IEF Thought Leaders' Roundtable:
Transport Sector Sustainability: Outlooks on Energy Demand and Sustainable Fuels

What is the Function of Sustainable Fuels Towards Carbon Neutral?

-Transition Approach in Japan with an Emphasis on Mobility–

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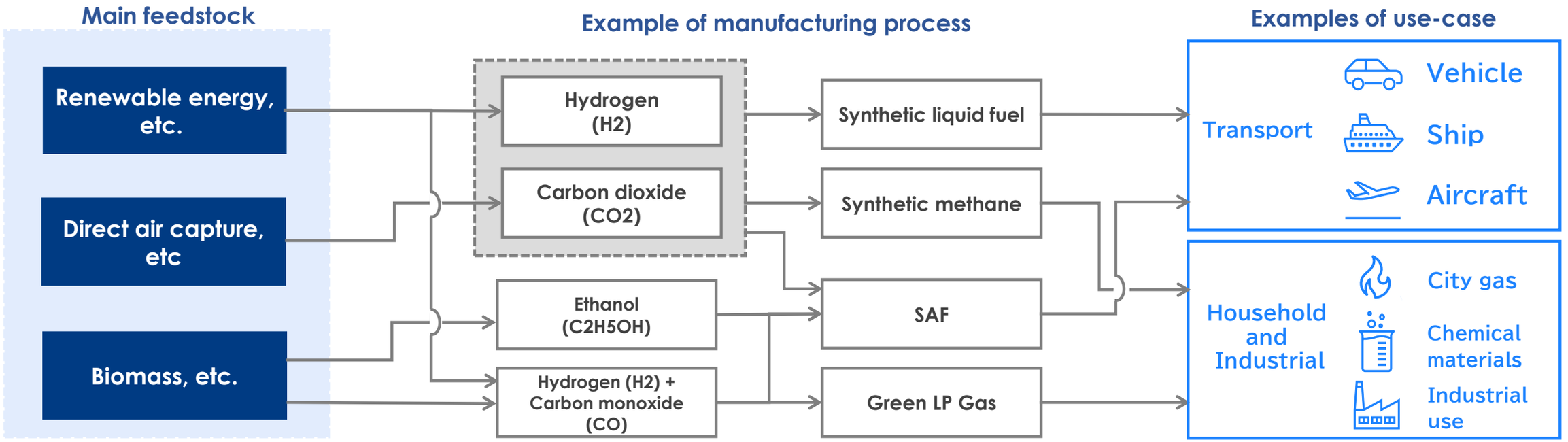
"Sustainable fuel" are anticipated to be a significant alternative for achieving CN

1. Strategies in domains where electrification is challenging and minor emission sources
2. Diversifying decarbonization measures to diminish reliance on particular resources
3. Function of enhancing the storage and transportation of decarbonized energy as a carrier

Image of a sustainable fuel supply chain



Source) University of Tokyo CGC & MRI, "The Role of Sustainable Fuels in Achieving net Zero"，https://www.mri.co.jp/news/press/20240927.html (Access on 10th, October 2024)

Three scenarios focus on providing renewable energy and sustainable fuels to the mobility sector

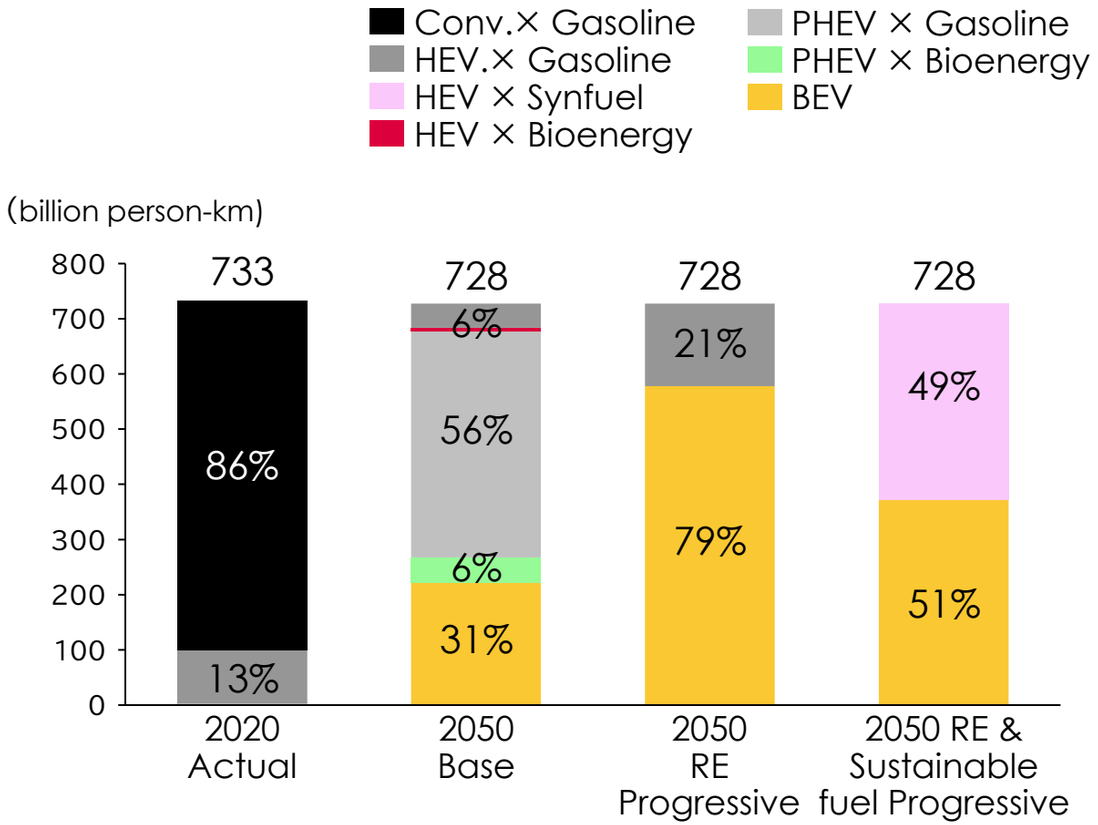
		i) Basecase	ii) RE and BEV progressive	iii) RE, BEVs and Sustainable fuels progressive
Conceptualized perspective for achieving CN by the year 2050		Emphasis on hydrocarbon energy sources + CCS. Aspiring for decarbonization	Broaden the implementation of RE and BESS Expediting BEV proliferation through cost reduction	In addition to ii), Presumed cost reduction of hydrogen and synthetic fuel
Supply side	Maximum amount of RE introduced	Low	High	High
	RE costs	High	Low	Low
	Storage battery costs	High	Low	Low
	Imported hydrogen costs	High	High	Low
	Imported synthetic fuel assumption	No imports	No imports	With imports (from 2030 onwards)
Demand side	EV costs	High	Low	Low
	Impact of widespread use of generative AI	2050: + approx. 40 TWh (MRI assumptions)		
	CO2 storage limit	2050: 120 million t/y (value assumed by the CCS long-term roadmap study group)		

Source) University of Tokyo CGC & MRI, "The Role of Sustainable Fuels in Achieving net Zero"，https://www.mri.co.jp/news/press/20240927.html（Access on 10th, October 2024）

Sustainable fuel utilization and electrification (BEV) possess complementary functions

- **In passenger vehicles**, BEVs have an advantage, especially for small, short-distance applications.
  If synthetic fuels can be procured, HEVs can be used as ZEVs.
- Technological selections related to **passenger vehicles impose negligible impact on energy consumption and electricity demand** due to high energy efficacy and the proportion of energy consumption within the transportation sector being small

Passenger vehicles demand in each scenario

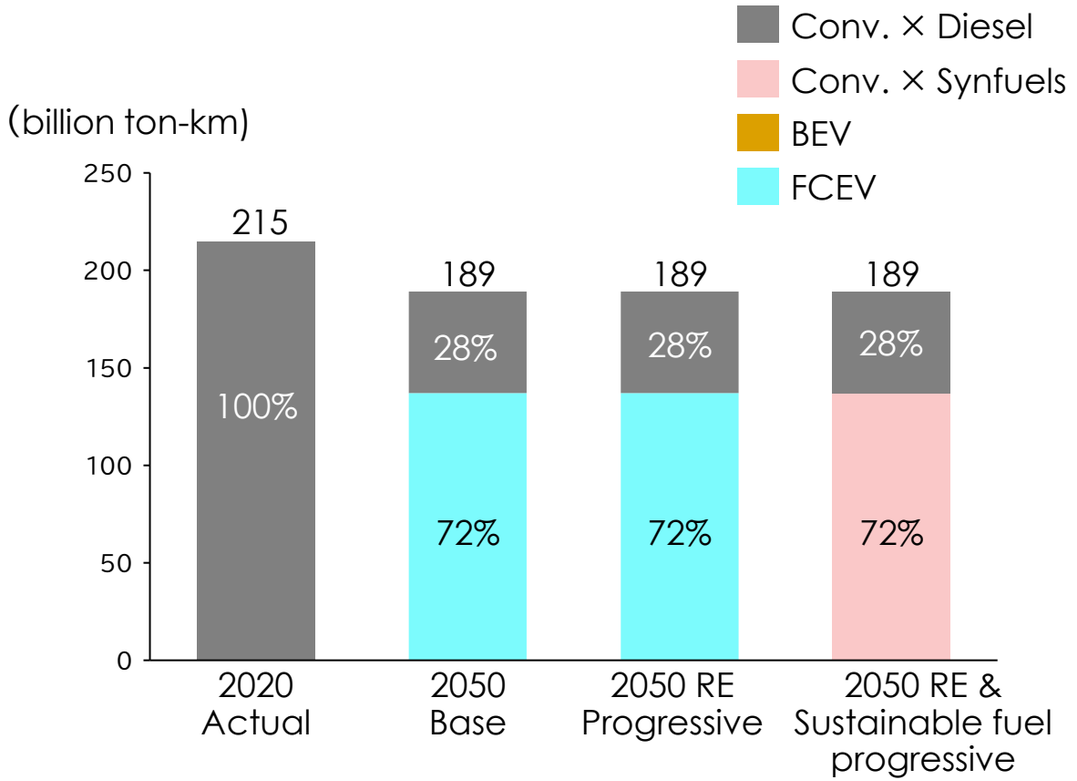


Source) University of Tokyo CGC & MRI, "The Role of Sustainable Fuels in Achieving net Zero" https://www.mri.co.jp/news/press/20240927.html (Access on 10th, October 2024)

BEVs are not selected for freight trucks, which utilize greater energy

- **In freight trucks**, sustainable fuels (hydrogen and synthetic fuels) are chosen in each scenario, with a combination of conventional engine (ICEs) and synthetic fuels replacing FCEVs where synthetic fuels are available.
- The results indicate **a certain amount of diesel**, which is generated as a co-product from the process of petroleum refining operating to fulfill the demand for petroleum products such as kerosene, heavy oil, etc. **is consumed in each scenarios**.

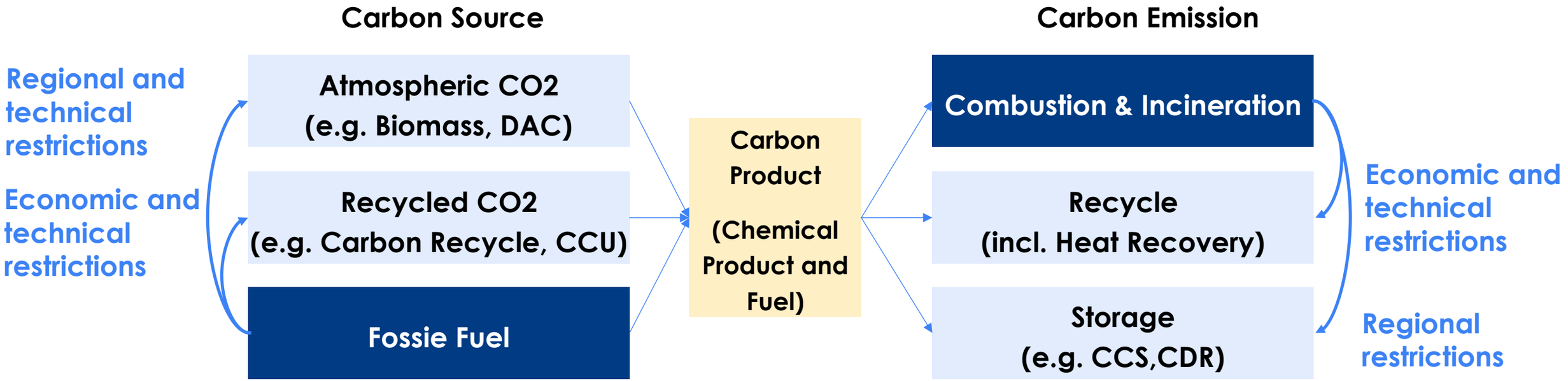
Freight trucks demand in each scenario



Source) University of Tokyo CGC & MRI, "The Role of Sustainable Fuels in Achieving net Zero" https://www.mri.co.jp/news/press/20240927.html (Access on 10th, October 2024)

The petrochemical industry necessitates resolutions customized to regional conditions, presuming sector coupling

- Carbon-containing products are classified into chemical products (e.g. plastics) and fuels (e.g. liquid fuels)
- To decarbonize these carbon products, in addition to decarbonizing the carbon source, recycling measures to reuse the CO2 contained in the product or reuse the CO2 emitted from the product are important.
- However, each measure has different economic and technical barriers, in addition to the potential of regional resources.



Source) MRI created based on "Kanazawa, D., Wagner, A., Kremer, A. B., Leung, J. J., Lingeswaran, S., Goult, P., … Kikuchi, Y. (2024). Scope 1, 2, and 3 Net Zero Pathways for the Chemical Industry in Japan. Journal of Chemical Engineering of Japan, 57(1). https://doi.org/10.1080/00219592.2024.2360900#"