49th AJBM Discussion Purpose Only

Deloitte.

KEIZAI DOYUKAI 公益社団法人 経済同友会 Japan Association of Corporate Executives

49th ASEAN – JAPAN BUSINESS MEETING

Sustainable Mobility Executive Forum 2023

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Self Introduction

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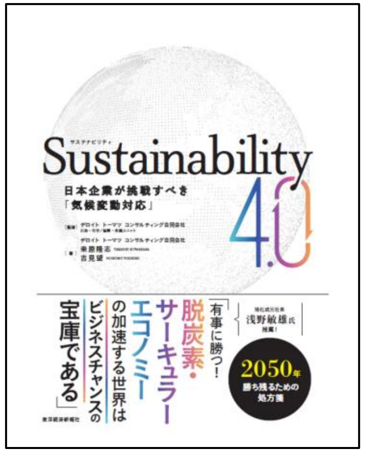
- Responsible for strategy and climate sustainability for chemical, material and energy industry
- Expert in strategy development, mid-long term business planning, partnering, etc.
- Has experience of 8 years in Europe strategy firm and 7 years in APAC region business expansion at Deloitte before current position (2021).
- Published books:
  - ➢ "Sustainability 4.0" (Oct 2022, Main author)
  - ➢ "Environment value for circular economy" (Mar 2023, Co-author)

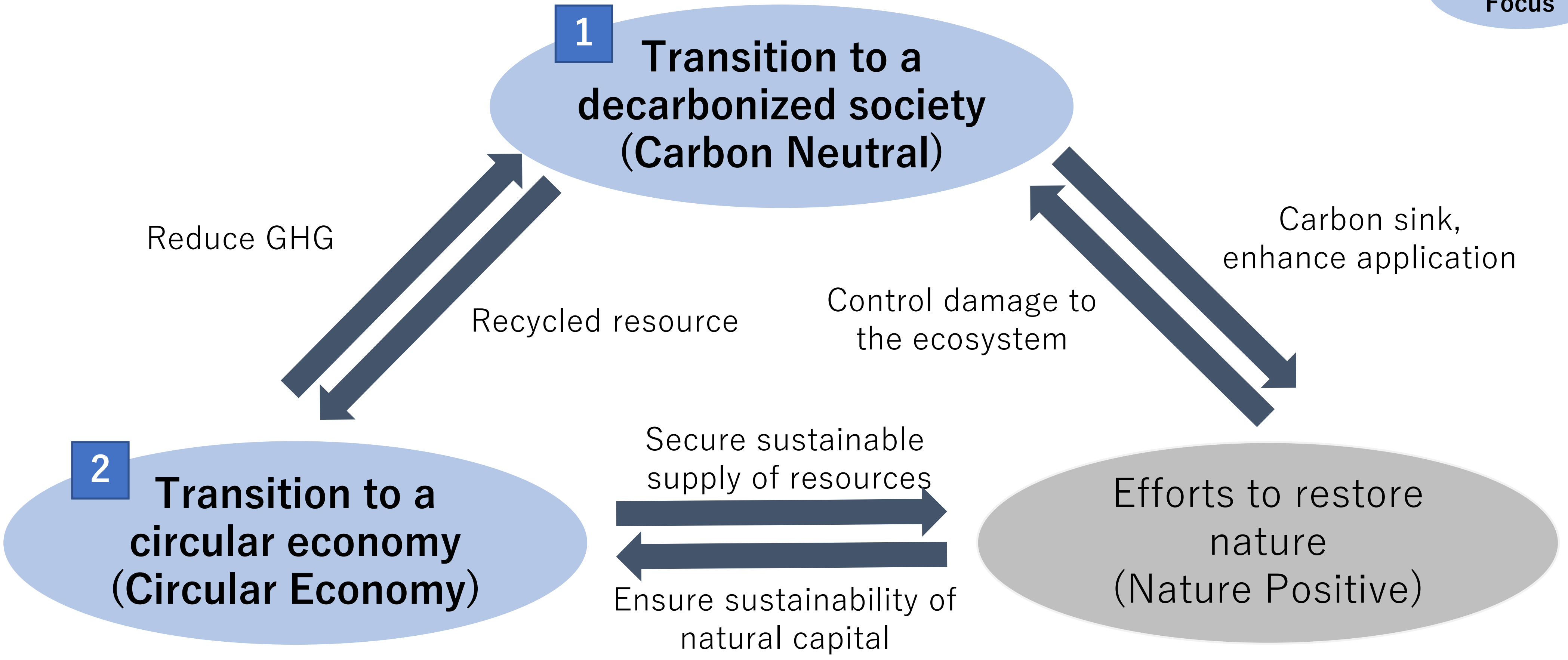


Global Climate Sustainability Trend

It is necessary to consider the relationship (nexus) among Carbon Neutral, Circular Economy and Nature Positive.

Integrated consideration for sustainability promotion

Today's Focus

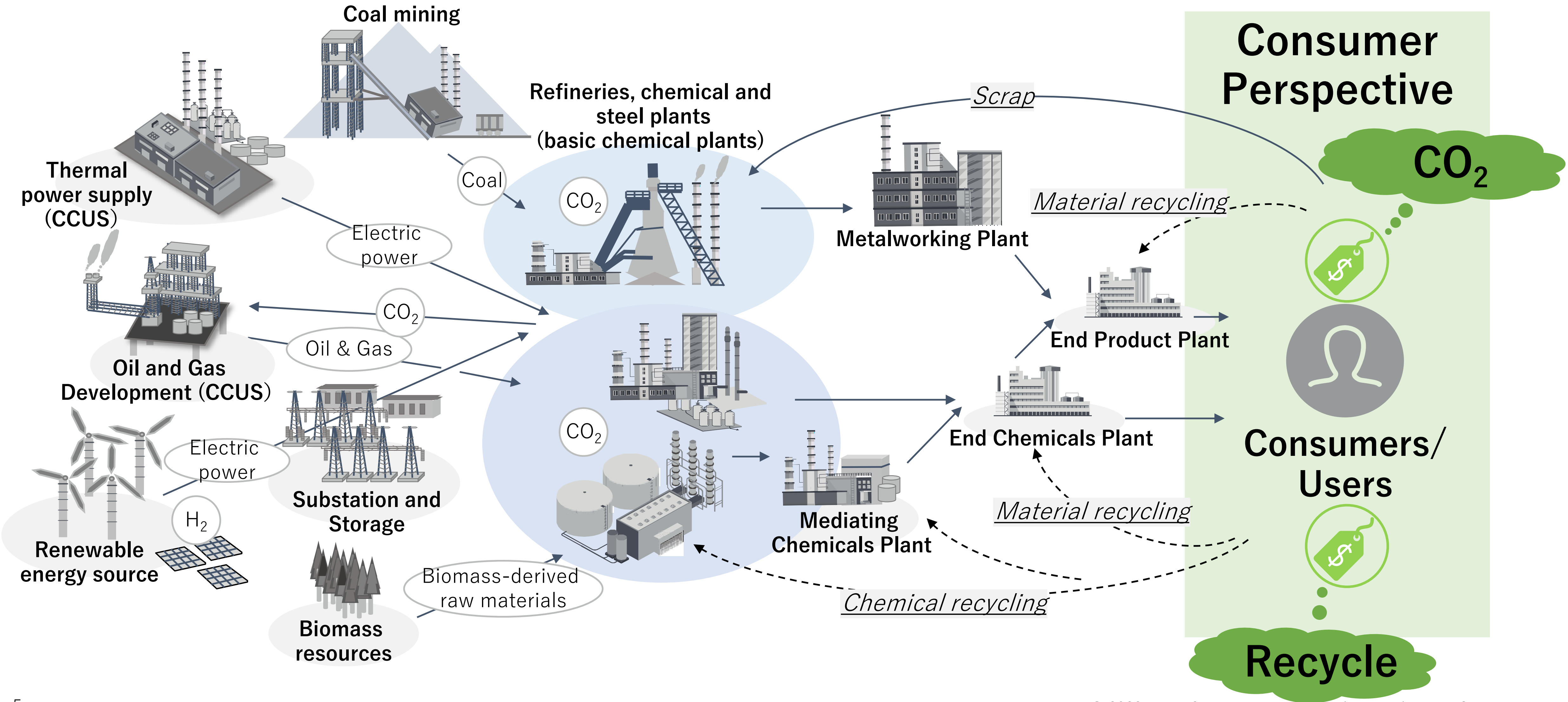


To realize economic development while reducing the total environmental impact, **GX is required to be based on the above three pillars**

Source: the Ministry of the Environment "Review Committee on Basic Matters for the Sixth Basic Environmental Plan"

In addition to QCD, “E (environmental value)” will be one of KBF

Change of Key Buying Factor



Commitments to CN towards a decarbonized society are directly connected to the competitiveness of countries, industries and companies

Movement of CN

A Commitments by Governments

End of COP25	End of COP26
121	154

# of countries & regions, time-limited CN statement

B Green Investment by Financial Institutions

- ESG Investment : **$35.3 trillion in 2020**
  (Total investment by Japan, the United States, and Europe)
- **3,496 financial institutions support TF TCFD** for information disclosure

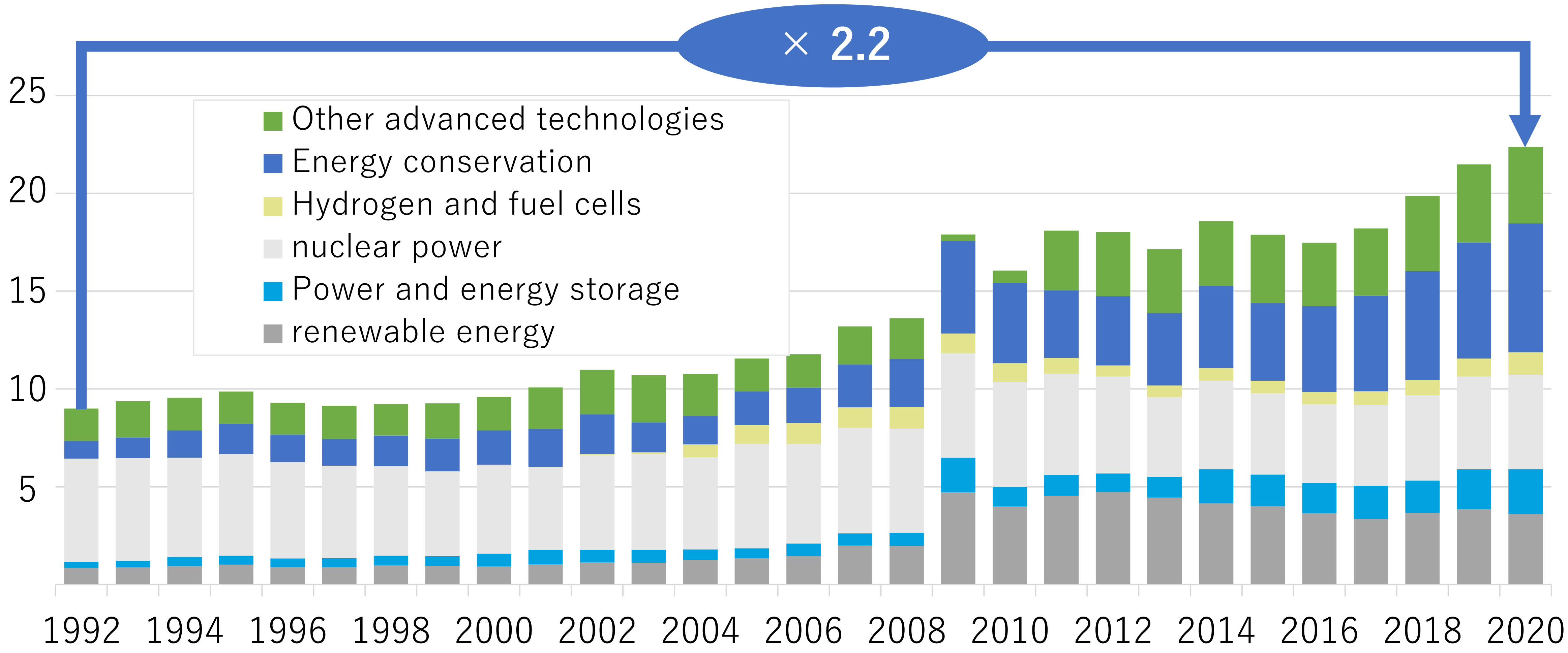
C Decarbonization by Industries

- **Supply Chain** Decarbonization
- Launch **new GX industry/Business**
  - ✓Ecosystem (Tracking, Sharing, etc.)
  - ✓Startups (Technology, business idea, etc.)

Governments aim to accelerate decarbonized society

A Commitments by Governments : Public Sector Budgets for Environmental Technology

R&D and demonstration budget ($1 billion)



Source: EA (updated May 3, 2022) Based on Energy Technology RD & D Budgets (32 countries + EU)

Attitude of investment has been changed to GX

B Green Investment by Financial Institutions

World Bank	2013	• Withdrawal from coal sector
	2019	• **Withdrawal from the upstream oil and gas sector**
European Investment Bank	2021	• New loans to **fossil fuel-related businesses** stopped by the end of the year
EULER HERMES	2020	• Daily Pending/Flaring • (Dissipation and amortization of gas)
ADB	**2021**	• Suspend financing for **upstream development/coal-fired power generation** facilities • Stricter **support requirements for gas-fired power generation**

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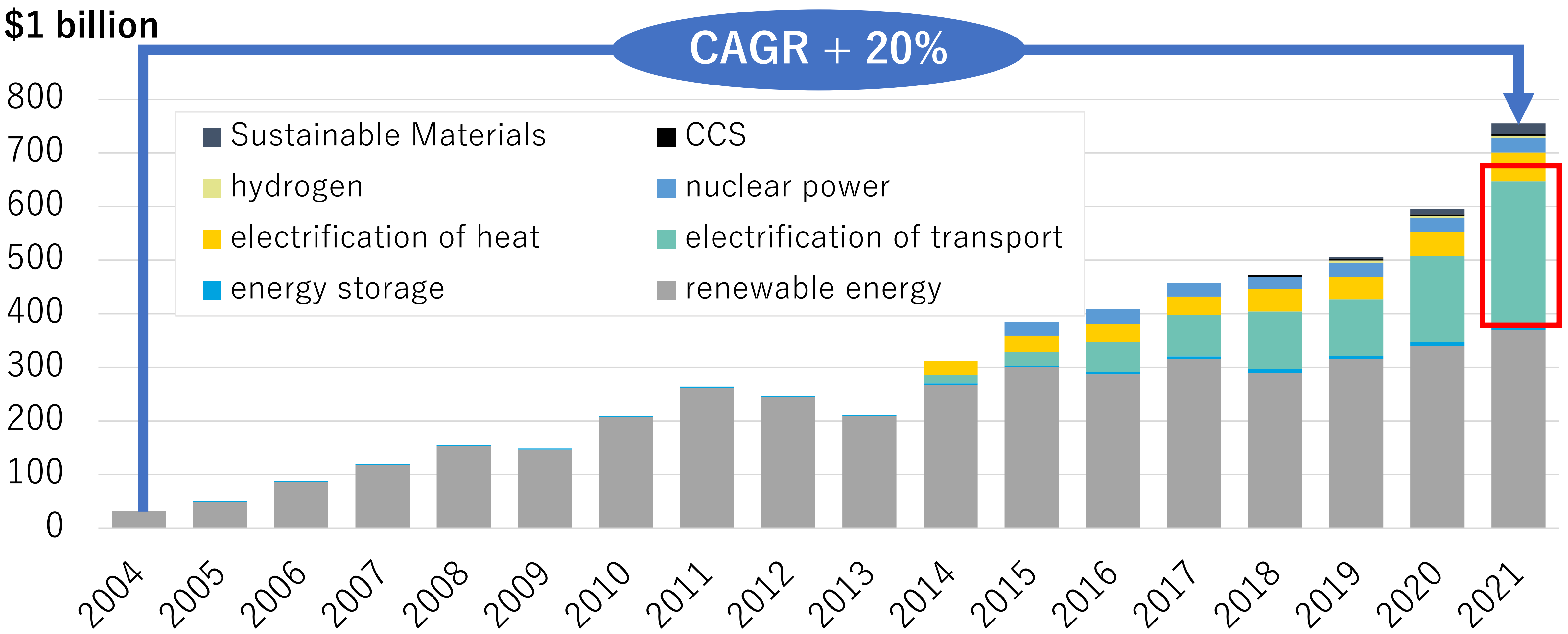
Decarbonization investments are growing dramatically

Ⓒ Decarbonization by Industries : Energy Transition Investments



Source: BloombergNEF (January 2022) Based on Energy Transition Investment Trends 2022

The emerging clean hydrogen ecosystem is complex, as it involves cooperation across public and private stakeholders and multiple industries

Ecosystem in US

US federal agencies

DOE | FERC | PHMSA | EPA | OSHA

Funding and regulation

State and Local Government

Funding and regulation

Multiple sectors intersect along each stage of the clean H_2 value chain

- H_2 Supply / generation
- Distribution / Pipelines
- Demand / Utilization

Nonprofits and industrial association

ARCHES, Center for Houston's Future, Midwest Alliance for Clean Hydrogen, PNWH2, Connected DMV, Appalachian Energy Future (Advancing Our Region's Clean Energy & Industrial Evolution; Ohio · Pennsylvania · West Virginia), Green Hydrogen Coalition etc.

For future transitions, it is necessary to consider 4 Key points

Key points for future CN transitions

1 Realization of Energy System

- Realization of cross-dimensional sector coupling and promotion of electrification and hydrogenation
- Optimization of energy systems
- System reform suitable for large amounts of renewable energy

2 Efficient Use of Energy

- Energy conservation through control using sensors and changes in consumer behavior

3 Realization of Circular Economy (mentioned in next pages)

- An economic system that uses resources efficiently and ensures resource security
- Long term aim to an optimal system by extending it to the energy sector

4 Promotion of PJ of NETs*1

- Internationally coordinated efforts of NETs*1 to address the global challenge of climate change

*1: Negative, Emissions, Technologies: negative emission technology/carbon dioxide removal (CDR) technology

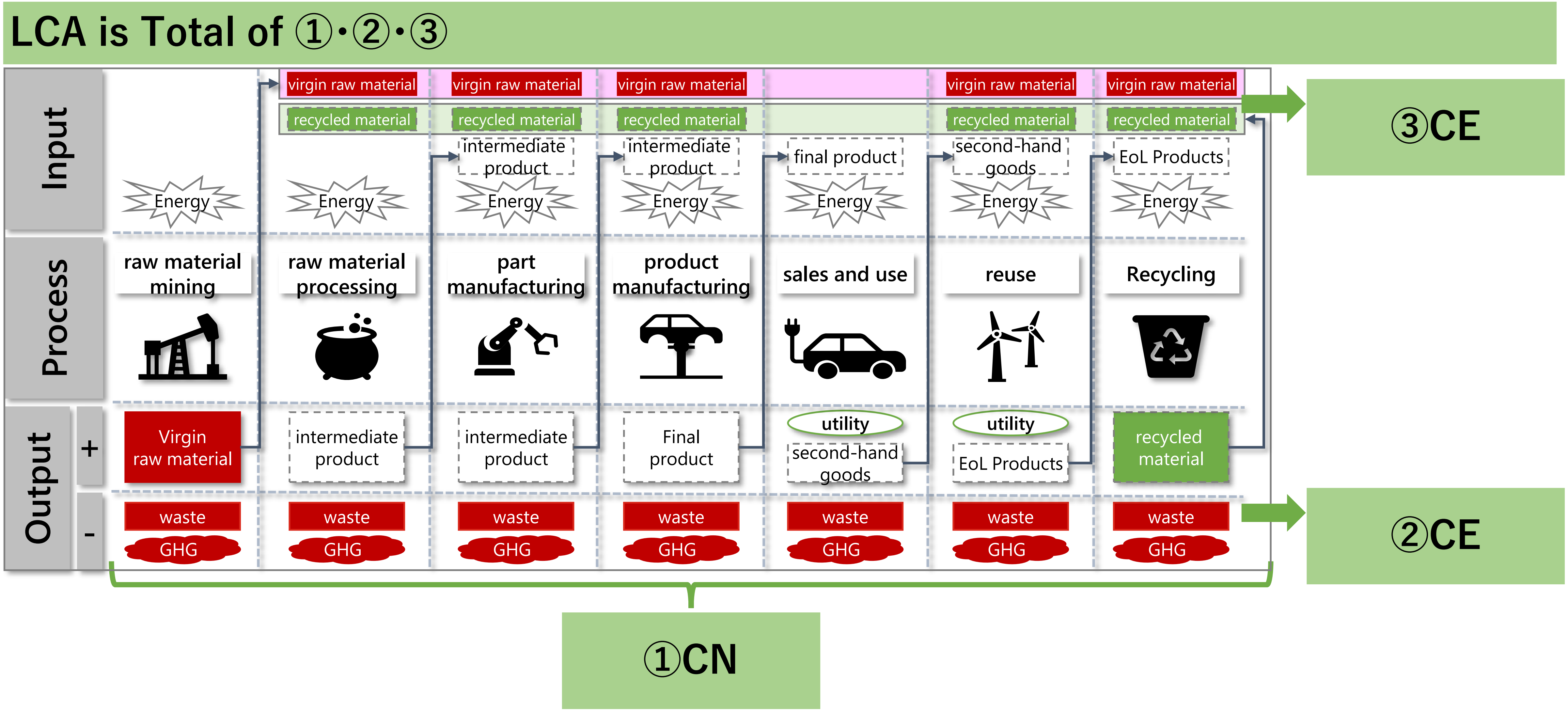
CE stimulates the transition to a sustainable society, resource security, and business opportunities

Background and Significance of CE

	Atttention for CE	Importance of addressing CE
A Sustainable Society	➢ Achieve long-term GHG emission reduction targets ➢ CE is one way to realize CN	**Lead the transition** with other industry
B Resource Security	➢ Required resource with Economy ➢ Increase of resource and energy prices	**Competitiveness in resource** of sustainable materials
C Business Opportunities	➢ Transition to CE-oriented society ➢ Governments formulated various policies as they transit to CE	**Change business model and create new profit**

LCA optimization will be realized by promoting circular economy

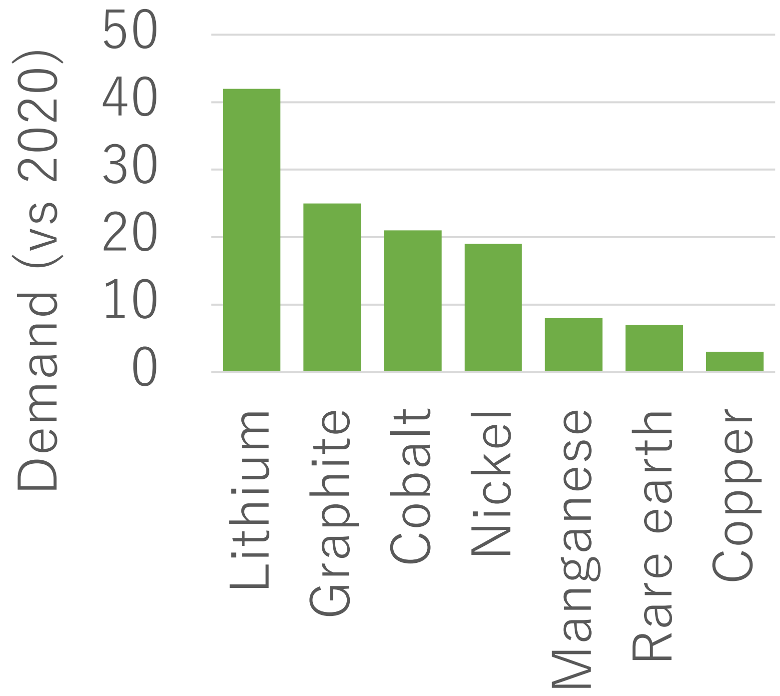
Ⓐ Sustainable Society



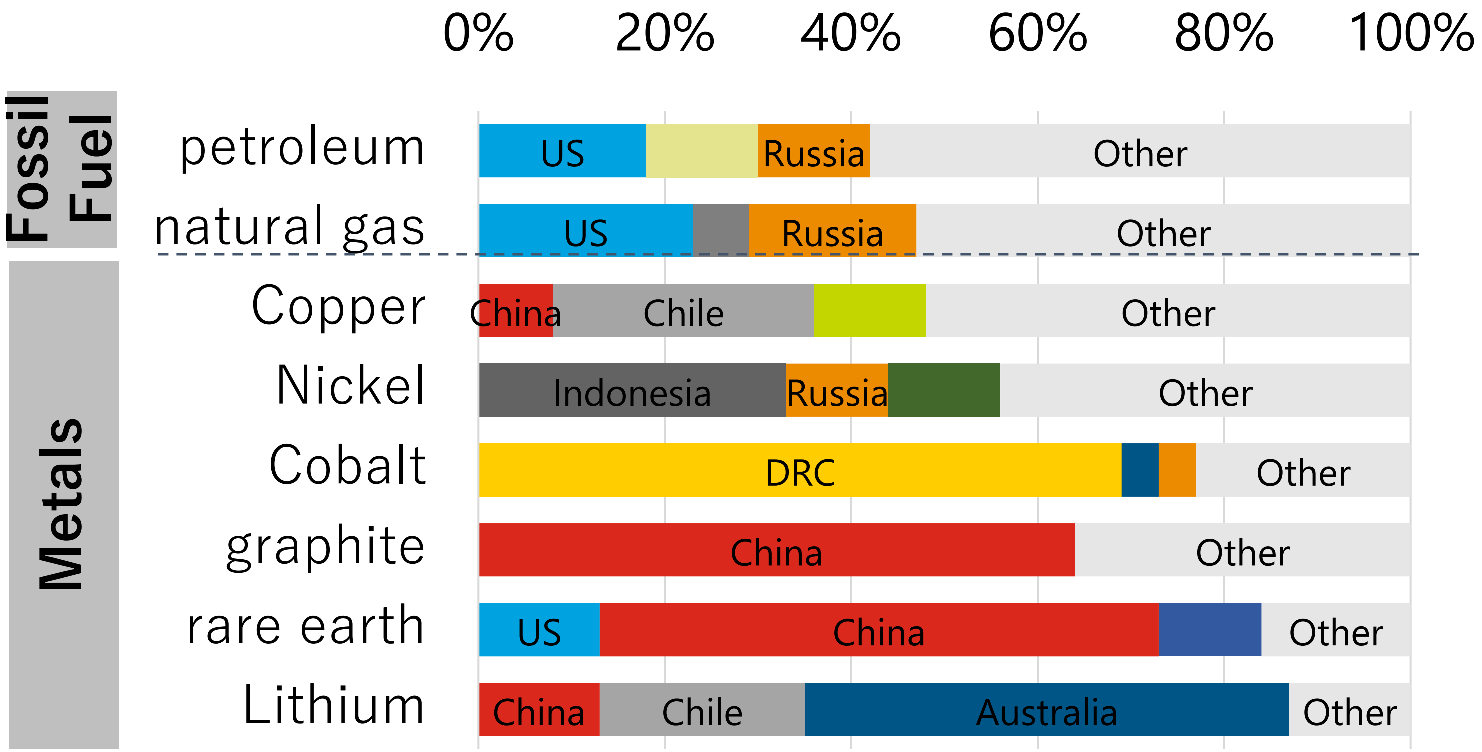
Material security for rare metals and rare earths necessary for clean energy technology should be considered together with circular economy

B Resource Security

Demand for Metals with Clean Energy Technologies (2040)



Mining Production Share of Fossil Fuels and Metals (2019)

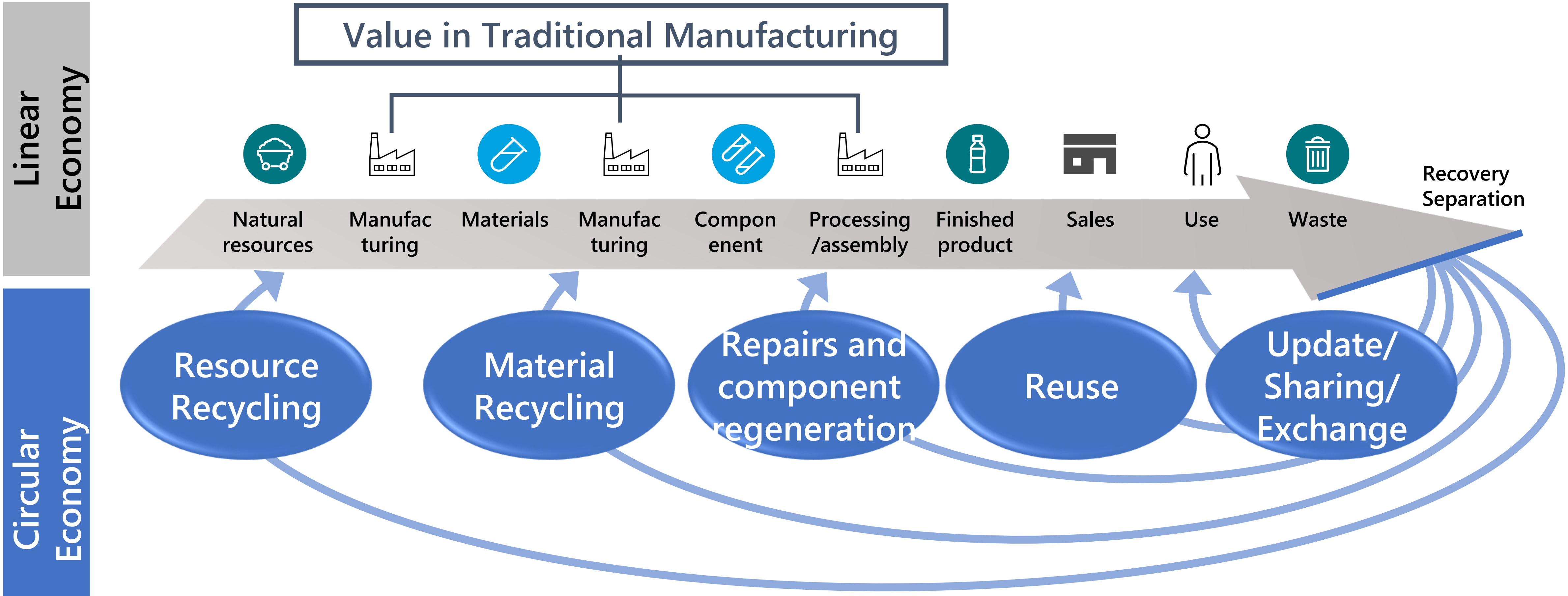


While significant supply capacity development is needed, **supply chains are now skewed towards a few countries, raising concerns about resource security**

Data source: Deloitte from IEA "The Role of Critical Minerals in Clean Energy Transitions," May 2021

The added value of manufacturing industries will shift from processing natural resources to "resource recovery"

Ⓒ Business Opportunities



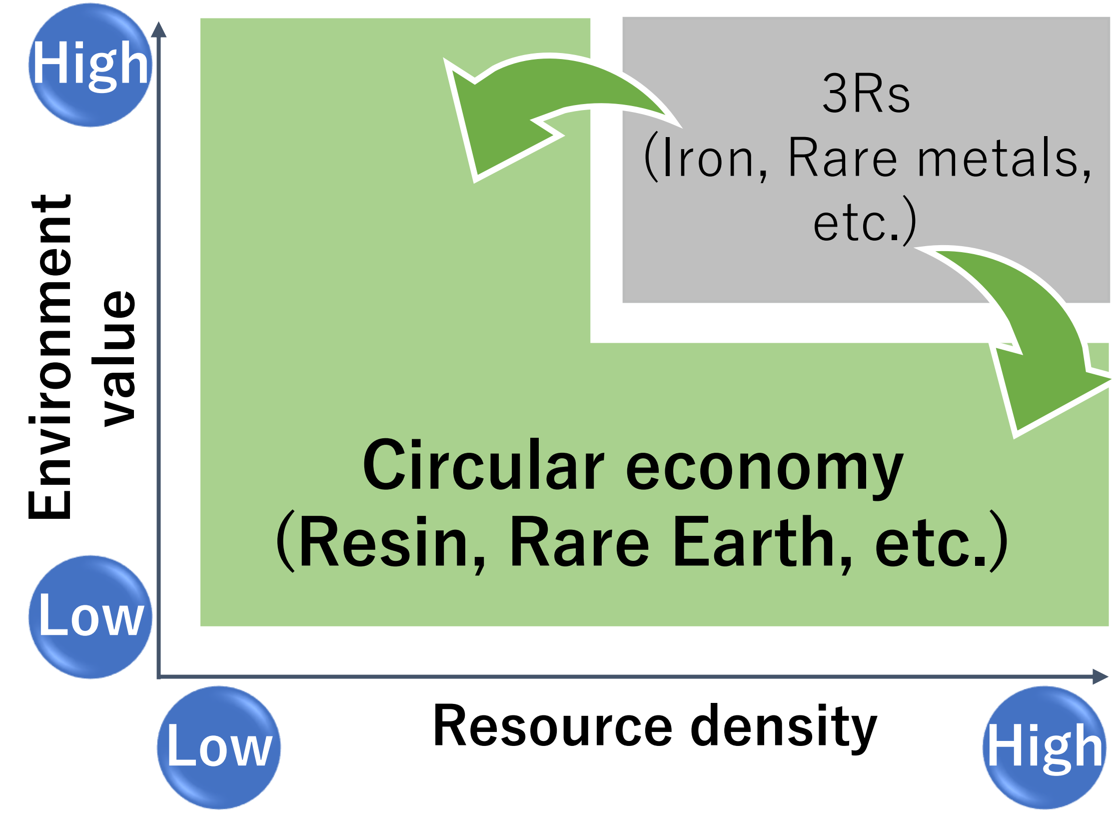
Generated value as a resource recovery business
【**50 trillion-yen** market (2020) to **80 trillion-yen** market (2030)】

Data source: Growth Strategy Follow-up Timetable (Web page of the Prime Minister's Office)

Design the ecosystem for materials to form a regional economic zone (=SEA regional economy)

Formation of Regional Economic Zones

Target material in Circular Economy



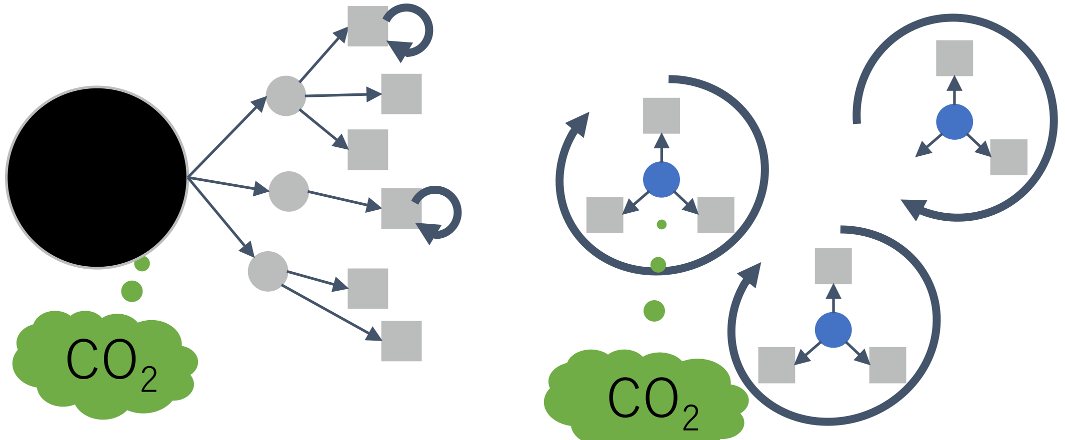
Formation of the "Economic zone"

Now

- ■Optimized for each industry
- ■Value slicer

From now on (Regional Economy)

- ✓ **Consolidate and optimize in area**
- ✓ **Resource recovery**



● Material manufacturing ■ Manufacturing of products and parts

Regulations on recycled materials for automobiles will be issued

Example of a new regulation (EU Battery Regulation)

EU Battery Regulation (2023)

■Battery recovery target

Portable	63% ('27)	73% ('30)
Transport	51% ('28)	61% ('31)

■Feedstock recycling target

Lithium	50% ('27)	80% ('30)

■Recycled materials used

Cobalt	85%
Lead	16%
Lithium nickel	6%

EU consortium CIRPASS (DPP)

Purpose

■Manage environment related information over product life cycle

■Development of infrastructure and digital technologies to utilize information in the DPP
(For batteries, electronics, textile, and metal industries)

Activities

▼Oct'22 — Apr'24▼

Step1	Step2	Step3	
DPP definition	Road map development	Pilot/ Implementation	Operation

OEMs in Europe have already set targets for the adoption of recycled materials and are moving forward

Adoption of recycled materials (European automobile OEMs)

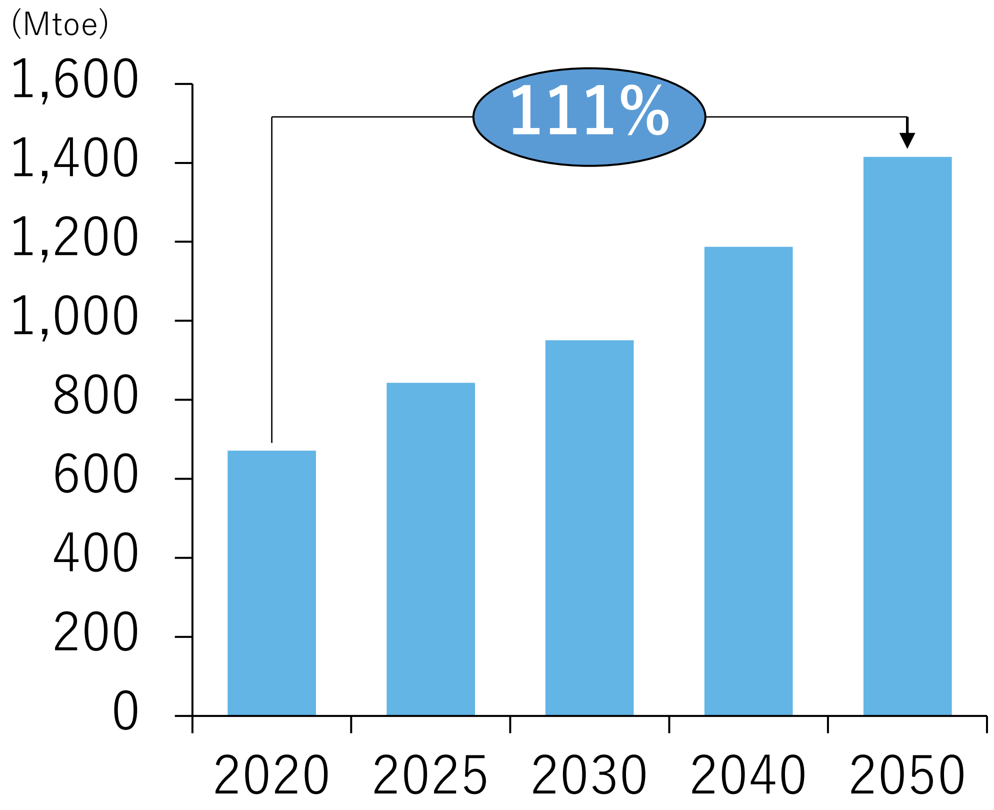
	Current	2025	2030	2032
Mercedes-Benz	✓Recycled resin used in **72 parts** of the E-class. ✓Recycled materials derived from household waste and **foam that combines CO_2**			For passenger cars, **>40% in average**
RENAULT	✓**Limit virgin use** ✓**Waste plastic in car body floor**		For new cars **>33%**	
VOLVO	✓Promotion to eliminate **leather materials** usage ✓**Increase recycled resin content**	For new cars, • **>25% of resin** • **>40% of aluminum** • **>25% of iron**		

Requirement for “One ASEAN” solution

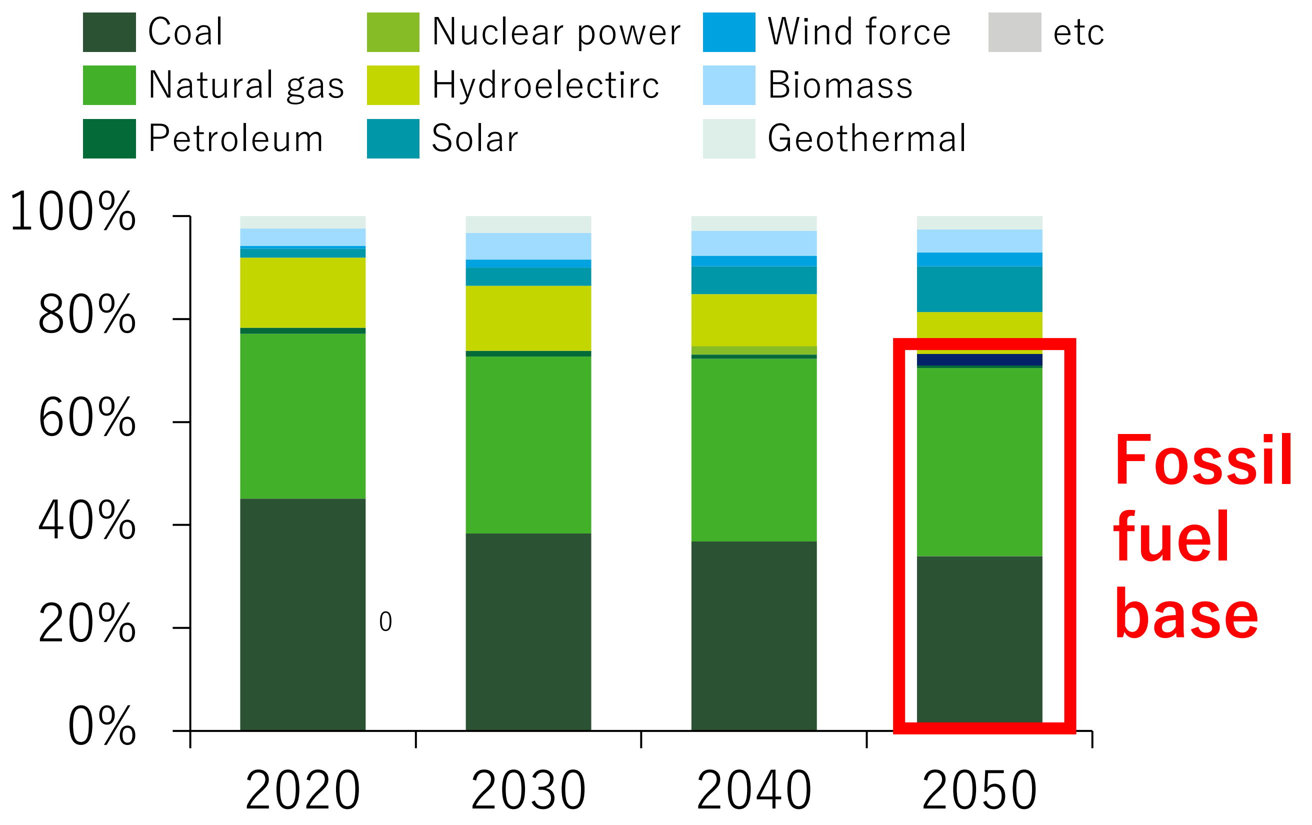
In ASEAN, fossil fuels are expected to account for about 70-80% of energy in 2050 (by IEEJ)

Energy demand in ASEAN

Primary energy consumption in ASEAN



Electricity generation by technology



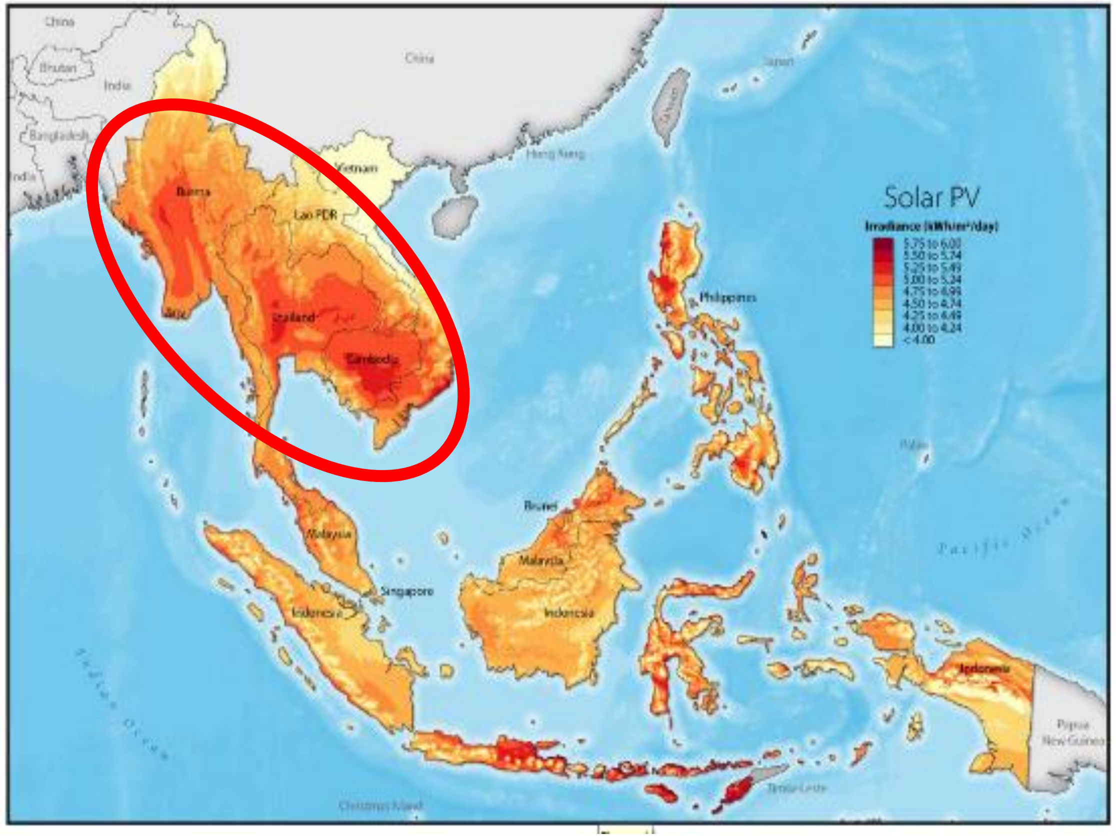
It is necessary to consider various means while sharing roles in ASEAN

Note: Scenarios that incorporate past trends and projected effects on the extension of energy and environmental policies and technologies to date
Data source: IEEJ Outlook 2023

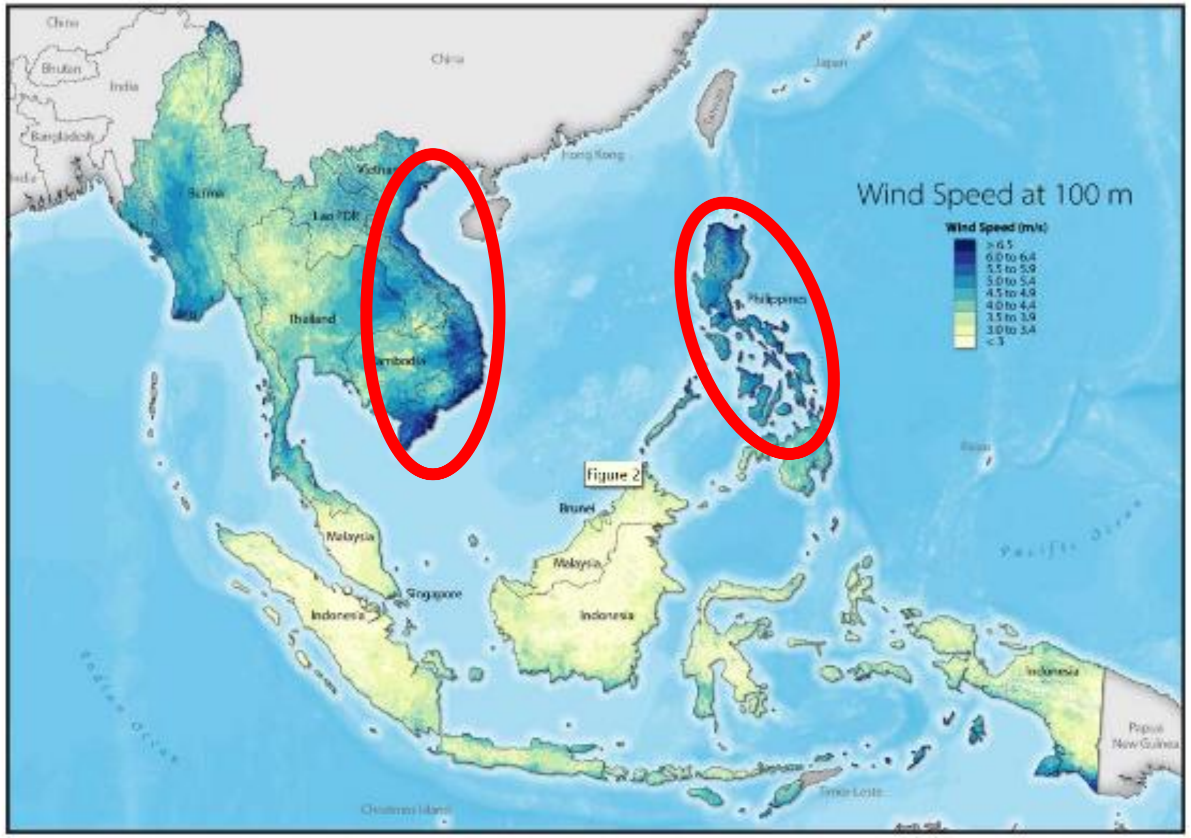
In ASEAN countries, renewable energy resources are distributed unevenly

Renewable energy（potential distribution）

Potential of Solar Resources in ASEAN



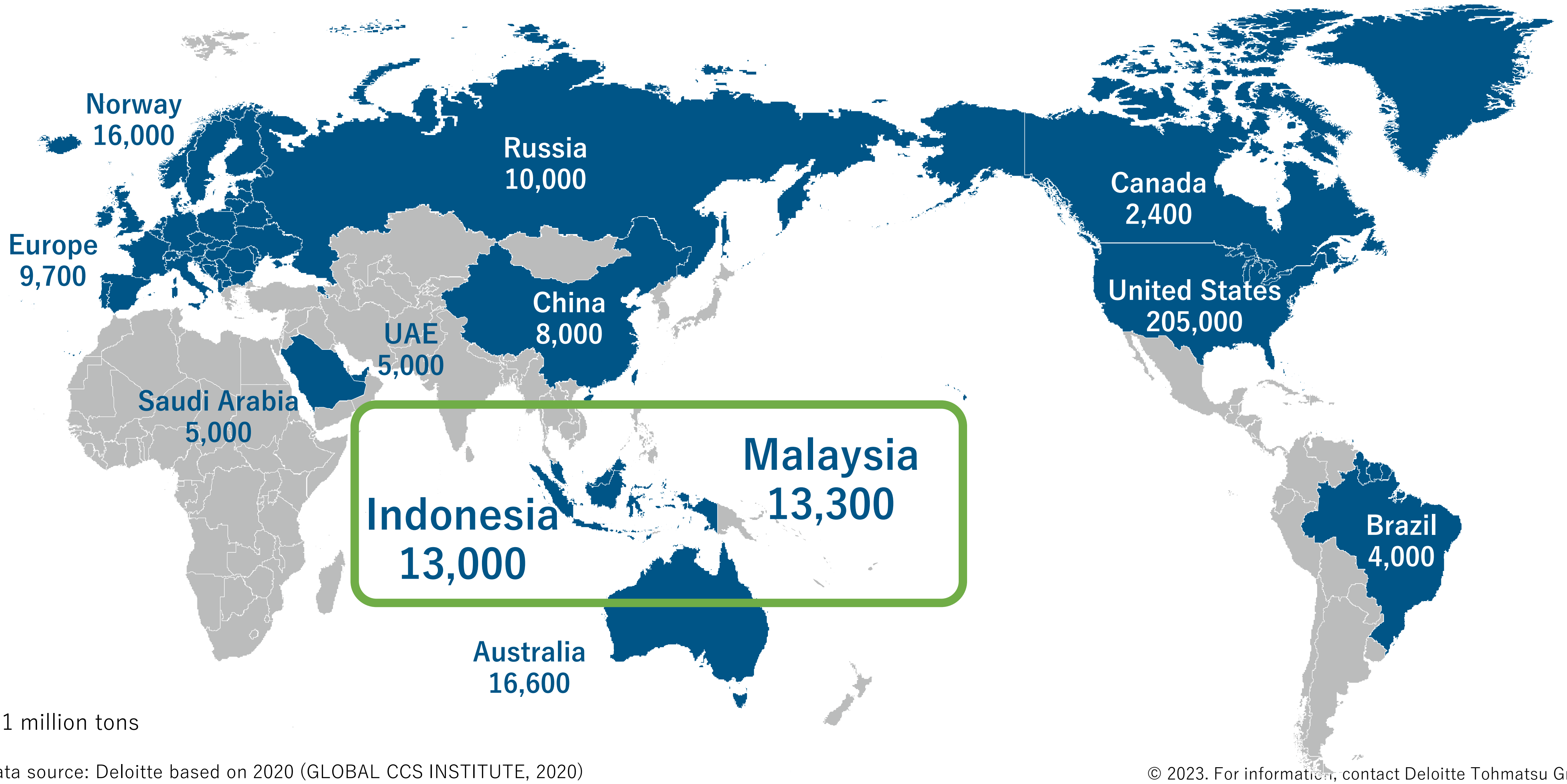
Potential of Wind Resources in ASEAN



Data source: Lee Nathan et al. (2020), EXPLORING RENEWABLE ENERGY OPPORTUNITIES IN SELECT SOUTHEAST ASIAN COUNTRIES

Only Malaysia and Indonesia has potential for EOR/EGR (Total 26.3 billion tons)

Global CO_2 geological storage (oil and gas fields)



Unit: 1 million tons

 Data source: Deloitte based on 2020 (GLOBAL CCS INSTITUTE, 2020)

Requirement of Multipath

There are several ways to achieve carbon neutrality in Europe

Four carbon neutral scenarios in Europe

	Summary	Description
High Electrification	Decarbonised and cheap electricity	Provides the conditions for process electrification with a fully decarbonized electricity mix (Assuming limited CCS*1 capability)
Fostering Circularity	Ambitious circularity policy	Focus on a strong circular policy agenda, boosting circular plastic feedstock availability and carbon use
Sustainable Biomass	Significant use of biomass	Policy has encouraged bio-based resources ensuring greater availability for all sectors
CO_2 Capture	High CCUS availability	Focus on the rapid and wide-spread CCS technology deployment

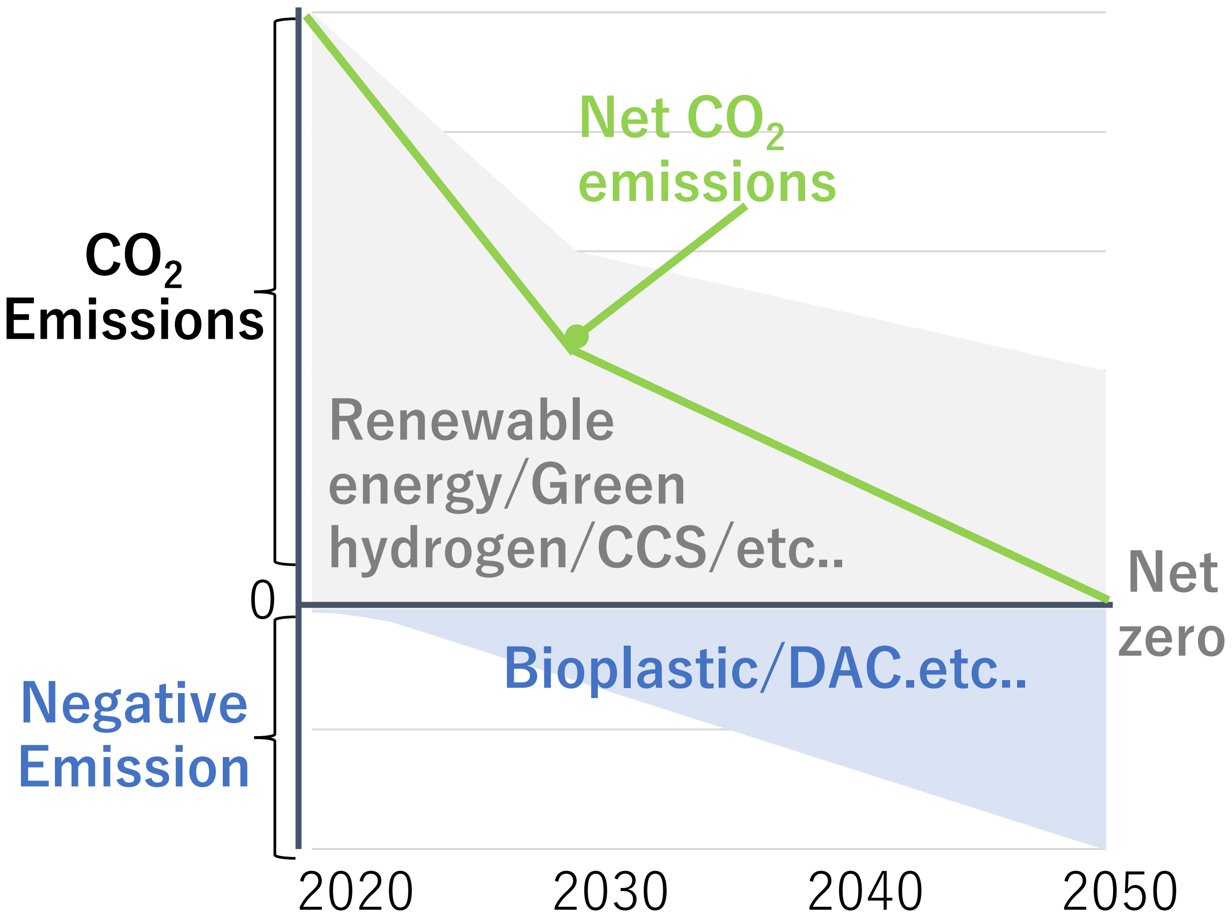
Note: The model is choosing how to reach climate neutrality. Although we change some inputs and parameters from one scenario to another within reasonable ranges (e.g., availability of resources, CAPEX trajectories, etc.). There is no direct decision to favour or impede the deployment of any technology or pathway. The selected scenarios do not represent extreme cases but "middle-of-the-road" approaches with key differentiators in order to (1) identify no regret choices, (2) inform the debate on enabling conditions and (3) enlighten industrial choices.

*1: Carbon capture and storage

To achieve CN by 2050, the European Commission is committed to take "all necessary measures"

The necessity of negative emissions

Image of achieving carbon neutrality in 2050



Perspective of Europe

- ✓ *It is essential to remove more carbon from nature and promote the "carbon cycle"*
- ✓ *Reduce its dependence on fossil-derived carbon*
- ✓ *Promote industrially sustainable solutions for carbon removal (Bioplastic/DAC/etc.)*
- ✓ *Target at least 20% non-petrochemical carbon in plastics and chemicals by 2030*

European Commission, December 2021

Data source： European Commission "Sustainable Carbon Cycles"

Even in Europe, there's a shift from an EV-only approach to a multipath strategy across public and private sectors

European Automotive Sector's Multipath Transition

Governments' movements

- **Adopting technology-open approach - Allowing eFuels**
- Drafting rules to allow **engines powered by "green" fuels** (i.e., Synthetic fuels, or eFuels*)

- **Postponing deadline** for sale ban of new gasoline vehicles to **2035**
- Take **realistic** measures to reduce the burden on the public

  \- UK Prime Minister Rishi Sunak

European OEMs' movement

Investment in e-fuel

- Porsche's **eFuels pilot plant** opened in Dec'22 in Chile

- 12.5 M.USD Investment into eFuel startup, Prometheus Fuels
- **24 engine families** produced since 2014, are **compatible with expected eFuels**

Investment in other vehicle types

- BMW's iX5 FCV production started in 2022

- Renault's Scenic Vision concept car that runs on Hydrogen-electric hybrid*2
- Expected production in 2024 or 2025

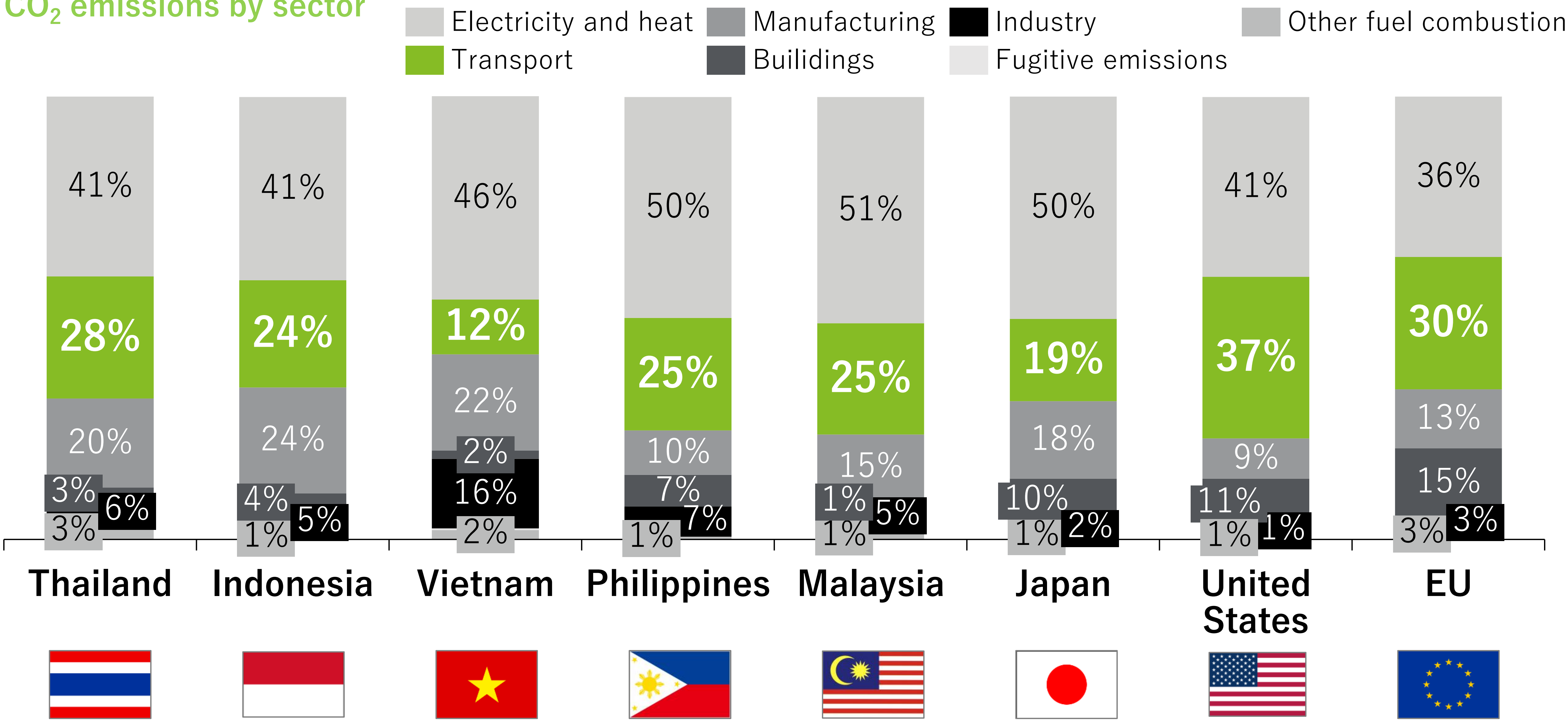
What is implied for Automotive Sector in ASEAN?

*1: Biofuels are still not allowed *2: hydrogen engine, electric motor, battery, fuel cell and a hydrogen tank

Realization of Sustainable Mobility

CO_2 emissions from the automobile sector are the second largest and are of great significance in reducing CO_2 emissions in each country

CO_2 emissions by sector



Data source: Our World in Data (2023), CO_2 emissions by sector

Should consider 3 points to realize sustainable mobility

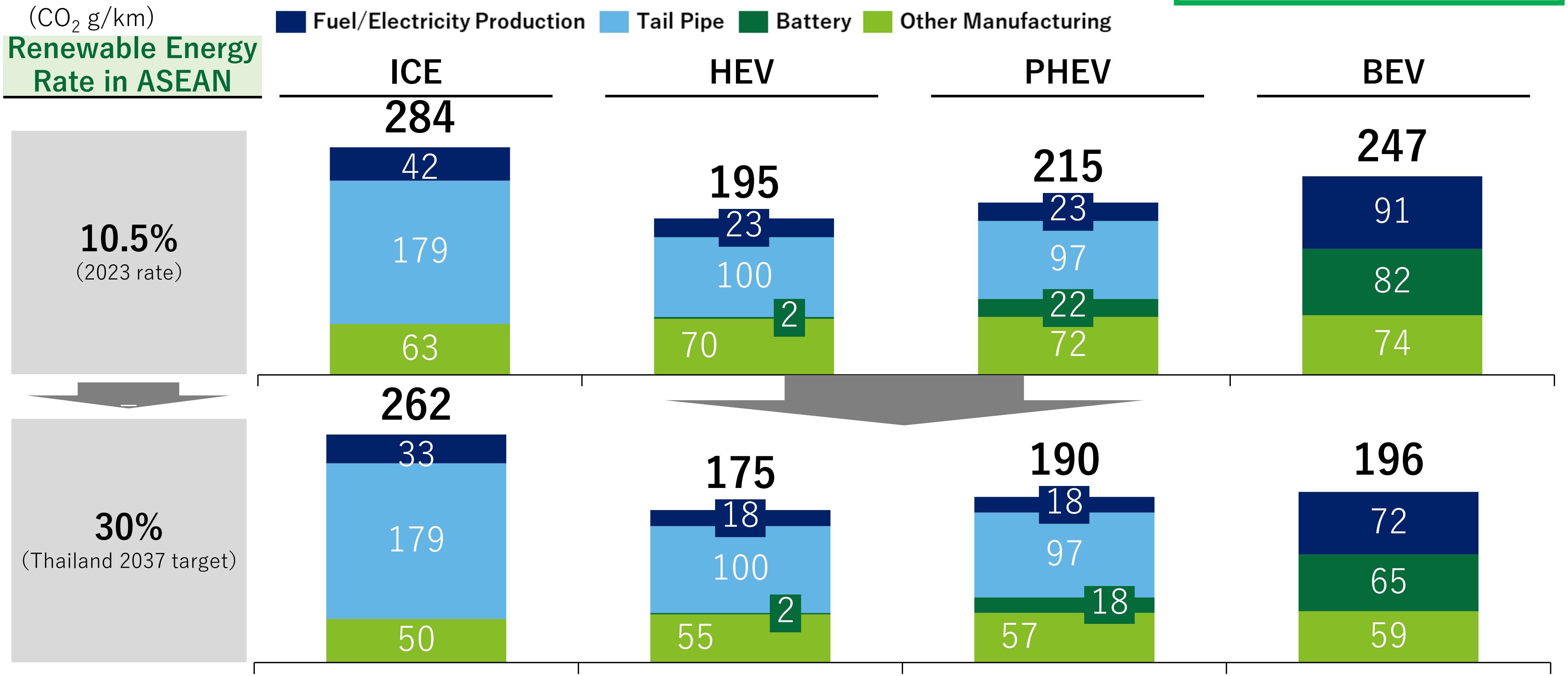
Key points for Sustainable Mobility

	Points
A CO_2 emission	➢ Select a suitable power train type according to the situation of renewable energy ➢ It is not only tail pipe, but also well to wheel
B Replacement of old vehicle	➢ CO_2 emission from an old vehicle is a significant contributor ➢ Have to consider how to proceed replacement holistically
C Resource efficiency	➢ Feedstocks such as rare metals, chemicals, etc. are from natural resources so far (not circulated yet) ➢ Choose suitable resources

Both 'well-to-wheel' and tailpipe perspectives are essential and BEVs' advantage amplify with greater renewable energy integration

Estimated CO_2 emissions of vehicles – Well to Wheel (Passenger Vehicle)

Estimated Value



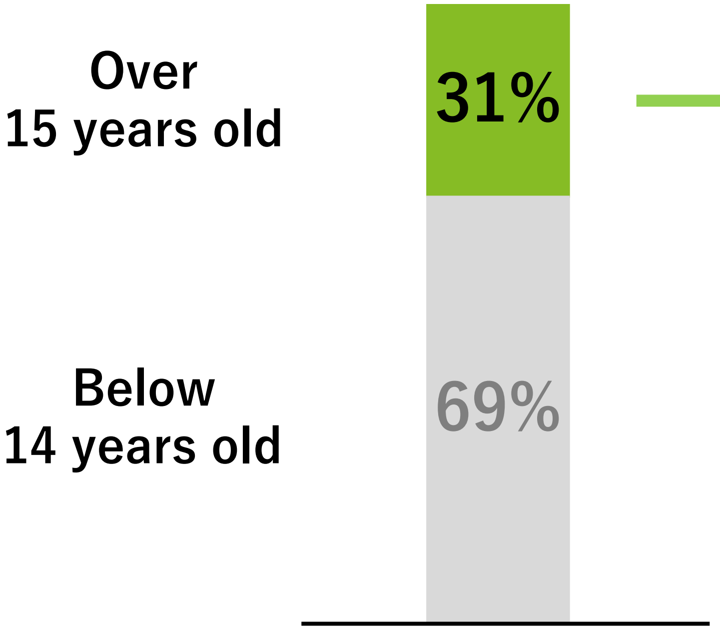
Note: Based on lifetime driving distance 100k KM, emissions from battery mfg and each energy power based on Japanese study. For energy generation, CO_2 emissions are based on a renewable energy ratio which is the state of current ASEAN market (Thailand, Phillipines, Vietnam, Malaysia, and Indonesia)
Source: Our World in Data, each vehicle's fuel efficiency report

It's vital to address carbon footprint reduction, especially in older vehicles, which are major contributors to CO_2 emissions

Carbon emission cause (Thailand)

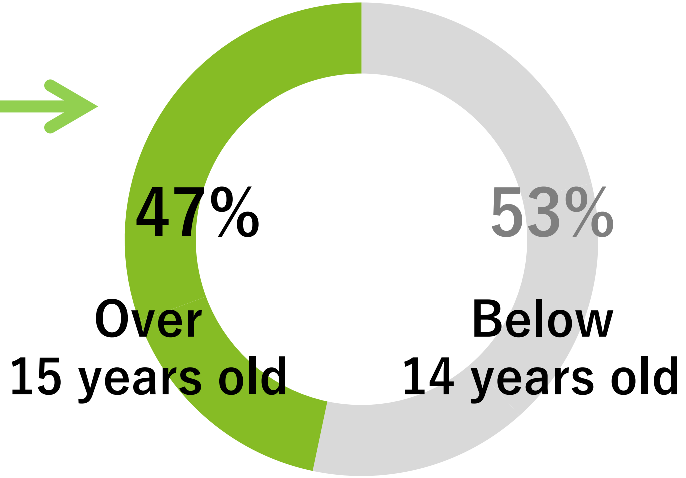
Units in Operation by Vehicle Age (2022)

20 *Million units in total*



CO_2 Emissions by Vehicle Age (2022)

67 *Million ton in total*



Older vehicles are a significant contributor to the CO_2 emissions

Owners of older cars in ASEAN typically have relatively **lower household incomes**, making BEVs less affordable for them (as of 2023 model lineups basis)

Thai Automotive expert

 Source: Our World in Data (2023), EPPO, Department of Land Transport, Deloitte analysis

HEVs can achieve decarbonization more effectively and efficiently than BEV, using the same amount of rare metals

Metals used in batteries can contribute to CO_2 reduction over the lifetime

Metals used for battery

Nickel

Cobalt

Manganese

BEV × 1 Vehicle

=

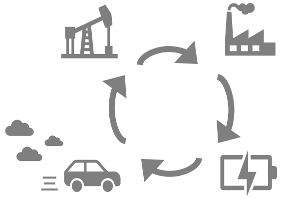
PHEV × 2.5 Vehicle

=

HEV × 39 Vehicle

CO_2 reduction amount

With 39 HEVs compared to 1 BEVs, you can achieve...



Lifecycle

55 times more CO_2 reduction

※The calculation refers to NMC 811, which has been the mainstream of EV batteries

 Source: International New York Times “A Climate Hawk’s Issues With Electric Vehicles”

Summary

Key message from presentation

Summary

- Customer/consumer's mindset has changed to consider Climate Sustainability (CN/CE)
- Should consider both CN and CE with business oppotunity. NP should be included in the near future
- There is no single route; should take Multipath (merits for customer)
- Cross industry/geography collaboration is required to achieve target in ASEAN (Regional Economy)
- For Automotive sector in ASEAN, it is the most important to take Multipath and cross industry/geography solutions

One of the competitiveness is from the management of
“True consideration for Climate Sustainability”