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Oil and gas industry net-zero tracker

To reduce emissions, fugitive methane capture, zero flaring technologies, and upstream electrification are effective in the short term. Long-term solutions include CCUS, downstream electrification and clean hydrogen.

- Reductions in methane and flaring emissions and an increase in renewable sourcing have led to a decrease in emission intensity in the sector.
- While progress is being made in developing CCUS, clean power and hydrogen technologies, increased investment is needed to scale them effectively.

6%

Decrease in absolute CO_2 emissions (2021-2022)

2.9%

Decrease in demand (2022-2023)

OIL AND GAS

Key performance data 2022[518,519,520]

5.1 Gt CO_2e

Scope 1 and 2 emissions

100%

Fossil fuels in the fuel mix (2019)

80%

Reduction in expected demand in NZE scenario by 2050, compared to 2023

3.3%

Emissions intensity decrease (2018-2022)

87 kg CO_2/boe

Emissions intensity in 2022

$1.1 trillion

Additional investment required for net zero by 2050

Performance summary

- The industry has reduced emissions by 3% 2018 and 2022.[521,522] This is mainly driven by reductions in methane and flaring emissions, increased electrification of operations and improved operational efficiency.
- The absolute emissions for oil and gas were 5.45 Gt CO_2e in 2021, which decreased to 5.1 Gt CO_2e in 2022.[523]
- The production, transport and processing of oil and gas in 2022 resulted in just under 15% of global energy-related GHG emissions.[524]
- In 2022, global consumption reached 97 million barrels per day (mb/d) of oil and 4,150 billion cubic metres (bcm) of natural gas.[525]

Future emissions trajectory

- As per the IEA NZE Scenario, the oil and gas industry aims to reduce emission intensity by 55% by 2030 and 91% by 2050.[526]
- The projected absolute CO_2e emissions (Scope 1 and 2 emissions) for the sector are 2 Gt in 2030, 0.45 Gt in 2040 and 0.15 Gt in 2050.[527]
- The industry aims to reduce methane emissions by over 75% by 2030 and eliminate all non-emergency flaring worldwide by the same year, leading to a nearly 95% reduction in flared volumes, according to the IEA's Net Zero Scenario.[528]

Readiness key takeaways

Technology	4	– Fugitive methane capture technologies, zero flaring technologies, and upstream electrification are mature and available solutions (TRL 10). – Upstream CCUS is in the early adoption stage (TRL 9). – Steam cracker electrification (TRL 5), clean hydrogen (TRL 3-5) and use of CCUS in cracking and process heater (TRL 3-5) are in the prototype stage.
Infrastructure	2	– 178 GW of clean power is required by 2030, out of which 34 GW is currently available. – 10 MTPA of clean hydrogen is required by 2030. Currently, none of the capacity is available. – 390 MTPA of CCUS is required by 2030, out of which 33 MTPA are currently available for natural gas processing and LNG operations.
Demand	3	– The oil and gas sector contributes to 1% of the total clean energy investments globally. – The green premium in the oil sector is estimated at 10% for B2B, while in the gas sector, it is estimated at 7%.
Capital	3	– Over $1.1 trillion in investments are required by 2050, out of which around $780 billion is for electrification and efficiency, $110 is for CCUS, $102 billion is for methane reduction, $83 billion is for clean hydrogen and $70 billion is for flaring reduction.[529] – Currently, the industry has an annual CapEx of $409 billion.
Policy	3	– Policies are introduced to reduce emissions from existing fossil fuel infrastructure, scale up the deployment of clean energy technologies and boost the deployment of CCUS.

Sector priorities

Company-led solutions

Mid-term (by 2030)

- Increase investments in renewable energy sources to provide the energy required for operations.
- Scale methane abatement and flaring reduction technologies.
- Improve energy efficiency in extraction, refining and distribution processes.

Long-term (by 2050)

- Capture CO_2 with CCUS technology and use it to enhance methanol production.
- Transition towards sustainable business models that focus on renewables.

Ecosystem-enabled solutions

Mid-term

- Expand the production and availability of renewable energy sources.
- Encourage the implementation of programmes and technologies aimed at reducing methane emissions.

Long-term

- Invest in the development of infrastructure for clean hydrogen, renewable energy generation and CCUS.
- Introduce policies to support the increase in demand for low-carbon materials to stimulate low-carbon hydrogen uptake.

Performance

The sector currently accounts for 14% of global CO_2e emissions. Methane emissions account for nearly half of all GHG emissions from oil and gas operations.

TABLE 18 **Oil and gas industry performance**

Performance metric	Change (2018-2022)
Industry output	-3% for oil
	+8% for gas
CO_2e emission intensity	-3%
Total CO_2e emissions	-4%

Despite a temporary decline in oil volume in 2020 due to COVID-19 pandemic restrictions, demand almost recovered to 2018 levels by 2022. As for natural gas, from 2018 to 2021, demand grew steadily, driven by industrial activity and power generation, particularly in Asia. In 2022, the Russia-Ukraine conflict led to a 1% global decline, with Europe seeing a sharper 13% drop due to supply disruptions and price spikes. Despite these challenges, overall demand remained stable across key sectors.[530] Absolute CO_2e emissions saw a decline of 4%, while CO_2e emission intensity saw a reduction of 3%. Which can be attributed to several key factors:

1. **Methane reductions**: Targeted initiatives (e.g. OCGI Satellite Monitoring Campaign[531]) aimed at detecting and eliminating methane leaks have decreased the overall GHG emissions of oil and gas operations.

2. **Reduced flaring**: Efforts to minimize the flaring of excess gas have led to significant reductions in CO_2 emissions, particularly from oil production sites.

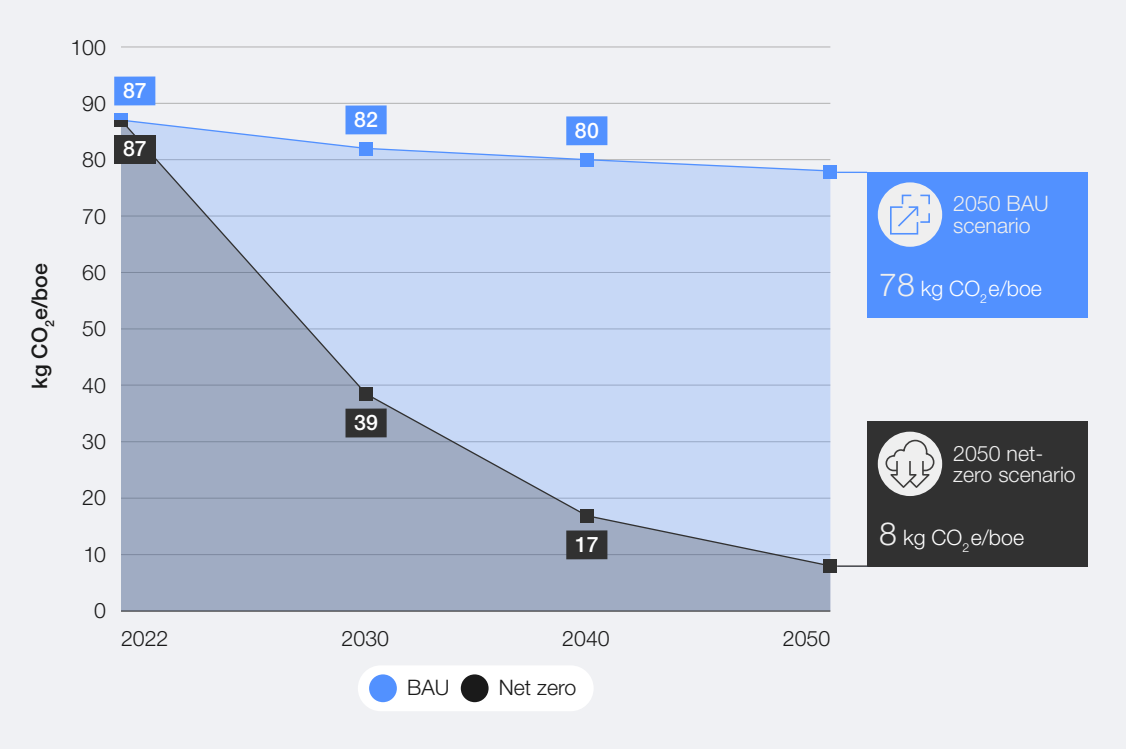
3. **Improved operational efficiency**: Enhanced practices in extraction and processing have lowered energy consumption, further reducing emissions.

4. **Shift to cleaner sources**: The industry has increasingly focused on producing lighter oil and natural gas liquids, which have lower emissions intensity compared to heavier alternatives.

The Zero Routine Flaring by 2030 Initiative, launched by the World Bank and the UN in 2015, commits governments and companies to ending routine flaring by 2030. There has been some progress since its launch (the amount of gas flared per barrel of oil produced fell by approximately 10% in 2022 from 2021) but the total gas flared globally is still very high.[532]

Readiness

FIGURE 65 **Emission intensity trajectory for the oil and gas sector**



Source: Accenture analysis based on IEA NZE and STEPS Scenario.[533]

The oil and gas industry has advanced significantly in technology, particularly in methane capture and zero-flaring techniques, which are now fully developed (TRL 10). Meanwhile, electrification and energy efficiency measures are still in the demonstration phase and serve as important decarbonization levers. By 2050, the sector will need approximately 0.7 EJ of hydrogen, as per the IEA NZE scenario.[534] Currently, green premiums are relatively low, with natural gas at 7% and oil at 10%.[535] Policies are required to scale up the deployment of clean energy technologies and boost the deployment of CCUS. The industry requires over $600 billion in annual investments by 2030, primarily directed towards electrification, CCUS and low-emission hydrogen initiatives.[536] Overall, forecasts indicate a 74% decline in oil demand and a 78% drop in gas demand will be required by 2050 to meet the IEA NZE scenario.[537]

To achieve net-zero emissions by 2050, the oil and gas sector must focus on five key levers: addressing methane emissions, eliminating non-emergency flaring, electrifying upstream facilities with low-emission electricity, integrating CCUS and expanding the use of low-emission hydrogen in refineries. Reducing methane emissions is the most critical step for lowering overall emissions by 2030 given that it is a short-lived climate pollutant (SLCP), followed by improvements in electrification and efficiency. In net-zero scenarios, scaling up CCUS and adopting low-emission fuels for shipping will also play a significant role.

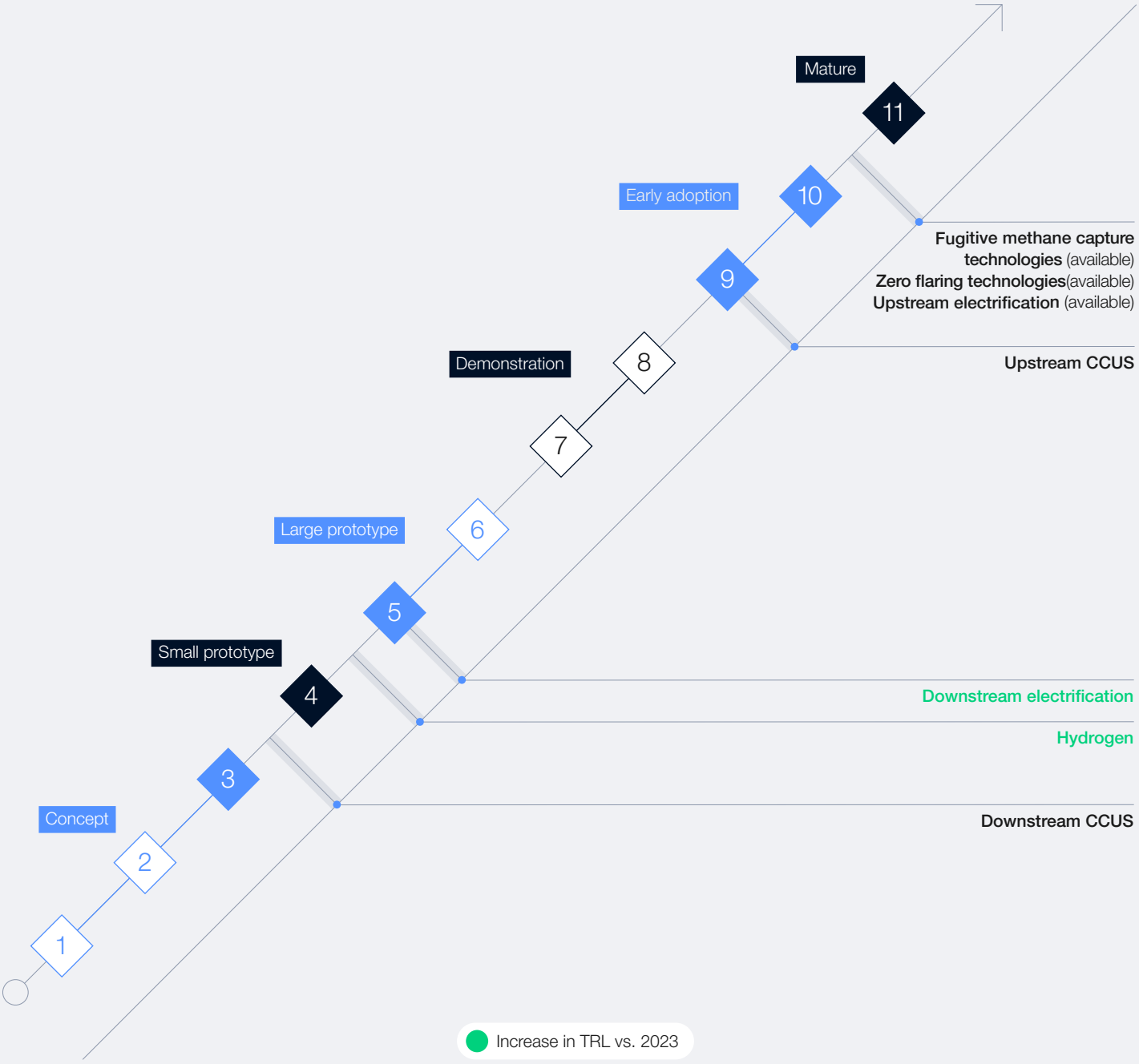
FIGURE 66 | **Decarbonization levers and top mitigation methods (NZE Scenario)**

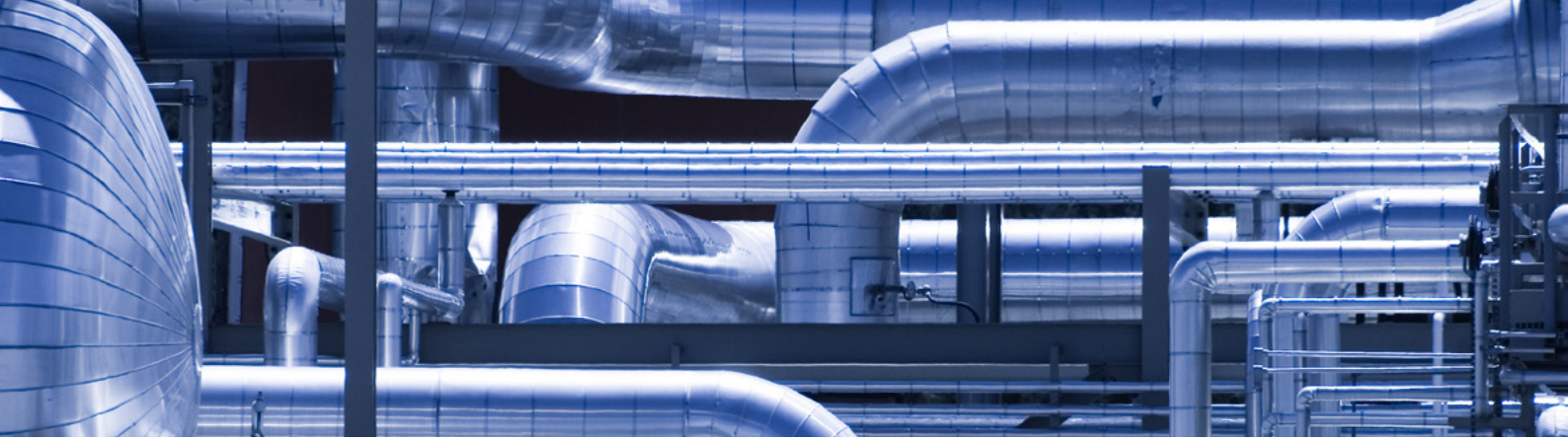
Source: IEA.

4 OIL AND GAS Technology

Technologies to implement the decarbonization levers are at different readiness levels. Four pathways have emerged: methane abatement and zero-gas flaring, electrification, CCUS and clean hydrogen.

FIGURE 67 **Decarbonization TRLs**





Technology pathway 1: Methane abatement and zero-gas flaring

Methane abatement in the oil and gas industry is a cost-effective strategy for reducing GHG emissions, due to methane's potency and the potential to monetize captured gas. It is estimated that 40% of global methane emissions from oil and gas operations could be eliminated at no net cost. Addressing large leaks is a priority, with initiatives like the Methane Alert and Response System (MARS) using satellite technology to detect significant leaks and notify operators. The Oil and Gas Climate Initiative is piloting satellite monitoring in Iraq, Kazakhstan, Algeria and Egypt, with plans for expansion.[538]

Companies are employing various technologies to reduce or eliminate flaring. For instance, ExxonMobil announced in January 2023 that it had ceased routine gas flaring in the Permian Basin, aligning with its goal of net-zero emissions in the region by 2030. Portable compressed natural gas (CNG) and mini-LNG facilities can compress gas on-site for transport, potentially eliminating up to 89% of flaring, according to the US EPA in the Bakken field. Additionally, small-scale gas-to-methanol or gas-to-liquids plants are being developed with modular equipment. Upgrading flare tips and stacks can further enhance combustion efficiency and reduce emissions.[539]

Oil & Gas Decarbonization Charter (OGDC) signatories aim to achieve near-zero methane emissions in upstream operations and eliminate routine flaring in all operations by 2030. The initiative also plans to influence partners to adopt similar practices, where applicable.[540]

Technology pathway 2: Electrification

Electrification in upstream oil and gas operations is at a mature stage (TRL10), while in downstream operations (i.e. refining operations), it remains in the prototype stage (TRL 5). Various technologies enable electrification in upstream processes, enhancing efficiency and reducing emissions. Centralized grid connections enable access to existing electricity infrastructure, which is a preferred option in North America and Eurasia. Alternatively, decentralized renewable energy systems (such as wind and solar power with battery storage) facilitate on-site generation, particularly in regions like the Middle East and North Africa. Operators can choose between direct and alternating current (DC/AC) technologies and implement hybrid systems for reliability. For instance, companies operating in the North Sea have collaborated to develop shared clean electricity infrastructure.[541] Upgrading to more efficient equipment, like combined-cycle turbines, can further enhance efficiency.

Technology pathway 3: CCUS

The oil and gas industry has invested in over 90% of operational CCUS capacity and contributed more than 40% of total CCUS investment since 2010 in projects linked to oil and gas value chains. Currently, approximately 45 Mt of CO_2 is captured annually across 11 countries, with around 75% of this being used for enhanced oil recovery (EOR). However, EOR typically lacks the stringent monitoring needed to ensure permanent CO_2 storage. Around 30 Mt is captured from natural gas processing in the US, Brazil, Australia, the Middle East and China, while refineries and upgrading facilities in Canada and the US capture around 3 Mt per year.[542] CCS with permanent storage effectively captures CO_2 from refining processes, allowing for safe reuse and storage.[543]

Technology pathway 4: Clean hydrogen

Globally, around 42 million tons of hydrogen is used for refining oil, comprising almost half of the world's hydrogen demand and resulting in about 380 million tons of CO_2 emissions each year.[544] The processes of hydrotreating and hydrocracking consume over 90% of this hydrogen.[545] Refineries are well-equipped to adopt low-emission hydrogen technologies without needing new equipment. They can act as key sources of demand, helping to grow the supply of low-emission hydrogen and reducing risks for nearby operations that depend on coordinated investments.

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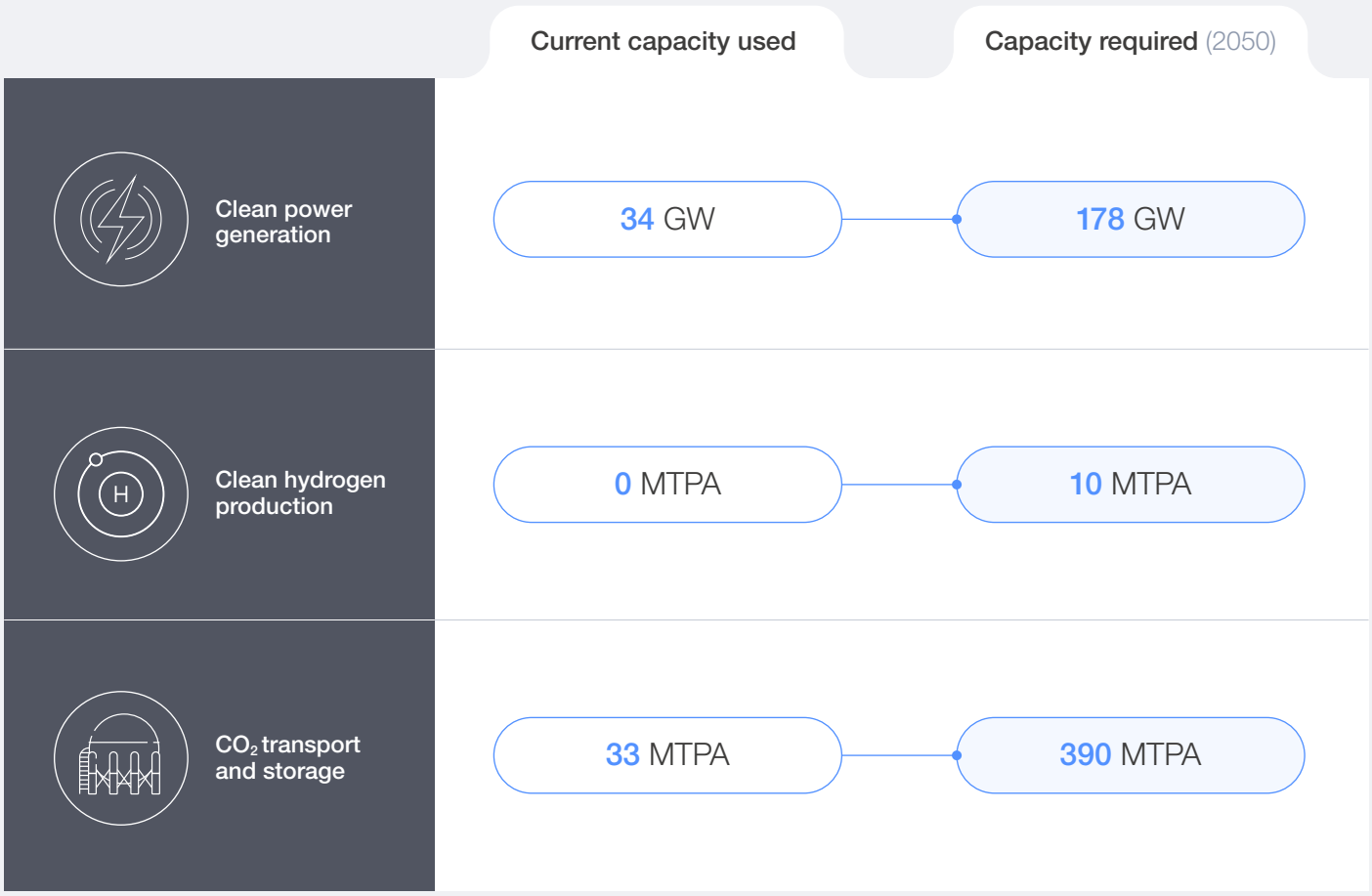
2 Infrastructure

Decarbonization of the oil and gas sector relies on three key factors: clean power, CCUS and clean hydrogen. Sufficient clean power generation capacity is needed for facility electrification, with a target of 178 GW by 2030.[546] As of 2022, oil and gas companies accounted for only about 1% of the total installed renewable energy capacity,[547] which translates to approximately 34 GW of clean energy used.[548]

Additionally, effective infrastructure for CCUS is essential at processing plants and refineries, requiring a total of 390 MTPA of CO_2 storage capacity by 2030,[549] down from 400 MTPA last year. Currently, approximately 33 MTPA[550] is already established for natural gas processing and LNG operations, an increase from 28 MTPA the previous year. The oil and gas industry possesses the necessary skills and expertise for CCUS, as it involves developing geological CO_2 storage resources, managing above-ground CO_2 handling facilities, monitoring gases underground and executing complex engineering projects. The CCUS Hub by the Oil and Gas Climate Initiative (OGCI) aims to help political decision-makers, industrial emitters, carbon transport and storage operators, and potential hub developers to set up their own CCUS hubs, learning from the experience of those already in advanced development.[551] It is important to note that the planning and permitting process for storing CO_2 is approximately 10 years, and could be a bottleneck in scaling up the use of CCUS.

In addition to CCUS, expanding clean hydrogen production is important for decarbonization efforts. The goal is to achieve a hydrogen production capacity of 10 MTPA by 2030,[552] which will support refining processes and contribute to overall emissions reduction.[553] Currently, clean hydrogen production has yet to gain momentum due to high costs, with a capacity of 0 MTPA.[554]

FIGURE 68 **Infrastructure for decarbonization capacity**



Source: Accenture calculations based on IEA.

3

OIL AND GAS

Demand

Achieving net-zero transitions requires addressing the growing demand for energy services while significantly lowering emissions. As markets evolve, low-emission alternatives such as biofuels, clean hydrogen-based fuels for transport and renewable energy sources for power generation are expected to become increasingly cost-competitive.

For example, the EV market has seen exponential growth, with nearly 20% of new cars sold globally in 2023 being electric. In the NZE Scenario, from 2040, all new trucks in advanced economies and China will be powered by electricity or hydrogen, with other emerging markets following suit by 2045. In aviation, low-emission fuels, including liquid biofuels and hydrogen-based liquids, currently account for less than 0.01% of total fuel use. However, by 2050 in the NZE Scenario, these fuels will make up approximately three-quarters of aviation fuel consumption. Similarly, for shipping, low-emission fuels (predominantly hydrogen and its derivatives) are expected to comprise around 85% of the global shipping fleet's fuel by 2050.[555]

Moreover, annual wind and solar capacity additions are projected to reach 1,150 GW in the NZE Scenario.[556] The integration of electric motors in industries that require low-temperature heat, along with the adoption of heat pumps in households, commercial buildings and small-scale industries, will further enable sustainable energy use.

To meet these ambitious targets, efforts are underway to decarbonize oil and gas operations, as these resources remain essential during the transition. For example, Chevron has made significant progress in reducing emissions in its Permian Basin operations, where oil and gas are produced with nearly one-third of the global industry average carbon intensity. Chevron's efforts also include converting traditional diesel-powered drilling rigs to electric or natural gas, and switching hydraulic fracturing equipment to dynamic gas blending, which uses a combination of diesel and natural gas. Furthermore, Chevron has installed electric-powered compressor stations and is supplementing grid power with solar fields, further driving down emissions.[557]

The B2B green premium for the oil and gas sector ranges between 7-10%, translating to a business-to-consumer green premium of 1-6%.[558] The market has shown limited price elasticity of demand in the long run, indicating that it can absorb these green premiums effectively.[559]

FIGURE 63 **Top countries for oil production (2023),[560] gas production (2023),[561] and lowest CO_2 emissions from oil production (2022)[562]**

Oil-producing countries (2023)		Gas-producing countries (2023)		Lowest CO_2 emissions from oil production (2022)	
1 US	20%	1 US	26%	1 Norway	36 kg CO_2e/boe
2 Saudi Arabia	12%	2 Russia	14%	2 Saudi Arabia	66 kg CO_2e/boe
3 Russia	12%	3 Iran	6%	3 United Arab Emirates	74 kg CO_2e/boe
4 Canada	6%	4 Canada	5%	4 Kuwait	74 kg CO_2e/boe
5 China	4%	5 Qatar	5%	5 Brazil	82 kg CO_2e/boe

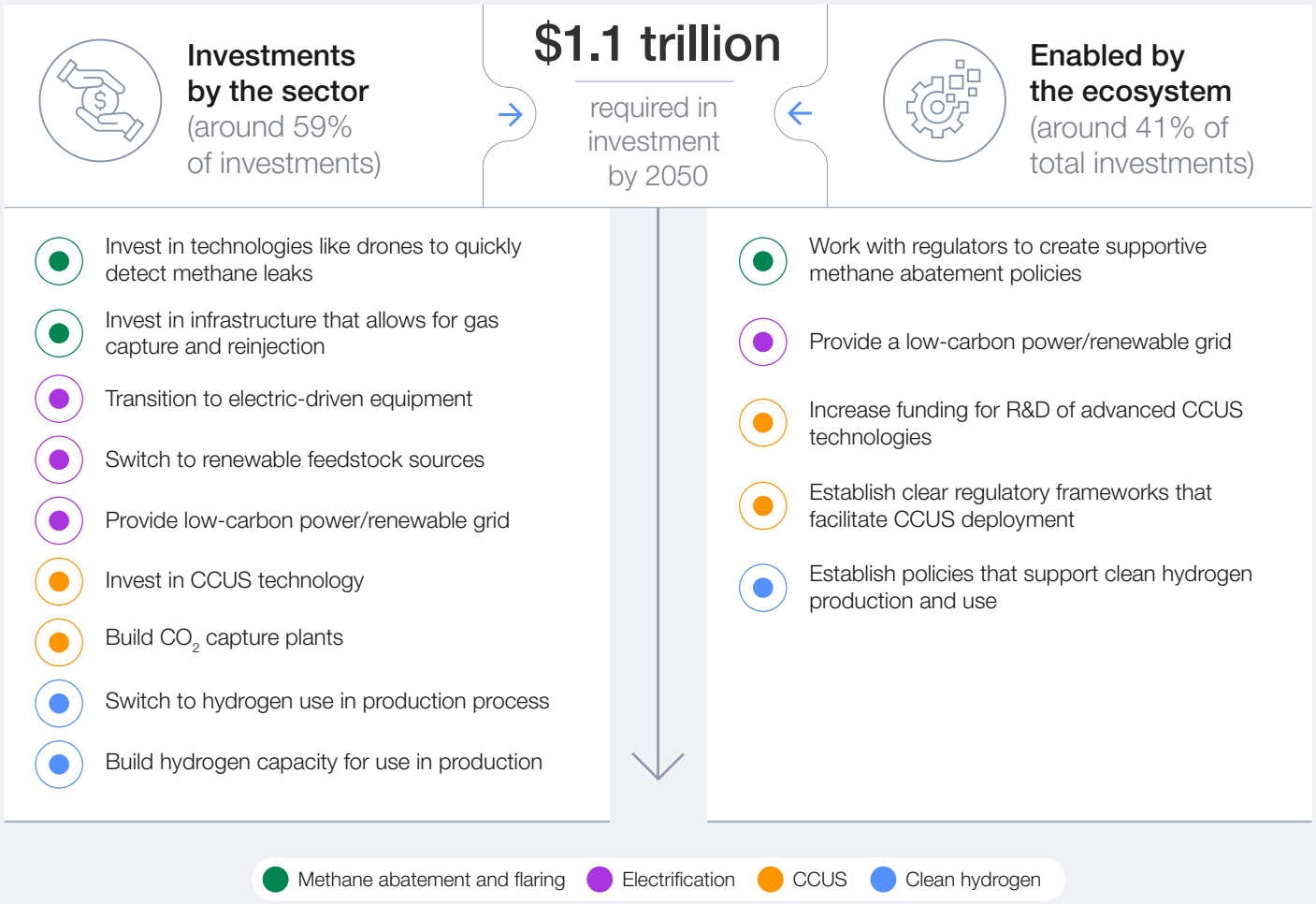
OIL AND GAS

3 Capital

The oil and gas industry will need an estimated investment of $1.1 trillion by 2050.[563] The majority of this investment must be invested by the sector (around 60%), and the rest will need to come from the ecosystem to build the enabling infrastructure. Oil and gas decarbonization requires a scale-up of methane abatement, clean hydrogen, CCUS and clean power.

It is projected that out of the total additional investment required, around $780 billion is for electrification and efficiency, $110 billion is for CCUS, $102 billion is for methane reduction, $83 billion is for clean hydrogen and $70 billion is for flaring reduction.[564] Investing in electrification and efforts to reduce methane emissions and flaring can lead to new revenue opportunities by optimizing the use of natural gas and minimizing waste. These strategies could help companies quickly recover their initial investments. By 2030, these measures could provide over 200 bcm of additional natural gas. Even in a low gas price environment, these gas sales might generate around $30 billion in revenue each year.[565]

FIGURE 70 **Investments required by the sector and enabled by the ecosystem**



With the oil and gas industry's profit margin of 15%[566] (which is higher than all other sectors in scope), the business case for investing in decarbonization initiatives is strong. This profitability allows companies to allocate significant funds towards clean technologies and infrastructure development. Many oil and gas firms are already committing substantial portions of their budgets to sustainable energy projects, reflecting a strategic shift towards greener practices. However, the risk profile of investments in decarbonization varies significantly compared to traditional investments in oil and gas production, making it complicated to invest in decarbonization. Moreover, investments in national oil companies (NOCs) are driven by government budgets.

3

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Policy

To achieve net zero in the oil and gas sector, key actions include accelerating methane emission reductions in line with the Global Methane Pledge; providing incentives for adopting zero-methane and zero-flaring technologies; and stimulating investments in electrification to help operators manage costs. Enhancing CCUS deployment through risk mitigation policies and performance-based payments for CO_2 avoidance is also necessary. Additionally, creating a market for low-emissions hydrogen will not only require production-based incentives and regulatory measures, such as cap-and-trade systems, but also incentives to stimulate demand for hydrogen. Establishing robust measurement and reporting frameworks is essential for ensuring clear eligibility criteria for support programmes and for effective governance of imports. While policies supporting methane abatement in the EU and US are quite advanced, efforts are required to scale up such policies in the rest of the world.

TABLE 19 **Oil and gas industry policy summary**

Policy type	Policy instruments	Key examples	Impact
Market-based	**Carbon price**	EU-ETS	Incentivizes oil refiners to reduce emissions.[567]
Mandate-based	**Targets**	Canada's target to reduce methane emissions from oil and gas	The new policy mandates a 75% reduction in methane emissions by 2030 compared to 2012 levels. This includes requirements for better leak detection, venting limits and equipment upgrades to capture fugitive methane emissions.[568]
		Nigeria's targets to eliminate routine flaring and fugitive methane emissions	Nigeria's emissions mitigation and reduction targets include the elimination of routine gas flaring by 2030 and a 60% reduction in fugitive methane emissions/leakages from oil and gas operations by 2031.[569]
	Direct taxes/fees	Methane fee under the IRA[570]	Establishes a maximum annual methane waste emission rate of 25,000 tonnes of CO_2e (vented, released or flared) for a facility and imposes penalty charges starting at $900 per tonne in 2024, increasing to $1,500 per tonne by 2026 for facilities emitting more.[571]
	National roadmaps	National Methane Action Plan – the EU, the US, Norway and Canada[572]	As part of the Global Methane Pledge, 150 countries have committed to work together to collectively reduce methane emissions by at least 30% below 2020 levels by 2030.[573]
	MRV guidelines	Colombia's national MRV standards	Technical standards and guidelines for fugitive and flaring emissions MRV for upstream oil and gas operations.[574]
	Standards and frameworks	GIIGNL framework for GHG neutral LNG MRV	Comprehensive framework for a consistent industry approach to declaring GHG neutral LNG cargoes.[575]
Incentive-Based	**International collaboration**	Oil and gas companies have joined the Oil and Gas Decarbonization Charter, a global industry Charter dedicated to high-scale impact, and to speed up climate action within the industry	Work towards industry best practices in emission reductions by:[576] – Investing in renewables, low-carbon fuels and negative emissions technologies – Enhancing transparency through better measurement, reporting, and verification of emissions and progress – Aligning with best practices to cut emission intensity and aiming to implement these by 2030 – Reducing energy poverty while ensuring secure, affordable energy for all economies
		US and United Arab Emirates' Partnership to Accelerate Transition to Clean Energy	A new bilateral Partnership for Accelerating Clean Energy (PACE) aims to fight climate change by deploying $100 billion and 100 GW of green energy by 2035.[577]
	Infrastructure capacity expansion plans	Norway government electricity capacity upgrade targets to support electrification of LNG assets	Targets grid expansion and renewables capacity by 2030 to support electrification of Norway's only LNG plant.[578]
	Direct technology funding	Methane Emissions Reduction Program	The initiative provides $1.36 billion in financial and technical assistance through various funding opportunities. It introduces a Waste Emissions Charge (WEC) for methane and mandates the EPA to update the Greenhouse Gas Reporting Program (GHGRP) subpart W regulations for the oil and gas sector.[579]

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