Proposal of E10 Use for Energy Security, Gasoline Price Control & CO_2 Reduction
(Bioethanol as a Bridge to Synthetic Fuel)

November 24, 2022

NEED Nippon Environmental Energy Development Co.
Issey Sawa

Profile

1980 Joined Mitsubishi Corporation (Machinery Group).

2000 ～ Development of Business related to Biomass Energy.

2016. 7 Started NEED (Nippon Environmental Energy Development Corporation) as President

Act as Advisor for the Companies & Organizations as Consultant specialized in Biomass Energy.

Lectures at Seminars held by METI, MAFF, MEXT, NEDO, JBIC, and the other Government Agencies, Universities, Research Institutes, and Private Companies & Organizations, as well as at Overseas Symposiums sponsored by Governments in Indonesia, Thailand, and the other Countries.

- **the External evaluation committee member** for **AIST** (METI) Research Center for "Biomass Refinery" and "New Fuels for Automobiles" **(2007-2014**)
- **Member of METI's Committee for "Biofuel Sustainability Criteria" (2008-2010)**
- Member of NEDO's Committee for "2010 Biomass Energy Introduction Guidebook".
- Member of 7 Ministries' Study Team for "Biomass Commercialization Strategy" (Feb.-Jun, 2012)
- Member of METI's Committee for "2nd. Generation Biofuels Strategy" (Feb.- July, 2013)
- Chairman, Biomass Working Group, NPO Agricultural and Metropolitan Council (2016-18)
- Founder of "Biomass Power Producers Association (BPA)" . Act as Vice President (2016-18)
- Invited Researcher for Waseda University "Environmental Research Center" (2016-Present)
- 2019.4 : Received an Award "**the Prince Higashikuni International Cultural Prize**"
- 2020.3 : Supervise Seed Planning 's "Global Warming & Coal-Fired PS 's Current Status and Direction"
- 2022.3 : Supervise Gentosha's "Bioethanol Comic" (as U.S. Grains Council's Advisor)
- 2022.5 : Co-Author of "Illustrated Guide to Carbon-Neutral Fuels" published by Gijutsu Hyoron Co.Ltd.

Bioethanol blended fuel used in Motorsports

F1 World Championship (Europe and the other countries around the world)

E10 from 2022※

IndyCar Series (North America)

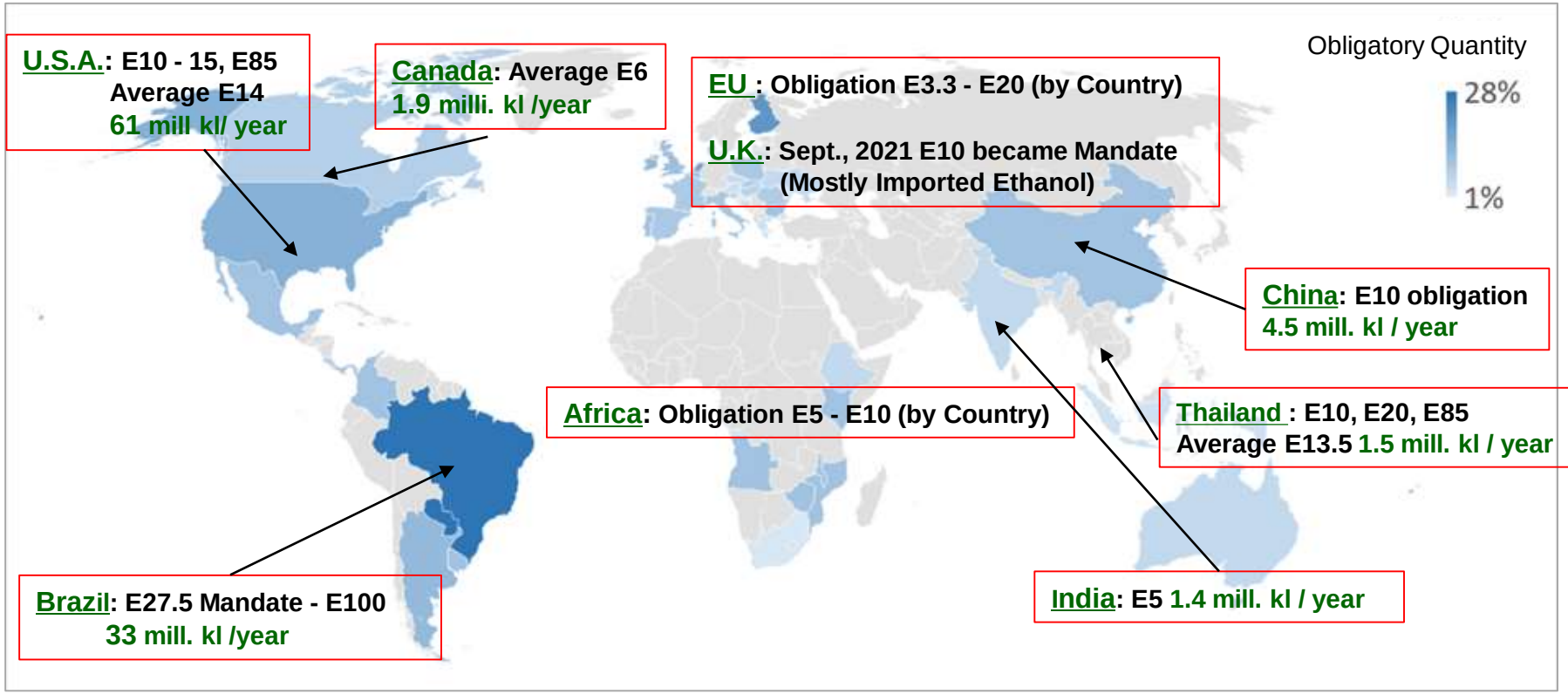
E85※ from 2007

Source: Ms. Sumie Dan, Writer, Japan Motor Sports Press Association

The Number after **"E"** indicates **Ratio of Bioethanol Blend** with Gasoline.

There is a plan to switch to Synthetic Fuel in the future.

World Status of Bioethanol blended Fuels



Global Bioethanol Consumption in 2018 : 112 mill. kl / year (¥ 6 trillion Market)

E10 became Global Standard !

Source: Prepared from Biofuels Digest (2020) and various USDA reports.

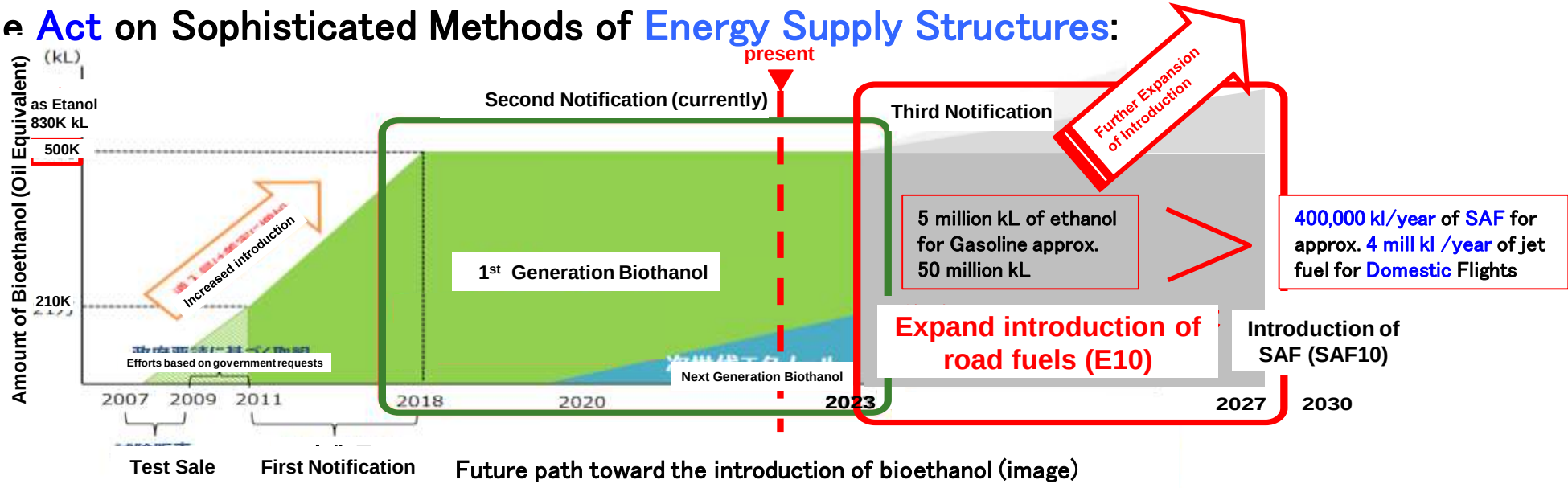
Still E1.7 in Japan (Lowest level in the world)

1. Introduction Method: Small Volume of ETBE (Additive) as Basic Agent for Octane Improver for Gasoline

Bioethanol 45% by mass 0.83mill. kl/year
(E1.7) ✚
Isobutylene (Petroleum-derived) 55%

→ **ETBE (4.0)**
1.96 mill. kl/year
Ethyl Tertiary Butyl Ether

2. The Act on Sophisticated Methods of Energy Supply Structures:



Future path toward the introduction of bioethanol (image)

Sources: METI's Committee for "the Study of Sustainability Criteria for Biofuels (–2011)," "Technical Study Committee for the Introduction of Biofuels in Japan (2017–)"

“Joint Statement“ by Leaders of Japan & U.S. (2022.5.23)

At the Japan–U.S. Summit Meeting between PM Kishida and President Biden on May 23 ,2022 , the Japanese Government committed expansion of Use of Bioethanol into aviation fuel and automobile fuel.

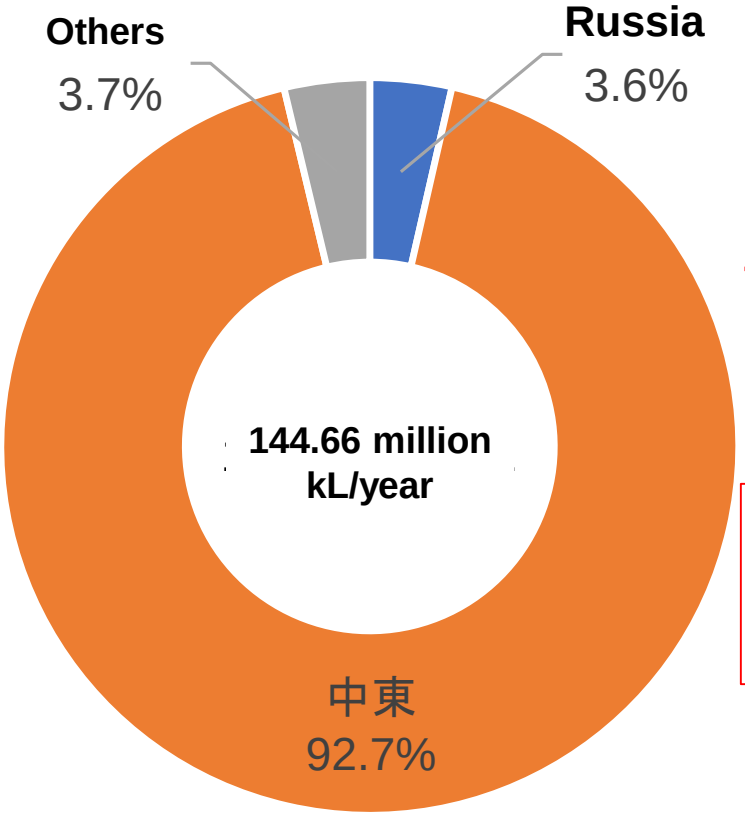
Japan-U.S. Joint Press Conference
(Photo: courtesy of the Cabinet Public Relations Office)

Joint Statement Excerpts

Prime Minister Kishida and President Biden welcomed Japan’s commitment to take all available measures to double demand for bioethanol, including for sustainable aviation fuel and on-road fuel, by 2030 to reduce dependence on imported petroleum.

Effect in view of “Energy Security Policy”

Substitutability of Russian Crude Oil



2020 Crude Oil Imports and Breakdown

Source: Energy Agency, Petroleum Import Survey

5.18 mill. kl/year

For the remaining 57% if it can be procured from Sakhalin 1 & 2.

Approx. 3 mill. kl /year

Biofuel
Synthetic fuel

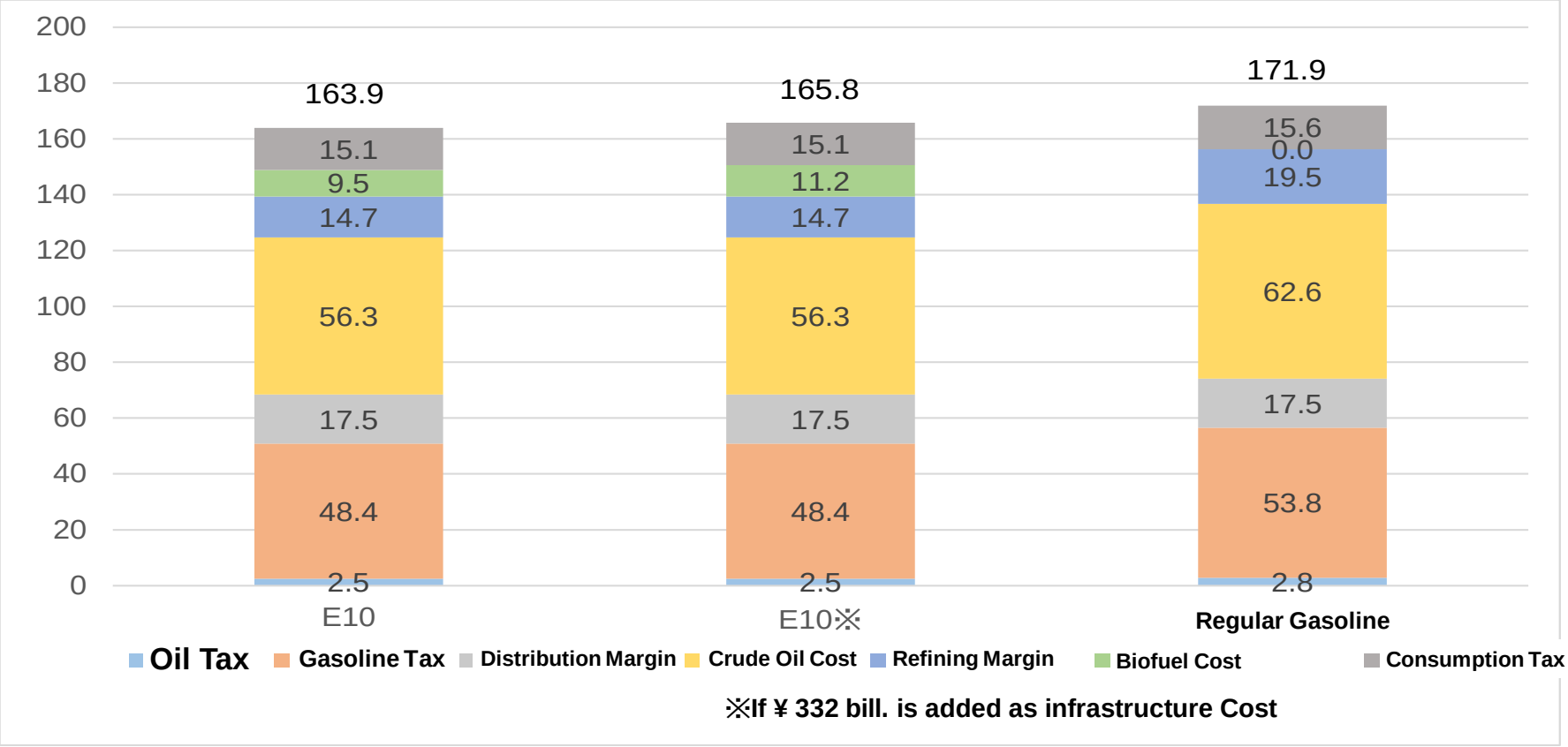
Supply Source

- **Domestic**
- **Southeast Asia**
- **North America**

Effect as a Gasoline Price Control Measure (E10 vs. Gasoline)

E10 is ¥ 8.0 /liter Cheaper than Regular Gasoline.

Even if ¥ 332 bill. in Infrastructure Cost is added, the price is still ¥ 6.1/liter lower.



Details as per "2022.5.6 Consideration of E10 as a measure to reduce gasoline prices, energy security, and CO2 emissions" in NEED HP DOCUMENT.

Issues and Countermeasures to implement E10

1. Legal Aspects :

In April 2012, the E10 note was added to the mandatory standards of the Quality Assurance Act. The Ministerial Ordinance was amended to allow blending of up to 10% ethanol.
NO LEGAL RESTRICTION on E10 implementation.

2. Technical Aspects :

(1) Vehicles: E3 can be used in the same way as other regular gasoline, and E10 can be used in any vehicle that is compatible with E10 as international standard.

(2) Infrastructure: 17 years ago (2005), infrastructure investment for E10 was estimated at 332 bill.yen. It is essential to re-estimate the amount strictly in line with the actual situation, taking into account the decrease in the number of refineries and service stations (approx. 30% decrease), past duplicated estimate made for blending facilities, and the current status of facilities at service stations (ETBE has already been introduced), etc.

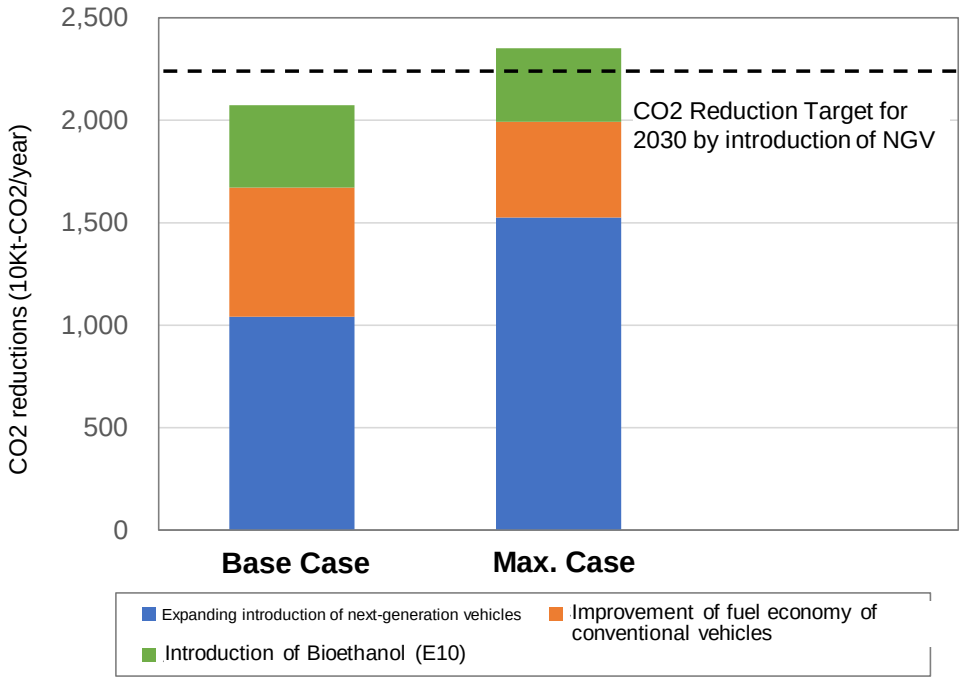
3. Supply Stability :

Compared to the production volume of 55 mill. kl /year in the U.S. and 38 mill. kl /year in Brazil, the volume of ethanol required for the introduction of E10 in Japan is only 2.47 mill. kl/year.
So there is NO CONCERN about Supply Stability.

Article 5 of Sony's 18 Articles of Development:
Reasons why you can't do something are proof that you can do it.
We can solve the reasons why we can't do it.

Calculation of CO_2 Reduction in FY 2030 by NGV + E10

		Base Case		Max. Case	
		CO2 Reductions (10kt-CO2/year)	Ratio to Target	CO2 Reductions (10kt-CO2/year)	Ratio to Target
National Target		2,287	100%	2,287	100%
Improvement of fuel economy of conventional vehicles		630	28%	468	20%
Expansion of NGV (Next-Generation Vehicles)	EV	129	6%	338	15%
	HV	832	36%	968	42%
	PHV	64	3%	168	7%
	FCV	17	1%	51	2%
	Subtotal	1,042	46%	1,525	67%
Insufficient Quantity		**615**	**27%**	**294**	**13%**
Introduction of Bioethanol	Conventional vehicles	284	12%	211	9%
	HV	110	5%	128	6%
	PHV	8	0%	21	1%
	Subtotal	402	18%	359	16%
Total (NGV + E10)		2,075	91%	2,353	103%
Insufficient Quantity		**212**	**9%**	**-66**	**-3%**



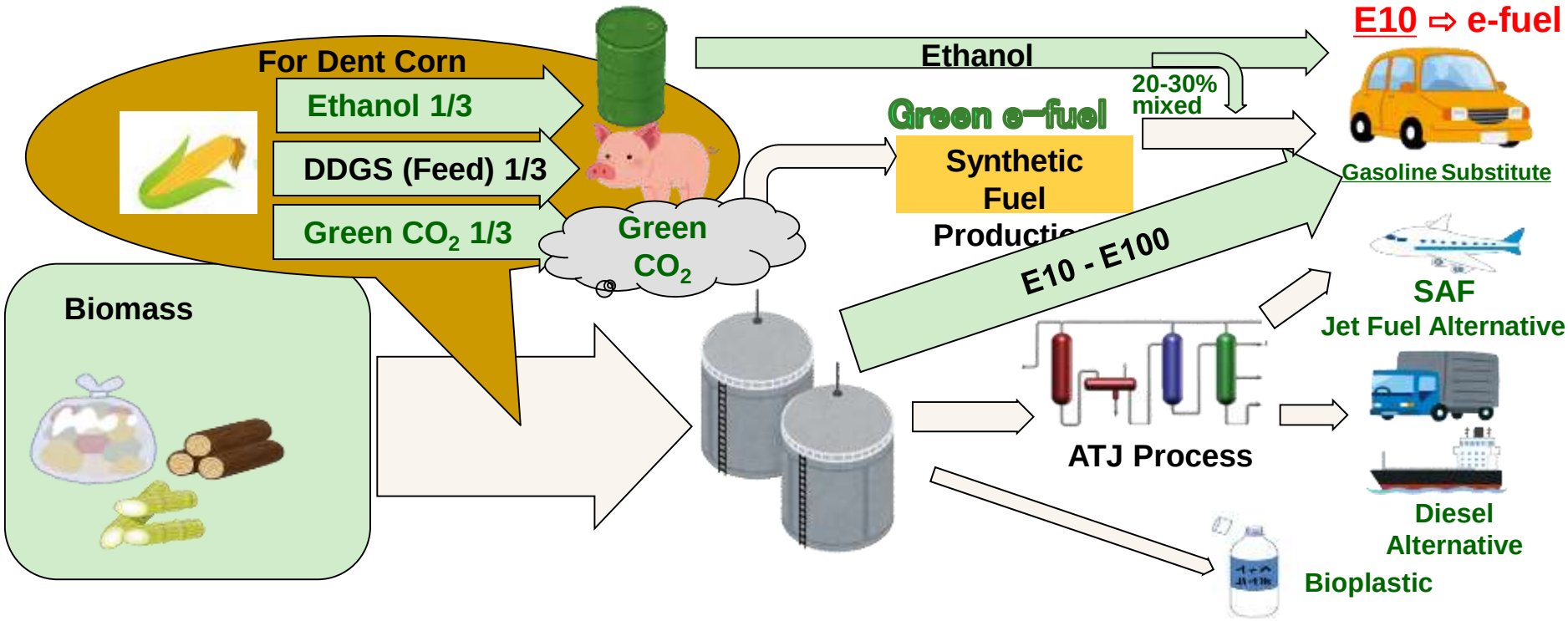
By Introducing E10 in Conventional Vehicles, HVs, and PHVs, National CO2 Reduction Targets can be achieved.

For details of the analysis, please refer to Chapter 3 of the "Illustrated Guide to Carbon-Neutral Fuels" or ” Proposal to introduce Bioethanol (E10) as additional measure to Reduce CO2 Emissions in Transportation Sector on Oct.30, 2021" in NEED HP (DOCUMENT).

Expansion to Synthetic Fuels and Bioethanol Platforms

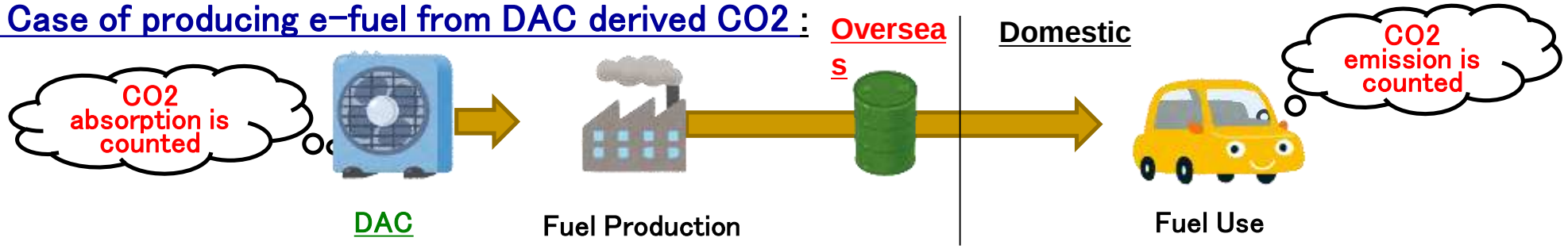
Production of **e-fuel** using **Green CO2** generated during Bioethanol production.
Building "**Bioethanol Platform**" by Co-production of **SAF (ATJ)**, Bioplastics, etc.

- Produce 100% Carbon Neutral "Green e-fuel" , as Synthetic Fuel of Green Hydrogen and Green CO_2
- Bioethanol can be blended with e-fuel at 20-30% to produce "Ideal CNF (Carbon Neutral Fuel)"



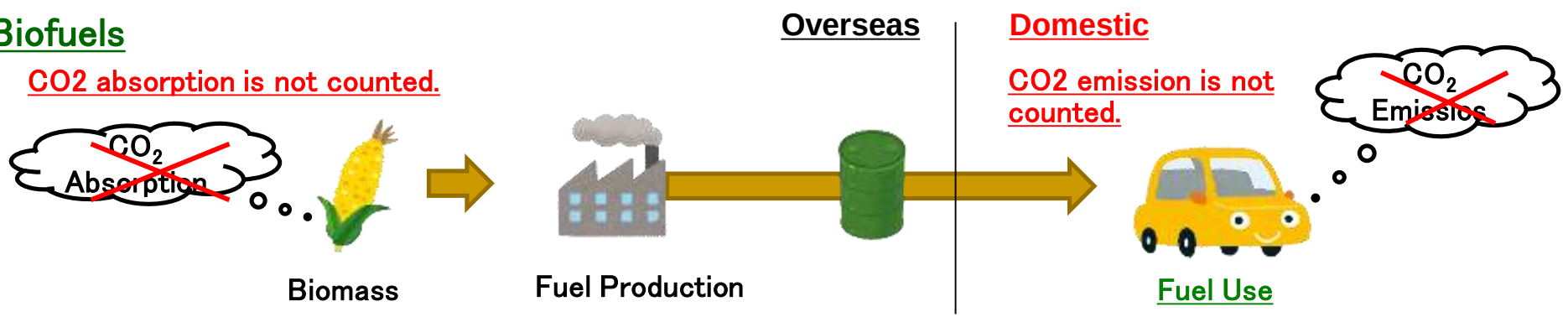
IPCC Rules for CO_2 Emissions Counting

In Case of producing e-fuel from DAC derived CO2 :



Under IPCC rules, if e-fuel is produced from CO_2 absorbed by DAC, the amount of Reduction should be the amount of CO_2 absorbed.
CO_2 emissions must be counted ,when imported e-fuel is burned (It can not be counted as GHG Reductions in Japan).

For Biofuels



For Carbon Neutral Biofuels, CO2 Emission at the time of burning is considered to have been absorbed by Biomass.
(The idea is that it can be offset on Global Scale and counted as Zero.)

Note: For simplicity, energy input and CO2 emissions at intermediate stages are not taken into account.

Potential of Domestic Bioethanol Production

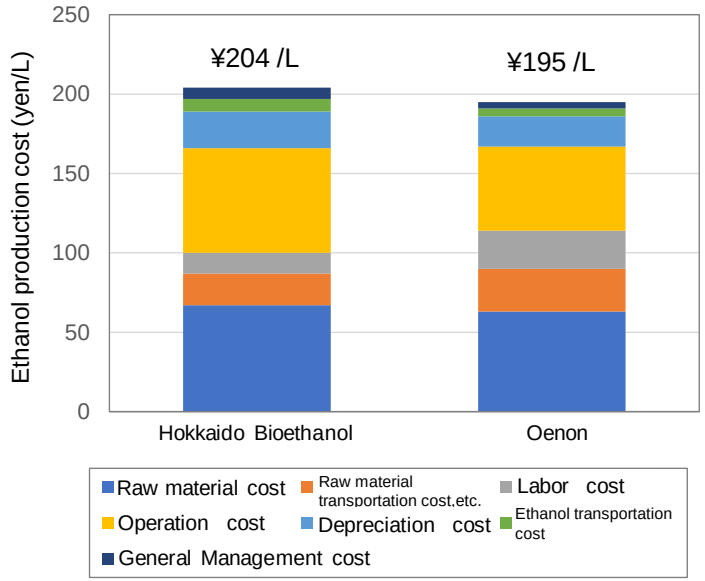
1. Production Potential:

- **Dent Corn:** 700,000 ha※1 x 9.1 t/ha※2 x 0.4 kL/t※2 = 2.5 mill. kl /year
- **High-harvest Rice:** 700,000 ha※1 x 5.3 t/ha※2 x 0.45 kL/t※2 = 1.7 mill. Kl /year

※1 The 700,000 ha planted area is the total of devastated farmland (280,000 ha) in 2018 and abandoned farmland (423,000 ha) in 2015, Ministry of Agriculture, Forestry and Fisheries.

※2 Biomass harvested and ethanol produced by the Ministry of the Environment, Global Environment Subcommittee of the Central Environment Council (2007).

2. Production Cost:



Raw Material Cost

- Hokkaido Bioethanol (¥67 /Liter):
  Off-Spec Wheat : 23.3 yen/kg,
  Government-owned Rice: 30.0 yen/kg
- OENON (¥63 /Liter)
  Hokkaido Rice :15.0 yen/kg,
  Government-owned Rice : 20.0 yen/kg

It may be lower in case of Forage Crops Raw Material

Source: Report of the verification committee for the project to establish a biofuel production base (2014).

2nd Gene. Bioethanol Production Technology Development Projects

Sekisui Chemical Co:

(1) Project Owner: **Sekisui Biorefinery, Ltd.**
(2) Site: Kuji City, Iwate Prefecture
(3) Raw materials/Product : 1-2 kl/day of Ethanol from approx. 20 tons/day of Waste
(4) Production Process: Pyrolysis gasification, gas purification, microbial liquefaction (LanzaTech, USA)
(5) Remarks: Ministry of the Environment-commissioned project, 1/10-scale demonstration project, scheduled to start operation in November this year

Green Earth Institute (GEI) :

(1) Project Owner : **GEI**
(2) Site: Kazusa, Kisarazu, Chiba Prefecture
(3) Raw materials/Product : Bioethanol from used Clothes for SAF production (JEPLAN / JAL)
Production of Ethanol and Bio-Chemicals from inedible Biomass (Sojitz)
(4) Production Process: Process utilizing Simultaneous C5/C6 Fermentation by RITE GMO Bacteria
(5) Remarks: Listed on Mothers in Dec 2021, President Ihara used to work for METI/Energy Agency

Source: JEPLAN
(former Nihon Kankyo Sekkei)

Biomaterial in Tokyo (Bits) :

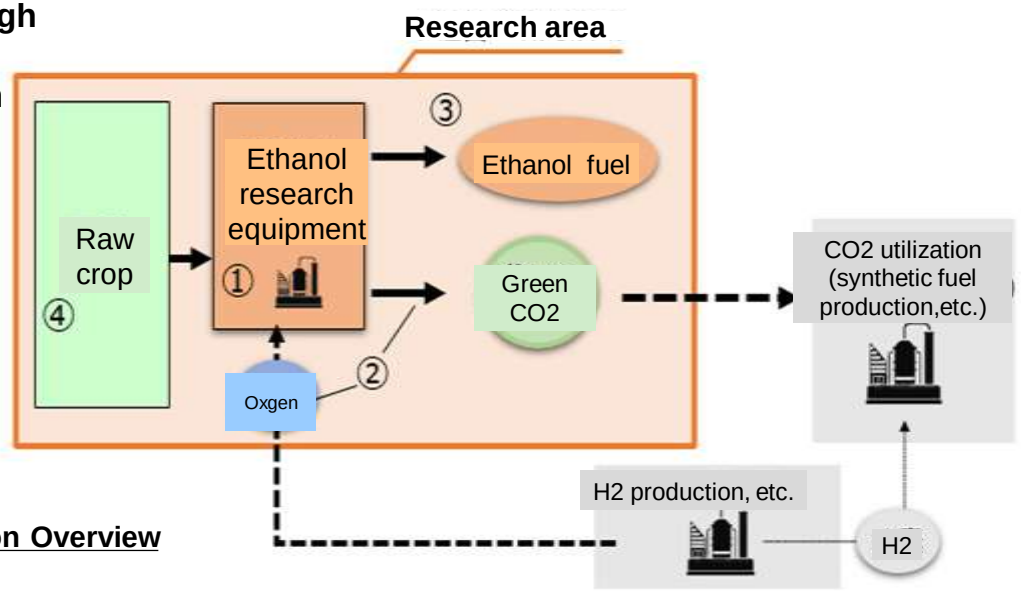
(1) Project Owner : **Bits**
(2) Sites : Kawasaki City, Kanagawa Prefecture , Niigata City, Niigata Prefecture
(3) Raw materials / Product : Bioethanol from Recovered Paper and Waste Pulp
→ SAF (Sanyu Plant), Bio-Chemicals manufacturing
(4) Production Process: Saccharification & Fermentation Process of Cellulose Raw Materials
(5) Remarks: NEDO demonstration project, President Izumi used to work for Oji Paper Co.,Ltd.

Ethanol / e-fuel Production Technology Development Project

"Next Gene. Green CO_2 Fuel Technology Research Association" was established on July 1, 2022 in order to improve Production Efficiency of Bioethanol & to Produce "e-fuel". Technology Development of Bioethanol Production was started to realize Carbon-Neutral Society.

To realize a Carbon-Neutral Society, Research on Technology to efficiently produce Bioethanol fuel for Automobiles through the use of Biomass and the optimal circulation of hydrogen, oxygen, and CO_2 during production shall be promoted.

① **Research on Efficient Production Systems for Ethanol**
② **Research on recovery and utilization of byproduct Oxygen and CO_2**
③ **Research on efficient operation of the entire system, including fuel utilization**
④ **Research on efficient Raw Material Crop Cultivation Methods**



Source: TOYOTA HP

Next Generation Green CO_2 Fuel Technology Research Association Overview

Date of establishment: July 1, 2022
Chairman of the Board: Koichi Nakata (General Manager, TOYOTA CN Development Dept.)
Union members: TOYOTA, ENEOS, SUZUKI, SUBARU, DAIHATSU, TOYOTA TSUSHO
Head Office Address: 230 Shimonokami Aza Shimizu, Okuma-machi, Futaba-gun, Fukushima Prefecture Fukushi Prefecture
Okuma-town Incubation Center
Purpose : R & D for improving the efficiency of Carbon-Neutral Technologies

“Asia Biomass Community ”

Under Public-Private Partnerships, Biofuel and Synthetic Fuel Production Projects of Development-Import type and Local Production-for-Local-Consumption type will be developed in Southeast Asia through Joint Ventures with Local Companies.
Development-import type projects in Southeast Asia ,U.S.& Brazil proceeded by Japanese should be regarded as “Quasi-Domestic” Projects.

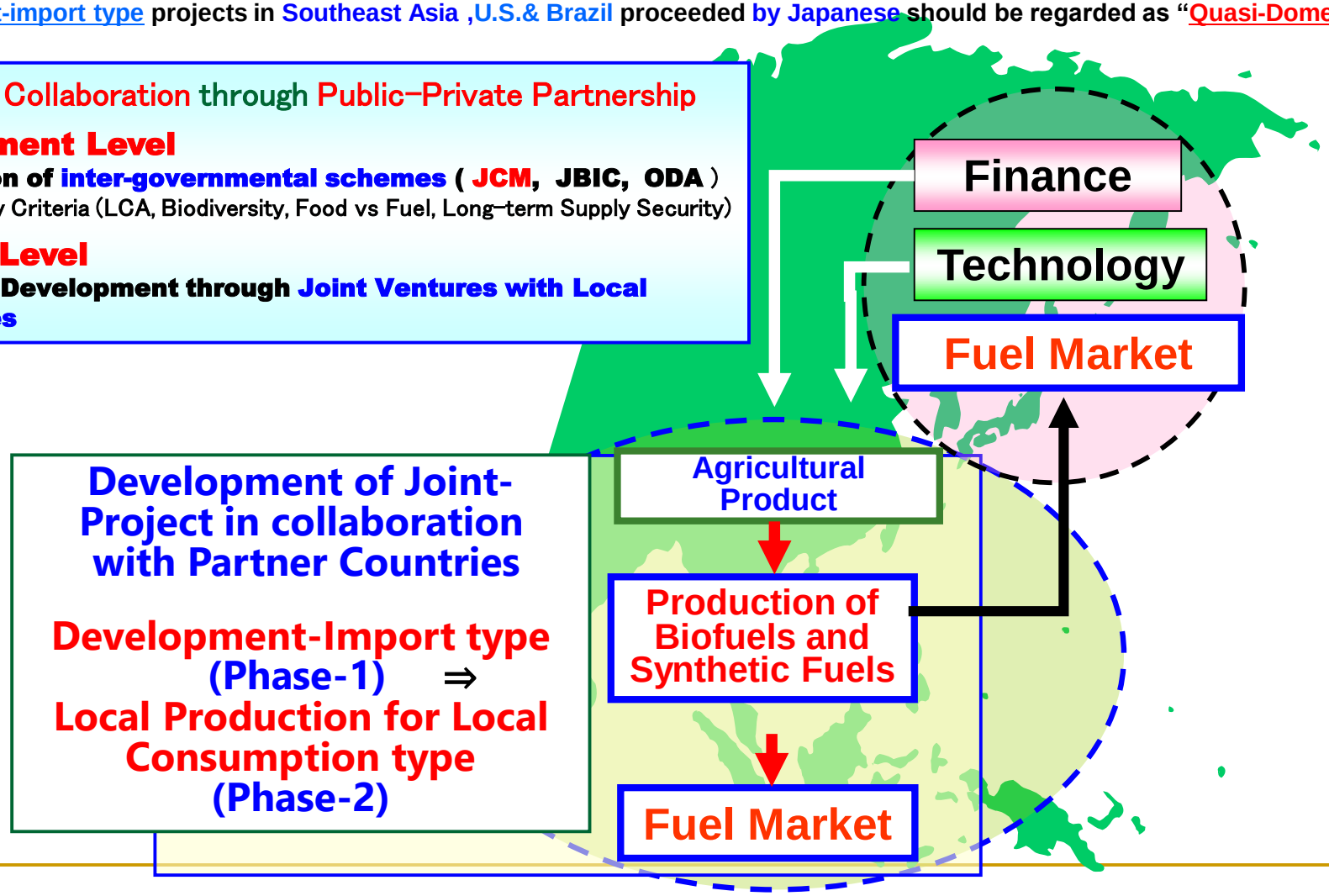
Strengthen Collaboration through Public–Private Partnership

■ **Government Level**

- **Application of inter-governmental schemes (JCM, JBIC, ODA)**
- Sustainability Criteria (LCA, Biodiversity, Food vs Fuel, Long–term Supply Security)

■ **Private Level**

Business Development through Joint Ventures with Local Companies



Development of Joint-Project in collaboration with Partner Countries

Development-Import type (Phase-1) ⇒ Local Production for Local Consumption type (Phase-2)

“Illustrated Guide on Carbon-Neutral Fuels”

Released on May 21, 2022
Edited by ” Team for Promotion of CN^2 * Fuels”
Publisher: Gijutsu-Hyohron Co.Ltd.
(＊CN^2 : Carbon Neutral & Carbon Negative)

Table of Contents:

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Toshiyuki Hamada (Counselor, The Institute of Applied Energy): Chapter 4
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Thank you for your attention !

NEED Nippon Environmental Energy Development Co.

HP: http://need.co.jp

(Details are as per the Reports in “Document” in NEED HP)