Chapter 4

Efforts in the Majors/Non-ASEAN NOCs

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Chapter 4

Efforts in the Majors/Non-ASEAN NOCs

This chapter analyses the energy transition strategies and activities of majors in Europe and the US (i.e., Western majors) actively engaged in low-carbonisation and decarbonisation efforts.

This chapter also provides examples that may be useful for ASEAN NOCs in developing future low-carbon and decarbonisation strategies.

1. Comparison of GHG Emission Reduction Targets of the Western Majors

Four companies – ExxonMobil, Shell, BP, and TotalEnergies – which are large-scale and active in climate change countermeasures amongst the Western majors, are selected as examples.

Table 4.1 compares the GHG emission reduction targets of the four Western majors, all of which have set a 2050 net-zero target.

TotalEnergies and BP have a net-zero GHG emission target, including Scope 3 for 2050, which is an ambitious target aiming to reduce emissions by at least 40% by 2030. Subsequently, Shell also set a similar goal of net-zero GHG emissions, including Scope 3 for 2050, with a reduction rate of more than 20% by 2030, a lower reduction rate than that of the two companies mentioned above. In October 2021, however, Shell changed its target to reduce GHG emissions by 50% from the 2016 level by 2030 (Scopes 1+2).[4] On the other hand, ExxonMobil has declared net-zero emissions by 2050 (Scope 1+2) but has not included Scope 3. Its GHG reduction target is based on GHG emission intensity, while those of the other three Western Majors are based on the amount of reduction.

[4] Shell Global Home Page, Our Approach to Climate Change and the Energy Transition, https://reports.shell.com/sustainability-report/2021/achieving-net-zero-emissions/energy-transition/climate-change-and-the-energy-transition.html (accessed 10 March 2022).

Table 4.1. Comparison of GHG Emission Reduction Target by Western Majors

	GHG Emission	GHG Emission Reduction Target by 2030	GHG Emission Reduction Target by 2050
Total Energies	All its operations, from production to the energy products used by its customers	-40% *worldwide -30% *Europe	Net zero (Scopes 1+2+3)
BP	Operation activities and oil and gas production	-30～35% *Operations -35～40% *Oil and gas	Net zero (Scopes 1+2+3)
Shell	GHG emissions from all operations and the energy products	-20% * In October 2021, Shell announced an absolute emissions reduction target of 50% by 2030, compared with 2016. * Shell is appealing the Dutch Hague District Court's ruling that global net carbon emissions must be reduced by 45% from 2019 by 2030.	Net zero (Scopes 1+2+3)
ExxonMobil	GHG emissions from its operating assets	Corporate-wide GHG emission intensity: 20%–30% reduction	Net zero (Scopes 1+2)

Source: Author.

2. Comparison of Western Majors' GHG Emission Reduction Targets and Upstream Activities

Table 4.2 compares Western Majors' GHG emission reduction targets, annual CCS targets, flaring elimination periods, and methane emission reductions.

Table 4.2. GHG Emission Reduction Target and Activities in Upstream by Western Majors

	Shell	BP	TotalEnergies	ExxonMobil
GHG emission reduction target	Net zero from Scopes 1+2 emissions from all operations by 2050. Net-zero Scope 3 emissions from all the energy products by 2050.	Net zero across BP's operations by 2050 (Scopes 1+2) Net zero on carbon in BP's oil and gas production by 2050 (Scope 3)	Net zero across Total's worldwide operations by 2050 or sooner (Scopes 1+2+3) Net Zero across all its production and energy products used by its customers in Europe by 2050 or sooner (Scope 1+2+3)	Net zero emissions from its operating assets by 2050 This ambition applies to Scopes 1 and 2 GHG emissions.
CCUS introduction target (annual recovery)	2035: 25 million tonne-CO_2	—	2030: 5 million tonne-CO_2	—
Flaring	Eliminate routine flaring by 2030	—	Eliminate routine flaring by 2030	Eliminate routine flaring by 2030
Methane	Maintain methane emission intensity below 0.2% by 2025	2025 target: 0.2%	<0.1% CH4 intensity for operated gas assets	70%–80% reduction in corporate-wide methane intensity

Source: Author.

3. Situation of Individual Companies

3.1. ExxonMobil

1) GHG reduction targets

In January 2022, ExxonMobil announced that it would reduce GHG emissions to zero by 2050 (Scopes 1+2). However, Scope 3 was not included. The company also updated its emission

reduction target. The company aims to reduce the emission density of GHGs generated by its corporate activities by 20%–30% from the 2016 level by 2030. The company states that if it achieves its target, the absolute number of emissions will also decrease by 20% by 2030. Specific measures include reducing excess gas (flare) in oil fields, preventing the leakage of methane gas, which has a greenhouse effect, and promoting the commercialisation of CCS. The company has already announced a policy of virtually zero emissions by 2030 for production in Permian, Texas, US, and is set to expand its efforts to other regions.

According to the Advancing Climate Solutions 2022 Progress Report (ExxonMobil, 2022), the company's GHG reduction targets by 2030 are as follows:

- 20%–30% reduction in corporate-wide GHG intensity and an absolute decrease of approximately 20% (or about 23 million metric tonnes)
- 40%–50% reduction in upstream GHG intensity and an absolute decrease of roughly 30% (or about 15 million metric tonnes)
- 70%–80% reduction in corporate-wide methane intensity
- 60%–70% reduction in corporate-wide flaring intensity

2) Investment plan

ExxonMobil plans to invest US$20 billion–US$25 billion annually in its entire investment program through 2027. Of the amount, the company will invest US$15 billion in decarbonisation-related activities. According to the report, the company plans to strengthen its methane gas leakage prevention measures and its businesses related to CCS, hydrogen, and biofuel.

3) Major efforts

a) Upstream

Methane

ExxonMobil set a goal of reducing methane intensity by 70%–80%. Figure 4.1 shows how it uses satellite technology and ground-based sensor technology are used to obtain methane emission data. ExxonMobil is participating in the US and EU’s Global Methane Pledge and the US Methane Emissions Reduction Action Plan.

Figure 4.1. ExxonMobil's Methane Measurement Technology

Source: ExxonMobil (2022).

Flaring

ExxonMobil has set a goal of reducing flaring intensity by 60%–70%. It also participates in the World Bank's Global Gas Flaring Reduction Partnership and Zero Routine Flaring by 2030 (ZRF2030).

b) Biofuel

In January 2022, ExxonMobil acquired a 49.9% stake in Norwegian biofuel producer Biojet AS. Biojet AS plans to build five biofuel production facilities in Norway, which will start operations in 2025. The five facilities have an annual production capacity of 3 million bbl., and ExxonMobil will purchase all of it.

c) CCS/Hydrogen

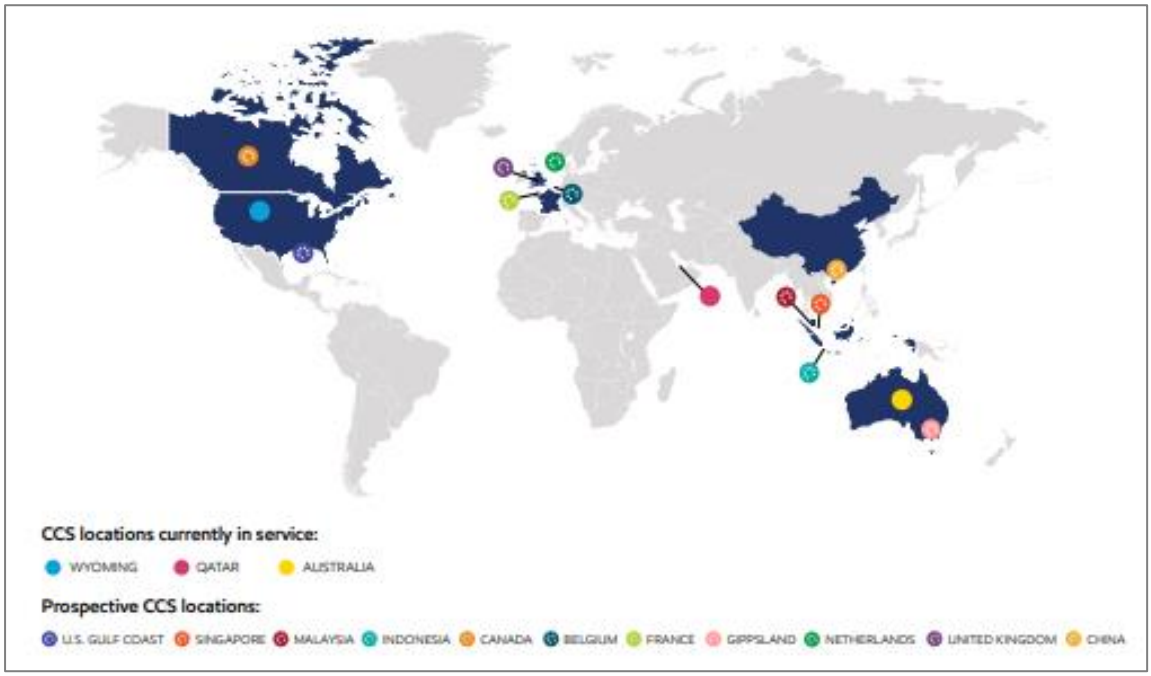
ExxonMobil's CCS history is longer than 30 years; it has a 20% share of the world's CCS capital. Figure 4.2 on ExxonMobil CCS Project Map shows specific projects. The projects include a hydrogen project with CCS at a Rotterdam refinery in Rotterdam, Netherlands; a CCS project at the Port of Antwerp, Belgium; and La Barge CCS project in Wyoming, US. In La Barge, the

capacity will be expanded by another 1 million tonnes from the current 7 million tonnes per year. ExxonMobil also plans to produce 1 bcf/d of natural gas–derived blue hydrogen and conduct the largest-class CCS in the world at its Baytown refining and petrochemical complex in Texas. This will allow the company to reduce CO_2 emissions (Scopes 1+2) by 30% and double its CCS capacity.

The company is also actively promoting CCS collaborations in the ASEAN region. It will jointly partner with PETRONAS in CCS technology development and Pertamina to survey potential CCS sites and transportation methods. It has also launched a scheme for developing a network of CCS facilities across several countries in Southeast Asia and plans to make Singapore the hub for the network. Singapore has a high concentration of power plants and oil refineries but no domestic CO_2 storage sites. In contrast, oil- and gas-producing countries, such as Indonesia and Malaysia, have oil fields with declining production – oil fields providing good conditions for CO_2 storage.

ExxonMobil is also working on DAC, not only on CCS.

Figure 4.2. ExxonMobil's CCS Project Map



Source: ExxonMobil (2022).

4) Divestment

Fossil fuel assets such as petroleum, coal, and natural gas are anticipated to significantly lose their value because they can no longer be utilised when GHG emissions must be reduced in response to global warming. The Western Majors are moving to sell their risky assets to prevent such a stranded-asset risk.

In January 2022, ExxonMobil started selling its shale gas assets in the Appalachian Basin in Ohio, US.

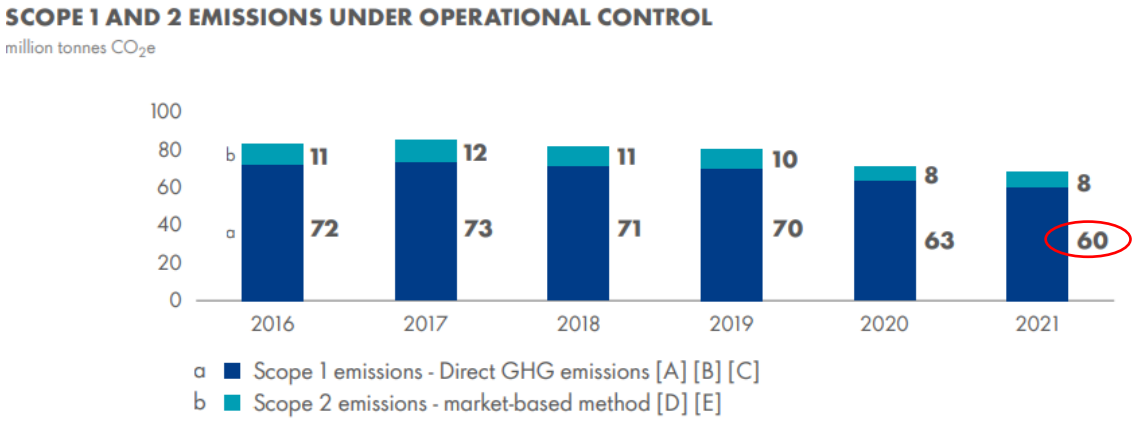
3.2. Shell

1) GHG reduction target

Shell announced its targets for reducing GHG emissions to zero by 2050 through Scopes 1+2+3.

According to the Shell Sustainability Report 2021 (Shell plc, 2021c), in 2021, Shell's total combined Scopes 1 and 2 absolute GHG emissions were 68 million tonnes on a CO_2 equivalent basis (Figure 4.3). Shell's Scope 3 emissions from energy products included in net carbon intensity were 1,299 million tonnes CO_2e.

Figure 4.3. Shell's GHG Emissions Transition (Scopes 1+2)



Source: Shell plc (2021).

Table 4.4 shows the breakdown of GHG emissions transition (Scope 1) by business and emission sources.

Table 4.3. Shell's GHG Scope 1 Emissions Transition by Business and Source (Scope 1)

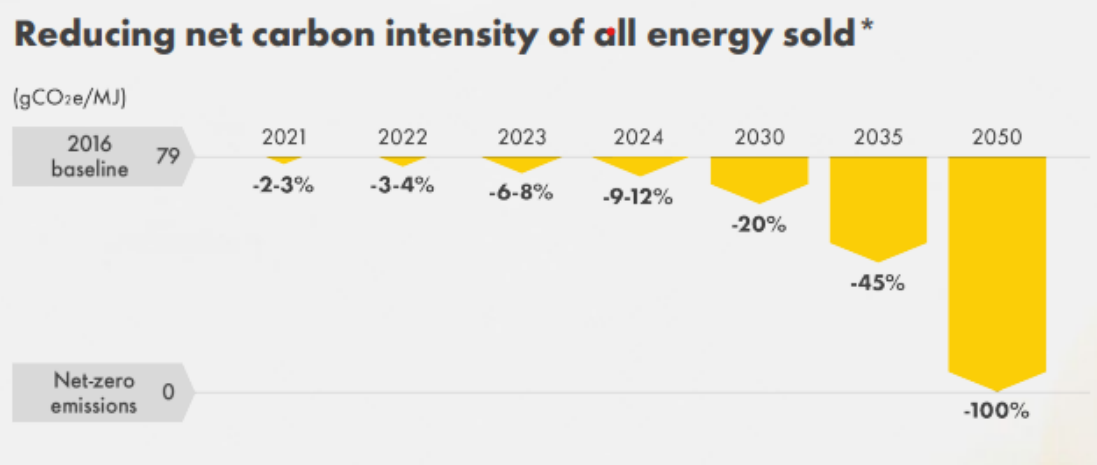
Scope 1 GHG emissions (operational control) [A] [B] [C] [D]

	Unit	2021	2020	2019	2018	2017
Direct GHG emissions (Scope 1)	million tonnes CO_2e	**60**	63	70	71	73
Carbon dioxide (CO_2)	million tonnes	**58**	61	67	69	70
Methane (CH_4)	thousand tonnes	**55**	67	91	92	123
Nitrous oxide (N_2O)	thousand tonnes	**1**	1	1	1	1
Hydrofluorocarbons (HFCs)	tonnes	**25**	30	29	31	22
Sulphur hexafluoride (SF_6)	tonnes	**0.01**	0.01	0.01	0.03	0.01
Perfluorocarbons (PFC)	tonnes	**0**	0	0	0	0
Nitrogen trifluoride (NF_3)	tonnes	**0**	0	0	0	0
Scope 1 emissions by business						
Upstream	million tonnes CO_2e	**11.7**	12.8	12.9	14.8	19.6
Integrated Gas	million tonnes CO_2e	**15.5**	14.1	16.3	13.0	12.0
Downstream	million tonnes CO_2e	**32.6**	35.8	40.2	42.7	41.1
Refining [E]	million tonnes CO_2e	**20.1**	23.4	28.0	29.1	27.8
Chemicals	million tonnes CO_2e	**11.0**	10.8	10.5	11.6	11.4
Other Downstream [F]	million tonnes CO_2e	**1.4**	1.6	1.8	2.1	2.0
Other [G]	million tonnes CO_2e	**0.2**	0.2	0.2	0.8	0.2

Source: Shell plc (2021).

Shell's GHG emission intensity (net carbon footprint) reduction targets (Shell plc, n.d.) are shown in Figure 4.4.

Figure 4.4. Shell's Net Carbon Footprint Reduction Targets



Source: Shell plc (n.d.).

2) Scenario

According to the Energy Transformation Scenarios, Shell (2021a) presented three scenarios – Waves, Islands, and Sky 1.5 –on the assumption of demand having been affected by COVID-19.

3) Major efforts

a) Upstream

Methane

Shell has set a goal of maintaining its methane emission intensity below 0.2% by 2025. The company uses infrared cameras to measure methane emissions, utilising drones and introducing advanced technologies to repair leaks (Figure 4.5).

Figure 4.5. Shell's Methane Measurement Using a Drone in Permian Basin

Source: Shell (2021b).

Flaring

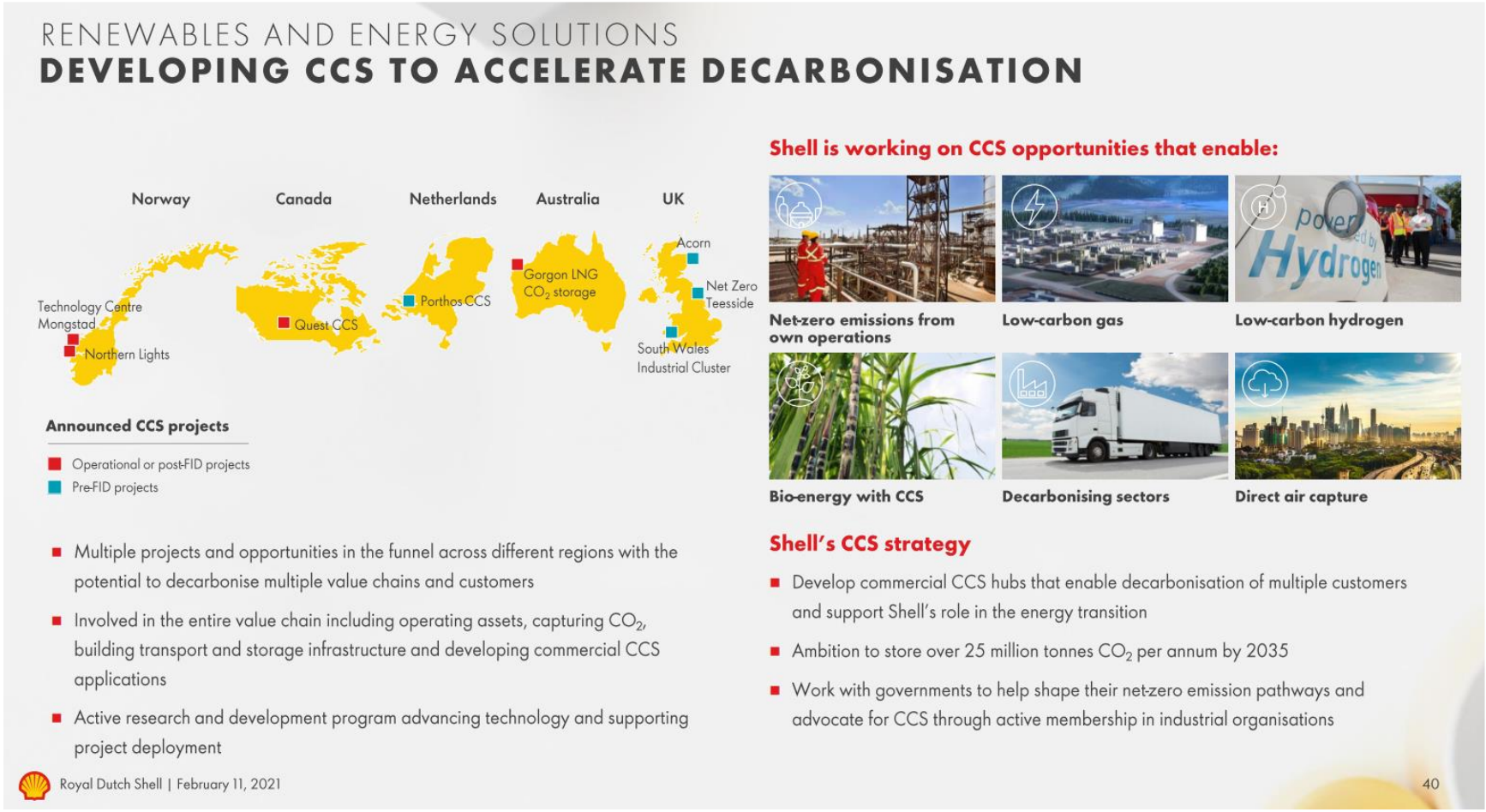
Shell has announced its plan to eliminate flaring by 2030. It also participates in the World Bank's Global Gas Flaring Reduction Partnership (GGFR) and Zero Routine Flaring by 2030 (ZRF 2030).

b) CCS

Shell plans to increase its CCS capacity to 25 million tonnes/year by 2035. It is working with Equinor and TotalEnergies on the Northern Lights CCS Project [5]in the North Sea off the coast of Norway and the Quest CCS Project in Alberta, Canada. It is also participating in the Porthos CCS Project with ExxonMobil at the Port of Rotterdam. Figure 4.6 shows Shell's CCS project map.

[5] https://norlights.com/

Figure 4.6. Shell's CCS Project Map



Source: Shell (2021b).

(c) Hydrogen

Electrolysis plant

Shell planned to build electrolysis plants in Rotterdam, Netherlands, in January 2022, and Hamburg, Germany (200 MW and 100 MW, respectively). The company will also install Europe's largest 10 MW polymer electrolyte membrane (PEM: polyelectrolyte multilayer) electrolysis plant at its Rheinland refinery, producing up to 1,300 tonnes of green hydrogen per year.

In January 2022, Shell started green hydrogen production in China with a local joint venture in Zhangjiakou, Hebei Province. It built a 20 MW electrolyser to provide green hydrogen to fuel cell vehicles at the Beijing Winter Olympics. It plans to expand the capacity of the electrolyser to 60 MW over the next 2 years.

Shell, RWE, Gasunie, and Equinor will start the Aqua Sector Project, Germany's first large-scale marine hydrogen park initiative. The project will construct an electrolysis plant of approximately 300 MW capacity to produce offshore 20,000 tonnes of green hydrogen per year. The green hydrogen is planned to be transported via a pipeline in 2028.

Green/blue hydrogen

In April 2022, Shell, and Mitsubishi Corporation's subsidiaries Eneco and Equinor plan to build about a 4 GW offshore wind power plant off the coast of the Netherlands to produce 400,000 tonnes of green hydrogen annually by 2030.

d) Biofuel/others

SAF

In September 2021, Shell planned to build one of Europe's largest facilities for producing sustainable aviation fuel (SAF) and renewable diesel fuel in Rotterdam, the Netherlands, with an annual production capacity of 820,000 tonnes. Moreover, in June 2021, the company will collaborate with Rolls-Royce to demonstrate a next-generation engine that uses SAF by 100%.

In April 2021, Shell and LanzaJet, Inc., a SAF producer, are planning to build a commercial-scale plant to produce 10 million gallons/year of jet fuel from alcohol (Alcohol-to-Jet: AtJ) in Georgia, US.

Bioethanol

In November 2016, with Cosan, a Brazilian biotech company, Shell established a joint venture company Raisen (Shell's investment share: 44%).

Low-carbon fuel

In May 2021, Shell, Bosch, and Volkswagen developed blue gasoline with a low CO_2 emission intensity. This gasoline is blended with 33% renewable fuel and is expected to reduce CO_2 emissions (wheel to wheel) by at least 20%.

e) Wind power

Shell has wind power interests in several countries, including onshore in the US and off the coasts of the US and the Netherlands. Shell is expanding wind power activities, which include developing wind projects on floating platforms in deeper waters off the shores of France, Ireland, Norway, Scotland, and South Korea. According to the Shell Sustainability Report 2021, at the end of 2021, the Shell share of total installed capacity combined from onshore and offshore wind was 466 MW alternating current (MWac), with a further Shell share of 838 MWac under construction.

The Americas

Shell is constructing wind power plants with a capacity of 2.2 GW in Mayflower (Shell's investment share: 50%) and 4.8 GW in Atlantic Shores, US (Shell's investment share: 50%).

Europe

Crosswind, a joint venture company of Shell and Mitsubishi Corporation's subsidiary Eneco, will build Hollandse Kust (Noord) offshore wind power plant (759 MW) in the Netherlands (Shell's investment share: 79.9%). The two companies are also planning hydrogen production using the offshore wind power plant. In January 2022, Shell and Scottish Power obtained two sites for wind power generation equivalent to 5 GW on Scotland's eastern and northeastern coasts. In February 2021, Shell agreed to supply Amazon.com with electricity derived from renewable energy generated from an offshore wind power plant in the Netherlands.

Asia/Pacific

Shell is building a floating wind power plant (Munmu Baram with 1.4 GW capacity) in South Korea (Shell's investment share: 80%).

f) Solar power

According to the Shell Sustainability Report 2021, at the end of 2021, Shell's share of installed solar power capacity was 734 MW direct current (MWdc), with 1,484 MWdc under construction.

The Americas

In November 2021, Shell Canada and Silicon Ranch announced to build a 58 MW solar power plant at Shell's Energy and Chemicals Park Scotford in Alberta, Canada.

Europe

In March 2019, Shell opened a solar power plant (27 MW capacity) at the Moerdijk Chemical Plant in the Netherlands.

Asia/Pacific

Shell installed roof-mounted solar power generation panels at 216 service stations in Malaysia and solar power generation facilities at seven lubricant plants in Singapore and other countries. In January 2021, Shell opened the Qabas Solar Power Plant with a capacity of 25 MW in Oman.

Shell Australia is constructing a 120 MW solar power plant in Queensland, Australia (Gangarri Project).

g) Charging point

Figure 4.7 shows that over 60,000 EV-charging points are operating in 14 countries. Shell plans to increase the number of EV-charging points from 60,000-plus to 500,000 by 2025.

Figure 4.7. Shell's EV-Charging Station

Source: Shell (2021b).

Europe

In February 2021, Shell acquired Ubitricity, Europe's largest roadside charging network. In September 2021, Shell planned to install 50,000 roadside charging points in the UK through Ubitricity by 2025.

Asia

In August 2019, Shell planned to install Southeast Asia's first EV-charging equipment at service stations in Singapore and launch EV-charging service 'Shell Recharge.' In March 2022, Shell also partnered with BYD, a Chinese battery and automotive giant, to provide charging services. The two companies plan to jointly establish BYD Shell EV service centres in the European market and a joint venture company for charging business in China.

h) Others

According to the Shell Sustainability Report 2020 (Shell plc, 2020), Shell is linking the salaries of its more than 16,500 employees to its goal of reducing its GHG emission intensity (net carbon footprint) by 6% to 8% by 2023 compared with 2016.

3.3. BP

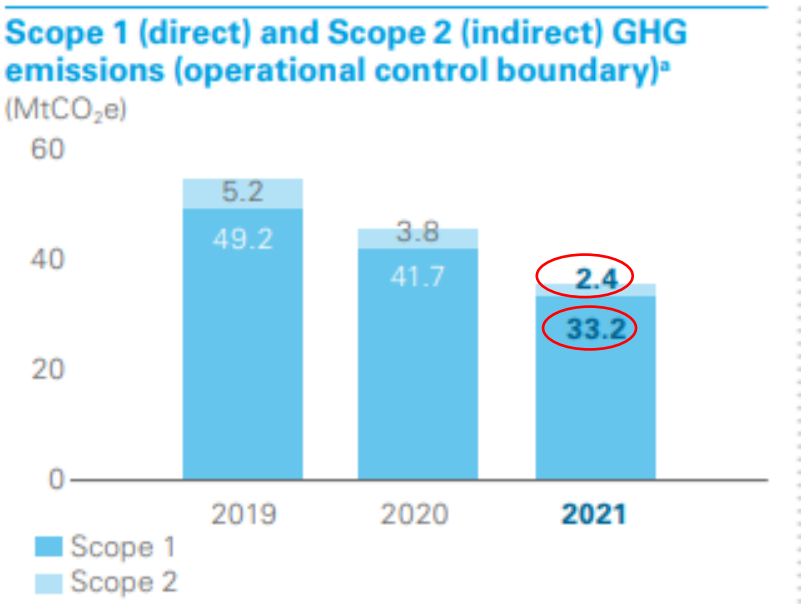
1) GHG reduction targets

According to the BP Sustainability Report 2020, GHG reduction targets are as follows:

- Aim 1: Net zero in absolute quantity in the company's operation activities (Scopes 1+2) by 2050 (set in February 2020)
- Aim 2: Net-zero emissions in absolute quantity in upstream oil and gas production by 2050 (Scope 3), *excluding Rosneft's investment.
- Aim 3: Reduce the carbon intensity of products to be marketed by 50% by 2050
- Aim 4: Install methane leakage-measuring equipment in all oil and gas facilities by 2023 to reduce methane intensity by 50%; encourage its joint ventures to set methane intensity at 0.2%.
- Aim 5: Increase the proportion of investment in non-oil and -gas businesses.

According to the Sustainability Report 2021 (BP, 2021), BP's combined Scopes 1+2 emissions in 2021 were 35.6 million tonnes CO_2e. Scope 1 emissions were 33.2 million tonnes CO_2e, and Scope 2 emissions were 2.4 million tonnes CO_2e (Figure 4.8).

Figure 4.8. BP Scope 1 (Direct) and Scope 2 (Indirect) GHG Emissions



Source: BP (2021).

According to the ESG date sheet 2022, BP disclosed the GHG emissions and intensity of Scopes 1+2 by unit (production and refining) (Table 4.4).

Table 4.4. BP GHG Emissions and Intensity (Scopes 1+2) by Unit

Metric	Unit	2017	2018	2019	2020	2021
GHG – Operational control [l]						
Scope 1 (direct) greenhouse gas emissions [m]	$MtCO_2e$	50.5	48.8	49.2	41.7	**33.2**
production	$MtCO_2e$	–	–	–	–	**15.5**
refining	$MtCO_2e$	–	–	–	–	**16.9**
Scope 1 (direct) carbon dioxide emissions	$MtCO_2e$	47.8	46.4	46.8	39.8	**32.0**
production	$MtCO_2e$	–	–	–	–	**14.4**
refining	$MtCO_2e$	–	–	–	–	**16.9**
Scope 1 (direct) methane emissions	Mt	0.11	0.09	0.10	0.07	**0.05**
production	Mt	–	–	–	–	**0.04**
refining	Mt	–	–	–	–	**0.00**
Sustainable GHG emissions reductions (Scope 1 and 2) [n]	$MtCO_2e$	0.5	1.3	1.4	1.0	**1.6**
Scope 2 (indirect) emissions	$MtCO_2e$	6.1	5.4	5.2	3.8	**2.4**
production	$MtCO_2e$	–	–	–	–	**0.0**
refining	$MtCO_2e$	–	–	–	–	**2.2**
Greenhouse gas intensity (Scope 1 and 2)						
production [o]	tCO_2e per thousand boe of production	–	–	–	–	**15.9**
refineries [p]	tCO_2e per utilized equivalent distillation capacity	–	–	–	–	**1,060**
petrochemicals [q]	tCO_2e per thousand tonnes of production	–	–	–	–	**688**
Methane intensity [r]	%	0.2	0.16	0.14	0.12	**0.07**
Flaring [s]	kt	1,987	1,634	1,395	831	**967**

l Operational control data comprises 100% of emissions from activities operated by bp, going beyond the IPIECA guidelines by including emissions from certain other activities such as contracted drilling activities.

m We provide data on GHG emissions material to our businesses on a carbon dioxide-equivalent basis. This includes CO_2 and methane for Scope 1 emissions.

n Sustainable emissions reductions (SERs) result from actions or interventions that have led to ongoing reductions in Scope 1 (direct) and/or Scope 2 (indirect) greenhouse gas (GHG) emissions (carbon dioxide and methane) such that GHG emissions would have been higher in the reporting year if the intervention had not taken place. SERs must meet three criteria: a specific intervention that has reduced GHG emissions, the reduction must be quantifiable and the reduction is expected to be ongoing. Reductions are reportable for a 12-month period from the start of the intervention/action.

o Scope 1 (direct) and Scope 2 (indirect) GHG emissions in tCO_2e from bp operated production assets per thousand boe of gross upstream oil and gas production.

p Scope 1 (direct) and Scope 2 (indirect) GHG emissions in tCO_2e from bp operated refineries per utilized equivalent distillation capacity.

q Scope 1 (direct) and Scope 2 (indirect) GHG emissions in tCO_2e from bp operated petrochemical facilities per thousand tonnes of petrochemicals produced.

r Methane intensity refers to the amount of methane emissions from bp's operated upstream oil and gas assets as a percentage of the total gas that goes to market from those operations. Our methodology is aligned with the Oil and Gas Climate Initiative's (OGCI). Methane intensity was previously reported to one decimal place but is now reported to two, in order to better demonstrate year-on-year changes.

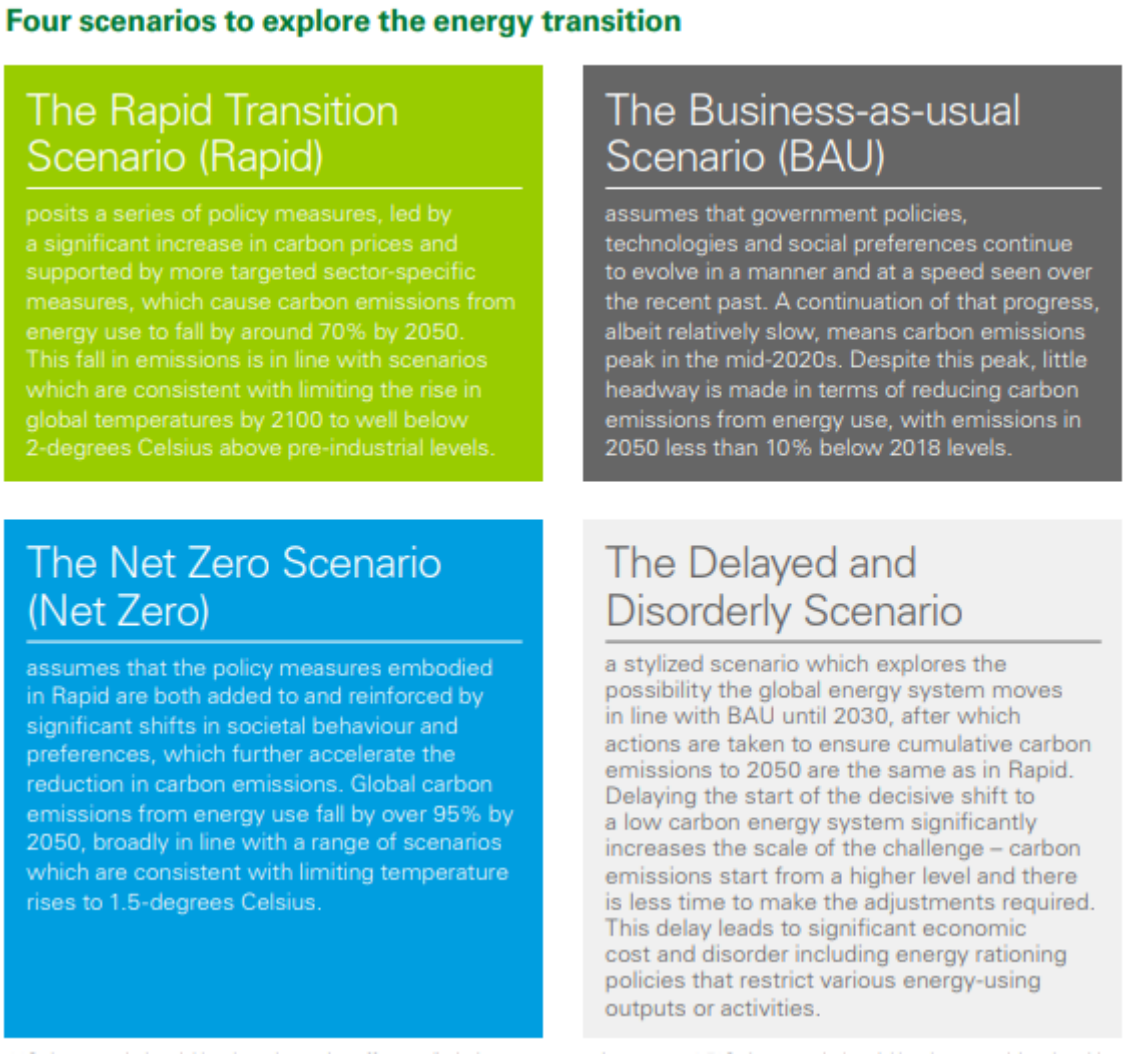
s We report the total hydrocarbons flared from our upstream operations.

Source: BP (2022).

2) Scenario

Figure 4.9 shows that BP has developed four scenarios to obtain the energy outlook for 2050.

Figure 4.9. BP's Scenario



Source: BP (2020).

3) Major efforts

a) Upstream

Methane

By 2023, BP plans to install methane leakage measurement equipment at all oil and gas facilities, reduce methane emission intensity by 50%, and encourage its joint ventures to set their methane emission intensity at 0.2%. The company will introduce satellite, drone, and aircraft-based technologies for measuring methane emissions and digitally measure the reduction of methane emissions using Flare IQ technology developed by Baker Hughes.

Flaring

The company will utilise Flare IQ developed by Baker Hughes as well as cloud computers and complex models to measure flaring conditions and provide second-by-second feedback (BP, 2020a).

It is also participating in the World Bank's GGFR Partnership and ZRF by 2030.

b) Retail

Reliance BP Mobility, a joint venture between BP and Reliance Industry, opened Jio BP-branded service stations (SSs) in Navi Mumbai, Maharashtra. It will also study the handling of low-carbon fuels in the future. Reliance BP Mobility operates more than 1,400 SSs and plans to gradually revamp them into Jio BP-branded SSs.

c) CCS

BP is participating in the Net Zero Teesside CCS Project in the northeastern part of the UK and plans to store 10 million tonne-CO_2 annually as an operator.

It will implement its CCS projects at Australia's Santos and Moombagas processing plants.

MIMI, a natural gas development company jointly invested by BP, Woodside, Mitsubishi Corporation, and Mitsui & Co., will start CCS project research in Australia.

d) Hydrogen

BP aims to have a 10% hydrogen share in core markets by 2030.

Hydrogen production

In November 2020, BP and Ørsted signed a letter of intent regarding green hydrogen. They will build a 50 MW electrolyser at the Lingen refinery in Germany. This green hydrogen project will be powered by electricity generated by the Ørsted offshore wind power plant in the North Sea. The produced hydrogen will be used at said refinery. In November 2021, BP planned to build a facility (HyGreen Teesside) in northeast England that can produce up to 500 MW of green hydrogen by 2030. The plan's first stage is to install a hydrogen production facility with a capacity of approximately 60 MW, aiming to start production by 2025. A final investment decision (FID) is scheduled for 2023. In March 2022, Scotland Aberdeen City Council and BP started a joint venture to build green hydrogen production, storage, and marketing facilities. Hydrogen production will begin in 2024.

Blue/green hydrogen

In March 2021, BP planned to build a hydrogen production facility (H_2Teesside) at Net Zero Teesside to produce up to 1 GW of blue hydrogen by 2030, equivalent to 20% of the UK's hydrogen goal. BP plans to make FID in 2024. The project will reform natural gas to produce hydrogen and capture and store emitted CO_2. In January 2022, BP agreed to a strategic

framework agreement with Oman's Ministry of Energy and Mineral Resources to develop renewable energy and green hydrogen by 2030.

e) Biofuel

According to the Low Carbon Electricity and Energy (BP, 2020b), BP plans to increase its bioenergy production from 22 Kb/d in 2019 to 50 Kb/d in 2025 and to more than 100 Kb/d in 2030.

Sustainable aviation fuel

BP has already supplied SAF to 18 airports in 6 countries and aims to achieve a 20% share of the global SAF market by 2030 (BP, 2021a).

Bio bunker fuel

In December 2021, BP and Maersk Tankers successfully tested the use of biofuel-blended shipping fuel for tankers.

f) Wind power

The Americas

In September 2020, BP and Equinor signed a strategic partnership contract regarding offshore wind power generation in the US. The two companies will invest US$1.1 billion in the Empire Wind (New York) and Beacon Wind (Massachusetts) wind power generation projects in the US (BP's investment share: 50%). Empire Wind has a power generating capacity of 2 GW and Beacon Wind 2.4 GW.

Europe

In June 2021, BP participated in an offshore wind power generation project off the coast of Norway with Statkraft and Aker Offshore Wind, both Norway's state-owned electricity companies. In January 2022, BP and EnBW acquired the lease rights to an offshore wind power generation project (known as Morven) on the east coast of Scotland. This project is for fixed-bottom type offshore wind power generation with a capacity of approximately 2.9 GW.

Asia/Pacific

In March 2022, BP and Marubeni Corporation signed a partnership contract with BP Alternative Energy Investments Limited (BPAEIL), a wholly owned renewable energy subsidiary of BP, for a decarbonisation project, including offshore wind power generation joint development and hydrogen utilisation.

g) Solar power

In December 2017, BP and Lightsource Renewable Energy Holdings, a UK renewable energy development and power generation company, formed a strategic alliance. As a result, BP invested in Lightsource by 43%, namely, US$200 million, and Lightsource changed its name to Lightsource BP.

h) Charging point

BP plans to increase the number of its EV charging bases from 11,000 in 2021 to 70,000 in 2030.

The Americas

In January 2018, BP acquired a US$5 million stake in quick-charging system manufacturer Free Wire Inc., US. In June 2021, it also invested US$7 million in IoTecha, a smart quick-charging company of the country. IoTecha's technology uses the internet of things to connect EV chargers to the power grid, automate payments, and optimise the charging process.

Europe

In June 2018, BP acquired Chargemaster, the largest charging network company in the UK. In May 2018, BP also invested in Store Dot, a developer of quick-charge batteries. BP would invest 1 billion pounds in deploying quick and ultra-quick charging facilities throughout the UK. In March 2021, BP and Volkswagen signed an MoU for ultra-quick EV charging facilities in the UK, Germany, and Europe.

Asia/Pacific

In August 2019, BP partnered with DiDi to expand the use of quick chargers in China. The joint venture plans to build a network of EV-charging hubs in China.

Reliance BP Mobility, a joint venture between BP and Reliance Industry, has also installed charging points for EVs at Jio BP-branded service stations.

i) Others

BP is linking remunerations to its about 28,000 employees and executives with GHG emission reduction (BP, 2020a). BP has also opened the ‘Discover Net Zero course’ at BP University to educate its employees.

j) Investment in decarbonisation

BP plans to increase investment in the low-carbon energy field to US$5 billion per year, 10 times the current level while projecting the reduction of oil and gas production by 40% by 2030.

3.4. Total energies

In May 2021, the company changed its name to TotalEnergies to clarify its stance of becoming less dependent on oil as a general energy company. The company declared its goal of becoming one of the world's top five renewable energy companies.

1) GHG reduction targets

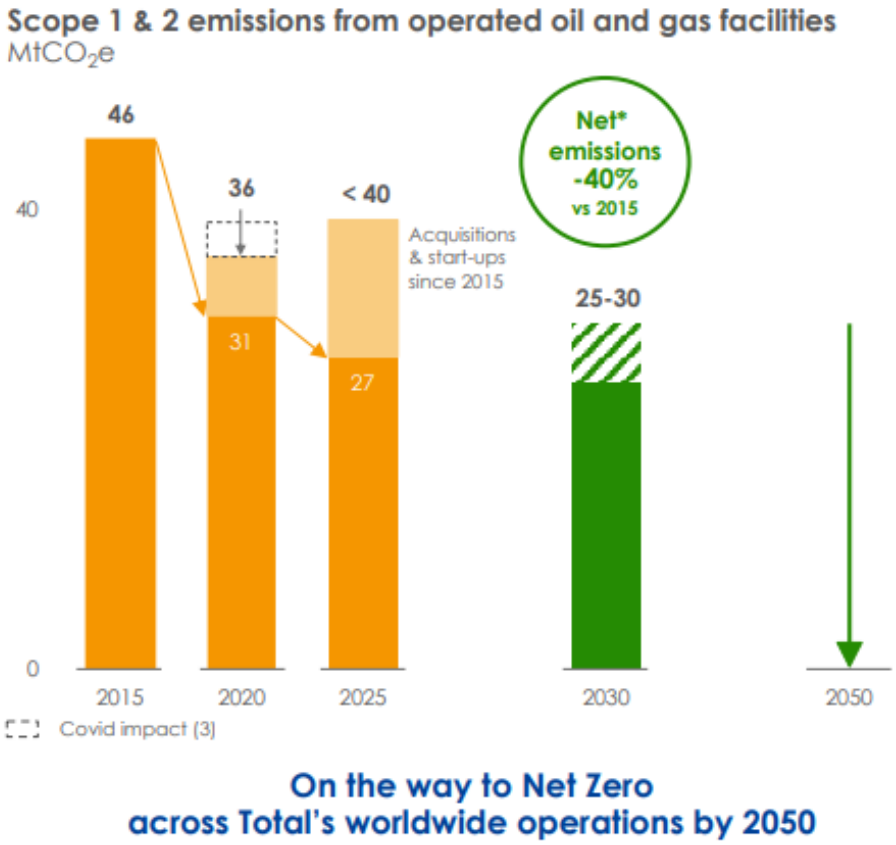
GHG reduction targets are as follows:

- Net zero across TotalEnergies’s worldwide operations by 2050 or sooner
- (Scopes 1+2+3)

- Net zero across all its production and energy products used by its customers in Europe by 2050 or sooner (Scopes 1+2+3)
- Revising its interim targets, as shown in Figure 4.12, to reduce GHG emissions (Scopes 1+2) from its oil and gas facilities by 40% in 2030 from the 2015 level

According to the Climate Roadmap in Action February 2021 (TotalEnergies, 2021a), TotalEnergies revised Scopes 1+2 emissions from operated oil and gas facilities in 2030 (Figure 4.10).

Figure 4.10. New Commitment Scopes 1+2: −40% in 2030 vs 2015



Source: TotalEnergies (2021a).

Form 20-F 2021 (Annual Report) reveals that TotalEnergies's indicators (2021b) related to climate change are as follows (Table 4.5):

Table 4.5. Indicators Related to Climate Change (TotalEnergies)

Indicators related to climate change[1]

GHG emissions		Operated emissions 2021	2020	2019	2015
SCOPE 1 Direct GHG emissions	Mt CO_2e	**34* *(33)***	**38* *(36)***	**41**	**42**
BREAKDOWN BY SEGMENT					
Upstream oil & gas activities	Mt CO_2e	14	16	18	19
Integrated Gas, Renewables & Power, excluding upstream gas operations	Mt CO_2e	5	3	3	–
Refining & Chemicals	Mt CO_2e	15* *(14)*	17	20	22
Marketing & Services	Mt CO_2e	<1	<1	<1	<1
BREAKDOWN BY GEOGRAPHY					
Europe: EU 27 + Norway + UK + Switzerland	Mt CO_2e	20* *(19)*	22* *(21)*	24	22
Eurasia (incl. Russia) / Oceania	Mt CO_2e	1	1	1	5
Africa	Mt CO_2e	9	10	11	12
Americas	Mt CO_2e	5	4	4	4
BREAKDOWN BY TYPE OF GAS					
CO_2	Mt CO_2e	32	34	39	39
CH_4	Mt CO_2e	1	2	2	2
N_2O	Mt CO_2e	<1	<1	<1	<1
SCOPE 2 Indirect emissions from energy use	Mt CO_2e	**2* *(2)***	**3* *(3)***	**4**	**4**
Of which Europe: EU 27+ Norway + UK + Switzerland	Mt CO_2e	1* *(1)*	2* *(2)*	2	2
SCOPE 1+2	Mt CO_2e	**37* *(35.7)***	**41* *(38)***	**44**	**46**
Intensity of GHG emissions (Scope 1+2) of Upstream oil & gas activities[a]	kg CO_2e/boe	17	18	19	21

Source: TotalEnergies (2021b).

2) Scenario

TotalEnergies has developed two scenarios (Figure 4.11).

Figure 4.11. TotalEnergies's Two-demand Scenario

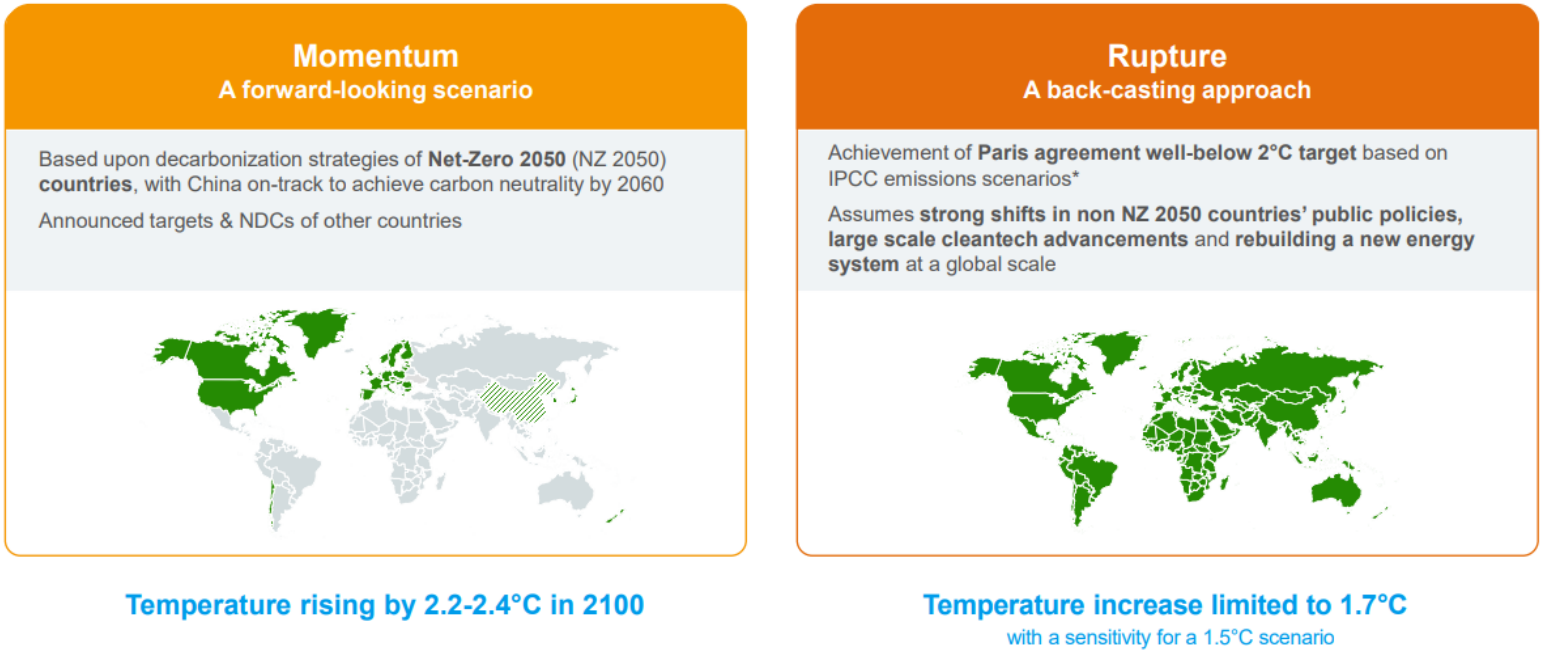
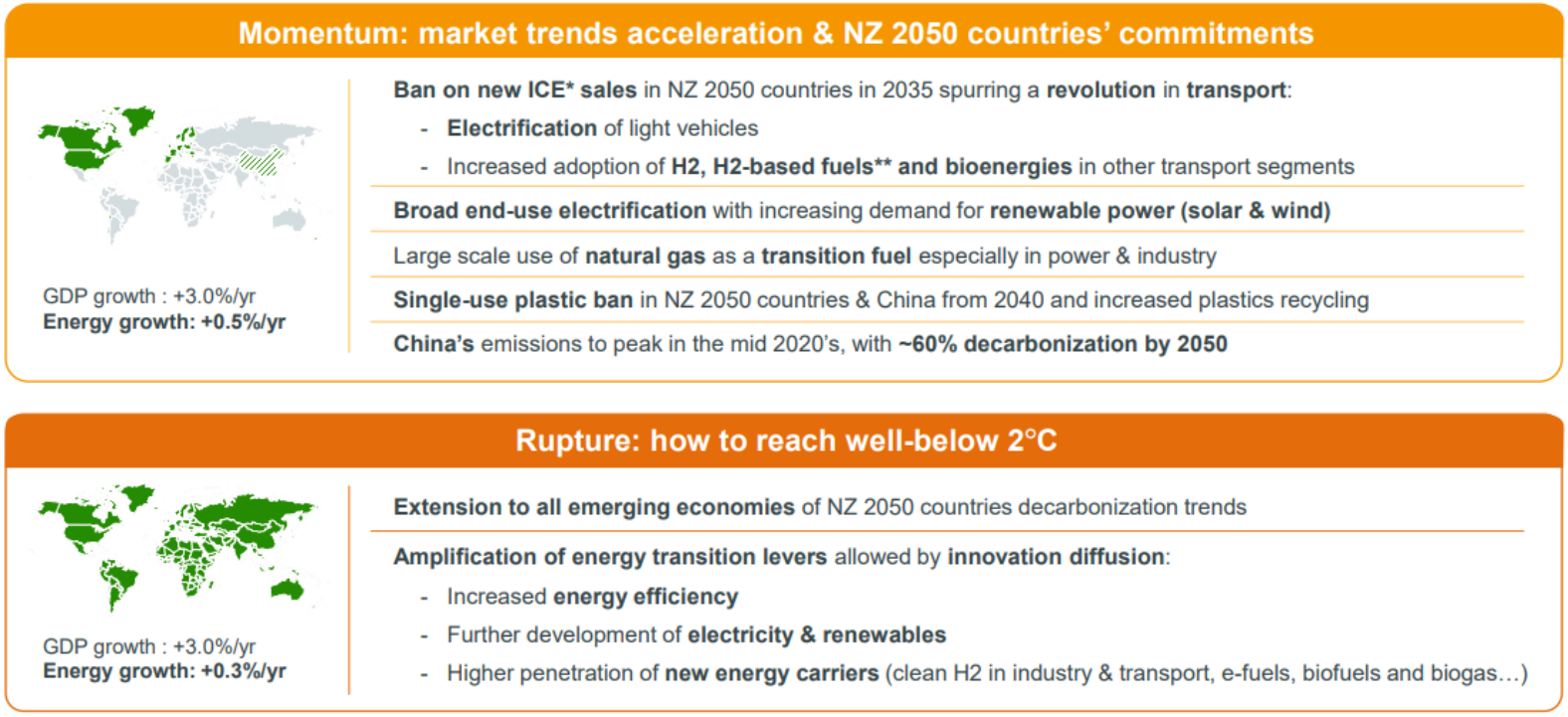


Figure 4.11. Continued



Source: TotalEnergies (2021c) .

3) Major efforts

a) Upstream

Methane

According to the Sustainability Climate 2022 Progress Report, TotalEnergies has set targets for reducing methane emissions from its operating oil and gas facilities by 50% in 2025 and by 80% in 2030 compared with the 2020 level. In addition, since 2014, the company has been participating in the second phase (OGMP 2.0) of the United Nations Environment Program's OGMP Initiative (Oil and Gas Methane Partnership).

The company is working with GHGSat to identify, quantify, and reduce methane gas emissions from their operations. It is developing a satellite imaging technology to monitor methane gas leakages from offshore facilities. This technology, called Glint Mode, observes sunlight glints on the ocean surface, nullifying interference with data acquisition. At the same time, satellite images are utilised in combination with on-site measurements by AUSEA1, an ultra-lightweight drone-mounted spectrometre developed by the company (Figure 4.12).

Figure 4.12. TotalEnergies's Methane Measurement Technology

Source: TotalEnergies (2021a).

Flaring

According to the Sustainability Climate 2022 Progress Report (TotalEnergies, 2022), TotalEnergies has set a new target to bring the level below 0.1 million cubic metres per day starting in 2025. TotalEnergies will eliminate routine flaring by 2030. The company is participating in the World Bank's GGFR Partnership and ZRF by 2030.

b) Refinery

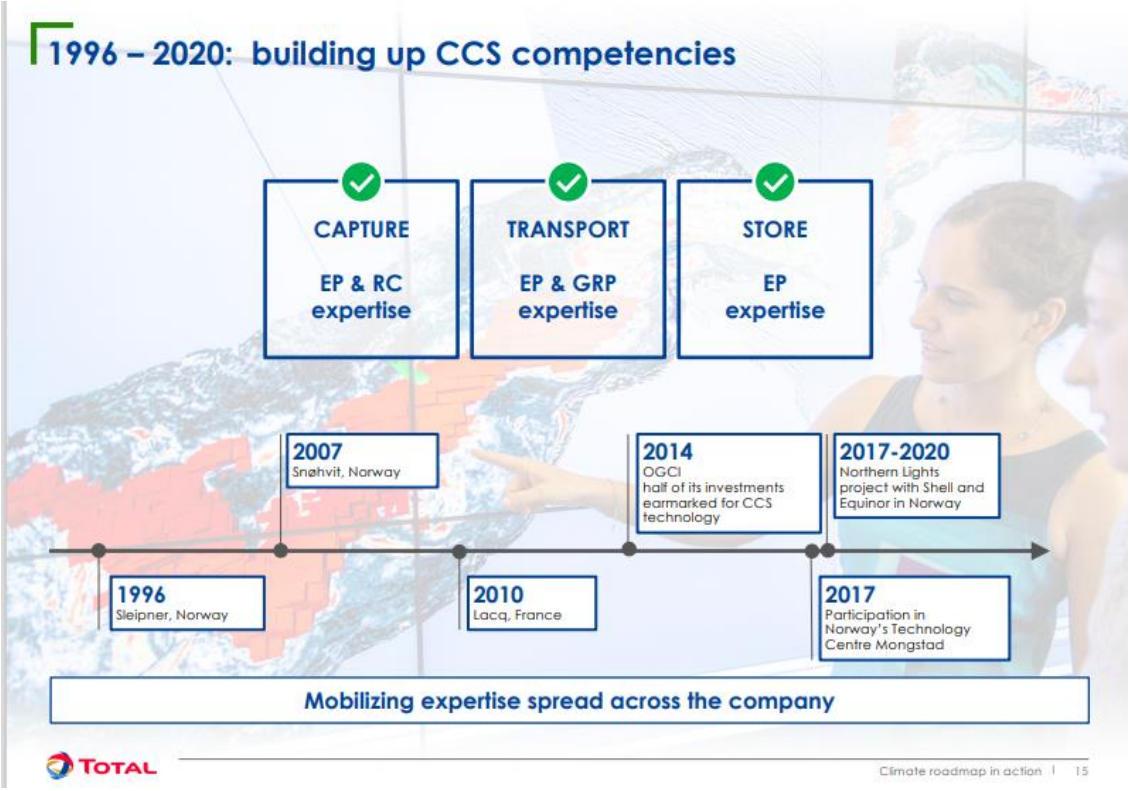
TotalEnergies has invested US$450 million to improve the energy efficiency of its refineries and chemical facilities since 2010 and has improved its energy efficiency by more than 10% through 250 projects. According to the Getting to Net Zero (TotalEnergies, 2020), the company will introduce an energy efficiency index, GEEI, and adopt an energy management system

capable of measuring, recording, and auditing energy efficiency according to standards such as ISO 50001. It has also installed 170 wireless sensors in its steam blast furnaces.

c) CCS

TotalEnergies plans to invest in CCS and DAC. Its annual budget as of 2021 was US$100 million, with a target storage capacity of 10 million tonne-CO_2 per year by 2030. TotalEnergies has been developing CCS technology since 1996 (Figure 4.13).

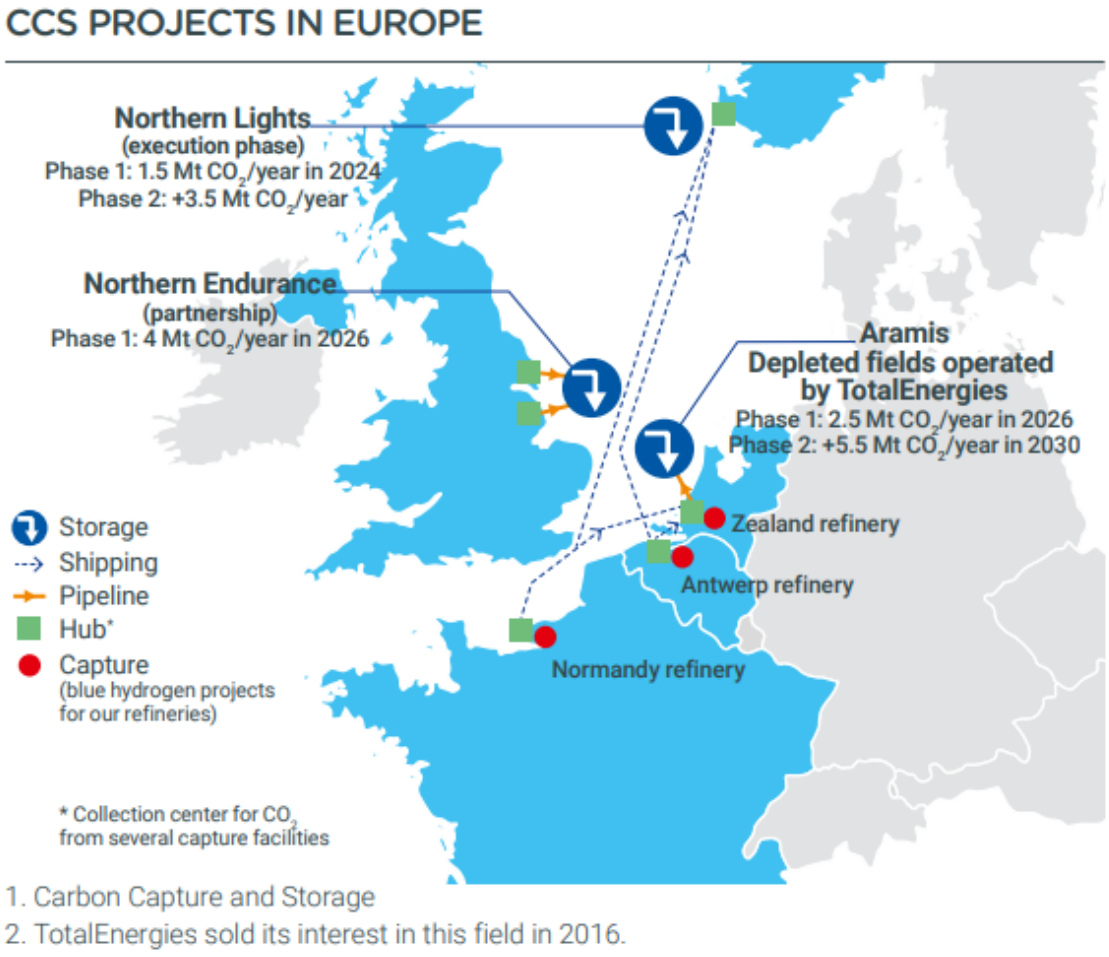
Figure 4.13. History of TotalEnergies's CCS Project



Source: TotalEnergies (2021a).

Major CCS projects in Europe include Northern Lights, Net Zero Teesside, and Aramis. Aramis aims to implement FID by 2023 and start operation in 2026. CCS projects at refineries include Antwerp, Normandy, and Zeeland (Figure 4.14).

Figure 4.14. CCS Project Map of TotalEnergies in Europe



Source: TotalEnergies (2022, p.36).

In September 2021, TotalEnergies and Air Liquide cooperated in decarbonising hydrogen production at TotalEnergies's Normandy platform. Air Liquide would supply low-carbon hydrogen to TotalEnergies by utilising Air Liquide's hydrogen network in Normandy and by introducing large-scale CCS.

In November 2020, TotalEnergies signed a strategic framework agreement with ADNOC of the UAE to engage in joint research, development, and dissemination in the CCUS field. At the same time, TotalEnergies developed GEOSX, a simulator of CO_2 reservoir behaviour in CCUS, with the Lawrence Livermore Laboratory of Stanford University, US.

d) Hydrogen/ammonia

Electrolysis plant

In January 2021, TotalEnergies and Engie partnered on the Masshylia Project to produce renewable hydrogen at the La Mède biorefinery. The project would produce 5 tonnes/day of

hydrogen from a solar power plant (100 MW) and a water electrolysis hydrogen production unit (40 MW) to supply hydrogen to the biorefinery. The construction was scheduled to start in 2022, with the operation expected to begin in 2024.

Ammonia

In April 2022, TotalEnergies Marine Fuels Pte Ltd, Pavilion Energy Singapore Pte Ltd, the Maritime and Port Authority of Singapore, Mitsui O.S.K. Lines (MOL), Itochu Corporation, and others signed an MoU to establish an ammonia fuel supply chain in Singapore, including ammonia bunkering vessels.

Hydrogen station

TotalEnergies is developing hydrogen stations through H_2 Mobility, Germany.

e) Biofuel

Biorefinery

La Mède refinery, France, will be converted into a biorefinery, with a production capacity of 500,000 tonnes/year. Grandpuits refinery, France, will be converted into a biorefinery at the cost of €500 million.

SAF

In September 2021, TotalEnergies and Safran signed a strategic partnership agreement to make current aircraft engines compatible with fuels containing SAF by up to 100%.

In April 2022, TotalEnergies and ENEOS will conduct a feasibility study for SAF production. The raw materials for SAF will be procured from Nomura Jimusho Inc. (Minato Ward, Tokyo), a chemical trading company, and SAF production will be studied at ENEOS' Negishi Refinery (Yokohama City) with the technologies of TotalEnergies utilised. A mass production system will be established by 2025 to produce 300,000 tonnes per year.

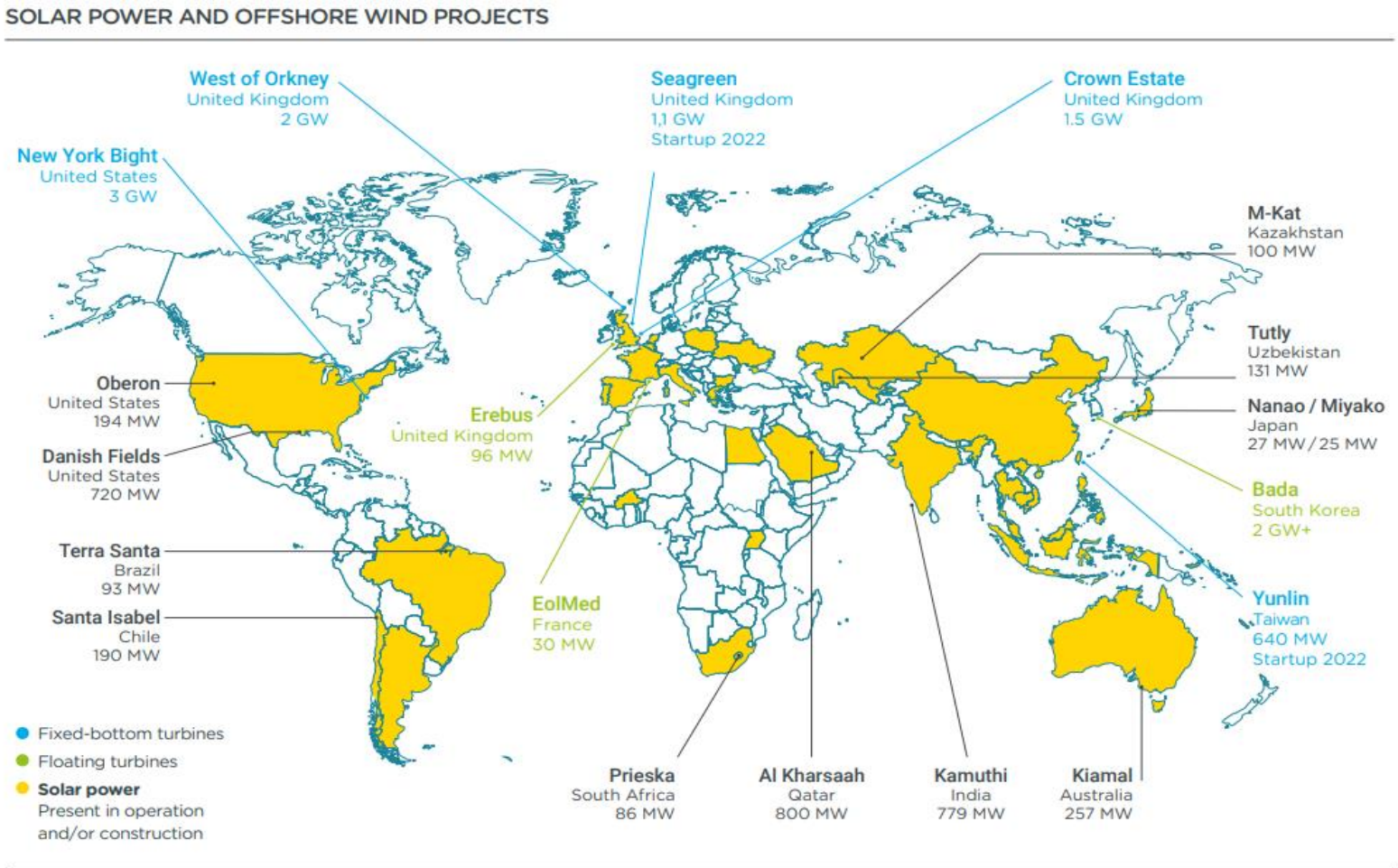
Biomethane

In November 2021, a joint venture company between TotalEnergies and the US-based Clean Energy will build a biomethane production facility in the US state of Texas. For the company, this is the first biomethane production in the US. It plans to produce more than 40 GWh of biomethane annually. In February 2022, TotalEnergies and Veolia of France agreed to promote the production of up to 1.5 TWh of biomethane per year domestically and internationally by 2025.

f) Wind power

TotalEnergies aims to install renewable electricity capacity of 35 GW in 2025 and 100 GW in 2030. Figure 4.15 shows a project map for solar and offshore wind power generation.

Figure 4.15. Location of Solar and Wind Power of TotalEnergies



Source: TotalEnergies (2022).

In October 2021, with Ireland's Simply Blue Group, TotalEnergies established a joint venture company, TotalEnergies SBE US, to deploy floating offshore wind power generation projects in the US. In March 2022, TotalEnergies and EnBW won the bid to develop a 3 GW offshore wind power plant on the East Coast of New York and New Jersey for US$795 million. The plant will start operation in 2028.

g) Solar power

TotalEnergies aims at a solar energy account for three-quarters of the 35 GW the company wants to develop by 2025.

The company has installed solar panels at 1,700 service stations (SSs) worldwide since 2016 and plans to expand solar panel installations to 5,000 locations in 57 countries. When completed, this initiative will have solar panels installed in 30% of the world's SSs, equivalent to a solar power generation capacity of 125 MW.

Europe

TotalEnergies and Ignis of Spain will develop a solar power facility in the Andalucia region, Madrid. It is scheduled to be completed in 2025.

Asia/Pacific

In January 2021, TotalEnergies and 174 Power Global (a wholly owned subsidiary of Hanwha Group of Korea) will establish a 50/50 joint venture to develop a solar power generation and energy storage project. In November 2021, Total Eren, a renewable energy company invested by TotalEnergies, entered the Cambodian solar power generation market by acquiring the power generation facilities of Risen Energy, a Chinese manufacturer of solar power products. In April 2022, TotalEnergies and ENEOS planned to jointly start a business in Asia to support their corporate customers' private solar power consumption. They planned to invest 50% each in the joint business and develop a power generation capacity of 2 GW over the next 5 years.

h) Charging point

TotalEnergies plans to install 150,000 charging points worldwide by 2025.

Europe

In 2019, TotalEnergies established EV Charge for the mobility electrification business, including charging facilities. TotalEnergies plans to build 1,000 high output charging points at 300 service stations by 2022 and expand charging points to 150,000 locations in Europe by 2025.

Asia/Pacific

In July 2021, TotalEnergies acquired Blue Charge, an EV-charging facility operator in Singapore. Blue Charge is Singapore's largest EV-charging operator deploying approximately 1,500 charging facilities. The Singapore government has set the goal of increasing the number of EV-charging facilities in the country to 60,000 by 2030. In September 2021, TotalEnergies established a 50–50 joint venture company with China Three Gorges Corporation, China's

leading hydropower generation company. The two companies plan to install and operate more than 11,000 charging points in Hubei Province by 2025.

i) Others

Battery

In September 2020, TotalEnergies's subsidiary Saft and Groupe PSA/Opel established a joint venture, Automotive Cell Company. They plan to develop and manufacture high-performance batteries for the automotive industry. Saft has built a new high-capacity battery plant (480 MWh) in Zhuhai, China. In December 2021, TotalEnergies opened the largest battery-type energy storage facility in France (capacity: 61 MW).

LNG bunkering

In November 2020, TotalEnergies implemented its first LNG bunkering to the world's largest LNG-fueled container ship at the port of Rotterdam, Netherlands. This bunkering supplied approximately 17,300 m^3 of LNG, which was the largest-scale LNG bunkering in the world.

j) Investment in decarbonisation

In September 2020, TotalEnergies planned to convert its Grandpuit refinery in France into a production base for renewable diesel fuel, SAF, and bioplastic and invest €500 million by 2024.

3.5. Efforts for decarbonisation and energy transition in the oil supply chain

The methods of measuring methane leakage using a drone, satellite, aircraft, and infrared cameras, as well as flaring reduction and routine flaring elimination, which the Western Majors are also working on, will be useful for ASEAN NOCs having upstream sectors (Table 4.6).

For ASEAN NOCs with a lot of oil and gas fields, promoting CCS and CCUS is also effective in utilising existing assets. Therefore, it is indispensable to accumulate knowledge on technical and cost issues by resolving them on one's own and by cooperating with other companies in the same industry and different industries, governments, and academia.

In the downstream sector, refineries should be converted into and maintained as highly efficient and energy-saving, using waste heat, cogeneration, in-house power generation, etc., to improve refinery efficiency.

Installing solar panels on the roofs of service stations and introducing in-house power generators reduce GHG emissions from the marketing sector and are effective as disaster countermeasures.

Table 4.6. Decarbonisation and Energy Transition Efforts in Oil Supply Chain

	Upstream (Oil Field Development and Production)	Downstream (Oil Refining)	Marketing
Scopes 1+2	・Methane emission reduction (Monitoring by drone, satellite, etc.) ・Flaring reduction ・Venting reduction ・CCS	・Improvement of refinery efficiency ・Cogeneration ・Waste heat utilisation ・Off-gas treatment ・CCS ・In-house power generation ・Biorefinery	・PV equipment installation on service station roofs ・PV equipment installation on lubricant oil plant roofs ・In-house power generation
Scope 3		・Low-carbon fuel production	・EV charging point ・Hydrogen station ・Lubricants for EVs ・Biofuel ・SAF

Source: Author.

4. Comparison of Strategies and Efforts by ASEAN NOCs and Western Majors

Finally, we compare the strategies and efforts of ASEAN NOCs and Western Majors. As the first step, setting a net-zero target year and determining a scope can define the range of efforts for low carbonisation and decarbonation.

Six companies have set their goal of net-zero by 2050, but Pertamina is excluded (Table 4.7). Shell, BP, and TotalEnergies target Scopes 1+2+3, while ExxonMobil, PETRONAS, and PTT target Scopes 1+2.

The strength of the oil majors and NOCs is their abundance of oil and natural gas assets. Thus, focusing on CCS (CCUS) and hydrogen, for which existing assets can be used, would be effective. The Western Majors already have been operating their CCS projects. On the other hand, the ASEAN NOCs are at the stage of having signed MoUs with their partners. Therefore, in the future, the CCS of projects of the oil majors needs to be accelerated. Pertamina and PETRONAS are already moving in that direction but need to accelerate CCS further. Moreover, Thailand is the centre of automobile production in Southeast Asia, so it makes sense for PTT to enter the EV production and battery fields.

Table 4.7. Comparison of Strategy and Activity between ASEAN NOCs and Western Majors

	Exxon Mobil	Shell	BP	Total Energies	PETRONAS	Pertamina	PTT
Net-zero declaration	2050 *Oil and gas production	2050	2050	2050	2050 *Oral declaration	NA	Net-zero GHG emission by 2050
Scope	1+2	1+2+3	1+2+3	1+2+3	1+2	NA	1+2
Flaring	Eliminate routine flaring by 2030	Eliminate routine flaring By 2030	—	Eliminate routine flaring by 2030	—	—	—
CCS target	—	25 $MtCO_2$ by 2035	—	5 $MtCO_2$ by 2035	—	—	—
Major CCS project and alliance	Baytown Texas La Barge Wyoming	Northern Lights Quest Teesside	Teesside Humber Tangguh Moomba	Northern Lights Aramis Teesside	ExxonMobil Shell ADNOC Posco	ExxonMobil Masdar SK Group Marubeni Mitsui & Co.	INPEX JGC Holdings
Hydrogen project and alliance	Baytown Texas	Double-digit share by 2035	10% share by 2030 H_2 Teesside	5-tonne Green H_2 per day by 2025	JERA ENEOS Masdar	SK Group Mitsubishi Pupuk	—
Renewables and others	Biofuel Mobil EV Lubricants DAC	Biofuel Wind Farm PV EV charge Link salary	Biofuel Wind Farm PV EV charge Link salary	Biofuel Wind Farm PV EV charge Battery	Ammonia PV CO_2 Transport	Biofuel Geothermal Ammonia PV EV charge	EV Production EV charge Battery PV

Source: Author.