Carbon Neutrality Plan

# Scenario Analysis and Our Role and Policy

## Basis for Strategy Formulation: Scenario Analysis and Identification of Risks/Opportunities

### Scenario Analysis

The ENEOS Group conducted scenario analysis for the review of its Long-Term Vision. In conducting the analysis, we referenced STEPS[1], APS[2], and NZE[3] of World Energy Outlook (WEO) 2022 by the IEA for long-term forecasts of world energy demand, and Representative Concentration Pathways (RCP[4]) of the IPCC for the assessment of physical risks such as changes in climate and sea levels. This resulted in the identification of the risks and opportunities outlined in the table at right.

In revising our Long-Term Vision announced in 2019, we referenced multiple WEO scenarios, using the middle ground among them as the Group's base case. As a result, although the overarching direction of the social scenario in our Long-Term Vision will remain the same as the one in 2019, we believe uncertainty regarding this change toward decarbonization is greater than anticipated.

In the base-case scenario, risks include a decline in domestic fuel oil demand by around half in 2040 compared to 2019, while opportunities include the growth of the market for energy derived from decarbonized and recyclable resources and the generalization of environmental value trading. Additionally, demand is expected to grow for high-value-added services in mobility, such as EVs and car sharing, and lifestyle support for making life more convenient, as well as recycled resources, along with high-performance and advanced materials required for digital devices.

During the transition from fossil fuels to a portfolio centered on decarbonization, the Group will achieve both a stable supply of energy and the realization of a carbon-neutral society while keeping close watch over demand trends for fuel oil. The Group is maintaining its high degree of resilience in responding to multiple scenarios as it has a number of advantages that enable it to withstand change and is carrying out investments and demonstration projects, as well as verifying scenarios annually in accordance with the external and internal environments surrounding the Group[5].

1 Stated Policies Scenario: A scenario that reflects government policies already announced
2 Announced Pledges Scenario: A scenario that assumes that countries will achieve their ambitious targets
3 Net Zero Emissions by 2050 Scenario: A scenario in which the world will achieve net zero in 2050
4 Representative Concentration Pathways: A scenario on rising temperatures based on a greenhouse gas concentration trajectory
5 Implemented by the Carbon Neutrality Promotion Committee, established in May 2024

### Financial Impacts for Each Timeline of Identified Risks

| | Category | Financial impact | | | |
|---|---|---|---|---|---|
| | | Short term (2025) | Medium term (2030) | Long term (2040) | Assessment method |
| Transition risks | • Higher costs for achieving carbon neutrality | None | ¥30 billion annually | ¥120 billion annually | Amount of decline in operating profit if carbon credits were purchased for the entire reduction targets for 2030 and 2040 of 4 million tons and 19 million tons, respectively Carbon credit price ($50/t-$CO_2$[6]) × quantity × exchange rate<br>6 Internal carbon price |
| | • Declining demand for petroleum due to the accelerated proliferation of EVs driven by technological innovation<br>• Declining demand for petroleum due to growing environmental awareness | Limited impacts | Approx. ¥50 billion/ year decline | Approx. ¥100 billion/ year decline | Amount of decline in operating profit if domestic petroleum demand declined by approx. 20% in 2030 and approx. 50% in 2040 compared to 2019 (Calculated based on the fiscal 2025 income targets of the third Medium-Term Management Plan) |
| | • Stranding of upstream oil assets | Limited risk | | | Estimation of oil upstream asset reserves based on the number of extractable years discounted by current production |
| Physical risks | • Increasing frequency and severity of wind and flood damage due to extreme weather events (major typhoons) and rising sea levels | ¥100 to ¥200 million/year | | | Referenced the IPCC RCP8.5 scenario for estimation of the total amount of damage (decrease in operating profit) using WRI Aqueduct[7], etc. for 31 of our facilities and assets in Japan, such as refineries and smelters<br>7 A water risk assessment tool developed by the World Resources Institute |
| | • Rising sea levels caused by global warming | Limited risk | | | Estimated from amount of increase (approx. 0.2 meters) in sea level around Japan as of 2040 as projected by Aqueduct |

Note: The above was developed in May 2023. It will be reviewed as appropriate in accordance with changes in various conditions surrounding the economy and the formulation of our medium- to long-term business strategies.

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# Scenario Analysis and Our Role and Policy

## Financial Impacts for Each Timeline of Identified Opportunities

| Category | Financial impact | | | |
|---|---|---|---|---|
| | Short term (2025) | Medium term (2030) | Long term (2040) | Assessment method |
| • Increasing demand for renewable energy, hydrogen, and carbon-neutral fuels | Careful planning and rollout phase | Up to ¥50 billion/year | Up to ¥200 billion/year | Profit estimated based on certain assumptions about the estimated market size, the Company's market share, and operating profit margin due to an expected increase in demand for renewable energy, hydrogen, and carbon-neutral fuels associated with advancements toward a decarbonized, recycling-oriented society |
| • Expansion of EV charging and environmentally friendly mobility services | Careful planning and rollout phase | Up to ¥50 billion/year | Up to ¥100 billion/year | Profit estimated based on certain assumptions about the estimated market size, the Company's market share, and operating profit margin due to an increase in demand for EV charging, which is expected to grow with the development of a decarbonized society, and an expansion of business opportunities such as environmentally friendly mobility services |
| • Increasing demand for products that effectively reduce environmental impacts<br>• Increasing demand for materials made from recyclable resources | ¥100 billion/year | Up to ¥150 billion/year | Up to ¥200 billion/year | Profit estimated based on certain assumptions about the estimated market size, the Company's market share, and the operating profit margin due to the expected increase in demand for products that contribute to the reduction of greenhouse gas emissions and the expected increase in demand for materials derived from recyclable resources for a circular economy |

Note: The above was developed in May 2023. It will be reviewed as appropriate in accordance with changes in various conditions surrounding the economy and the formulation of our medium- to long-term business strategies.

## Carbon Neutrality—Our Role and Policy

In its Carbon Neutrality Plan, the Group has set targets to achieve net zero emissions for Scope 1+2 greenhouse gases by fiscal 2040. In addition, working in step with the government and other companies, we aim to contribute to the realization of a carbon-neutral society by 2050.

The movement toward carbon neutrality is changing throughout society. Meanwhile, leading roles in carbon neutrality and the timing of necessary technological breakthroughs are uncertain. We believe the turning point will be around 2030.

The Group, which is engaged in the energy and materials businesses, will take on the challenge of energy transitions for the future while fulfilling its current responsibility of providing a stable supply of energy and materials. By executing preemptive measures while utilizing our strengths, we will establish strategic advantages ahead of this turning point around 2030.

### ENEOS Group Carbon Neutrality Policy

**To realize a carbon-neutral society, we will reduce our greenhouse gas emissions while pursuing energy transition and a circular economy to contribute to the reduction of society's greenhouse gas emissions.**

Carbon Neutrality Plan

# Progress of the Plan

## Reduction of Our Greenhouse Gas Emissions

→ For details about our Carbon Neutrality Plan, see our corporate website.

WEB Long-Term Vision and Medium-Term Management Plan
https://www.hd.eneos.co.jp/english/company/system/plan.html

### Overview and Progress of the Plan

**Preparation for future increases in carbon prices**

**For Scope 1+2, aim for a reduction of 46% by FY2030 and the realization of carbon neutrality by FY2040**

| Policies on Initiatives | ENEOS Group measures | Progress in FY2023 | |
|---|---|---|---|
| Curbing greenhouse gas emissions | • Appropriate treatment of crude oil (according to demand)<br>• Efficiency improvement of manufacturing and businesses (energy conservation, fuel switching, utilization of renewable energy, etc.)<br>• Utilization of carbon credit | • Determined refinery emissions in a timely manner by introducing a $CO_2$ visualization system and established a system that can calculate carbon footprint | See page 29 |
| Artificial fixation of $CO_2$ | • CCS (carbon dioxide capture and storage)<br>• New methods such as BECCS[1] and DACCS[2] utilizing CCS | • Selected for a "Study on the Implementation of Japan's Advanced CCS Project" in fiscal 2023<br>• Made Japan Drilling Co., Ltd. a consolidated subsidiary<br>• Concluded partnership agreements with external partners to build a CCS value chain overseas | See page 29 |
| Increase of natural absorption of $CO_2$ | • Absorption by forests (afforestation, forest management, etc.)<br>• Other natural absorption methods (blue carbon and soil carbon fixation) | • Concluded partnership agreement with Mori Town in Hokkaido Prefecture for the creation of J-Credits derived from forest management<br>• Made a joint investment in the US Large-Scale Forestry Fund<br>• Commencement of study on large-scale blue carbon creation through industry-government-academia collaboration | See page 29 |

### Working to Achieve the Roadmap for Reduction of ENEOS Group Greenhouse Gas Emissions

The Group has set a target to achieve carbon neutrality in terms of its own greenhouse gas emissions by fiscal 2040. This is based on the idea that, as a company that supplies energy, we should aim to achieve our emission reduction target 10 years ahead of the Japanese government's goal of achieving carbon neutrality by 2050. At the same time, achieving our target will also prepare us for future carbon price increases.

To ensure the steady implementation of this initiative, we have set an interim target to reduce emissions by 46% by fiscal 2030 compared to fiscal 2013.

### Roadmap for Reduction of ENEOS Group Greenhouse Gas Emissions (Scope 1+2)

(Unit of greenhouse gas emissions: million tons per year)

| | | Third Medium-Term Management Plan | Medium and Long Term | |
|---|---|---|---|---|
| | | FY2025 | FY2030 | FY2040 |
| Targets | **Greenhouse gas emission targets (Scope 1+2)**<br>Parentheses: baseline year[3] comparison | **≤31 (-14%)** | **≤19 (-46%)** | **±0 Realization of carbon neutrality** |
| | Methane emissions (Oil and Natural Gas E&P)<br>Parentheses: baseline year (fiscal 2021)[4] comparison | **350 tons (-80%)** | **Less than 300 tons** | |
| Assumptions | Assumed emissions according to demand for fuel, etc. | **31.5** | **23** | **19** |
| Action | (1) Curbing our greenhouse gas emissions | **-0.5** | **-1** | **-3** |
| | (2) Artificial fixation of $CO_2$ | — | **-3 (fixation)** | **-11 (fixation)** |
| | (3) Increase of natural absorption of $CO_2$ | **-0.5 (create[5])** | **-2 (create)** | **-5 (offset)** |

1 Bio energy with carbon dioxide capture and storage 2 Direct air capture with carbon dioxide capture and storage
3 Baseline year for greenhouse gas emissions target: fiscal 2013. Greenhouse gas emissions in baseline year: 36 million tons. Figure revised from time of announcement in May 2022 (30 million tons) due to a change in calculation method for domestic emissions from the standard under the Global Warming Countermeasures Act to the GX-ETS standard. While there is no change in the target for transition-linked bonds (issued June 15, 2022), the target for greenhouse gas emissions in fiscal 2030 was revised from 16 million tons to 19 million tons.
4 Baseline year for methane emissions: fiscal 2021. Methane emissions in baseline year: 1,600 tons.
5 Credit creation for absorbed portion

Carbon Neutrality Plan

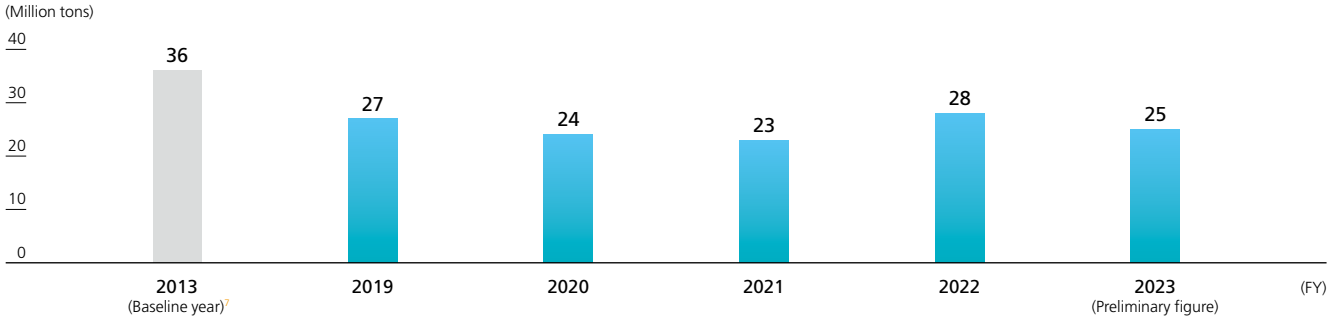
# Progress of the Plan

## Curbing Greenhouse Gas Emissions

In fiscal 2023, the ENEOS Group's $CO_2$ emissions (Scope 1+2) totaled 25 million tons (preliminary figures). Emissions decreased year-over-year thanks to improvements made in the efficiency of refineries, along with a decrease in refinery operations due to a decline in domestic demand and operational issues, as well as a decrease in the operation of power generation facilities for electricity retailing due to fluctuations in electricity market prices.

To reduce our greenhouse gas emissions, the Group is focusing on energy conservation in our business activities. Energy conservation measures include increasing the number and efficiency of heat exchangers and introducing higher efficiency rotary equipment at our refineries and plants, which play a main role at the production stage.

## Changes in Greenhouse Gas Emissions (Scope 1+2)[6]




6 Calculated in accordance with the Act on Promotion of Global Warming Countermeasures. From fiscal 2022, the calculation is in accordance with the GX-ETS standard based on the Act on Promotion of Global Warming Countermeasures.
7 Baseline year for greenhouse gas emissions target

### Example of Activities

## Curbing Greenhouse Gas Emissions

**Introduction of a $CO_2$ visualization system**

In order to advance emissions reductions at its refineries, ENEOS introduced a $CO_2$ visualization system, putting into place an operating structure that enables centralized management of company-wide emissions and calculation of these emissions (carbon footprint: CFP) for each product. The calculation of CFP using data actually acquired at refineries is the first initiative of its kind by an oil company in Japan.

## Artificial Fixation of $CO_2$

**Selected for the fiscal 2023 Study on the Implementation of Japan's Advanced CCS Project**

ENEOS, JX Nippon Oil & Gas Exploration, and J-POWER are exploring the commercialization of CCS in Japan. In August 2023, this project was adopted by the Japan Organization for Metals and Energy Security (JOGMEC) for the fiscal 2023 "Study on the Implementation of Japan's Advanced CCS Project."

In this project, we are conducting design work and storage assessments for $CO_2$ separation, capture, transportation, and storage. Our joint venture company West Japan Carbon dioxide Storage Survey Co., Ltd. is taking the lead in studying storage. We aim to build a CCS value chain that can be implemented by fiscal 2030.

**Concluded MOU for the joint study of CCS value chain overseas**

In December 2023, ENEOS and JX Nippon Oil & Gas Exploration signed a memorandum of understanding (MOU) with Santos Limited, a major Australian oil and gas company, to conduct a joint study to establish a CCS value chain between Japan and Australia. In March 2024, a separate MOU was concluded between ENEOS, JX Nippon Oil & Gas Exploration, Mitsubishi Corporation, and PETRONAS CCS Solutions, an affiliate of Malaysia's state-owned oil company PETRONAS, for a joint study on the establishment of a CCS value chain from the separation, capture, and accumulation of $CO_2$ emissions in Tokyo Bay to shipping and $CO_2$ storage in Malaysia. By strengthening collaboration with pioneering local companies in CCS, we will contribute to the achievement of Japan's carbon neutrality plan.

## Increase of Natural Absorption of $CO_2$

**Partnership agreement with Mori Town, Hokkaido Prefecture for the creation of J-Credits derived from forest management**

The ENEOS Group is working to revitalize the $CO_2$ absorption capacity of forests. Following projects in Ehime and Niigata prefectures, we began working with Nippon Life Insurance Company in November 2023 to create J-Credits in collaboration with Mori Town, Hokkaido.

**Investment in US Large-Scale Forestry Fund**

In July 2023, ENEOS, through a subsidiary of the ENEOS Group in the United States, invested in Eastwood Climate Smart Forestry Fund I, a United States forestry fund established by the Sumitomo Forestry Group. Whether in Japan or overseas, we will contribute to the formation of a decarbonized, recycling-oriented society through the circular use of forests.

# Contribution to the Reduction of Society's Greenhouse Gas Emissions

## Overview and Progress of the Plan

**Carbon neutrality as a pillar of future business working in step with the government and other companies**

**Aim for carbon neutrality including Scope 3 emissions by FY2050**

| Policies on Initiatives | ENEOS Group measures | Progress in FY2023 | |
|---|---|---|---|
| Contribution to the reduction of emissions in the energy area | • Pursuit of energy transition (hydrogen, carbon-neutral fuels, renewable energy, etc.) | • Steadily expanded power generation capacity by starting operation of renewable energy power plants in various parts of Japan<br>• Feasibility study for SAF production at the Wakayama Refinery<br>• Collaborated with external partners to build a hydrogen supply chain and commenced demonstration project for social implementation | See page 41<br>See page 38 |
| Contribution to the reduction of emissions in the materials and services area | • Pursuit of circular economy (recycling, sharing, etc.)<br>• Expansion of supply of products contributing to avoided emissions | • Concluded a comprehensive partnership agreement for the realization of a circular economy with Wakayama Prefecture, Kao Corporation, and Suntory Holdings Limited<br>• Established manufacturing processes for low-carbon lubricant base oils that contribute to the realization of a recycling-oriented society<br>• Established an in-house certification program for products that contribute to emissions reduction | See page 49 |

## Working to Achieve the Roadmap for Reducing Society's Greenhouse Gas Emissions

The Group's energy business has a significant impact on society's greenhouse gas emissions. We are working to reduce emissions in society as a whole through the expansion of our Renewable Energy business, the early commercialization of hydrogen and carbon-neutral fuels, and the development and sales of products that reduce environmental impacts.

We aim to halve our $CO_2$ emissions (CI[1]) per unit of energy supply by fiscal 2040. In order to achieve carbon neutrality by fiscal 2050, including for Scope 3 emissions, we will contribute to the reduction of emissions in society by working toward a circular economy in energy transitions and the materials and services field. In addition, we will work to make carbon neutrality-related businesses a pillar of our future business portfolio.

1 Carbon Intensity

## Roadmap for the Reduction of Greenhouse Gas Emissions of Society

| | | | | FY2025 | FY2030 | FY2040 |
|---|---|---|---|---|---|---|
| Energy field | Promote energy transition | CI (Carbon Intensity) | | **87** g-$CO_2$/MJ | **81** g-$CO_2$/MJ | **44** g-$CO_2$/MJ |
| | | $CO_2$-free hydrogen | | Investment decision for commercialization | 250 thousand tons | 1–4 million tons |
| | | Carbon-neutral fuels | SAF | 1st case investment decision | 500–700 thousand KL | Domestic share: 50% |
| | | | Biofuel | — | Supply<br>10% mixing to high-octane gasoline[2] | Supply<br>20% mixing to gasoline[2] |
| | | | Synthetic fuel | Demonstration of 1 barrel/day-scale | Manufacture synthetic fuel<br>300 barrels/day | Manufacture synthetic fuel<br>10 thousand barrels/day or more |
| | | Renewable energy total power generation capacity | | 2 GW | 3 GW | 6–8 GW |
| | | CCS (for other businesses) | | — | — | 4–10 million tons |
| Materials and services field | Promote circular economy | Petrochemicals | | 20 thousand ton scale<br>Start of waste plastic liquefaction business | Non-fossil resource ratio[3]: 20% | Non-fossil resource ratio[3]: 35% |
| | | Lubricants | | Completion of demonstration | Recycling amount: 100 thousand KL | Recycling amount: 200 thousand KL |
| | | Copper smelting | | — | Recycling ratio: 25% | Recycling ratio: 50% |
| | | Final disposal ratio of waste | | Less than 1.0% | | |
| | Expansion of products which contribute to avoided emissions | Avoided emissions (materials)[4] | | 750 thousand tons-$CO_2$e | 1,500 thousand tons-$CO_2$e | 2,000 thousand tons-$CO_2$e |

2 Biofuel + Synthetic fuel
3 Input ratio of green raw materials (waste-plastic-recycled oil, bionaphtha, etc.) against the production volume of products derived from naphtha cracker
4 Assuming about 20–50 million tons-$CO_2$e of avoided emissions (for fiscal 2040) by hydrogen and carbon-neutral fuel

**Message from the CTO**

# Contributing to the advancement of business strategies by determining the technological direction of the entire Group for carbon neutrality

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Senior Vice President, CTO
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ENEOS Holdings, Inc.

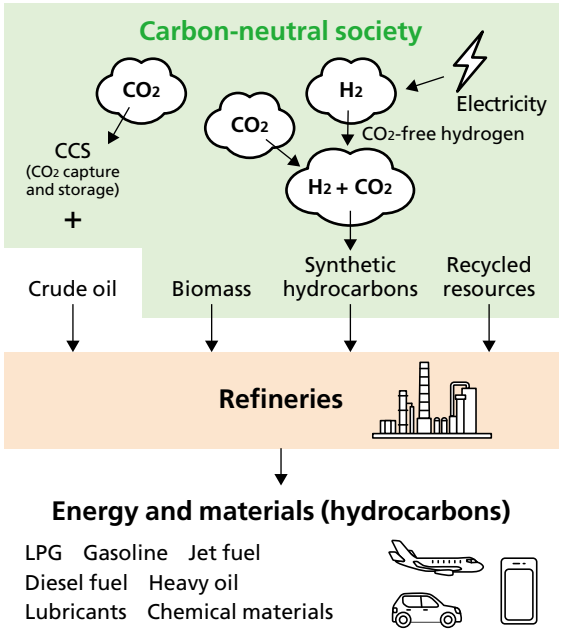
The ENEOS Group is working to achieve carbon neutrality, including its own emissions (Scope 1+2) by 2040 and Scope 3 emissions by 2050. The difficulty lies not only in reducing greenhouse gas emissions, but in doing this while also maintaining a stable supply of energy and materials. Even in a carbon-neutral society, humanity will likely continue to use hydrocarbons, made up of carbon and hydrogen. Airplanes, ships, and heavy vehicles, needed for long-distance travel, require energy-dense hydrocarbons (liquid fuels), and the chemical materials we use on a daily basis are also hydrocarbons. All of these will continue to be needed.

The Group will continue to supply hydrocarbons as energy and materials. Our strengths are the assets and supply chains that we have built over time, along with the new bases of renewable energy and CCS, among others. Currently, we supply energy and materials made from processed crude oil, but in a carbon-neutral society, these will change to raw materials that do not increase $CO_2$ in the atmosphere (see the figure at right). Even in a carbon-neutral society, our supply chains will be indispensable for supplying products to people around the world. We believe that the turning point toward the spread of next-generation energy and materials will be around 2030, and we aim to establish the necessary technologies by then. By 2040, we would like to develop carbon-neutral energy and materials into a business that contributes to earnings, and realize energy transition.

Specific initiatives are also progressing steadily. For example, demonstration and technological development for building a $CO_2$-free hydrogen supply chain, and creation of an in-house manufacturing system for sustainable aviation fuel (SAF). We are also working on the development of technologies related to the circular economy, such as synthetic fuels made from $CO_2$-free hydrogen and $CO_2$ as raw materials, and waste plastic recycling, as well as studying CCS implementation. These efforts are being carried out not only by utilizing the Group's proprietary technologies and assets, but also with the support of the Japanese government and the cooperation of universities and other companies.

In order to accelerate our efforts, in May 2024 we established the Carbon Neutrality Promotion Committee, led by the CTO. The committee's objective is to update the basic strategies in response to the drastically changing business environment and reflect them in the Medium-Term Management Plan and management strategies. The role of the CTO is to bring together the wide-ranging knowledge of each Group company to formulate and disseminate strategies backed by cutting-edge technologies to achieve carbon neutrality.

## Supply of Energy and Materials in a Carbon-Neutral Society




In a carbon-neutral society, refineries will produce energy and materials from raw materials that do not increase $CO_2$ in the atmosphere, such as biomass, synthetic hydrocarbons produced from hydrogen and $CO_2$, and recycled resources. Conventional crude oil processing will be combined with CCS to achieve net zero $CO_2$ emissions.