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Approaches to Biofuels in Japanese Oil Industry

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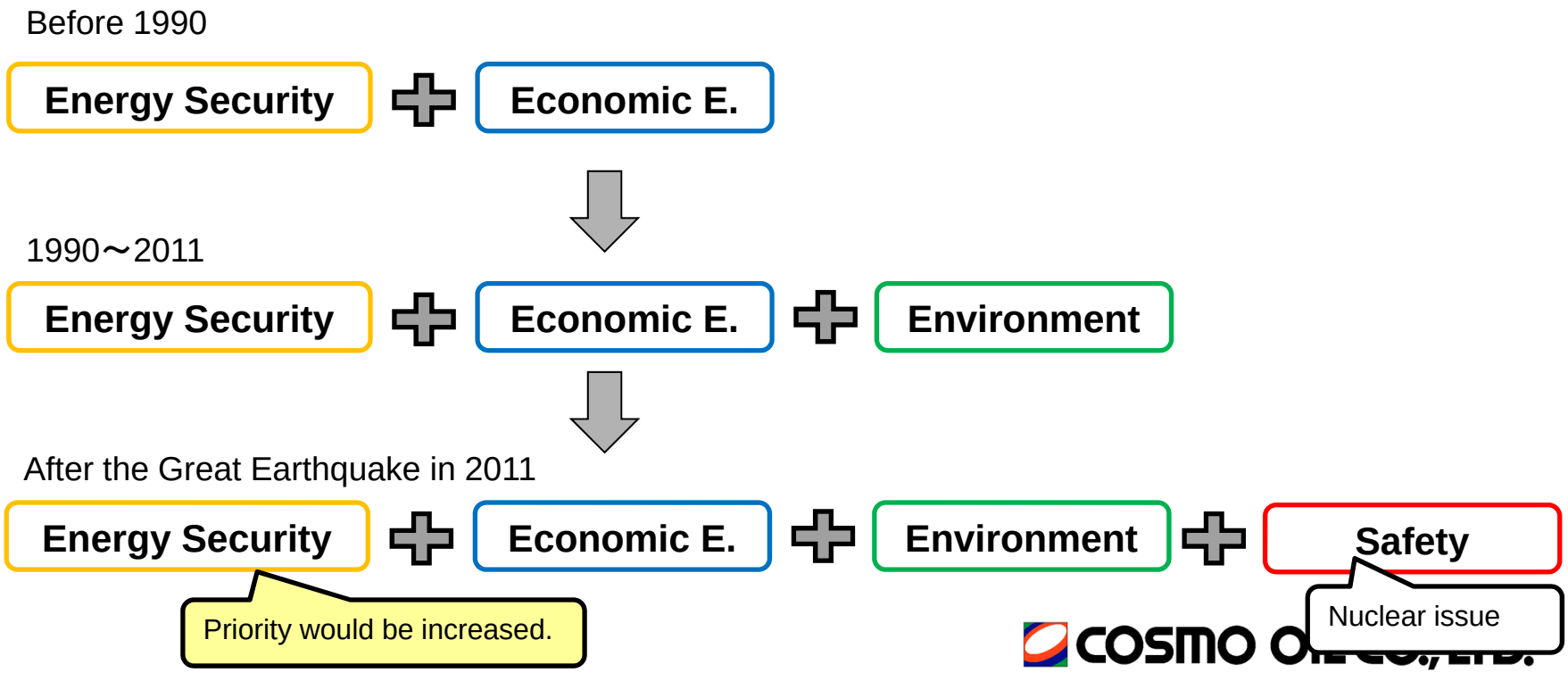
Energy policy change after the Great Earthquake in Japan

The Japanese Government is reconsidering its basic energy policy after the Great Earthquake of March 11, 2011;

- **Shift from "3E (= Energy Security, Economic Efficiency & Environment)" to "3E + S (=Safety)"**
- **Priority to "Energy Security" would be increased.**
- **The future direction to lower the dependence on nuclear power generations and to increase reliance on renewable natural energy.**



Biofuel introduction target of the Japanese government

◆ The Japanese government expects the future direction to increase reliance on renewable natural energy to countermeasure CO2 emission increase caused by lowering the dependence on nuclear power generations.

◆ The governmental policy on bio-fuel is expected not to change substantially for some time in the future.

Brief extract taken from the government's Energy plan
(approved by the Cabinet, 18 June,2010)

(1) The future goal :
The government will try to increase the percentages of the renewable energy in primary energy supply to the level of 10% by 2020.

(2) Bio-fuel :
The government introduces the sustainability standard (e.g. CO2 emission in life cycle assessment) applied to bio-fuel.

The target level to blend bio-fuels (e.g. bio-ETBE, bio-ethanol, bio-diesel, bio-jet) with petroleum products is the amount equivalent to more than 3% of domestic gasoline demand by 2020.

The maximum bio-fuel use should be aimed by establishing next-generation technology, such as cellulosic bio-fuel ,algae and etc by 2030.

Biofuel mandated by Energy Supply Structure Sophistication Act

◆The law went into effect which mandated the use of non-fossil energy for energy suppliers (since 2009).

◆The law mandates biofuel blend with petroleum products for oil refiners. (500,000 COE-KL in 2017FY)

Energy Supply Structure Sophistication Act

Purpose : By Energy suppliers (electricity, oil and gas)

(1) Promotion of Effective Utilization of fossil energy sources

(2) Use of non-fossil energy

Blending bio ethanol (or bio ETBE) to gasoline

(Unit :COE(Crude Oil Equivalent)-KL)

FY2011	FY2012	FY2013	FY2014	FY2015	FY2016	FY2017
210,000 COE-KL	210,000 COE-KL	260,000 COE-KL	320,000 COE-KL	380,000 COE-KL	440,000 COE-KL	500,000 COE-KL

The sustainability standards of bio-ethanol

e.g. Its GHG emissions should be less than 50% compared with those of gasoline by the LCA.

The sustainability standard of biofuel in Japan

Main points on the sustainability standard of biofuel:

(1) CO2 emissions-reduction by the life cycle assessment (LCA).
⇒ Its GHG emissions should be less than 50% compared with those of gasoline by the LCA.

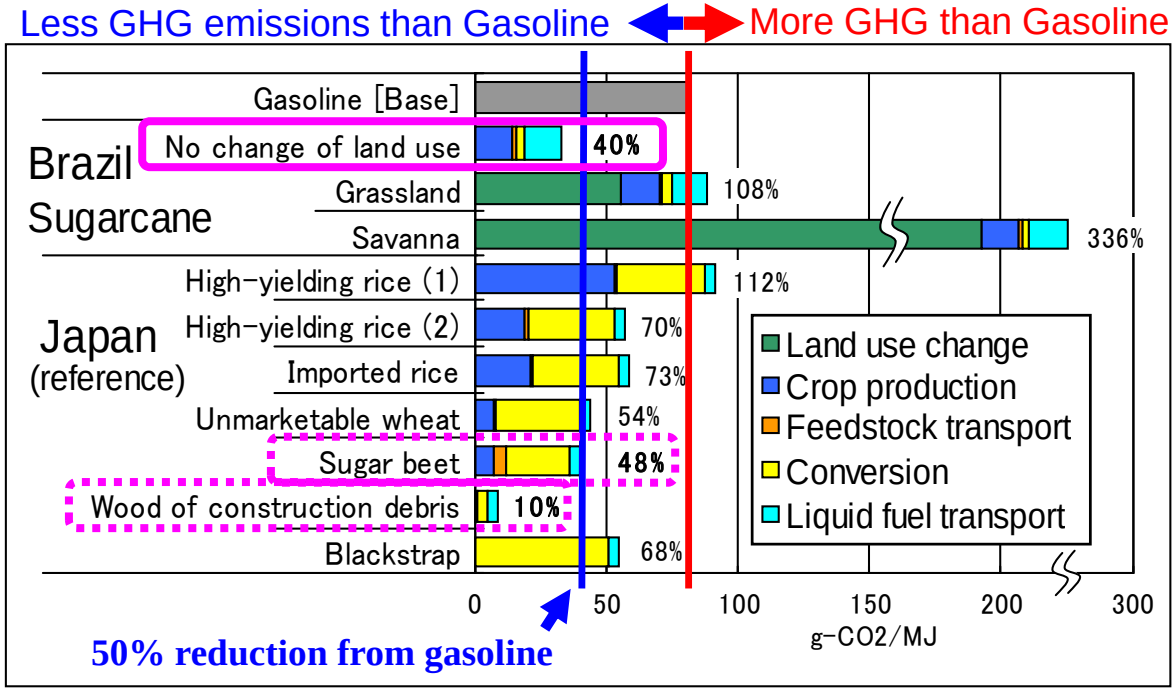
(2) Energy security
⇒ The high self-sufficiency ratio of biofuel should be aimed in terms of energy security.

(3) Addressing food security
⇒Next-generation technology such as cellulosic biofuel should be developed in the future.

The sustainability of bio-fuel(1) (GHG Reduction Effect by LCA)

- **Ethanol satisfying the Japanese sustainability standards (more than 50% reduction of GHG emissions compared with gasoline) is mostly produced in existing farmlands in Brazil.**
- **The increase of bio-fuels consumption is considered one of factors which could trigger the food price rise.**

GHG emissions of bio-ethanol by country/feedstock



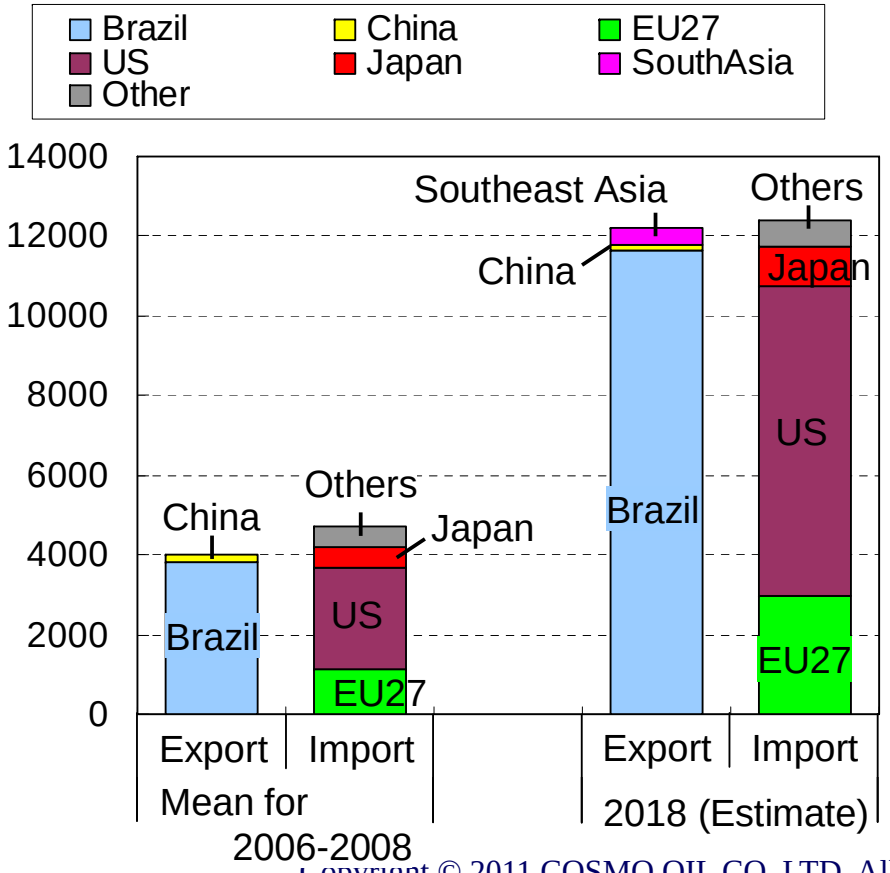
(Source) Study group on sustainability standards for the introduction of biofuel (METI)

Note: High-yielding rice(2) is the case of reducing methane emissions from irrigation.
"Land use change" does not include the effect of "Indirect land use change".

The sustainability of bio-fuel (2) (stability of supply)

- **If Japan have to depend on bio-fuels import from overseas, ethanol producers in Brazil will be the only supplier substantially, and it could cause the uncertainty of energy security.**
- **Ethanol is almost always more expensive than gasoline. Productions of bio-fuel materials are affected by weather and food prices, which is unstable in supply.**

Ethanol supply and demand outlook for the future



Source: “OECD-FAO Agricultural Outlook 2009-2018”

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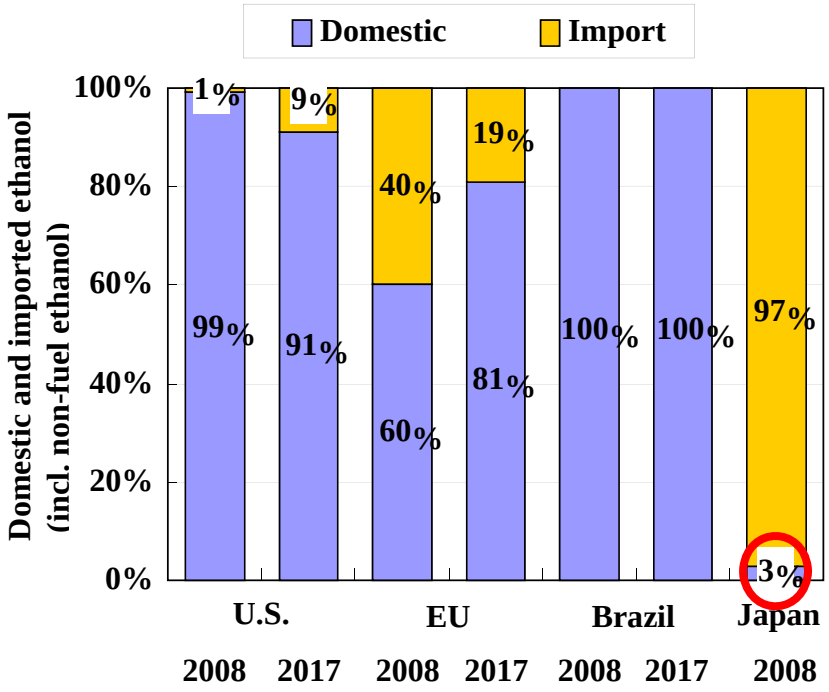
The sustainability of bio-fuel (3) (Energy VS Food)

- Bio-fuel domestic production in 2008 was approx. 30,000 KL(8% of domestic demand) and remains at the same level now.
- Consumption of bio-fuels could cause food prices rise and threaten food security in Japan.
- EU and US bio-fuels policies put importance on agriculture promotion and national energy security mainly, rather than for the global warming.

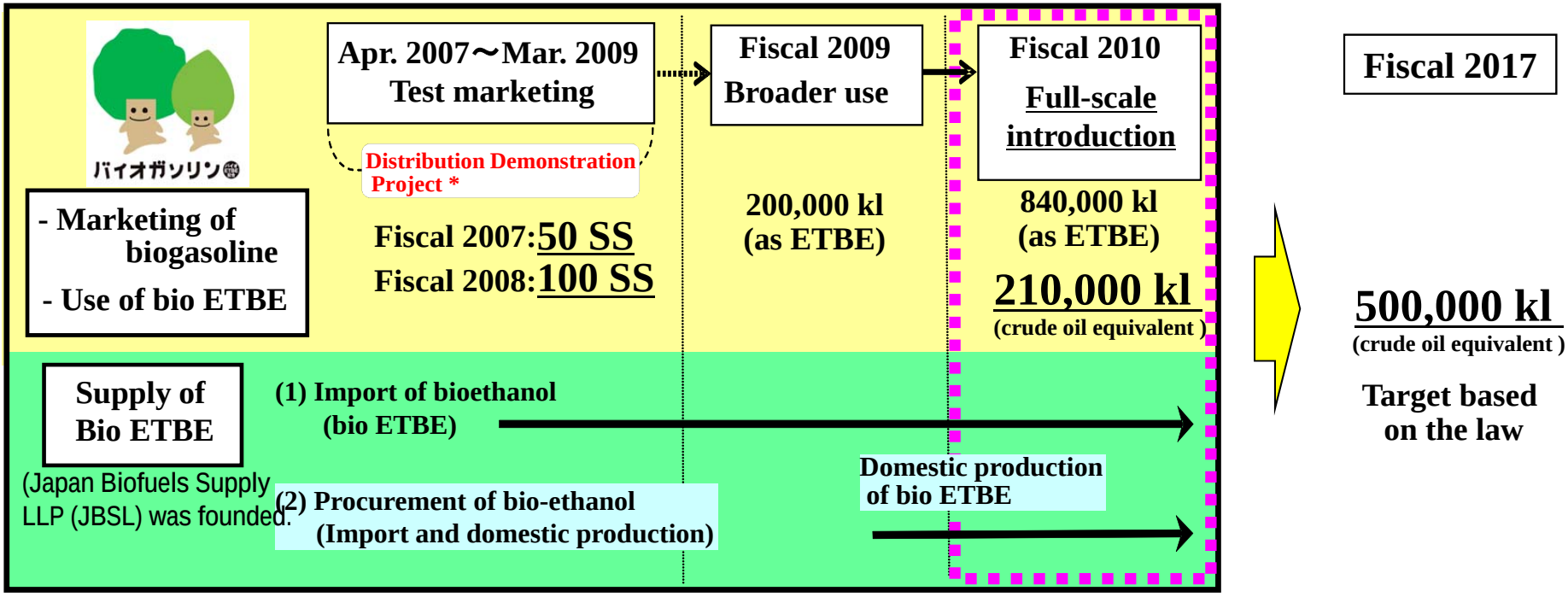
Ethanol self-sufficiency in various countries



（Source) Study group on sustainability standards for the introduction of biofuel (METI)

Efforts of Bio-fuels use by the Japanese Oil Industry

- In April 2007, Japanese oil industries started the test marketing of “bio gasoline” (blended bio ETBE with gasoline) at 50 service stations.
- In fiscal 2010, Japanese oil industries achieved their own commitment to supply bio-fuel of 210,000 crude oil equivalent KL (=840,000 KL of bio ETBE) in fiscal 2010”.
- It is scheduled to expand bio-fuel supply to meet the Japanese government's target, 500,000 crude oil equivalent KL in fiscal 2017 (mandated by the law).



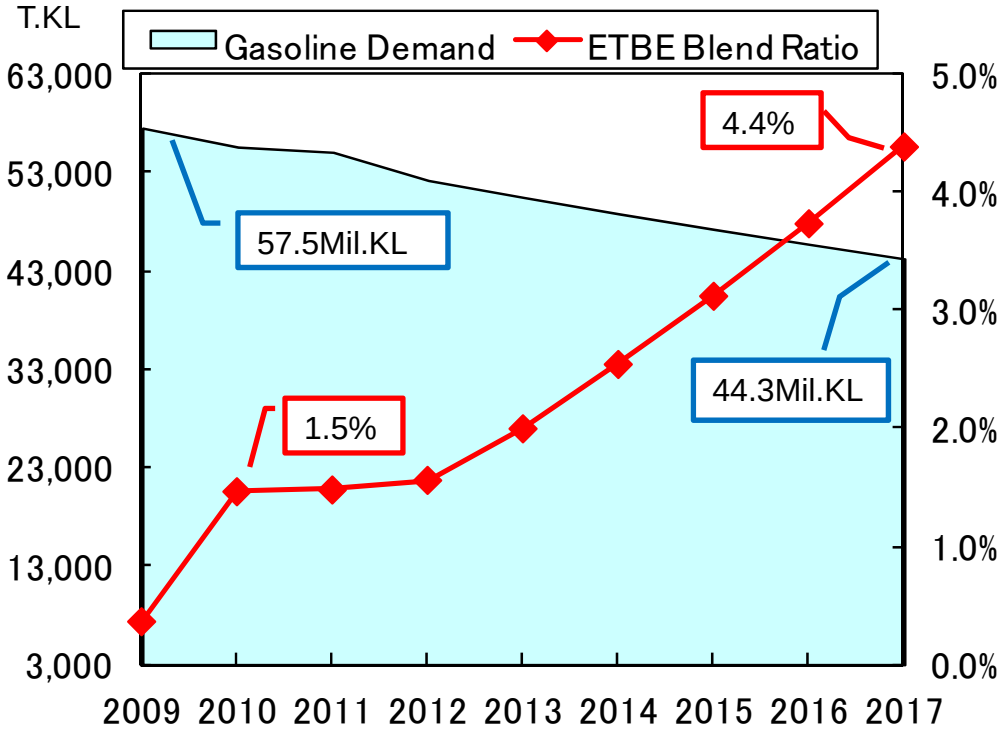
•The test marketing was a part of the Distribution Demonstration Project under a grant from the government for two years since fiscal 2007.

Source : PAJ

Aimed at the goal in 2017FY

◆ The Japanese oil industry continues efforts aimed at the goal (blending bio-ethanol of 500,000 COE-KL with gasoline in 2017FY) that the law mandates.

◆ 8 Japanese oil refiners will continue blending bio-ethanol with gasoline products on an ETBE basis to keep safety and security of consumers, while satisfing the governmental sustainability standards such as GHG emissions by the LCA, harmful effect to food securty and etc.



【Unil : KL (Approx.)】

Year	Legal obli. EtOH	Legal obli. (ETBE conv)
2011	346,000	817,000
2012	346,000	817,000
2013	428,000	1,011,000
2014	527,000	1,244,000
2015	626,000	1,478,000
2016	725,000	1,711,000
2017	**824,000**	**1,944,000**

Equivalent to 500,000 COE-KL

Joint procurement through the JBSL(Japan Biofuels Supply LLP)

◆8 Japanese oil refiners established the joint procurement association, JBSL(Japan Biofuels Supply LLP) to import and delivery biofuel material.

◆The law JBSL have 3 import terminals. (Chiba, Wakayama and Hyogo)

	JBSL(Japan Biofuels Supply LLP)
Partners	Idemitsu Kosan Co., Ltd. Tonen General Sekiyu K.K. Taiyo Oil Co., Ltd. Fuji oil company, Ltd. Cosmo Oil Co., Ltd. Kyokuto Petroleum Industries Ltd Showa shell Sekiyu k.k. JX Nippon Oil & Energy Corporation
Establishment	January, 2007
Main Activities	1. Importing of Bio-ETBE and Bio-ethanol and purchasing Bio-ethanol from domestic production. 2. Distributing Biofuels to our partners' refineries.
Import terminals	Chiba and Wakayama（for ETBE） Hyogo（for ethanol）

R&D of cellulosic biofuel technology

Japanese oil refiners focus on research and development of cellulosic biofuel technology which doesn't use food materials.

R&D activities of cellulosic biofuel technology by Japanese oil refiners

JX Nippon Oil & Energy Corporation	◆Aiming at biofule production at the cost of JPY 40 /L(=approx. USD 0.5/L) based on the future technology innovation. ◆The joint research study on bio-jetfuel derived from algae
Exxonmobil	◆R&D on biofuel derived from algae
Cosmo Oil	◆Feasibility study on bio-ethanol derived from black liquor which paper making plants produce. ◆R&D on BTL technology which could produce kerosene and diesel derived from cellulosic biofuel materials
Idemitsu	◆R&D on technology to transform cellulose to ethanol (simultaneous fermentation of C5 and C6)

The tax exemption system for biofuel

The gasoline tax exemption system for biofuel:

The government started a new tax system that bio-ethanol contained in gasoline should be exempt from gasoline tax JPY53.8/L (=USD0.67/L) in February 2009.

The outline of the gasoline tax exemption system for biofuel:

An outline of the tax system	Bio-ethanol contained in gasoline is exempt from gasoline tax JPY53.8/L (=USD0.67/L) which is produced and ship out of refineries or blending plants.
The applicable period	From :25 February, 2009 To :31 March, 2013

Summary: Challenge to bio-fuels supply with 3Es

“3Es” in the Japan’s energy policy should be simultaneously achieved in bio-fuel supply by Japanese oil industry.