

Full-Scale Introduction of E10 / E20 & SAF in Japan

July 21&22, 2026
at Shizuoka University

NEED

Nippon Environment and Energy Development Co., Ltd.

Issei Sawa

Profile

- 1980** Joined Mitsubishi Corporation (Machinery Group, Construction Machinery Division)
- 2000 ~** Engaged in new business development related to biomass energy (**over 25 years**)
- July 2016** Founded Japan Environmental Energy Development Co., Ltd. (**NEED**) and assumed the position of Representative Director
Active as an advisor to corporations and organizations as a **consultant specializing in biomass energy**
Gave lectures at seminars sponsored by government agencies (METI, MAFF, MEXT, NEDO, JBIC, etc.), universities, research institutions and private companies/organizations, and at overseas symposia sponsored by governments in Indonesia, Thailand, etc.
- External evaluation committee member of the "New Automotive Fuel Research Center" and "Biomass Refinery Research Center" at Advanced Industrial Science and Technology (AIST, **METI**) (**2007-2014**)
 - Member of the METI Study Committee on "Sustainability Standards for Biofuels" (**2008-2010**)
 - Study committee member for **NEDO's** "2010 Biomass Energy Introduction Guidebook"
 - Member of the "Biomass Commercialization Strategy Study Team" for seven government ministries
 - Served in positions such as member of the METI "Second-Generation Biofuel Strategy Study Group" (**February-July 2013**)
 - Chairperson of the Biomass Working Group at the NPO Agricultural-Urban Congress (**2016-18**)
 - Established the Association for Biomass Power Generation (**BPA**). Vice Representative Director (**2016-18**)
 - Invited Researcher, **Waseda University** Institute for Environmental Studies (2016~Present)
 - **April 2019** Received the "Higashikuni-no-miya International Culture Award"
 - **March 2020** Supervised Seed Planning's "2020 Edition: Current Status and Future of Global Warming and Coal-fired Power Generation"
 - **March 2022** Gentosha's "Understanding Bioethanol Through Manga" (supervised at the **American Grains Council**)
 - **May 2022** Co-authored Gijutsu-Hyoron-Sha's "Illustrated Guide to Understanding Carbon Neutral Fuels"



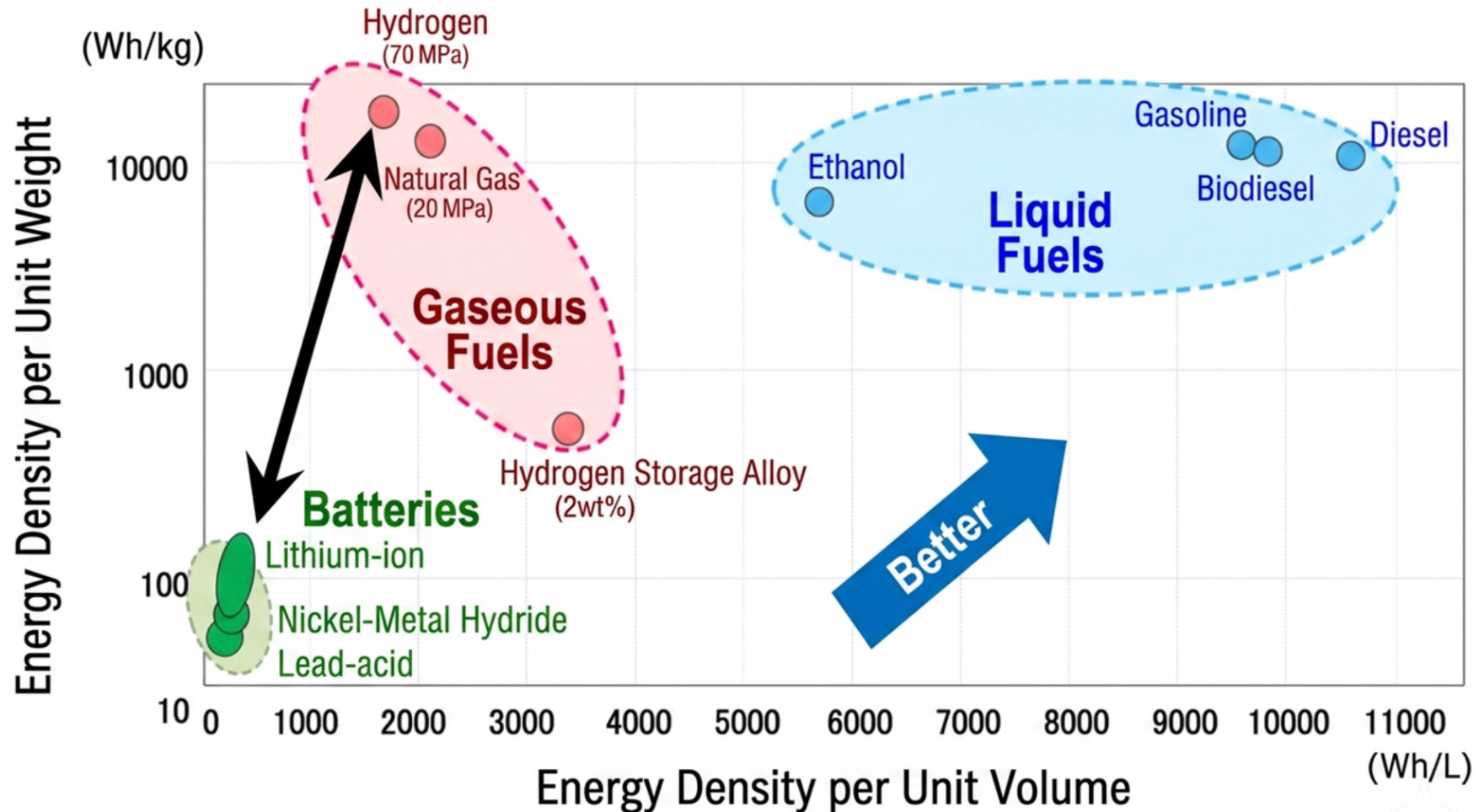
Transition of Japanese Energy Policy Since 2010

June 2010	'Third Strategic Energy Plan' (70% from nuclear and renewables)
March 2011	Great East Japan Earthquake (Fukushima Daiichi Nuclear Accident)
July 2012	Enactment of the 'FIT Act (Renewable Energy Feed-in Tariff System)'
April 2014	'Fourth Strategic Energy Plan' (Renewables, highly-efficient coal-fired power)
July 2015	Announcement of 'FY2030 Energy Mix'
December 2015	COP21 (Paris Agreement)
December 2017	Announcement of 'Basic Hydrogen Strategy' (Realization of a 2050 Hydrogen Society)
July 2018	'Fifth Strategic Energy Plan' (80% reduction in CO2 by FY2050)
January 2020	Announcement of 'Innovative Environmental Innovation Strategy' (Carbon recycling, hydrogen, ammonia, etc.)
July 2020	METI expresses 'Inefficient Coal-fired Power Fade-out Policy'
October 2020	Former Prime Minister Suga ' Declaration of 2050 Carbon Neutrality (Net-Zero) '
October 2021	'Sixth Strategic Energy Plan' (46% reduction in CO2 by 2030)
February 2022	Invasion of Ukraine by Russia
April 2022 onwards	Launch of ' Public-Private Council on SAF ' by the Agency for Natural Resources and Energy
September 2022 ~	Launch of ' Public-Private Council on Synthetic Fuels ' by the Agency for Natural Resources and Energy
February 2023	'Basic Policy for GX Realization' (150 trillion yen in GX-related investments over 10 years, with government contribution of 20 trillion yen)
June 2024	LDP ' League of Diet Members on Biofuels and Synthetic Fuels ' Recommendation Paper (6 study sessions held between October 2022 and March 2023)
November 2024	Agency for Natural Resources and Energy ' Subcommittee on Decarbonized Fuel Policy ' (Policy for E10 introduction by 2030, E20 introduction by 2040)
December 2024	Agency for Natural Resources and Energy renames ' Public-Private Council on Synthetic Fuels ' to ' Next-Generation Fuels (including Biofuels) '
February 2025	' Seventh Strategic Energy Plan ' (Includes descriptions of E10 introduction by 2030 and E20 introduction by 2040)

Energy Evaluation Axes “S + 3 E + 2 E”

- **S**afety
 - **E**nergy Security
 - **E**nvironment
 - **E**conomical Efficiency
 - **E**arnings (Profitability /Business Viability)
 - **E**mployment (Job creation)
-

Comparison of Energy Density per Unit Volume and Weight of Various Fuels



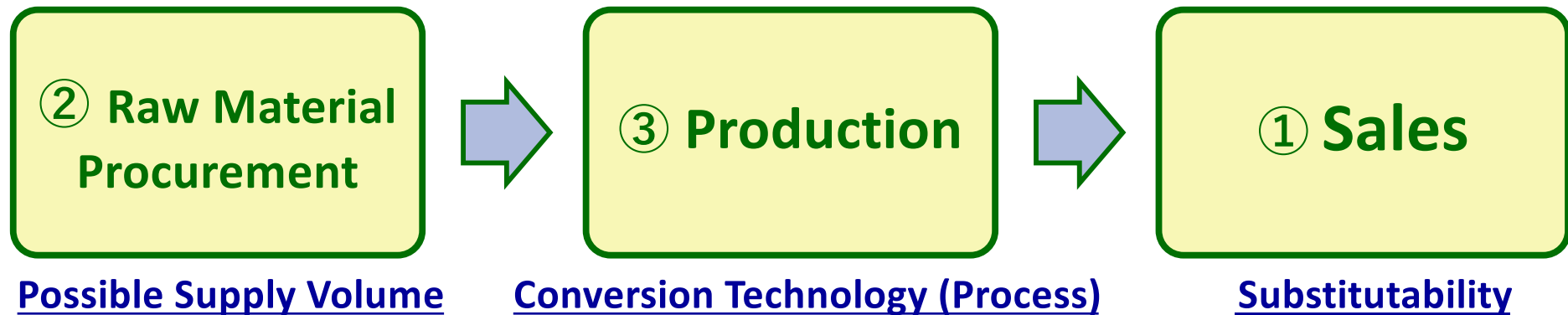
Source) Agency for Natural Resources and Energy, "Carbon Neutrality Even in Engine-Powered Vehicles? What Are Green Liquid Fuels, "Synthetic Fuels"?" (July 2021)

https://www.enecho.meti.go.jp/about/special/johoteikyo/gosei_nenryo.html

Types of Carbon Neutral (CN) Fuels

Classification		Type	Conversion Technology (Process)	Main Applications	Main Raw Materials / Feedstock	Fossil Fuels Replaced
Liquid Fuel	Biofuel	Bioethanol	First Generation (C6 Saccharification, Fermentation)	Passenger cars (ETBE, direct blending) SAF Feedstock (ATJ)	Corn, Sugarcane, Cassava, Beet, Wheat, Sweet Sorghum	Gasoline
			Second Generation (C5/C6 Saccharification, Fermentation)		Cellulose feedstock: Old paper, Pulp, Lignocellulosic biomass, Plant residue, Household waste, Waste paper, Exhaust gas	
		Biodiesel	FAME (Fatty Acid Methyl Ester)	Trucks, Buses, Heavy equipment, Farm machinery, Ships	Waste cooking oil, Vegetable oil, Animal fats, Microalgae	Light oil (Diesel) / Heavy oil
			HVO, RD (Hydrogenated Vegetable Oil / Renewable Diesel)			Light oil (Diesel) / Heavy oil
		SAF	HEFA, ATJ etc.	Aircraft	HEFA (Bio-HEFA), Ethanol (ATJ), Synthetic gas (FT, BTL), Microalgae	Jet fuel
	Fuels	e-fuel etc.	FT Synthesis, Methanol Synthesis	Passenger cars, Aircraft, Trucks, Buses, Heavy equipment, Farm machinery	Green hydrogen, Green CO2	Gasoline, Gas oil, (Diesel), Jet fuel
	Ammonia	Ammonia	-	Power generation	Green/Blue hydrogen, N	Coal
Gaseous Fuel	Gaseous	e-methane	Sabatier catalyst reaction, Biometanation, SOEC methanation	City gas, Ships	CO2 (DAC, Blast furnace gas, Wastewater treatment gas, Biogas etc.), Green/Blue hydrogen, or Water (SOEC methanation)	City gas (PG, NG)
	Hydrogen	Hydrogen	Water electrolysis etc.	Passenger cars, Trucks (FCV, Hydrogen engine), Power generation, Aircraft, Ships, Heavy equipment, Farm machinery	Renewable energy electricity, Water	Coal, NG, Gasoline, Light oil (Diesel), Jet fuel
Solid Biofuel	Woody Biofuel	Wood chips, Wood pellets	Crushing/Grinding, Pellet molding, Second generation: Torrefaction	Coal-fired power generation, Heat utilization (Boilers etc.)	Woody (Coniferous/Broadleaf), Herbaceous (Sorghum, Napier grass etc.), Waste biomass	Coal, Heavy oil, Kerosene
Electricity	Renewable Electricity	Solar, Wind, Hydro, Geothermal, Biomass	Power generation	Passenger cars, Trucks (BEV), Heavy equipment, Farm machinery	Solar, Wind, Hydro, Geothermal, Biomass	Gasoline, Light oil (Diesel)

Business Feasibility Evaluation Criteria in the Supply Chain



Business Feasibility Evaluation Criteria (KPI) :

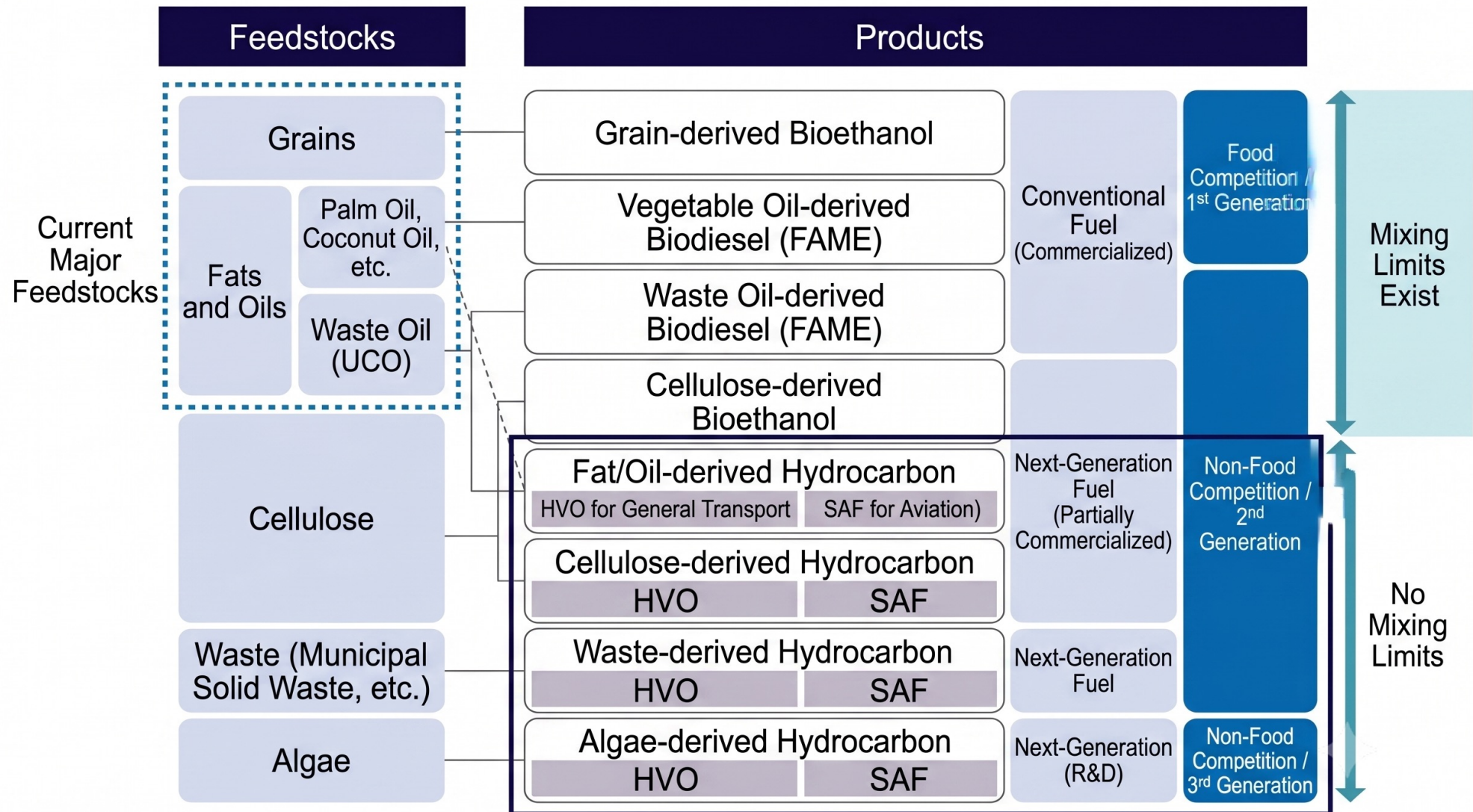
- **Quality** : Efficiency
Convenience
Environment
- **Quantity** : Sustainable
- **Cost** : Affordable

Comparison of Various Biofuels

		Blending Limits	Technical Maturity	Production Costs	Life Cycle GHG Emissions
Conventional Fuels	Conventional Bioethanol	△ Blending limit exists (approx. E5 to 20)	◎ Technically mature	◎ ※Relatively cheapest among biofuels but extremely high compared to fossil fuels	△ Requires blending into gasoline during use
	Conventional Biodiesel (FAME)	△ Blending limit exists (approx. B5 to 30)	◎ Technically mature	◎ ※Relatively cheapest among biofuels but extremely high compared to fossil fuels	△ Requires blending into diesel during use
Next-Generation Fuels	Oils & Fats-Derived Hydrocarbons (HVO)	○ No blending limit	◎ Technically mature	○ Cost is higher than conventional biofuels	○ Emissions are comparable to conventional biofuels, but blending into diesel is not required
	Cellulosic Ethanol	△ Blending limit exists (approx. E5 to 20)	△ R&D to demonstration stage	✕ Highest production cost, excluding algae	○ Emissions are lower than conventional biofuels, but blending into gasoline is required
	Cellulosic Hydrocarbons (FT process)	○ No blending limit	△ R&D to demonstration stage	△ Production cost is higher than HVO, and expected to remain higher in the future	◎ Emissions are lower than conventional biofuels, and blending into diesel is not required
	Waste-Derived Hydrocarbons (FT process)	○ No blending limit	○ Partially commercialized	△~○ Currently higher than HVO, but potential to become comparable or cheaper with production cost reduction	◎ Emissions are lower than conventional biofuels, and blending into diesel is not required
	Algal-Derived Hydrocarbons	○ No blending limit	✕ R&D stage	✕ Comparing to costs of other feedstocks, algae is over 10 times higher	△ Current technology has higher emissions than conventional biofuels

Source) Nikkei XTECH, Biofuels Expected in 2nd to 3rd Generation (2022.9.21) <https://xtech.nikkei.com/atcl/nxt/column/18/02148/00004/>

Types of Biofuels by Raw Material



Note) UCO: Used Cooking Oil, FAME: Fatty Acid Methyl Esters, HVO: Hydrotreated Vegetable Oil

Source) Nikkei XTECH, Biofuels Expected in 2nd to 3rd Generation (2022.9.21), <https://xtech.nikkei.com/atcl/nxt/column/18/02148/00004/>

Japan's CO₂ Emission Reduction Targets (Draft Commitments)

Guidelines for Emissions by Sector of Energy-Derived Carbon Dioxide (Unit: Million t-CO₂/year, Non-LCA Base)

	Guidelines for Emissions by Sector for Fiscal Year 2030	Fiscal Year 2013 (2005 Level)
Energy-Derived CO ₂	927	1,235 (1,219)
Industrial Sector	401	429 (457)
Commercial and Other Sectors	168	279 (239)
Residential Sector	122	201 (180)
Transportation Sector	163	225 (240)
Energy Conversion Sector	73	101 (104)

Source: Global Warming Prevention Headquarters, Japan's Draft Commitments (2015.7)

Japan's CO₂ reduction target is 308 million t-CO₂ (26%) by fiscal year 2030. Achieving this requires a transportation sector emissions reduction of **62 million t-CO₂ (27.4%)** by fiscal year 2030.

Passenger Car CO₂ Reduction Measures (Introduction of Next-Generation Vehicles, Fuel Efficiency Improvements, Biofuels)

Progress Status of the Global Warming Countermeasures Plan in **FY2018** (Released March 30, 2020, Ministry of the Environment)

	Unit		2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Measure evaluation indicators		Result	23.2	25.6	32.3	33.8	36.7													
Percentage of next-generation vehicles in new car sales	%	Forecast (Upper)								50										70
		Forecast (Lower)								20										50
Average fuel efficiency of vehicles owned	km/L	Result	14.7	15.3	16.0	16.6	17.2													
		Forecast (Lower)								18.5										24.8
Energy savings	10 ⁴ kL	Result	19.9	49.2	85.1	89.7	128.6													
		Savings								283.4										938.9
Emission reductions	10 ⁴ t-CO ₂	Result	53.3	131.5	227.5	239.8	343.0													
		Results								702.5										2379

By **FY2030**, emission reduction of $2,379 \times 10^4$ t-CO₂/year (**2,089*10⁴ t-CO₂/year** from **FY2018 onwards**) is necessary.

$$*2089 = 2379 - (343.0 - 53.3)$$

What are E10 and SAF?

- What is E10?

- A fuel produced by **directly blending 10% bioethanol** into gasoline
- **E10 and above is the Global Standard** for gasoline worldwide
- Japan is still at **E1.7** (as an ETBE additive)
- Why Japanese People? Is this acceptable as it is?
(Atsugiri Jason)

- What is SAF?

- Abbreviation for **Sustainable Aviation Fuel**, a jet fuel alternative
- IATA has decided to implement SAF as a CO2 reduction measure for the aviation industry
- **Airlines are required to reduce CO2 by 10% by 2030.**
- **Bioethanol** is attracting attention as a primary raw material for SAF



日本だけが知らない「バイオエタノール」

アメリカ製ガソリン

バイオエタノール

トウモロコシやサトウキビなどの
植物から作られるエタノール

アメリカのガソリンには
10%もバイオエタノールが入っているよ

Bioethanol blended fuel used in Motorsports

F1 World Championship
(in Europe and various
countries worldwide)
E10 introduced since 2022

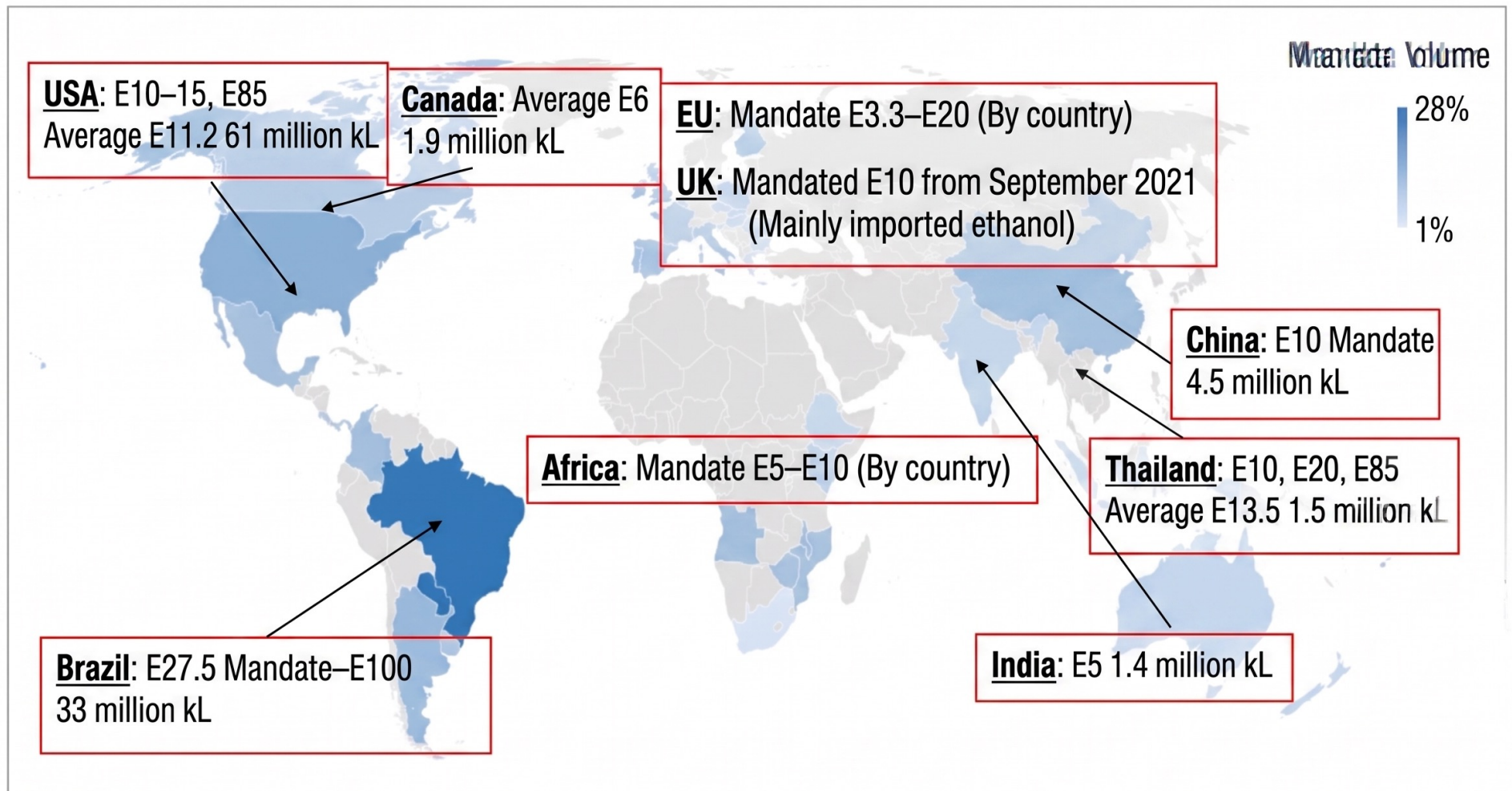


Indy Car Series
(North America)
E85 introduced since 2007



Provided by: Jun'e Dan, Japan Motorsports Journalists and Writers Association

Global Status of Bioethanol Blended Fuel Introduction



Global bioethanol consumption in 2018 was **112 million kL** (Approx. 6 trillion yen market sale)
E10 or higher is **Global Standard!**

Source: Biofuels Digest (2020) and various reports from www.USA

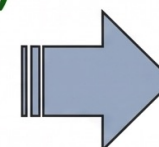
In Japan, still at E1.7 equivalents lowest level

1. **Introduction:** a gasoline octane improver or ETBE (additive), a blended in small proportion

Bioethanol Mass Ratio **45% 830,000 kL (E1.7)**



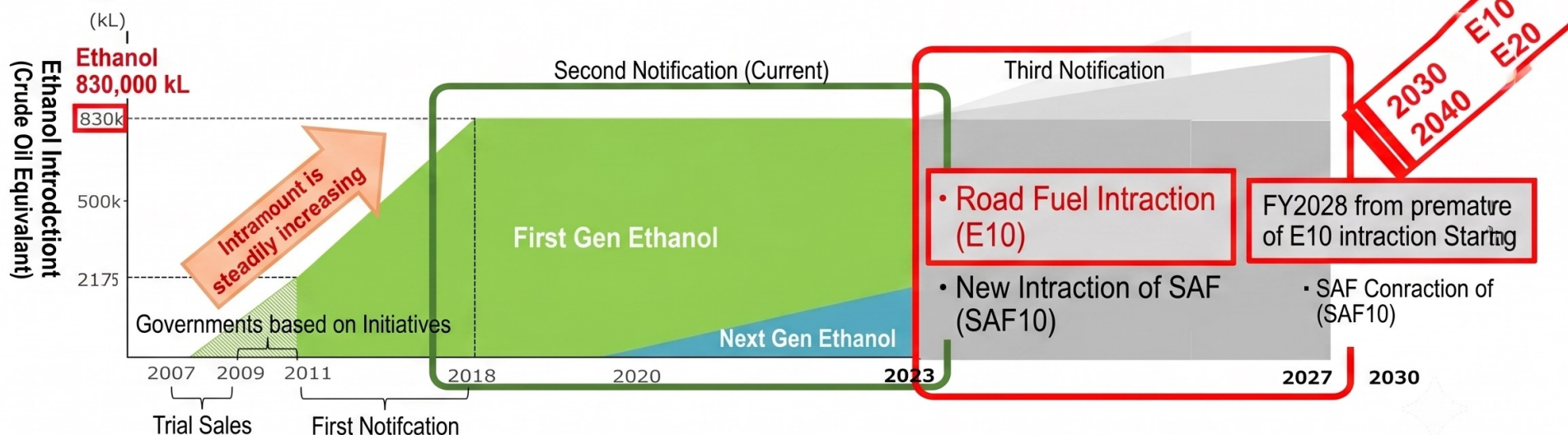
Isobutylene (Petroleum-derived) **55%**



ETBE (40)

1,960,000 kL
Ethyl Tertiary
Butyl Ether

2. **Energy Sophistication of Supply Structures :**

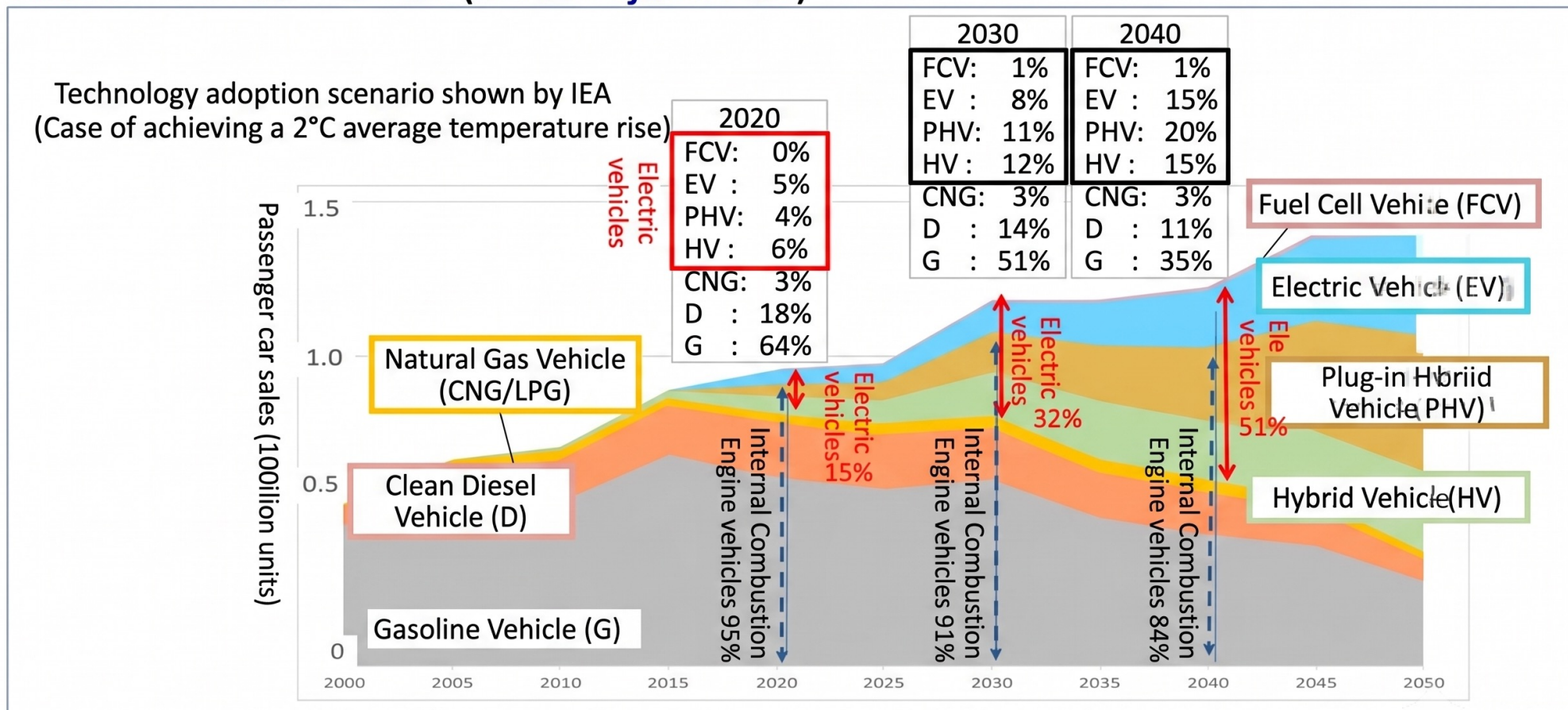


From the CO2 redpective of Japan's (ntls), introduction of **E10** (gasoline, over 40 million kL) is over **10 times more effective than SAF10** (domestic lines, 4 million kL)

"Biofuel Sustainability Standards Committee (2008–2010) ", "Committee for Technical Considerations toward the Introduction of Biofuel in Japan (2017–2022)"
"Decarbonized Fuel Policy Subcommittee. Public-Private Council on Next-Generation Fuels (Synthetic Fuels) (2024–Present)"

The Reality of Global BEV Adoption Projections

For vehicle stock, **Internal Combustion Engine vehicles** will remain at **91%** in **2030** and **84%** in **2040** (IEA Projections).

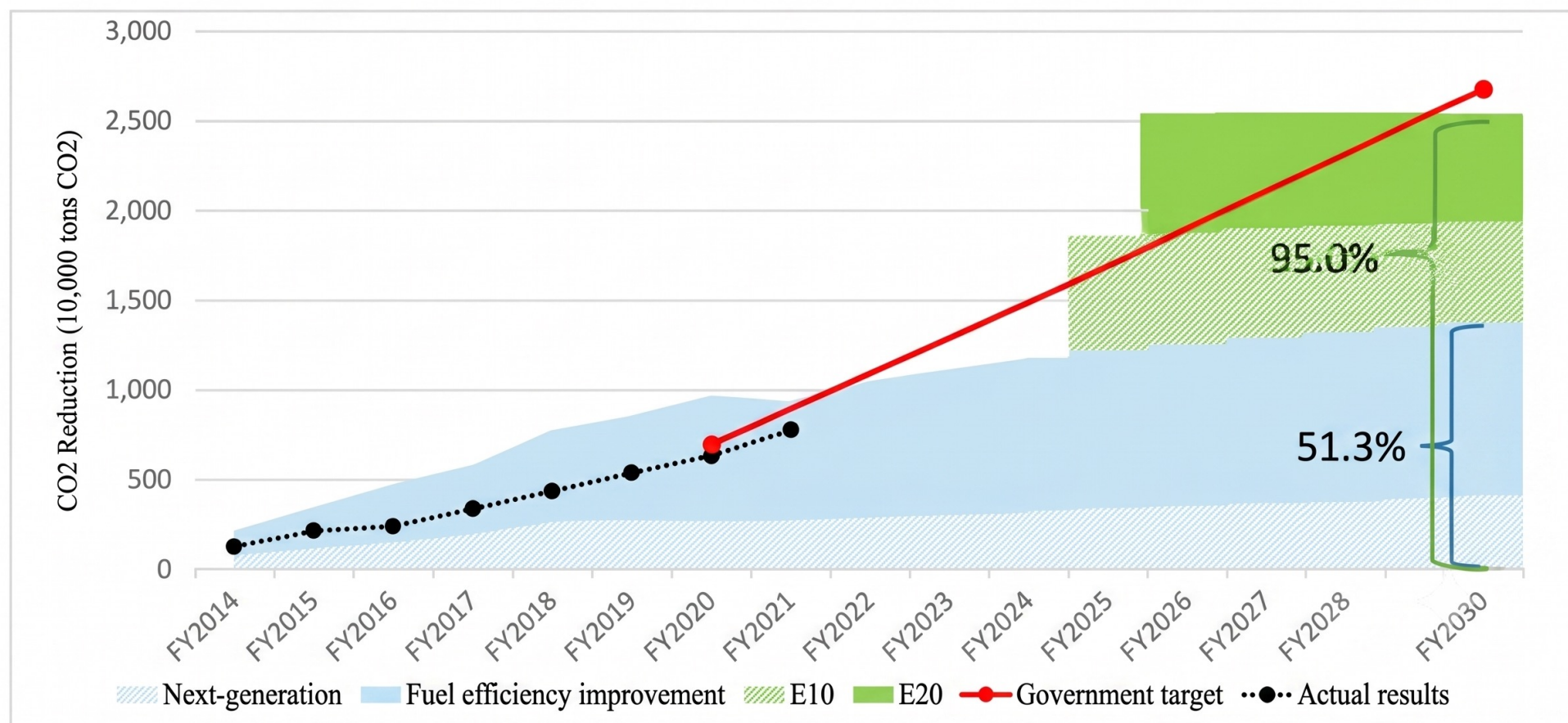


The power required when replacing all vehicles in **Japan** with **BEVs** is **approximately 200 billion kWh** (equivalent to a **20% increase in total power capacity** is required).

(Source) Created by the Ministry of Economy, Trade and Industry based on IEA "Energy Technology Perspectives) 2017"

Necessity of Early Introduction of E10 and E20 (CO₂ Reduction Effect Simulation)

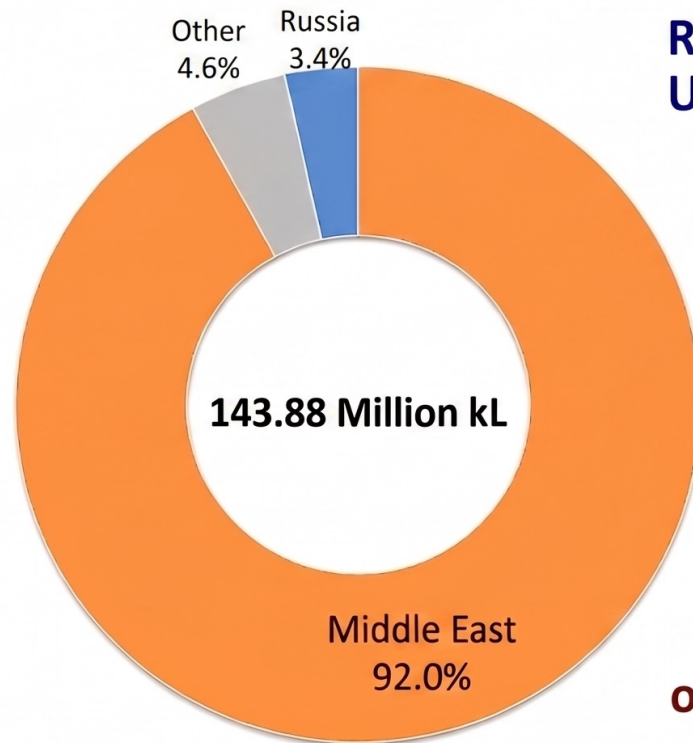
- Current measures, such fuel efficiency improvement and neneration vehicle introduction, are insufficient.
- Falling short of CO₂ reduction targets since FY2021, at this rate FY2030 will remain at 51.3% of the government target.
- To recover from target shortfalls after FY2021, introducing **E20** in FY2030 will be too late.
- **FY2025 E10** introduction and **FY2026 E20** introduction can achieve up to 95.0% of the government target.



(Simulation results from the Institute of Applied Energy)

Introduction of Biofuels as an Energy Security Policy

95.1% Crude Oil Imports Reaching 95.1%, Introducing Biofuels is Effective as a Policy to Reduce Middle East Reliance.

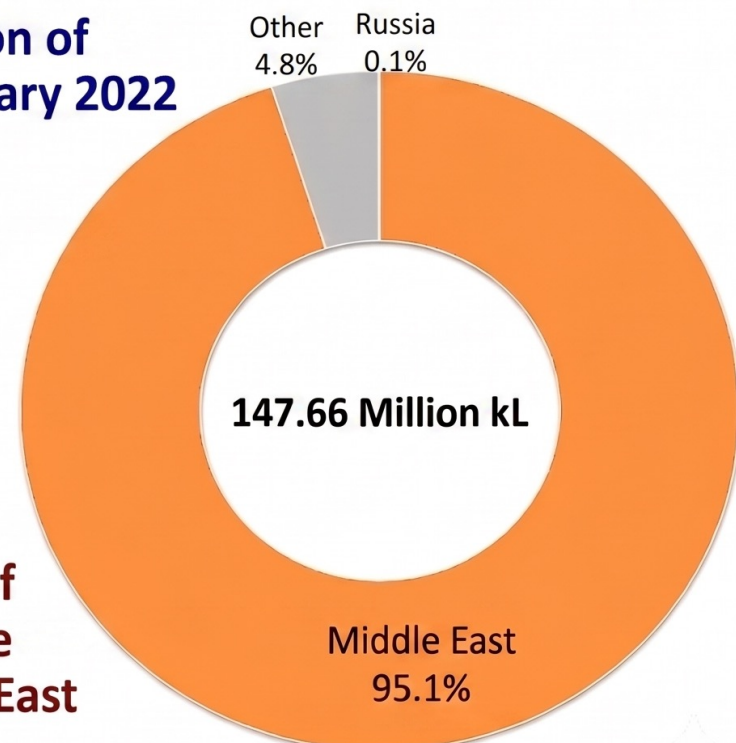


**2020 Crude Oil Import
Volume and Breakdown**

**Russian Invasion of
Ukraine, February 2022**



**Expansion of
Dependence
on the Middle East**



**2023 Crude Oil Import
Volume and Breakdown**

Source: Agency for Natural Resources and Energy, Petroleum Statistics (Annual Report)

Retail prices of E10, E15, E85 in the United States



E85
106 yen/L

E15
132 yen/L

E10
138 yen/L

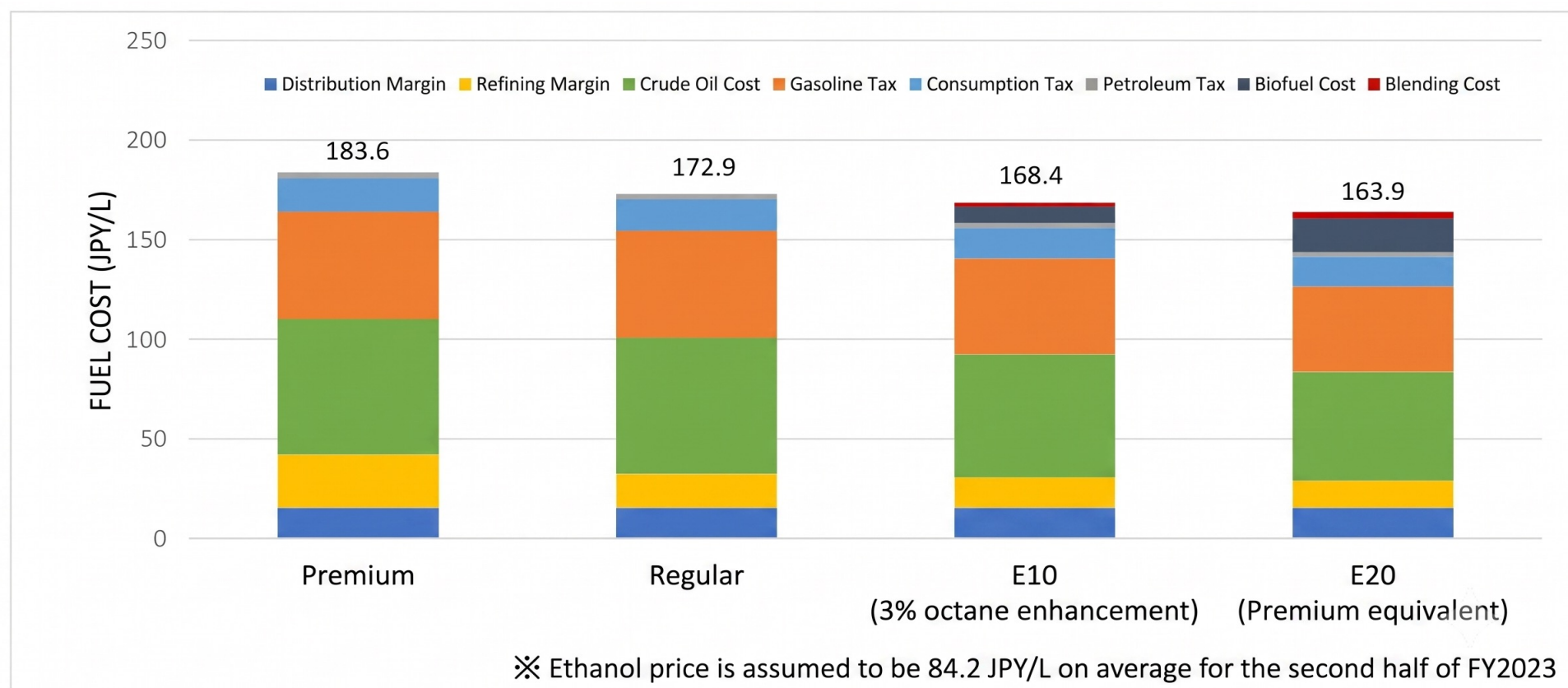
Gasoline
161 yen/L (@¥155/U.S.D)

Because low-octane sub-octane gasoline (BOB) can be used as the base gasoline mixed with bioethanol, it becomes significantly cheaper

EFFECTIVENESS AS A GASOLINE PRICE CONTAINMENT MEASURE (E10/20 VS. GASOLINE COST COMPARISON)

- E10 will be ¥4.5 /L cheaper than Regular, ¥15.2 /L cheaper than Premium
- E20 will be ¥8.9 /L cheaper than Regular, ¥19.7 /L cheaper than Premium

※ Blending gasoline is Regular (base without subsidy), not sub-octane (BOB)



(Simulation results by The Institute of Applied Energy)

Truth about the 'Food Competition Issue' Surrounding Bioethanol

Past media reports that 'bioethanol production has a major impact on food' are different from the truth



Feed Corn

Dent Corn

Annual Import Volume (FY2020) : 15.37 million tons (98.7%)

Main Uses **Livestock feed**, Corn starch,
Ethanol production



Sweet Corn

Annual Production Volume approx. 200,000 tons (1.3%)

Main Uses **Food**

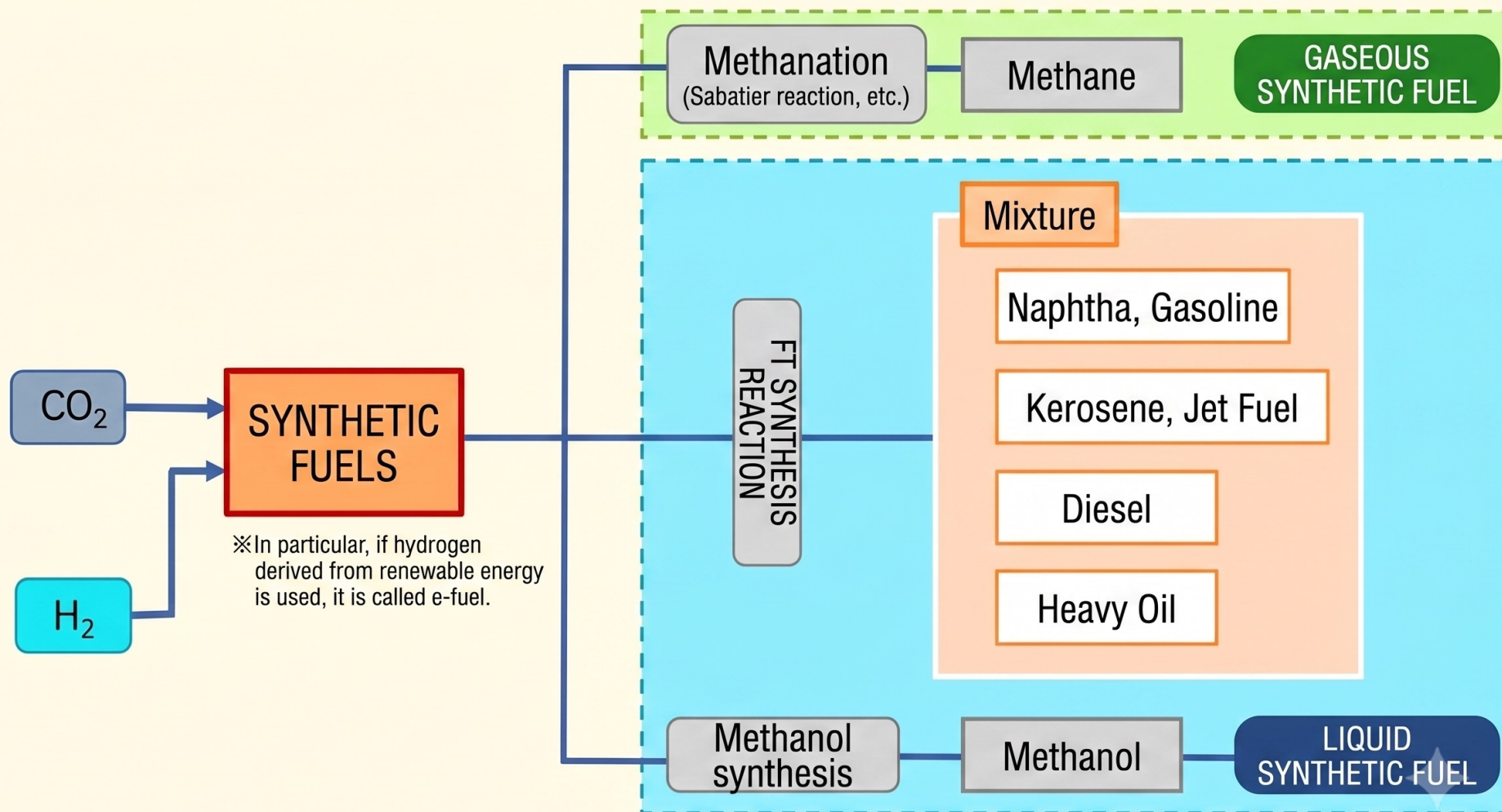
※ Of this, **DDGS** remaining after ethanol production is a raw material for **livestock feed**.

[DDGS] [Distiller's Dried Grains with Solubles]

Grain residue remaining from alcoholic beverage or bioethanol production using grains like corn. Rich in protein and fats, it is used as a raw material for compound feed. Grains distillation residue. Corn distillation residue.

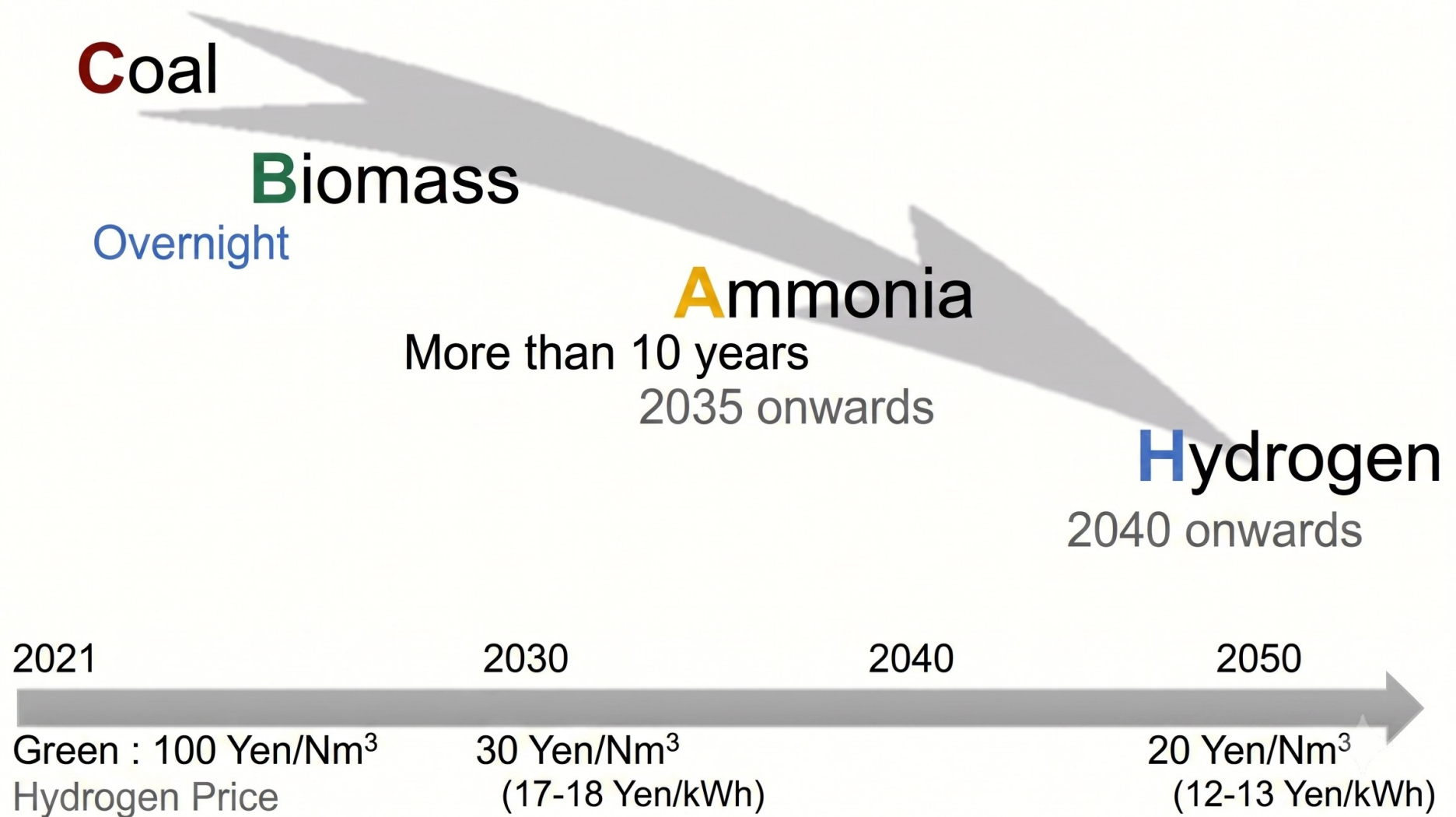
Food corn accounts for of the total annual corn production **Only 1.3%** → **There is virtually no impact on the dining table**

OVERVIEW OF SYNTHETIC FUELS



Source) Agency for Natural Resources and Energy, Decarbonizing even internal combustion engine cars? What are green liquid 'synthetic fuels'? (2021.7)
https://www.enecho.meti.go.jp/about/special/johoteikyo/gosei_nenryo.html

Future Outlook for Green Hydrogen Prices



Synthetic Fuel Manufacturing Technology and Cost Outlook

Targeting ¥700/L now, ¥350/L by 2030, and ¥200/L by 2050.

H ₂	CO ₂	Manufacturing Cost		※Calculation based on the results of the NEDO study, “Research for Identifying Development Seeds for Liquid Fuel Manufacturing Technology from CO ₂ (2020.3)”
¥100/Nm ³ × 6.34Nm ³ /L	¥5.91/kg × 5.47kg/L			
= ¥634/L	+ ¥32/L	+ ¥33/L	= Approx. ¥700/L	Case where domestic hydrogen is used to manufacture synthetic fuel domestically.
(¥32.9/Nm ³ + ¥14.65/Nm ³) × 6.34Nm ³ /L				
= ¥301/L	+ ¥32/L	+ ¥33/L	= Approx. ¥350/L	Overseas hydrogen is transported to domestic manufacture synthetic fuel domestically.
¥32.9/Nm ³ × 6.34Nm ³ /L				
= ¥209/L	+ ¥32/L	+ ¥33/L	= Approx. ¥300/L	Synthetic fuel is manufactured overseas.
¥20/Nm ³ × 6.34Nm ³ /L				
= ¥127/L	+ ¥32/L	+ ¥33/L	= Approx. ¥200/L	Case where the future hydrogen price becomes ¥20Nm ³ .

Proposal of the “Diet Members’ League for Promoting Domestically-Produced Biofuels and Synthetic Fuels” (2023.06.01)

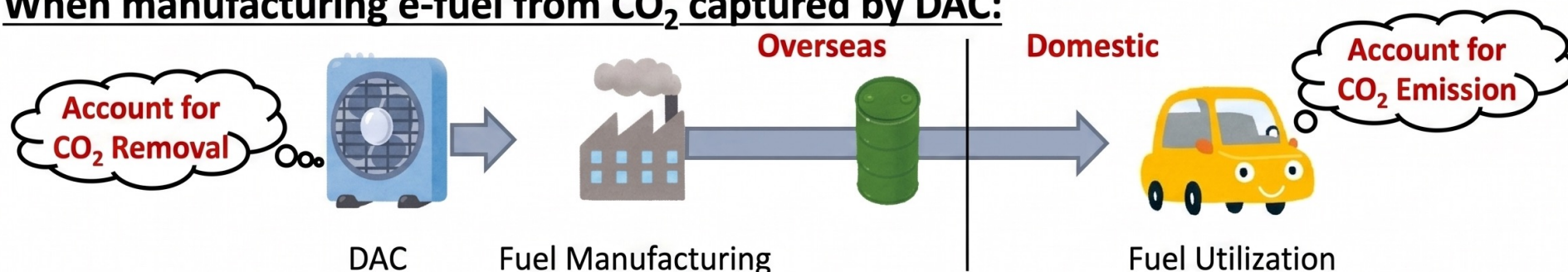
Proposal of the “Diet Members’ League for Promoting Domestically-Produced Biofuels and Synthetic Fuels for Carbon Neutrality”

[Proposals to the Government] (Held 6 study group meetings from October 2022 to March 2023)

- ① Regarding the leading aviation sector, in anticipation of expanding biofuel use to e-fuel implementation and application, promptly present an overall policy package that includes manufacturing support, establishment of price pass-throughs and carbon credit incentives, and securing of overseas partnerships and rights, to vitalize corporate activities.
- ② From the perspective of advancing the decarbonization of the entire vehicle fleet in the most crucial (**Automotive Sector - RED**), through the prompt presentation of a series of policy packages, such as (**increasing the introduction ratio of biofuels**) and ensuring manufacturing, distribution, price pass-throughs, and incentives for the social implementation of e-fuels, demonstrate the possibility of selecting EVs or internal combustion engines utilizing e-fuels / (**biofuels**) in accordance with needs and regional characteristics.
- ③ While advancing domestic procurement or the securing of rights for the raw materials of (**biofuels**), including SAF, undertake technological development, demonstration, and implementation for the construction of a domestic / semi-domestic model for (**biomass resources**) in order to establish a stable supply chain through cooperation between the supply and demand sides.

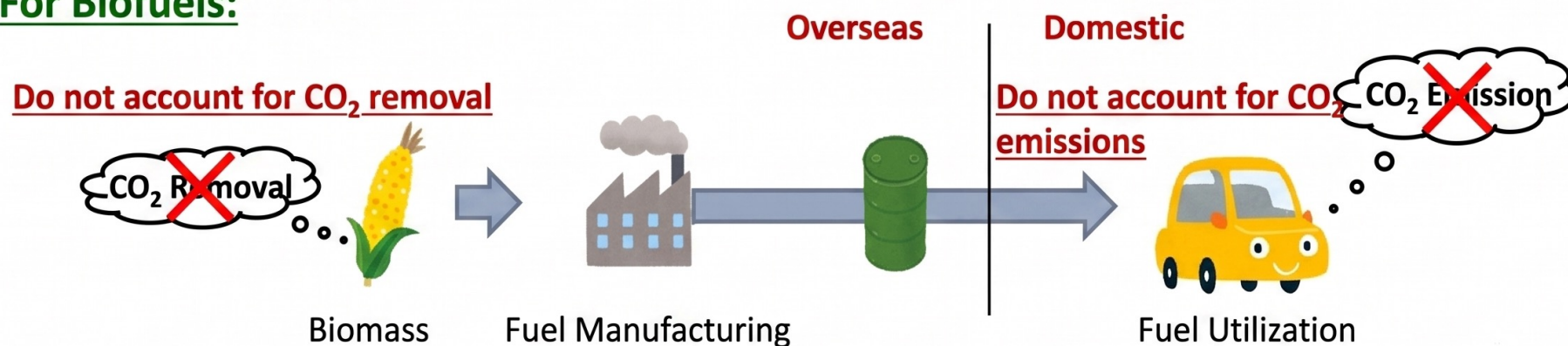
IPCC Rules Regarding CO₂ Emission Counting

- When manufacturing e-fuel from CO₂ captured by DAC:



Under IPCC rules, if e-fuel is manufactured using CO₂ captured by DAC as a feedstock, **the amount of CO₂ captured counts as a removal amount**. When the imported e-fuel is combusted, it is necessary to **account for the emission of CO₂** (this does not lead to GHG removal in Japan).

- For Biofuels:



* For simplicity, energy inputs and CO₂ emissions at intermediate stages are not considered

For carbon-neutral biofuels, the amount of CO₂ emissions at the point of combustion is considered to have been offset by absorption. (The concept is that it is offset globally and results in a zero count)

On the Potential of Domestic Bioethanol!

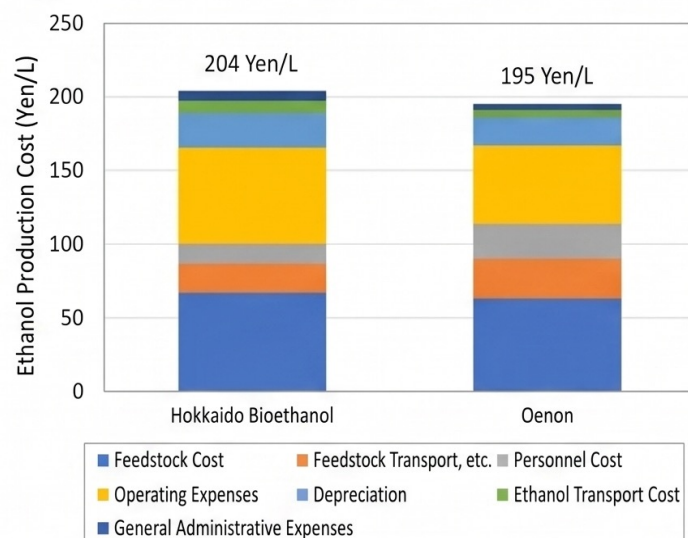
1. Production Potential (Estimation from Abandoned & Derelict Agricultural Land in Japan) :

- **Dent Corn:** $700,000 \text{ ha}^{*1} \times 9.1 \text{ t/ha}^{*2} \times 0.4 \text{ kL/t}^{*2} = \underline{2.5 \text{ Million kL}}$
- **High-Yield Rice:** $700,000 \text{ ha}^{*1} \times 5.3 \text{ t/ha}^{*2} \times 0.45 \text{ kL/t}^{*2} = \underline{1.7 \text{ Million kL}}$

* 1 The planted area of 700,000 ha is the sum of derelict agricultural land in 2018 (280,000 ha) and abandoned cultivated land in 2015s (423,000 ha), Ministry of Agriculture, Forestry and Fisheries.

※2 Biomass yield and ethanol production quantity are from the Central Environmental Council, Global Environment Committee, Ministry of the Environment (2007).

2. Production Cost (From Past Hokkaido Examples) :



Bioethanol Feedstock Cost and Production Cost

- **Hokkaido Bioethanol (204 Yen/L) :**
Off-Grade Wheat 23.3 Yen/kg, Government-Owned Rice 11.0 Yen/kg
- **Oenon (195 Yen/L) :**
Hokkaido Rice 15.0 Yen/kg, Government-Owned Rice 20.1 Yen/kg

In the case of feed crops, there is a possibility of reduction

Source: Verification Committee Report for the Biofuel Production Base Establishment Project (2014)

3. Potential in the E10 Demonstration Project in Okinawa, to be Implemented from FY2028:

Approx. 650,000 kL/year of Okinawa's gasoline consumption, equivalent to 10%, is 65,000 kL/year

Second-Generation Bioethanol Production Technology Development Project

1. Sekisui Chemical Co., Ltd.:

- (1) Project Entity: Sekisui Bio-Refinery Co., Ltd. (Sekisui, INCJ)
- (2) Site: Kuji City, Iwate Prefecture
- (3) Feedstock / Production: Producing approx. 1–2 kL/day of ethanol from approx. 20 tons/day of **general and industrial waste**
- (4) Production Process: Pyrolysis gasification, gas purification, liquefaction by microorganisms (US LanzaTech)
- (5) Remarks: Commissioned project by the Ministry of the Environment; while a prospect for practical application was established, the production cost was high, and commercialization was judged difficult. In December 2025, **Sekisui announced its withdrawal.**



2. Green Earth Institute (GEI):

- (1) Project Entity: GEI
- (2) Site: Kazusa, Kisarazu City, Chiba Prefecture
- (3) Feedstock / Production: Bioethanol from **clothing waste** → SAF production (JEPLAN / JAL)
Production of ethanol and bio-chemicals from **non-edible biomass** (Sojitz)
- (4) Production Process: Process utilizing C5/C6 simultaneous fermentation technology by RITE bacteria
- (5) Remarks: Listed on Mothers (TSE) in December 2021; CEO Ihara is from METI/Agency for Natural Resources and Energy



Source: JEPLAN (from my,
Japan Environment Design)

3. Biomaterial in Tokyo (Bits):

- (1) Project Entity: Bits
- (2) Site: Kawasaki City, Kanagawa Prefecture, and Niigata City, Niigata Prefecture
- (3) Feedstock / Production: Bioethanol from **old paper and waste pulp** → SAF (San-Yu Plant), bio-chemicals production
- (4) Production Process: Saccharification and fermentation process of cellulosic feedstock
- (5) Remarks: NEDO demonstration project; CEO Izumi is from Oji Paper

Introduction of E7 by Nakagawa Bussan

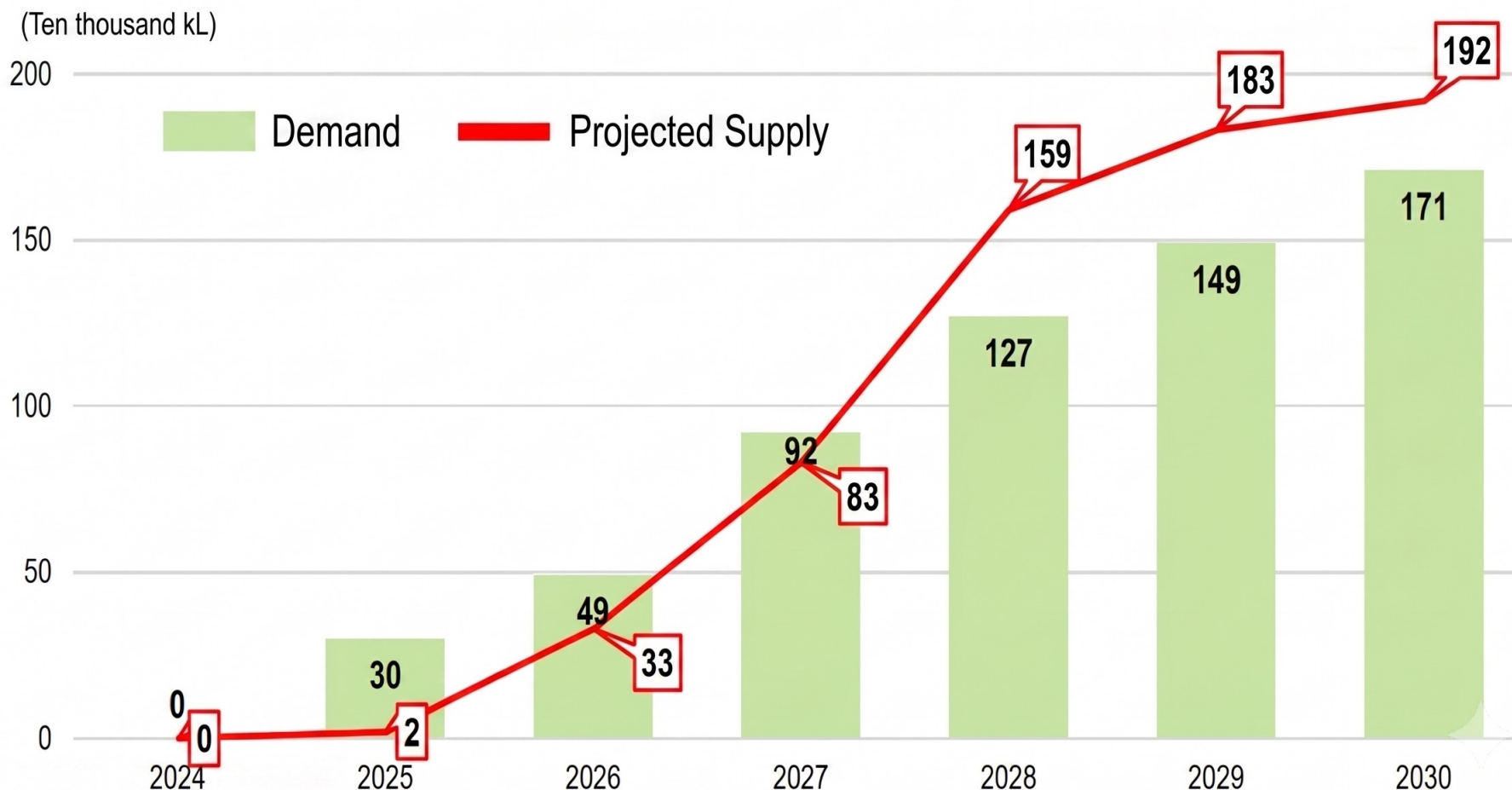
On June 8, 2023, Nakagawa Bussan (Nagoya City) held the "**E7 Gasoline Sales Start Commemoration Ceremony**".



Attended by Mr. Hosokawa, Director, Petroleum Refining & Stockpiling Div., Resources & Fuels Dept., Energy Agency, METI.

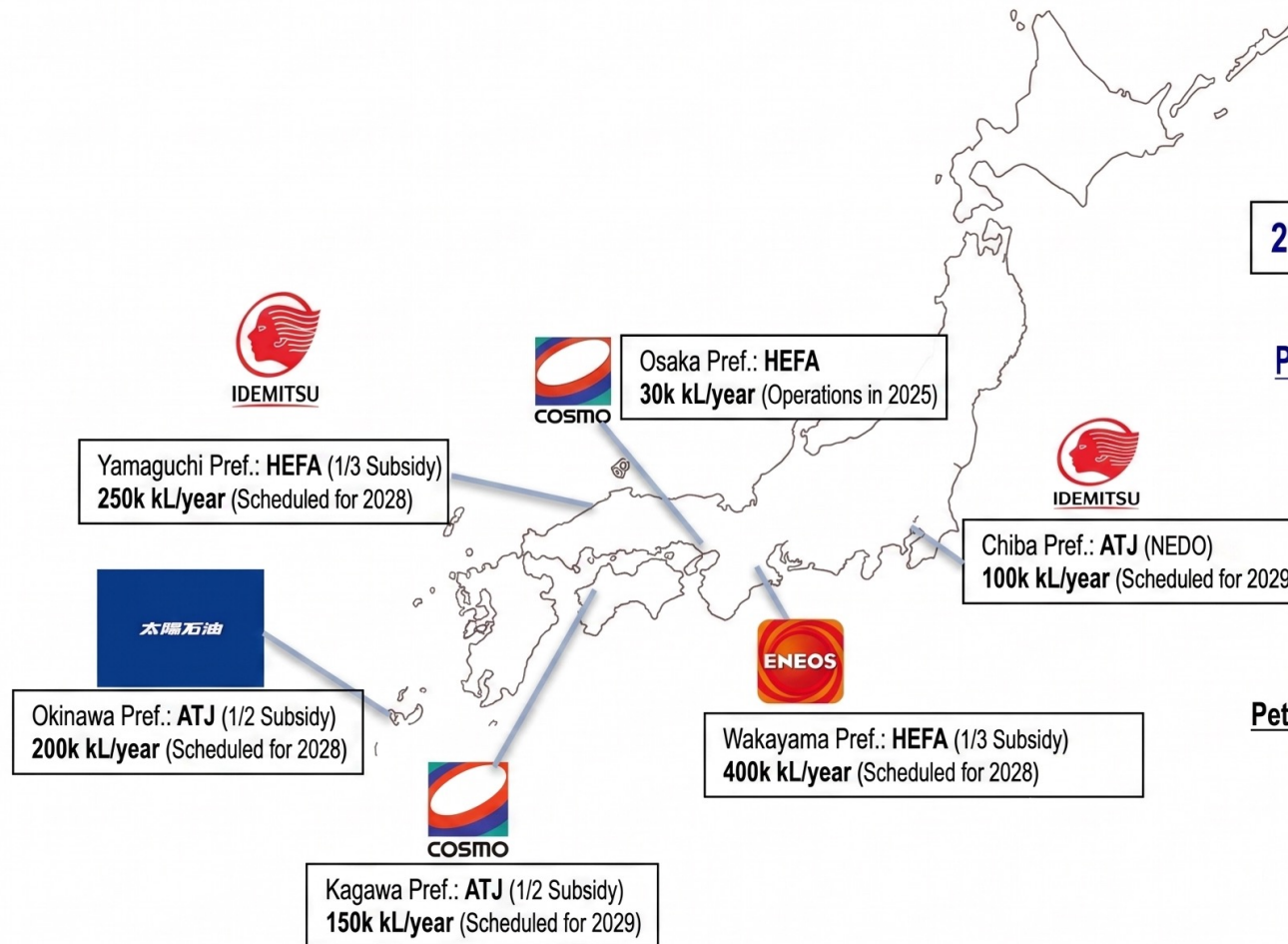
SAF Public-Private Council Interim Report (May 26, 2023)

Projections of SAF Utilization and Supply Capacity to 2030 (as of May 2023)



Source) 3rd Public-Private Council for Promoting the Introduction of Sustainable Aviation Fuel (SAF), Interim Report Draft (May 26, 2023)

SAF Production Projects in Japan



2030 Introduction Goal of **1.25 million kL/year**

Project Implementation is Tending to Delay Globally !

SAF Production Capacity Unit: 10,000 KL

Petroleum Company	HEFA	ATJ	Total
ENEOS	40	-	40
Idemitsu	25	10	35
Cosmo	3	15	18
Taiyo	-	20	20
Total	68	47	<u>113</u>

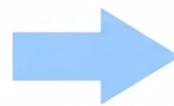
Government Policy Regarding Introduction of E10 in 2030 and E20 in 2040

- Aims to commence supply of low-carbon gasoline with a maximum bioethanol concentration of 10% by fiscal year 2030.
- Aims to make E20-compatible vehicles 100% of new passenger car sales at the earliest possible stage within the 2030s.
- Pursues the commencement of supply of low-carbon gasoline with a maximum concentration of 20% from fiscal year 2040.

Decarbonized Fuel Policy
Subcommittee
(November 11, 2024)



Next-Generation Fuel (Synthetic Fuel) Public-Private Council
(December 25, 2024)



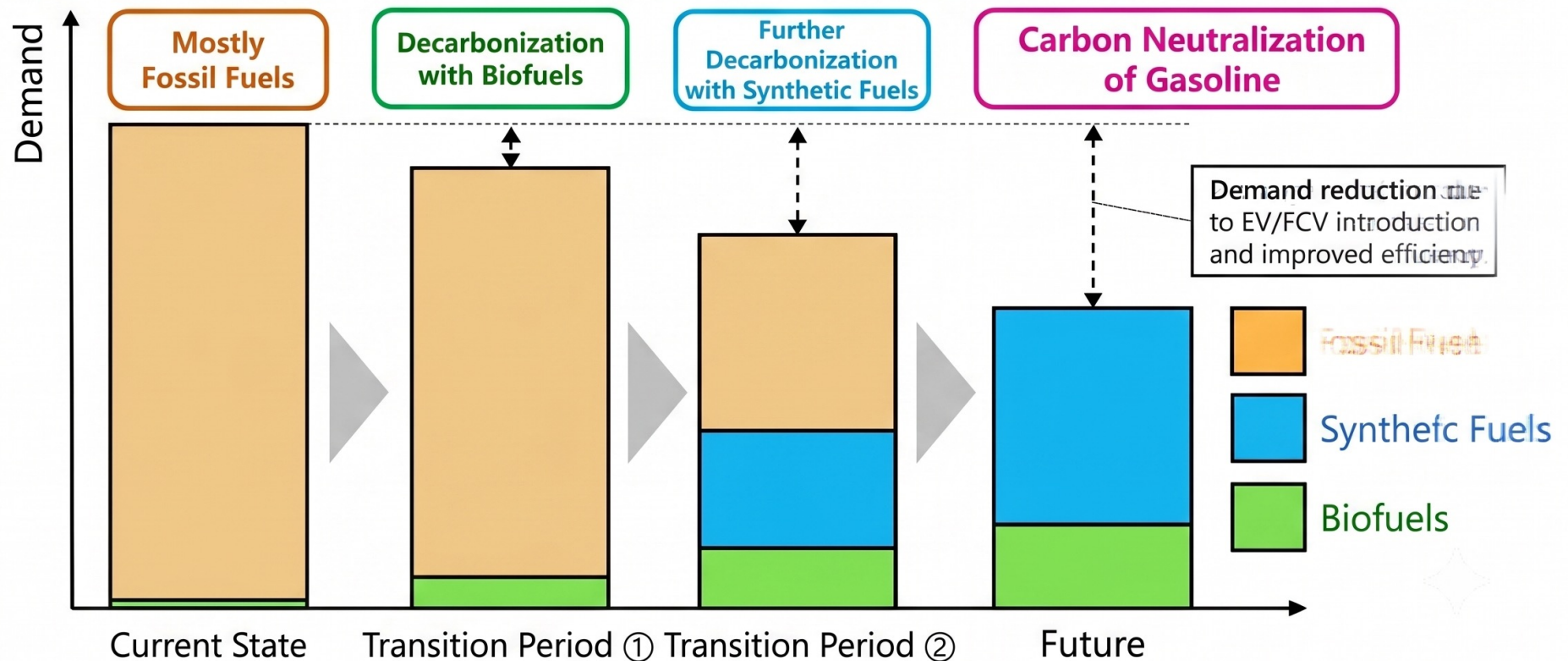
February 18, 2025 7th Strategic Energy Plan
(Cabinet Decision)

February 18, 2025 Plan for Global Warming Countermeasures
(Cabinet Decision)

The Necessity of Carbon Neutral Fuels

Conceptualizing Gasoline Carbon Neutralization

- With the introduction of EVs and FCVs, and improvements in fuel efficiency, **gasoline demand is expected to decrease**, yet **a certain level of demand will remain**.
- Therefore, **the carbon neutralization of gasoline is crucial**.

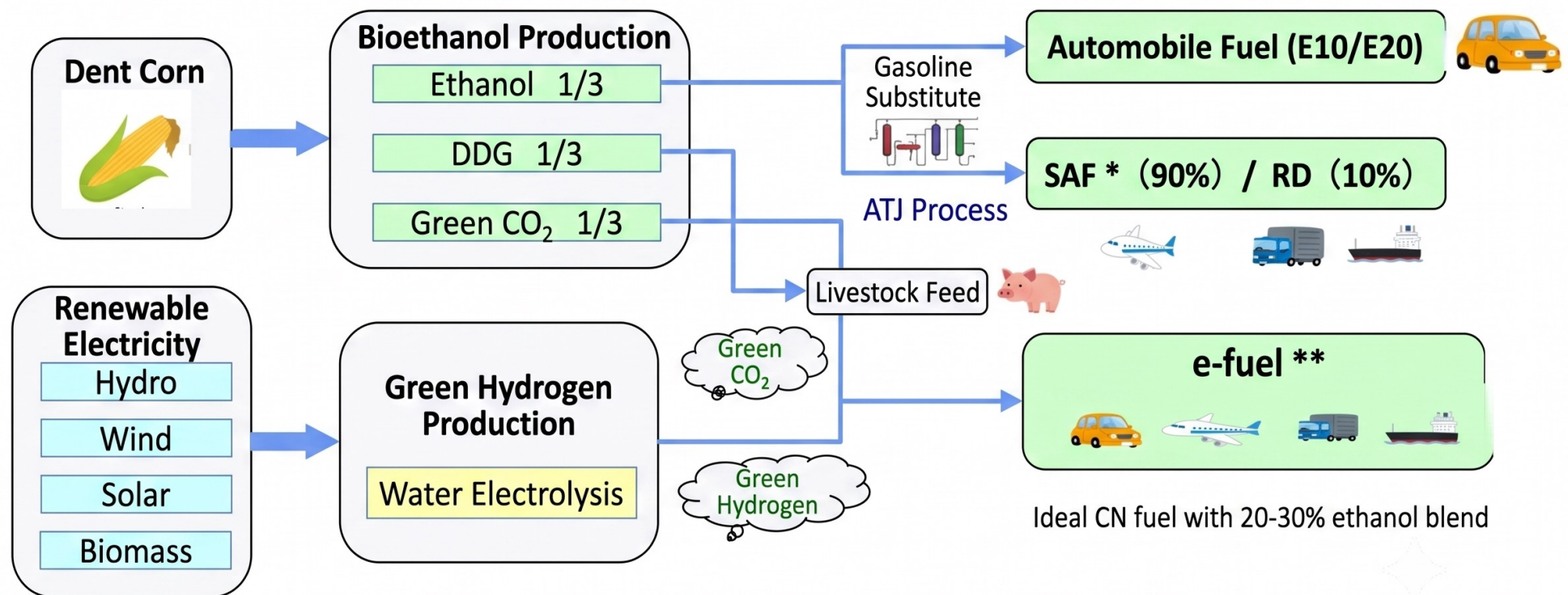


Source: Public-Private Council on Synthetic Fuels (Next-Generation Fuels), Document 5: Initiatives for Synthetic Fuels (e-fuels) in Japan and Future Directions, Including Council Name Change (Dec 25, 2024)

Green CO₂ and Hydrogen-based e-fuel Production Project

Proposes an e-fuel production business utilizing “**Green CO₂**” from bioethanol manufacture.

- Ethanol is a key component for automobile fuel (E10/E20) and a feedstock for SAF and RD production via the ATJ
- Byproduct DDG is livestock feed. Since **Green CO₂** is e-fuel feedstock, complete cascade use is possible. Also covered from ethanol. A “Bioethanol Platform” can be built from ethanol.



* SAF introduction target: 10% by FY2030 (equiv.). Total domestic sales: 1.92 million kL/year.

* * e-fuel ENEOS introduction target: 10k B.D. by FY2040. (= 580,000 kL/year)

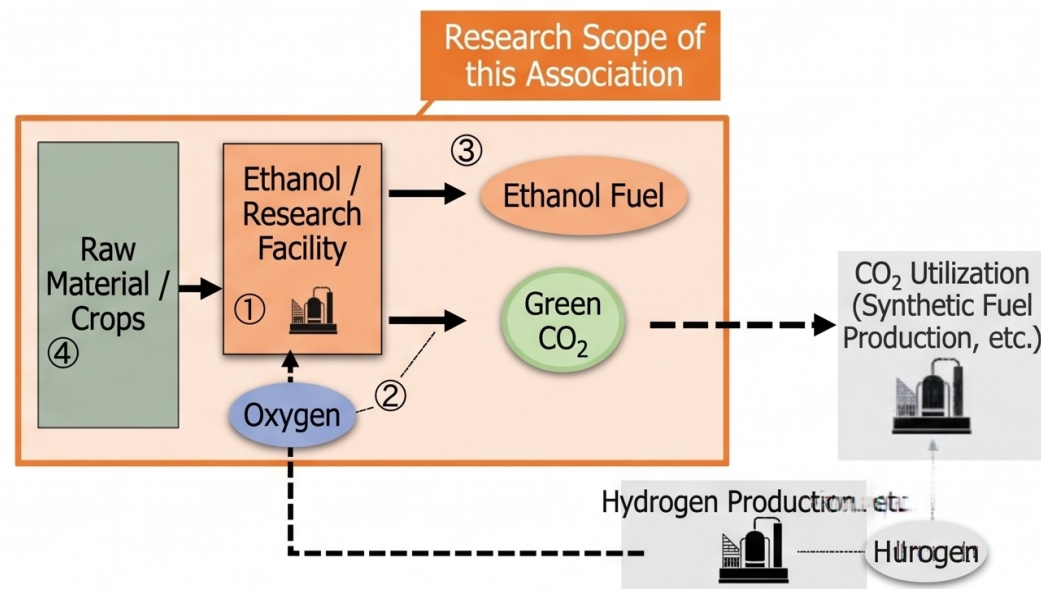
Initiatives of 6 Companies Including Toyota and ENEOS (Ethanol / e-fuel Production Technology Development)

Established the "Next-Generation Green CO₂ Fuel Technology Research Association" on July 1, 2022, to study efficiency improvements in the process of "creating" fuel.

Commenced research into bioethanol fuel production from sorghum and other sources.

- To realize a carbon-neutral society, we will advance technical research to efficiently produce bioethanol fuel for vehicles by optimally recycling the hydrogen, oxygen, and CO₂ generated during the utilization of biomass and production processes.

- ① Research on efficient production systems for ethanol.
- ② Research on collection and utilization of byproduct oxygen and CO₂.
- ③ Research on efficient operation methods for the whole system, including fuel utilization.
- ④ Research on efficient methods for cultivating raw material crops.



- Overview of the Next-Generation Green CO₂ Fuel Technology Research Association

Establishment Date: July 1, 2022

Chairperson: Koichi Nakata (Toyota, General Manager of CN Development Div.)

Members: ENEOS, Suzuki, SUBARU, Daihatsu, Toyota, Toyota Tsusho (in alphabetical order)

Headquarters Location: 230 Aza-Shimizu, Shimogami, Okuma-machi, Futaba-gun, Fukushima (within Okuma Incubation Center, Fukushima)

Business Activity: Research on improving the efficiency of carbon-neutral technology

Source: Toyota Website

“Asia Biomass Community” Initiative

Develop **biofuel production business** of the **development-and-import type** and the **local-production-local-consumption type** in Southeast Asia through **public-private partnerships (PPP)** and **joint ventures** with local entities.

Note: These development-and-import projects should be considered as “quasi-domestic projects” by Japanese corporations.

Strengthening of Partnerships through Public-Private Cooperation

■ **Government Level:**

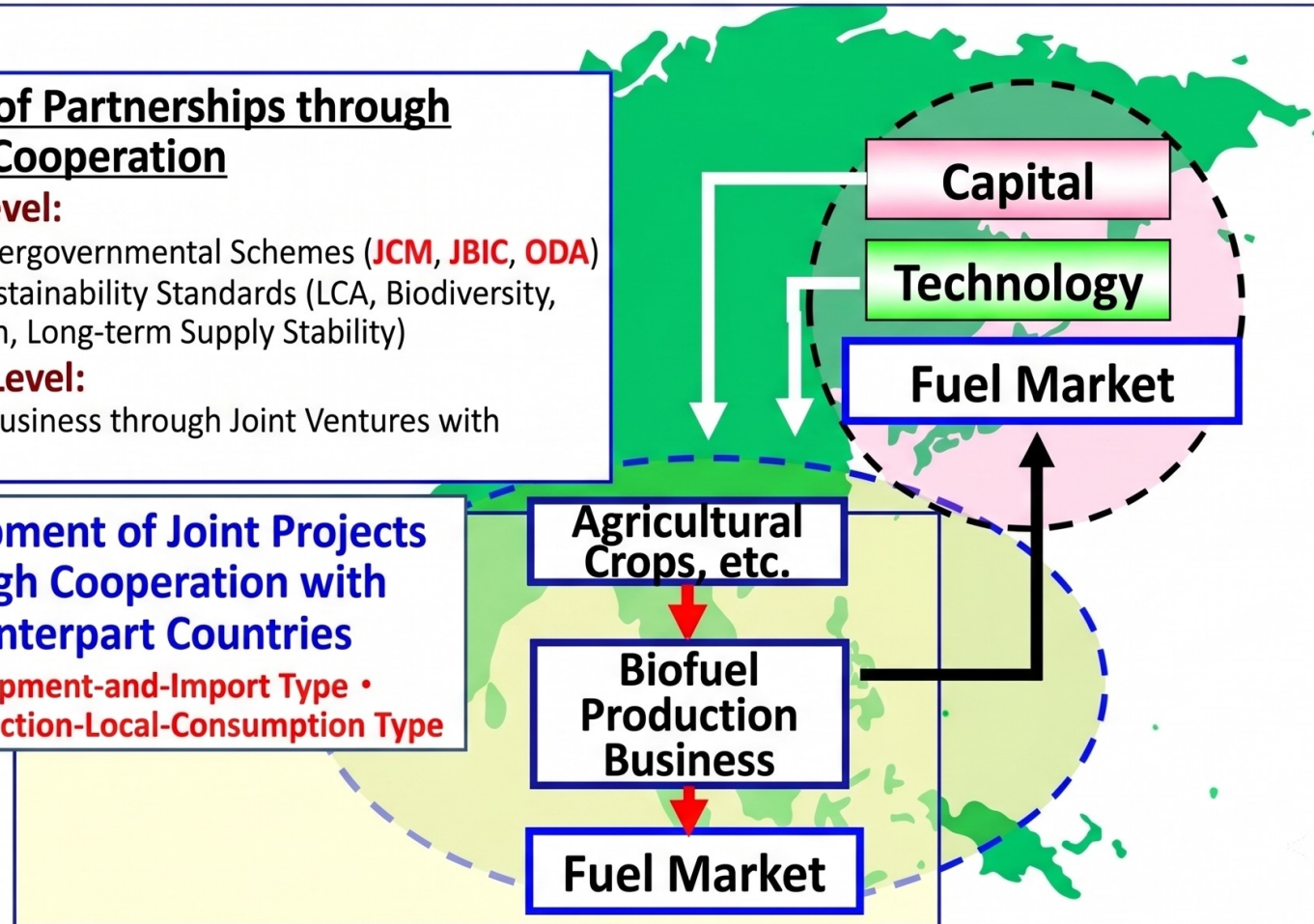
- ◆ Application of Intergovernmental Schemes (**JCM, JBIC, ODA**)
- ◆ Application of Sustainability Standards (LCA, Biodiversity, Food Competition, Long-term Supply Stability)

■ **Private Sector Level:**

Development of Business through Joint Ventures with Local Companies

Development of Joint Projects through Cooperation with Counterpart Countries

Development-and-Import Type • Local-Production-Local-Consumption Type



America Brasil Consortium ⇒ **Asia Biomass Community Initiative**

Establishment of Sustainable Biomass Industry

Biomass plantation

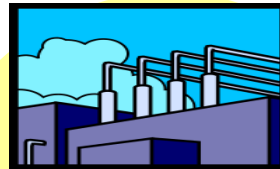


Next-generation agriculture and forestry responding to new demand

1. **Increasing agricultural resources using ODA, etc.**
 - Farmland development and irrigation facilities
 - Breeding improvement (yield enhancement)
 - Mechanization (cultivation, collection)
 - Fertilization management technology
 - Development of transportation infrastructure
 - Agricultural Fund (providing funds to farmers)
2. **Contract farming schemes by local companies**

Stable procurement of raw materials / Cascade Utilization

Biomass refinery



Development of biomass complex industries

- **Bioethanol / e-fuel**
- **SAF**
 - HVO / BDF
 - Biomass power generation / bio pellets
- **Biochemicals, materials**
- **Manufacture of feed, fertilizer, etc.**

Co-Location · Co-Production

Market



Creation of a stable consumption market at an industrial scale

- **Export to Japan (development import)**
- **Consumption in the local market (local production for local consumption)**
- **Export to third countries**

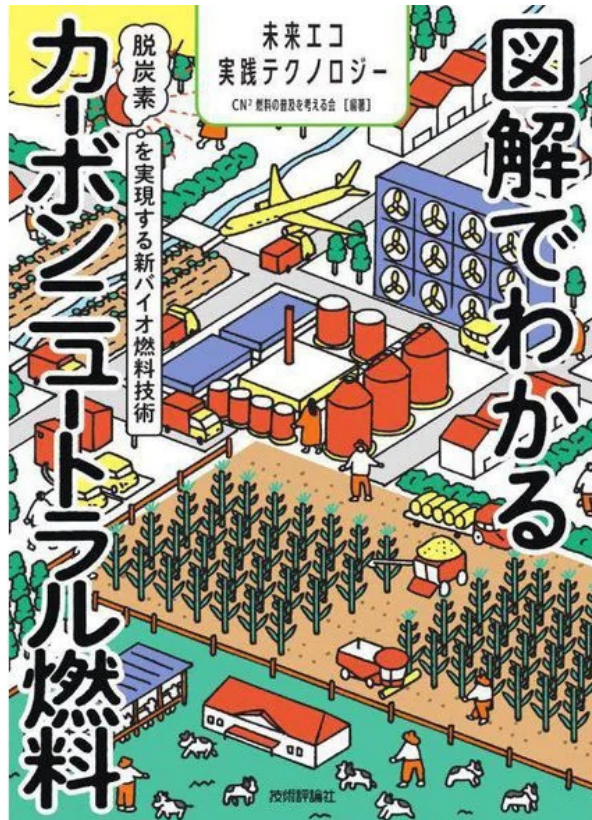
Prerequisites

- **Stable sales volume (long-term contracts, etc.)**
- **Stable sales price (linked to raw materials, etc.)**

Securing Stable Sales

Building a sustainable supply chain where risk and return are balanced

"Illustrated Guide to Carbon Neutral Fuel "



<https://direct.gihyo.jp/view/item/000000002965>

Released May 21, 2022

Edited by "the Study Group on the Spread of CN2 Fuel"

Publisher: Gijutsu Hyoronsha

Table of Contents

Chapter 1: Domestic and International Trends in CO2 Reduction

Chapter 2: Introduction and Production Technology of Carbon Neutral Fuels

Chapter 3: Trends in CO2 Reduction Measures in the Automotive Industry

Chapter 4: Trends and Future Potential of Biofuels

Chapter 5: Biofuel Initiatives in the Aviation Industry

Chapter 6: Expansion of New Applications for Bioethanol

Chapter 7: Industrialization Scenarios and Policy Proposals for Bioethanol

Author

Ryo Moriyama (Director, General Incorporated Foundation Energy Comprehensive Engineering Research Institute): Chapter 1

Tetsuro Hamamoto (Japan Representative, USA Rice Federation): Chapter 2

Miharu Kishioka (Advisor, Nippon Environmental Energy Development Co., Ltd. (NEED)): Chapter 3

Toshiyuki Hamada (Counselor, General Incorporated Foundation Energy Comprehensive Engineering Research Institute): Chapter 4

Shinya Yokoyama (Professor Emeritus, University of Tokyo): Chapter 5

Kinya Sakunishi (Assistant Director, Energy and Environment Area, National Institute of Advanced Industrial Science and Technology): Chapter 6

Issei Sawa (President and CEO, Nippon Environmental Energy Development Co., Ltd. (NEED)): Chapter 7



Thank you for your kind attention

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(Many related materials that formed the basis of this lecture are posted on the HP)
