasohol—to 99.5% ethanol by volume). The transformation take place prior to sale to oil traders under Section 7 of the Fuel Trader Act B.E. 2543.



Oil traders take the denatured ethanol to mix with gasoline in ratios of 10%, 20% and 85% to produce gasohol E10, E20, or E85 respectively.

Most customers are responsible for transportation of the purchased denatured ethanol. Customers will arrange for trucks to transport the product from the plant. Some request the Company to provide transportation for them. In this case, the Company outsources to a hired transporter which is responsible for any damage occurring during transportation between the plant and the customers' storage. Trading volume of ethanol is measured by the meter at the Company's factory which is regularly calibrated as required by law.

(E) Industry and competitive

(1) Situation of Ethanol Industry

Ethanol consumption demand in year 2018 averaged at 4.20 million liters per day, which was lower than the target in accordance with the Alternative Energy Development Plan B.E. 2558-2579 that had projected the ethanol consumption in 2018 at 4.72 million liters per day. Nonetheless, ethanol demand in 2018 increased from year 2017 (4.00 million liters per day) by 5 percent. Mainly due to, the global oil prices remained low on average US \$ 65 per barrel including the cumulative volume of cars increased from year 2017 around 60,000 cars or 9.5 percent and the promotion policy from the government on fuel pricing structure.

While the consumption of gasohol in the Country has continued to increase significantly from 21.94 million liters per day in 2014 to 29.97 million liters per day in 2018 or compound annual growth rate (CAGR) of 8.11 percent per year as new cars are able to use higher ethanol content in the gasohol. In addition, retail prices of gasoline are still relatively at low level and the consumption and sale of E20 and E85 gasohol, which have higher ethanol content, have continued to increase due to support from the Government sector by increasing the difference in prices of E10 and E20 gasohol and compensation from oil fund, as well as, new type of cars can use higher ethanol content gasoline.

Table: Consumption of ethanol used as fuel 2014-2018

(unit: million litres)	2014	2015	2016	2017	2018
Consumption volume	1,181.88	1,273.08	1,334.91	1,435.40	1,532.65
Average daily consumption	3.24	3.49	3.66	4.00	4.20

Source: Department of Alternative Energy Development and Efficiency, Ministry of Energy

(2) Gasohol situation in Thailand

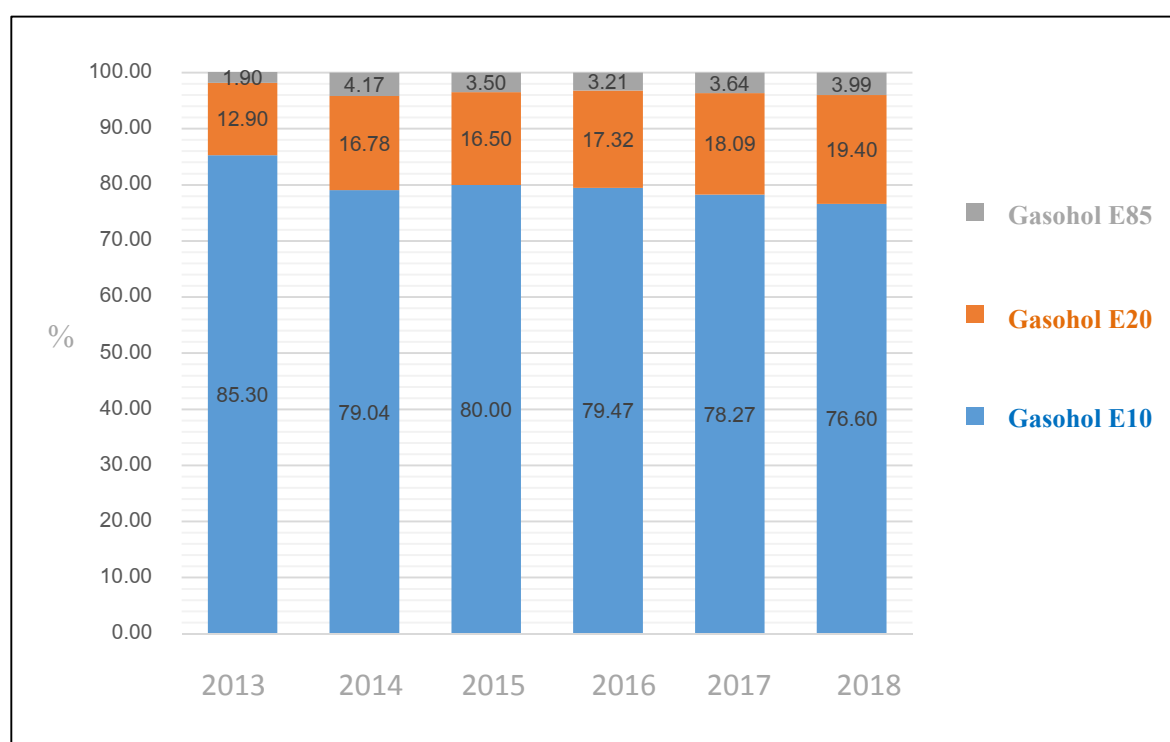
Ethanol used in fuel is blended with gasoline in ratios of 10%, 20% and 85%, resulting in E10, E20 and E85 gasohol respectively. This affects domestic demand for fuel ethanol, which is substantially determined by gasoline consumption. While the consumption of gasohol in the Country has continued to increase significantly from 21.94 million liters per day in 2014 to 29.97 million liters per day in 2018 or compound annual growth rate (CAGR) of 8.11 percent per year as new cars are able to use higher ethanol content in the gasohol. In addition, retail prices of gasoline are still relatively at low level.



Table: Gasohol sales 2014-2018					
(Unit: million litres)	2014	2015	2016	2017	2018
Annual sales volume	8,007.92	9,130.33	10,118.37	10,521.90	10,939.05
Daily sales volume	21.94	25.01	27.65	28.80	29.97
Source: Department of Energy Business, Ministry of Energy					

Besides increasing sales volumes, consumption of gasohol by type is also revealing. From 2013, sales of gasohol with high-ethanol ratios—gasohol E20 and E85—increased steadily, due to government support for the sector which included a programme to expand the price difference between E10 and E20, a tax measure and compensation from the oil fund combine with the increase in the number of new vehicles compatible with gasohol featuring higher ratios of ethanol.

Graph: Proportion of gasohol consumption by type 2013-2018



Nevertheless, oil traders continued to increase the number of service stations equipped to cope with more E20 and E85. As of end-2018, there were 4,256 service stations for E20 and 1,333 service stations for E85.

(Unit: baht/litre)	Gasoline 95	Gasohol 95	Gasohol 91	Gasohol E20	Gasohol E85
Contribution to oil fund	8.0800	2.1200	2.1200	-	-
Subsidy rate	-	-	-	0.7800	6.3800
Marketing margin	3.3094	2.2452	2.3886	2.1427	3.4002
Retail price	34.1 600	26.7500	26.4800	23.7400	19.5400
Source: Fuel Price Structure as of February 8, 2018, Energy Policy and Planning Office Ministry of Energy.					



(3) Molasses Situation

Molasses is a by-product of cane processing in sugar mills. One metric tonne of sugar cane can produce approximately 45-50 kilogrammes of molasses, accounting to 4.5-5.0% of the cane sent for milling. In Thailand, cane crushing season falls between November and May.

Sugar cane, and molasses volumes 2013/2014-2017/2018				
Year	Sugar cane plantation (million rai)	Average yield (tonnes/rai)	Sugar cane to mill (million tonnes)	Molasses produced (million tonnes)
2013/2014	10.08	11.24	103.67	4.29
2014/2015	10.53	11.08	105.96	4.61
2015/2016	11.01	9.15	94.05	4.23
2016/2017	10.99	9.43	92.95	3.89
2017/2018	11.54	12.06	135.00	5.49
Source: The Cane and Sugar Office				

According to the government's policy on the management of agricultural land, to change the area of paddy fields that are not suitable for cultivation other crops such as sugarcane for industry, tapioca, oil palm and corn for animal feed. Sugarcane is a good economic crop to encourage farmers to replace rice. Because sugarcane can be used in all parts, used to produce sugar, a by-product used ethanol production as a renewable energy and sugarcane residue can be used as a fuel for power generation or pulp production, to add value to the industry continuously.

In 2017/2018 sugarcane plantations in the surveyed communal area increased by 500,000 rai, or 5 percent from 2016/2017, while the average yield increased by 2.63 tonnes/rai or 28 percent because of rainfall increased which have good effect on sugar cane.

Competition

As of 2018, there were 26 operating ethanol production plants in Thailand, with a total installed capacity of 5.79 million litres per day. The ethanol production facilities can be categorised by raw material types as follows:

Operating Ethanol Plants				
Ethanol Plant		Province	Capacity (litres/day)	Main raw material
1	Thai Agro Energy Plc, Phase 1	Suphanburi	150,000	Molasses
2	KSL Green Innovation Plc.*	Khun Kaen	150,000	Molasses
3	KSL Green Innovation Plc. (Bo Phloy)*	Kanchanaburi	200,000	Molasses
4	Thai Sugar Ethanol Co., Ltd.*	Kanchanaburi	100,000	Molasses
5	K.I. Ethanol Co., Ltd.*	Nakhon Ratchasima	200,000	Molasses
6	Mitrphol Biofuel Co., Ltd. (Kalasin)*	Kalasin	230,000	Molasses
7	Mitrphol Biofuel Co., Ltd. (Kalasin)* Kuchinarai	Kalasin	320,000	Molasses
8	Mitrphol Biofuel Co., Ltd. (Chaiyaphum)*	Chaiyaphum	500,000	Molasses
9	Ekarat Phatthana Co., Ltd.*	Nakhon Sawan	230,000	Molasses
10	Thai Rungrueng Energy Co., Ltd.*	Saraburi	300,000	Molasses
11	Mitrphol Biofuel Co., Ltd. (Dan Chang)*	Suphanburi	200,000	Molasses
12	Mae Sot Clean Energy Co., Ltd.*	Tak	230,000	Sugar cane syrup



Operating Ethanol Plants			
Ethanol Plant	Province	Capacity (litres/day)	Main raw material
13 Ratchaburi Ethanol Co., Ltd.*	Ratchaburi	150,000	Cassava chips/ molasses
14 E.S. Power Co., Ltd.*	Sakaew	150,000	Cassava chip/molasses
15 Thai Alcohol Plc*	Nakhon Pathom	200,000	Cassava chip/molasses
16 Thai Agro Energy Plc., Phase 2	Suphanburi	200,000	Cassava chip/molasses
17 Sapsin Co., Ltd.	Lopburi	200,000	Cassava chip
18 Tai Ping Ethanol Co., Ltd.	Sakaew	150,000	Fresh cassava
19 P.S.C. Starch Production Co., Ltd.	Cholburi	150,000	Fresh cassava/ cassava chip
20 Thai Ethanol Power Plc.	Khon Kaen	130,000	Fresh Cassava
21 E 85 Co., Ltd	Prachinburi	500,000	Fresh cassava/liquid cassava
22 Ubon Bio Ethanol Co., Ltd	Ubon Ratchathani	400,000	Fresh cassava/cassava chip
23 Sima Inter Product Co., Ltd.	Chachoengsao	150,000	Fresh cassava/cassava chip
24 T.P.K Ethanol Co.,Ltd.(Plase 1)	Nakhon Ratchasima	340,000	Cassava chip
25 Impress Ethanol Co.,Ltd.	Chachoengsao	200,000	Fresh cassava
26 Fah Kwan Thip Co.,Ltd.	Phajinburi	60,000	Fresh cassava/ cassava chip/ Molasses
Total production capacity		5,790,000	
Source: Thai Ethanol Manufacturing Association			
Remark: * Ethanol production plants operated by sugar mill entrepreneurs			

For the year 2018, the market share is 7.56 percent increased from 2017 by 10.69 percent.

Year	Domestic consumption of ethanol (Million litres)	Company's sales volume of conversion ethanol (Million litres)	Company's market share (%)
2016	1,334.91	105.92	7.93
2017	1,435.18	98.092	6.83
2018	1,532.65	115.833	7.56
Source: Department of Alternative Energy Development and Efficiency			

Public administration of ethanol industry

Production and distribution of ethanol used as fuel is a business sector that operates under the supervision of governmental authorities. This public administration oversees and sets policies concerning the sector's various facets:

(1) Production and distribution of ethanol

To set the same standard for licensing ethanol production plants, the Thai Cabinet on 12 December 2006 approved a liberalisation of regulations governing production of *Sam Thab* (ethanol) type distilled spirits used as fuel. Subsequently, on 24 September 2007, the Ministry of Finance issued Notification Concerning Administration of *Sam Thab* Distilled Spirits (ethanol) Used As Fuel B.E. 2550 defining procedures and directions for applying for authorisation to establish a plant manufacture and sell ethanol used as fuel, as well as other issues concerning production and distribution of ethanol, all of which is overseen by the Excise Department.

The Ministry of Energy on 21 January 2005 issued a notification defining ethanol used as fuel whether directly in an engine or blended with gasoline, in accordance



with the Fuel Distribution Act B.E. 2543. Producers and distributors of ethanol used as fuel must be registered as fuel traders with the Department of Energy Business under Section 7 or Section 10 of the Act, as applicable.

- Fuel traders under Section 7 includes oil traders that operate commercial quantities of each or a combination of oil types of 100,000 metric tonnes per year or more.
- Fuel traders under Section 10 are those that operate commercial quantities of each or a combination of oil types of less than 100,000 metric tonnes per year, whose commercial quantities of each or combination of oil types is 30,000 metric tonnes (about 36 million litres) up, or traders with fuel storage capacity of 200,000 litres or more of each or a combination of oil types.

(2) Determining ethanol characteristics and quality

To encourage commercial application of ethanol and build confidence in it among consumers, the Department of Energy Business has determined characteristics and quality requirements for denatured ethanol fuel blended with basic gasoline to produce gasohol. Details appear in the Department's Notification on Determining Characteristics and Quality of Denatured Ethanol B.E. 2548 launched on 11 July 2005.

(3) Excise tax exemption

The government has a policy to support the production and use of ethanol as fuel. Therefore, the Excise Department issued a notice on: The Alcohol Tax Exemption for Ethanol Distillates Used as Raw Materials or Components for Fuel Production on September 29, 2017, by those who would seek tax exemptions will be necessary to set up an electronic database system and reporting according to Excise Department designated

Product supply

(1) Manufacturing

The Company's ethanol production facilities are located at 9, Moo 10, Dan Chang-Samchuk Road, Tambol Nong Makhamong, Dan Chang District, Suphanburi Province, on an area of over 1,400 rai. The plant comprises two production lines equipped with the French MAGUIN INTERIS technology which is well-recognised among ethanol producers worldwide.

MAGUIN technology features multi-tank continuous fermentation (Cascade Continuous) and a refining process with two distillation columns. The Company's production process holds Quality Management System ISO 9001: 2015 certification and Environmental Management System ISO 14001: 2015 certification from SGS (Thailand) Limited.

Details	Production Line 1	Production Line 2
Raw materials	Molasses	Molasses or cassava
Installed capacity	165,000 litres/day	200,000 litres/day
Commencement	31 January 2005	2 April 2012

Production Line 2, which can use both molasses and cassava, is now enabled for commercial operation. Production Line 1, using molasses as its sole raw mat, has been in operation since 31 January 2005.

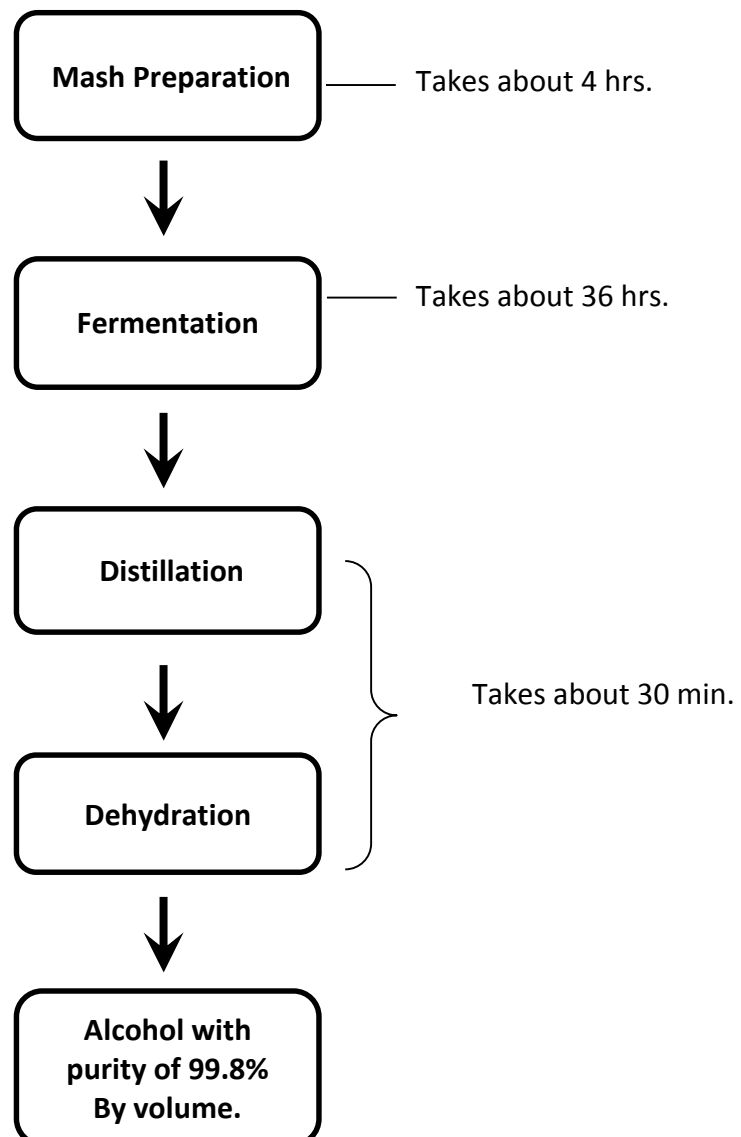


Line 2, which started commercial output in April 2012, has in fact only used molasses as raw material. Upgrading is on the way to enable cassava chip processing. Selection of raw material for Line 2 is based on the Company's production plans and costs.

(2) Production capacity

Details	2017		2018	
	Production Line 1	Production Line 2	Production Line 1	Production Line 2
Installed capacity (unit: litres)	54,750,000	66,000,000	54,750,000	66,000,000
Actual production volume (unit: litres)	39,754,683	58,117,545	45,655,182	70,136,418
% of capacity installed	72.61	88.06	83.39	106.27
Total installed capacity (unit: litres)	120,750,000		120,750,000	
Total actual production volume (unit: litres)	97,872,228		115,791,600	
% of total capacity installed	81.05		95.89	

(3) Production and production process



**Ethanol production at Thai Agro Energy comprises four main stages as follows:****(1) Mash Preparation Process**

Molasses is delivered by pipeline from a storage tank for preparation prior to fermentation. The preparation process involves diluting the molasses with water to the required concentration. A special acid that reduces surface tension is added to separate out organic salts from the molasses.

(2) Fermentation

Diluted molasses is delivered to the next stage where yeast is added to begin a fermentation process. Essential nutrients, acid and air are added in a yeast culture chamber. The optimally fermented yeast and other diluted molasses is moved from pre-fermenters to fermenters. The Company's uses a cascade continuous fermentation process, passing through six fermenters fitted with radial flow pumps and cooling systems that stabilises the temperature in the fermenters. It takes 36 hours for the yeast to transform the sugar into alcohol. After fermentation, the fermented liquid is delivered to buffer tanks to await distillation. The processes produce alcohol with a purity level of 9%-10% by volume.

(3) Distillation

Fermented alcohol stored in the buffer tanks is transferred to Distillation Column 1 where the alcohol is separated from the fermentation broth. The distillation is conducted at a lower atmospheric pressure. The alcohol vapour wafts out of Column 1 and flows through a cooling system. Here, the purified alcohol vapour is condensed into liquid alcohol with approximately 50% purity by volume before being forwarded to Column 2 for further distillation at a higher atmospheric pressure. This produces 92% purified alcohol by volume. The alcohol vapour from Column 2 is conveyed to the dehydration process.

The distillation process renders fuel oil, a by-product utilized in perfumes, resins, plastics, lacquer and ink. Spent wash from the distillery spent wash is sent to the treatment system to generate biogas for application in other areas of the Company's operations.

(4) Dehydration

The dehydration process removes the remaining water after alcohol production, raising it to 99.8% purity by volume. Alcohol vapour drifts through a double-barrelled dehydration unit. Zolytes installed in the barrels absorb water from the vapour. The dehydrated alcohol is condensed and cooled before delivery to storage tanks to await distribution. The Company possesses four storage tanks with a total capacity of 4.5 million litres. Each tank is equipped with nitrogen blanketing to maintain the ethanol quality while it awaits delivery to customers.

Raw materials supply**(1) Molasses**

Molasses is the main raw material used in the Company's production of ethanol, accounting for 80.00% of ethanol production costs. The Company sources molasses from producers and distributors around the country. Negotiation begins every year before the sugarcane milling season begins.

A by-product of sugar processing, the volume of molasses mainly depends on the amount of sugarcane sent for milling each season. To reduce the risk of insufficient molasses to meet the ethanol production plan, the Company contracts with molasses manufacturers and/or suppliers in advance. Each contract determines a certain quantity of molasses and delivery details.



The Company's main molasses supplier is Mitr Phol Sugar Co., Ltd. accounting for 30% of all intake in 2015. Located in close proximity with the Company's plant and with the freight cost included in the purchase price, purchasing molasses from Mitr Phol's sugar mill helps the Company save on both its raw materials cost and transportation. The Company's contract with Mitr Phol requires the molasses producer to deliver 200,000 tonnes of molasses per year for a period of 15 years, from 2005- 2019. Renewal or reconsideration of the purchase price takes place every five years in the main contract and every year in the supplementary agreement.

Besides Mitr Phol, the Company orders molasses from seven other producers and/or distributors. This is both to maintain good relations throughout the industry and reduce the risk of relying on only a few molasses traders. The latest long-term contract signed is with new supplier Nakhon Petch Sugar Co., Ltd. The contract is of five years duration, from 1 January 2014 to 31 December 2018.

Molasses vendors are mostly responsible for delivering the contracted consignments to the Company's factory. However, in some cases the Company arranges transportation of the molasses itself. In such cases the Company outsources the delivery. Such contracts clearly specify that all damage, whether by contamination, degradation or loss that occurs in transit as well as damages due to accidents, are the transportation contractor's responsibility and that they are required to pay the Company an indemnity.

(2) Chemicals

Apart from molasses, the main raw material, the Company uses other chemical substances in the production of ethanol. In 2016-2018, chemical ingredients accounted for 1.68 percent, 1.82 percent and 1.78 percent of the ethanol production cost.

Yeast, urea, diammonium phosphate, anti-foam and sulfuric acid are among the essential chemicals used in the production process. Most of the substances are supplied by domestic manufacturers and/or distributors. As quality is top priority, the Company focuses on purchasing only from manufacturers and/or distributors that deliver quality ingredients accurately and punctually as defined in the orders.

The Company has prepared an Approved Vendor List collating quality manufacturers and/or distributors. The list is updated every two years through performance reviews and assessments.

Orders are placed on a minimum stock basis. As stocks are reduced to minimum amounts that must be retained, ERP reports the situation to the concerned personnel to reorder. The system enables the Company to achieve efficient stock management and maintain appropriate inventories of raw materials.

(3) Cassava chips

Consideration of which raw material to use in Production Line 2 is based on cost and the current plan. Having a choice enables the Company to control its costs effectively and reduce the risk arising from solely depending on molasses as raw material. It gives the Company the freedom to choose whichever raw material is available at the lowest cost to use to produce ethanol.

The Company is also making preparations for using cassava chips as another raw material for its ethanol production. It will procure cassava chips from producers in provinces in the vicinity of its plant, including Kanchanaburi, Uthai Thani, Nakhon Sawan and Kamphaeng Phet, in which cassava is a major crop. The Company surveyed various cassava yards to assess their



capability of producing cassava chips of the required quality. Sampling will be conducted to determine the quality of the material every time before deciding whether to purchase.

Prior to acceptance, the Company checks the quality of the produce loaded onto each truck. Cassava of lower quality than that required by the Company is immediately rejected, ensuring that only quality cassava chips are used for ethanol production.

(4) Raw Sugar

Due to the production line 2 can use raw sugar for production process, this will gain the flexibility of raw material selection. Therefore, the Company can efficiently manage on production cost.

In the meeting of the cane and sugar board each year, the board will consider the policy to increase the sale volume of raw sugar within the country to the ethanol industry which will consider from the amount of raw sugar each production season.

(3) Risk factors

Thai Agro Energy Public Company Limited (TAE) is engaged in ethanol production. The Company's product is mixed with gasoline to produce gasohol E10, E20 and E85 which are alternative fuels for automobiles. The Company's risk management is as follows:

(1) Risk from Procurement of Main Raw Material: Molasses and cassava are the main raw materials used to produce ethanol of the Company, contributing more than 80 percent to the overall ethanol production cost. As molasses and cassava are agricultural products then various factors affected, for example, the size of land used for planting which varies by the price comparing to other crops, climate, crop disease, rainfall and water level, demand in other industries and export volume each year, etc. Accordingly, TAE has entered into long-term sale and purchase agreements with domestic molasses producers or sellers in order to conclude the volume and delivery schedule of molasses, while the procurement of cassava will be purchased from the cassava farm near TAE plant. This allows efficient management on inventory and effective ethanol production.

(2) Risk from Fluctuation of Main Raw Material: Fluctuation of raw materials prices directly impact to the cost of ethanol production since they are major costs in production process. The price of molasses varies by the supply and demand, following the same trend as the price of sugar which is seasonal and market force; as well as the price of cassava, in addition to the supply and demand in the market, it is also affected by government intervention. Therefore, if the raw materials prices jump up rapidly, the selling cost and the profit margin of TAE may be affected since the selling price may not change proportionally with the increased cost of raw material. Recognizing this issue, TAE determines its ethanol selling price from appropriate cost plus gross profit, with close and regular monitoring on the market and molasses price trend. Additionally, negotiations on the purchases of molasses are done in advance before the harvest season to ensure low and competitive price of molasses or having good gross profit margin.

(3) Risk from being Dependent on Major Customers: TAE sells ethanol-for-fuel to oil companies as defined by Section 7 of Fuel Trade Act B.E. 2543 for mixing in gasohol production. Being an oligopoly, the major buyers with high ethanol demand have more negotiating leverage in terms of price and selling terms, such as, longer credit term. However,



without the purchase from the major buyers, or with lower volume of purchase, the revenue and profit of TAE may be affected. Accordingly, TAE focuses on keeping good relationship with customers, ensuring trust and satisfaction from customers. TAE also try to decrease its dependence on any single customer, having expanded its customer base to ensure ethanol sales target with optimal terms and prices.

(4) Risk from the Government Policy: Due to the policy promoting the use of renewable energy has an impact on ethanol business; the Alternative Energy Development Plan (AEDP 2015), which targets on ethanol needs and action plans and the bio-fuel management plan (Oil Plan 2015) to determine the appropriate type of oil to be sold. Therefore, if the government policy has changed or in case where the government policy is discrete or unclear, this will impact the business of TAE. TAE recognizes such risk and aims to manage the production and distribution of ethanol at the highest efficiency, with emphasis on cost management, product quality and good relationship with customers, including export market expansion or add value to the products, ensuring minimal impact from government policy.

(5) Risk from the Growing Trends of Electric Cars and Hybrid Cars: As the government has a policy to support the electric vehicles industry (“EVs”) in line with the Energy 4.0 policy to shift fossil reliance to renewable energy, in addition, the use of hybrid cars using both electricity and fuel is likely to increase, despite the disadvantage of price and battery life, charging time, including the number of service stations to be improved in the future, by which the utilization of electricity power in cars will have an impact on fuel and ethanol demand in the future. Accordingly, TAE is currently conducts a feasibility study of producing other products or derivatives products of ethanol to mitigate the impact of a decrease in ethanol demand.

(6) Risk from the Utilization of Biogas as Main Fuel on Steam and Power Generation to use in Ethanol Production: TAE uses biogas as main fuel for steam and power generation in ethanol production as one of the policies concerning cost reduction and improvement on ethanol production efficiency, instead of using fuel oil as before, which significantly reduces the fuel cost. Currently, TAE can produce enough biogas for steam and power generation, however, there is some risk from natural disaster, causing damage to the biogas ponds, rendering them dysfunctional and requiring substituted fuel (e.g. fuel oil, palm shell), increasing the cost of ethanol production. Recognizing such risk, TAE has strengthened the structure of the biogas ponds and conducts regular maintenance to ensure continuous and effective biogas generation. Moreover, insurance policies covering every type of risk from natural disaster are also in place.

(7) Risk from Environmental Impact: TAE places emphasis and recognizes the health impacts to the surrounding community, with great care to the environment and two potential pollution risks as follows:

(7.1) Risk from Environmental Impact of Air Pollution: TAE uses bio scrubber for removal hydrogen sulfide in biogas, which is used for steam and power generation for the biogas to be clean and has better quality. Additionally, there is a team monitoring and repairing the canvas covering biogas to ensure that it is in good condition, in



case where it is damaged, it will be repaired immediately in order to minimize air pollution that would have an impact on the surrounding community.

(7.2) Risk from Environmental Impact of Water Resources and Wastewater Treatment: TAE has been complied with the requirements of the Department of Industrial Works, Ministry of Industry, in “Wastewater Management in Industrial Plants” by constructing of properly treated spent wash ponds from biogas production process with inspecting and repairing the levees follow the engineering standard and maintain the water level below 1 meter from the levee to reduce the risk of the overflows caused by heavy rains. In addition, the investment in spent wash evaporation project with evaporation system will take place in order to reduce the treated spent wash and mitigate the risk of water leakage in the event of flooding to prevent the potential impact on the surrounding community.

(8) Risk from Compliance with Loan Agreements

The lending bank has stipulated a condition concerning the maintenance of shareholding of Lanna Resources Public Co., Ltd. (“LANNA”) in TAE of no less than 50 percent of all shares during the whole duration of the loan agreement. Therefore, TAE has the risk of breaching the loan agreement condition, and the lending bank may demand a full repayment of loan if LANNA sells its shares in TAE and the shareholding proportion in TAE decreases to less than 50 percent of all shares, which will ultimately affect the liquidity and the operation of TAE. Accordingly, the management has informed the Board of Directors of LANNA regarding such condition. If LANNA plans to decrease its shareholding proportion in TAE in the future, a written notification is needed to be sent to TAE so that TAE may negotiate with the lending bank without breaching the loan agreement.

(4) The Company’s assets used for doing business

The Company possesses various assets that it utilises in doing business as of 31 December 2018, the Company’s total assets used in doing business were as follows:

Type/characteristic of asset	Ownership	Obligation As of 31 Dec. 18	Net Book ValueAs of 31 Dec. 18 (million baht)
Land comprising agricultural plots and desiccation ponds, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 1,220-1-24.9 rai	Owner	Land mortgaged with commercial banks	65.14
		–	104.70
Land for biogas production: Well 3, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 23-2-32 rai	Owner	–	5.21
Land for slops water wells, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 128-3-63 rai	Owner	Land mortgaged with commercial banks	13.05
Land for fresh water storage, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 42-3-72 rai	Owner	Land mortgaged with commercial banks	4.42
Land for truck parking yards, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 245-2-19.5 rai	Owner	Land mortgaged with commercial banks	24.82
		–	3.19



Type/characteristic of asset	Ownership	Obligation As of 31 Dec. 18	Net Book ValueAs of 31 Dec. 18 (million baht)
Land for Production Process Line 2 and biogas production Well 4, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 83-1-16 rai	Owner	Land mortgaged with commercial banks	8.22
Land for Production Line 1, located in Tambol Nong Makhamong, Dan Chang district, Suphanburi Province. Total area: 103-1-17 rai	Owner	Land mortgaged with commercial banks	10.63
Land improvement	Owner	-	56.79
Machinery and equipment	Owner	Machinery with loan finance by commercial banks	1,349.80
			360.08
Buildings and construction	Owner	buildings mortgaged with commercial banks	137.53
		-	242.44
Office equipment	Owner	-	3.43
Vehicles	Owner	-	4.91
Assets under construction and installation	Owner	-	361.70
Total			2,756.06

Molasses purchase contract

Contract party	: Mitr Phol Sugar Co., Ltd. ("Principal Contract")
Contract date	: 28 May 2003
Nature of contract	: The Seller agrees to sell molasses to the buyer, amounting 120,000 tons per year, with a price agreement reached every 5 years.
Duration	: 2005-2019
Delivery	: The seller contracts to deliver molasses to the buyer at the buyer's factory.
Penalty	: Should the seller be unable to deliver to the buyer the volume of molasses defined in the agreement, the seller must procure molasses from elsewhere to be delivered to the buyer in place of any shortfall in order to maintain the contracted volumes and prices as agreed through to completion of the contract. Should the seller be unable to procure and supply the substitute molasses in accordance with the contract, the seller is obliged to return to the buyer that portion of the contract value necessary for the buyer (the Company) to procure molasses to compensate for the shortfall in supply by the seller. Moreover, the seller must pay any excess in the price of molasses that the buyer has to pay other suppliers for higher priced molasses than stipulated in the agreement. The seller is also required to compensate the buyer for any related loss or damage incurred by the buyer.
Cause of cancellation of contract	: In case the buyer's factory has to stop working, close or reduce operations by half or more of its normal level for whatever reason, so that the buyer is unable to take delivery of molasses from the



seller as per the contract, by no fault of the seller, for more than 45 consecutive days, the molasses purchase agreement will be terminated immediately without notice. Upon the contract termination, all the money that the buyer has paid for the molasses purchases shall be vested in the seller immediately. Force majeure — war, revolution, insurrection, natural disasters, storms, floods, strikes or other unexpected incidents — are not included among such causes of cancellation.

Contract party	: Mitr Phol Sugar co., Ltd. (“Supplementary contract”)
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Contract date : 28 May 2003

Nature of contract : The Seller agrees to sell molasses to the buyer, amounting to 80,000 tonnes per year. An agreement about the price and amount of molasses will be made every year.

Duration of contract : 15 years, 2005-2019

Other obligations : To follow the obligations prescribed in the principle contract

Contract party	: Nakhon Petch Sugar Co., Ltd.
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Contract date : 1 August 2013

Nature of contract : The Company will buy molasses from the seller as per the agreement

Duration of contract : 5 years, starting January 1, 2014 until December 31, 2018

Delivery : The seller must deliver molasses to the buyer at the buyer’s factory.

Contract party	: Mitkasem Uthai Thani Co., Ltd.
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Contract date : 1 August 2013

Nature of contract : The Company will buy molasses from the seller as per the agreement

Duration : 5 years, starting January 1, 2014 until December 31, 2018

Delivery : The seller must deliver molasses to the buyer at the buyer’s factory.

(5) Legal disputes

Conclusion of lawsuit : In September 2011, a company sued the Company for its alleged non-compliance with the cassava chip purchase agreement dated 21 January 2011 and memorandum dated 29 April 2011, claiming a compensation for damage of Baht 186.9 million. On 8 November 2011, the Company submitted the testimony and countersued that company, claiming a compensation for damage of Baht 82.4 million. Subsequently, on



9 October 2014, the Civil Court dismissed the lawsuit filed by that company and ordered it to make payments for purchases of cassava chip that the Company paid in advance of Baht 6.9 million which together with interest expense of 7.5 percent per annum, calculated from 8 November 2014 (the countersue date) until completion of payment. In addition, that company shall pay for charges and partial lawyer fee for the Company. However, on 3 December 2014, the Company lodged an appeal with the Court of Appeal. On 9 February 2016, the Appeal Court affirmed the judgment of the Civil Court.

Subsequently on 7 April 2016, the Company lodged an appeal with the Supreme Court and on 18 May 2018, the Company sued that company for bankruptcy case. Presently, the case is under consideration of the Courts. As at 31 December 2018, the Company has not received such payment. However, the Company recorded allowance for impairment for the full amount of the advance paid to that company.

(6) General and essential information

Company name:	Thai Agro Energy Public Company Limited
Company Registration Number:	0107550000157
Nature of business:	Production and distribution of ethanol used as fuel
Head office:	888/114 Mahathun Plaza Building, 11 th floor, Ploenchit Road, Khwaeng Lumpini, Pathumwan District, Bangkok 10330 Tel 02-627-3890-4 Fax 02-627-3889
Factory:	9 Moo 10, Dan Chang-Samchuk Road, Tambol Nong Makhamong, Dan Chang District, Suphanburi Province
Website:	www.thaiagroenergy.com
Securities registrar:	The Thailand Securities Depository Co., Ltd., 62 The Stock Exchange of Thailand Building, Ratchadaphisek Road, Khlongtoey, Bangkok 10110 Tel: 02-2292000
Auditor:	One of the names below: 1. Miss Kamonthip Lertwitworatthep Certified Public Account Registration No. 4377 and/or 2. Miss Satida Ratananurak, Auditor Registration Number 4753 and/or 3. Miss Siriwan Nitdamrong, certified public accountant no. 5906 of EY Office Co., Ltd. Address: 193/136-137 Lake Ratchada Building, 33 rd floor, Ratchadaphisek Road, Khlongtoey, Bangkok 10110 Tel: 02-264-0777 Fax: 02-264-0789