9 Oil and gas industry net-zero tracker

Addressing methane and flaring emissions remain the key priority for the industry, but achieving net zero needs increased use of electrification and CCUS across the value chain.

Key emissions data[436,437, 438, 439]

15%	Contribution to global GHG emissions
5.1 gtCO_2e	Scope 1 and 2 emissions
-4%	Emissions growth (2018-2022)
90 kgCO_2e	Emissions intensity (emitted per barrel, 2022)
100%	Fossil fuels in the fuel mix (2019)
0.6 times	Expected demand increase by 2050
<1%	Current low-emission production
9-11%	Reduced emission production

Readiness key takeaways

Technology

Mature technologies like methane monitoring and mitigation, zero flaring, electrification and CCUS for gas processing face deployment limitations. Due in part to upfront costs, policy incentives, standards and infrastructure access. Low-emission refinery technologies are in early stages of development.

Infrastructure

Decarbonization of the oil and gas sector will need clean power generation capacity for electrification, CO_2 handling capacity for CCUS deployment at processing plants and refineries, and clean hydrogen generation capacity for refineries. Required investments are estimated to be up to c.$300 billion.[440]

Demand

Current green premiums remain below 10%,[441] but the market may switch to cost-competitive low-emission alternatives, particularly in developed economies.

Policy

Effective policies are vital, including incentives for low-emission tech, standards, taxation, flaring bans and R&D funding. Although major production areas have outlined emission targets, action plans and measurement, reporting and verification (MRV) guidelines, more effort is needed to turn these policies into practical, widely embraced initiatives.

Capital

The sector can invest in decarbonization by directing capital to low-emission technology, including methane reduction, electrification, CCUS and refinery transformation. Investments needed by 2050 could be up to $870 billion, about 4-6% of annual industry CapEx.[444] High levels of free cash flows could fund these investments.

Stated energy transition goals

– To align with net-zero ambitions, the industry aims for a 50% emissions intensity reduction by 2030 and 80% reduction by 2050.[442]
– 93% of large publicly traded oil and gas companies consider climate change in their decision-making processes.[443]

Emission focus areas for tracker

Oil and gas emissions can be divided into two main categories:

1. **Energy-related emissions** primarily due to energy consumption across the value chain.
2. **Process emissions** stem mainly from vented and fugitive methane emissions, gas flaring, transportation of crude oil, oil products and natural gas over long distances, and process emissions from refining.

Sector priorities

Exisiting assets

Reduce near-term emissions intensity from upstream and midstream operations by:

– Deploying available methane abatement and zero flaring technologies, supported by robust MRV standards
– Electrifying upstream and liquid natural gas (LNG) operations where feasible and enhance carbon capture gas processing
– Optimizing asset portfolios by directing capital allocation towards low-emission intensive assets.

Next generation assets

Accelerate downstream technology and infrastructure to drive absolute emissions reduction by:

– Deploying CCUS to capture carbon from rich CO_2 streams in refining
– Enabling access to clean hydrogen for heating and process application where refineries are co-located with clean hydrogen infrastructure
– Diversifying products – from traditional refining products to biofuels and synthetic fuels.

Ecosystem

De-risk investments to scale infrastructure capacity by:

– Using policy incentives for advanced technologies, while expanding access to existing infrastructure
– Progressing the technical maturity of low-emission refinery applications through R&D and pilot projects
– Deploying strategic partnerships to collaborate on technology advancement, infrastructure buildout and offtake agreements for low-emission products.

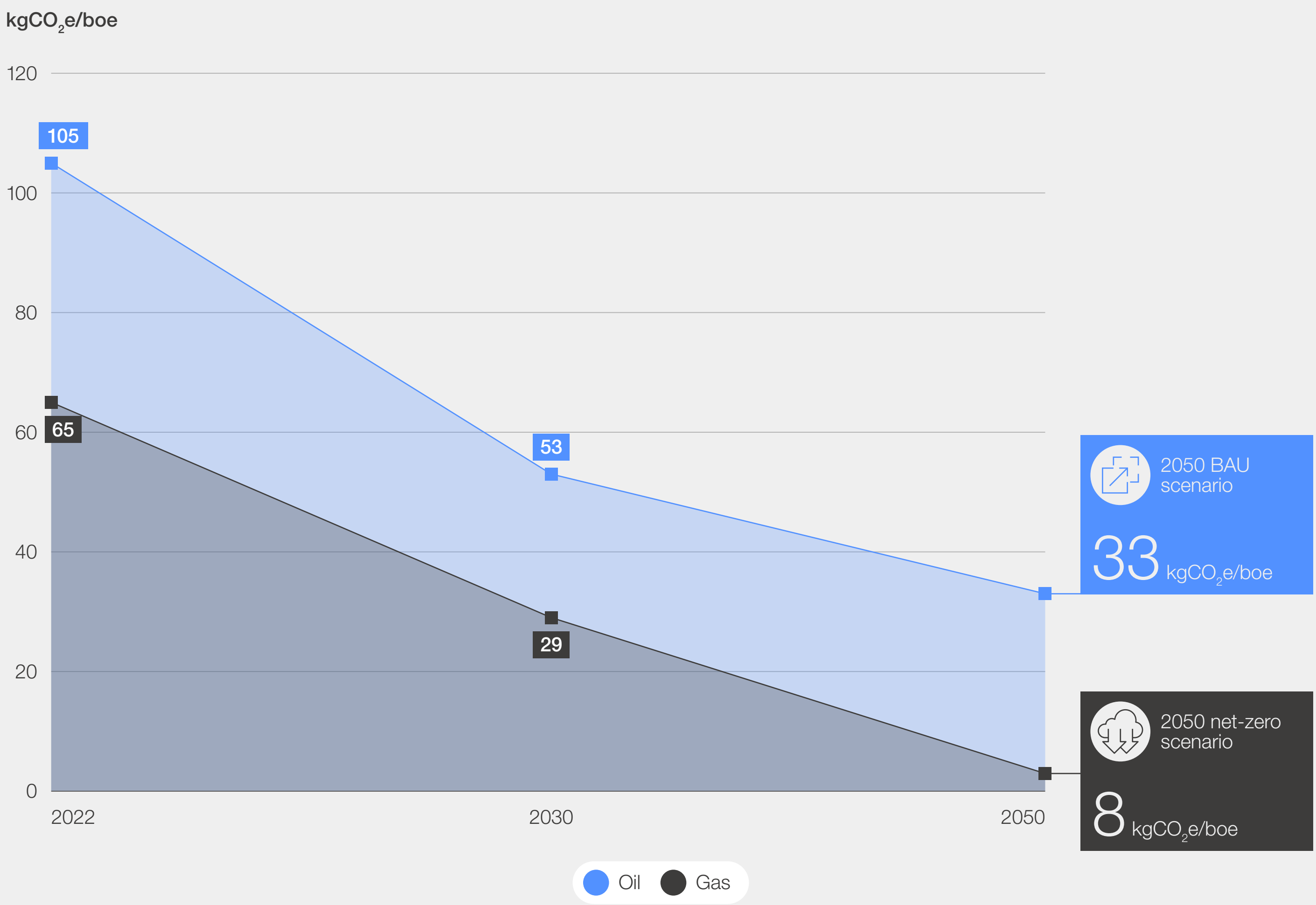
Performance

Over half of scope 1 and 2 emissions result from methane venting, fugitive emissions and gas flaring. Energy consumption across the value chain constitutes approximately 15% of the emissions, with the remaining from process emissions (refining, natural gas processing and midstream operations). Globally, the emissions intensity of operations average 90 $kgCO_2e$/boe, but this varies by operator and asset type.[445] For instance, Middle Eastern assets are, on average, 26% less emission-intensive than their North American counterparts.[446]

Methane emissions increased by 4% from 2020 to 2022 due to recovering oil and gas demand,[447] but 150 countries have pledged to reduce them by 30% below 2020 levels by 2030 under the Global Methane Pledge.[448]

Flaring emissions have dropped by 3% between 2020 and 2022, with a 12% reduction in flaring intensity (flared volume per barrel of oil produced).[449] The Zero Routine Flaring by 2030 initiative is endorsed by 35 countries and 54 oil and gas companies.[450]

FIGURE 67 **Oil and gas emissions intensity trajectory**



Source: IEA

Note: BAU projections for scope 1 and 2 emissions intensity are not available.

Path forward

To align with net-zero ambitions, the industry aims to achieve the following by 2030: a more than 50% reduction in scope 1 and 2 emissions intensity, a 75% reduction in methane emissions[451] and a 95% reduction in flaring emissions.[452] Achieving these objectives requires deploying methane abatement technologies, eliminating non-emergency flaring, electrifying oil and gas facilities, adopting CCUS in gas processing and decarbonizing refinery operations through CCUS and clean hydrogen, where possible. Energy efficiency will also be vital.

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4 Technology

Five leading decarbonization pathways have emerged to address energy and process-related emissions: methane abatement, zero gas flaring, electrification, CCUS and clean hydrogen. Methane and flaring reduction technologies, along with upstream electrification technologies, are already available with little to no cost increase. CCUS technology for gas processing operations is available with a cost increase of 7%.[453] However, refining decarbonization measures, including CCUS and clean hydrogen, are still in their early stages and are expected to raise refining costs by 7-9%.[454]

Upstream and midstream emissions abatement measures

Barriers to technology deployment include limited access to gas markets, higher upfront costs for smaller operators and the absence of technology standards.

Many methane abatement technologies, like vapour recovery units and leak detection and repair (LDAR), enable methane capture and reduction without added costs when considering the value of recovered gas. However, barriers to technology deployment include limited access to gas markets, higher upfront equipment costs for smaller operators and the absence of technology standards. These technologies also require support from effective methane detection tools and reporting guidelines. To enhance methane detection and mitigation, the UN introduced the Methane Alert and Response System (MARS) at COP27, a satellite-based system that notifies governments, companies and operators of methane leaks for faster response times.[455]

Zero-flaring techniques involve on-site gas use, treatment, storage or distribution to existing gas markets, aided by appropriate infrastructure like gas pipelines, on-site gas compression and gas reinjection. Most of this technology is available with minimal cost increase. Many major players are committed to eliminating routine flaring, as seen with Exxon's cessation of all routine flaring in their Permian operations.[456]

The electrification of oil and gas facilities reduces dependence on diesel or natural gas for energy requirements. Technologies for electrifying upstream operations and LNG processes are readily available and can be deployed with incremental production costs. For instance, bp's US shale subsidiary, bpx, has already electrified 80% of its Permian operations with the aim to increase coverage up to 95% by the end of 2023.[457] To address energy consumption and associated emissions, energy efficiency initiatives are also being explored, including energy demand optimization using digital and AI-based technologies. Some examples include the use of digital twins to optimize the power consumption of electric submersible pumps, reducing the energy consumption of turbines using analytics and data-driven asset maintenance programs to improve efficiency.[458,459]

Decarbonization technologies for gas processing, such as CCUS, are commercially available, albeit with a modest 7% increase in production costs.[460]

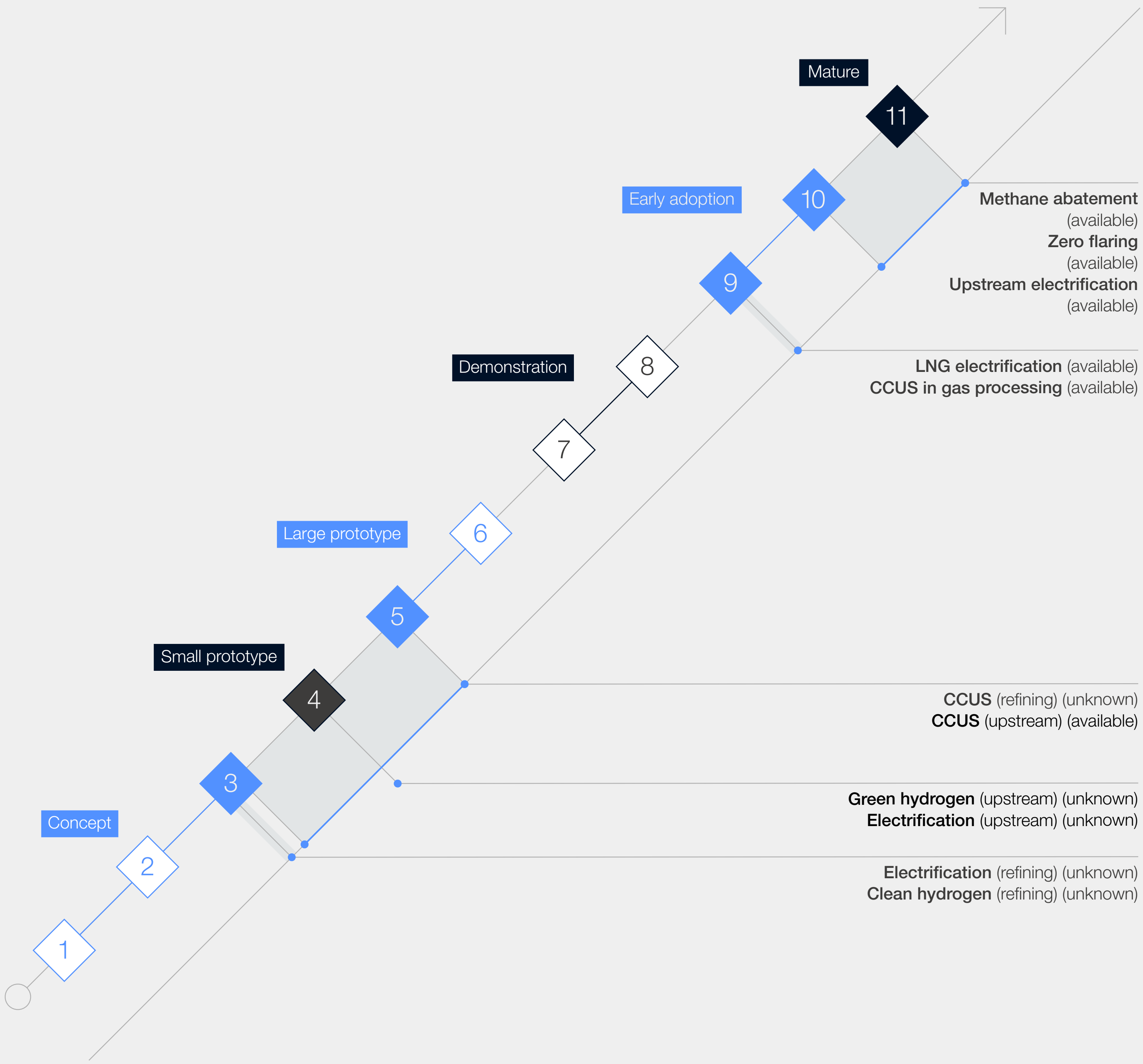
Refining decarbonization measures

CCUS is the primary decarbonization pathway for refineries, particularly for reducing emissions from burning waste fuel gases and pet coke. Refinery hydrogen production units generate a sufficiently pure stream of CO_2, making carbon capture suitable. Additionally, emerging technologies like clean hydrogen and electrification of heat and power sources offer potential decarbonization alternatives, albeit at early stages of development.

Technology pathways

FIGURE 68

Estimated TRL and year of availability for key technology pathways



Source: IEA; MPP

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2 Infrastructure

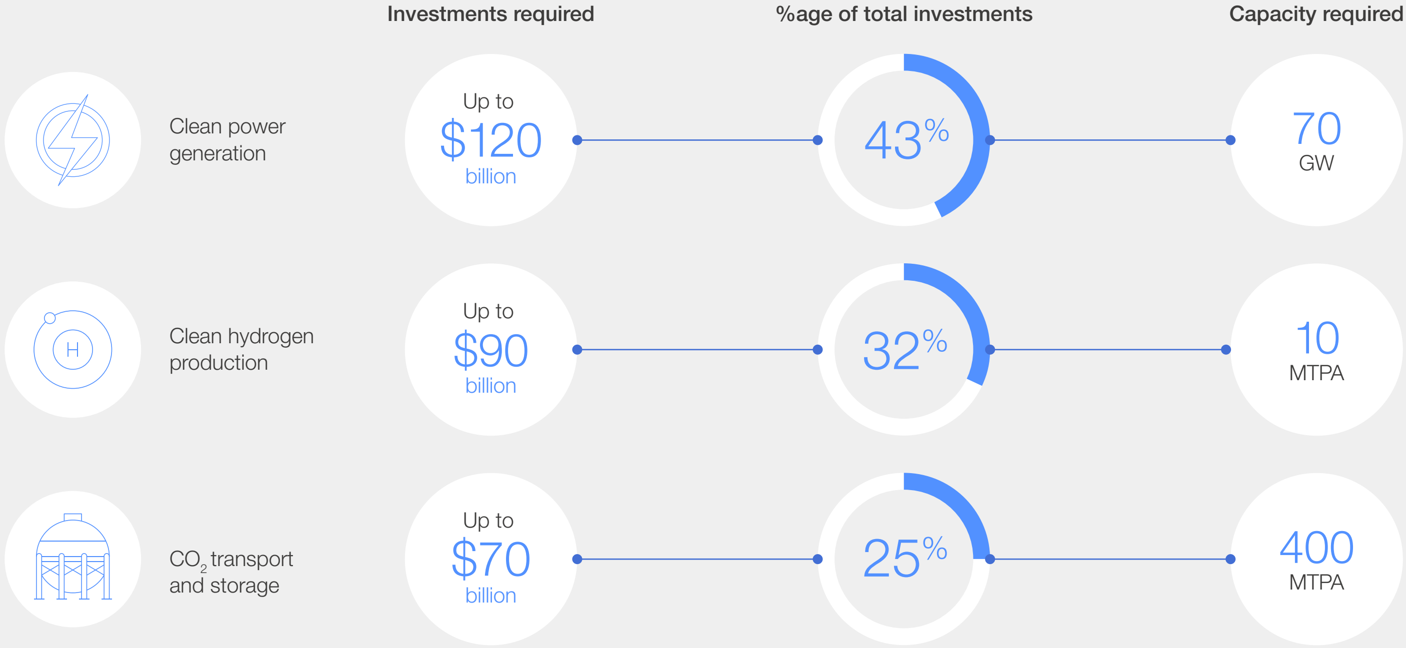
Decarbonization of the oil and gas sector relies on three key factors: the capacity of clean power generation available for facility electrification, robust CO_2 handling and storage capacity for CCUS deployment at processing plants and refineries, and clean hydrogen generation capacity for refineries. The required infrastructure investments are estimated to be up to $300 billion,[461] a figure that falls below the industry's annual CapEx. Considering the industry's experience in CCUS, natural gas and hydrogen infrastructure, and renewables position the industry as a potential leader in developing infrastructure hubs.

Electrifying production sites can be achieved through grid-sourced renewable electricity or captive power generation systems, necessitating an investment of approximately $120 billion to enable 70 GW of clean power capacity by 2050.[462]

To meet the demand for clean hydrogen in refineries, an additional 8 MTPA of clean hydrogen generation capacity is needed, requiring investments of $30-90 billion.[463]

The construction of up to 380 MTPA of CO_2 handling infrastructure is necessary, with over 50% of its capacity dedicated to managing carbon captured during gas processing, and the rest to support refineries.[464] Approximately 28 MTPA of CO_2 handling infrastructure is already in place for existing gas processing operations.[465] Building this infrastructure will require an investment of $30-70 billion.[466] Exxon's acquisition of Denbury, a provider of carbon transport and storage solutions, is a significant development that positions the company to expands its CO_2 handling infrastructure, not only for its operations but for adjacent industries like clean ammonia, clean hydrogen and synthetic transportation fuels.[467]

FIGURE 69 **Investments required for enabling infrastructure**



Source: Accenture analysis based on multiple data sources, including IEA, IRENA, BloombergNEF and Global CCS Institute

3

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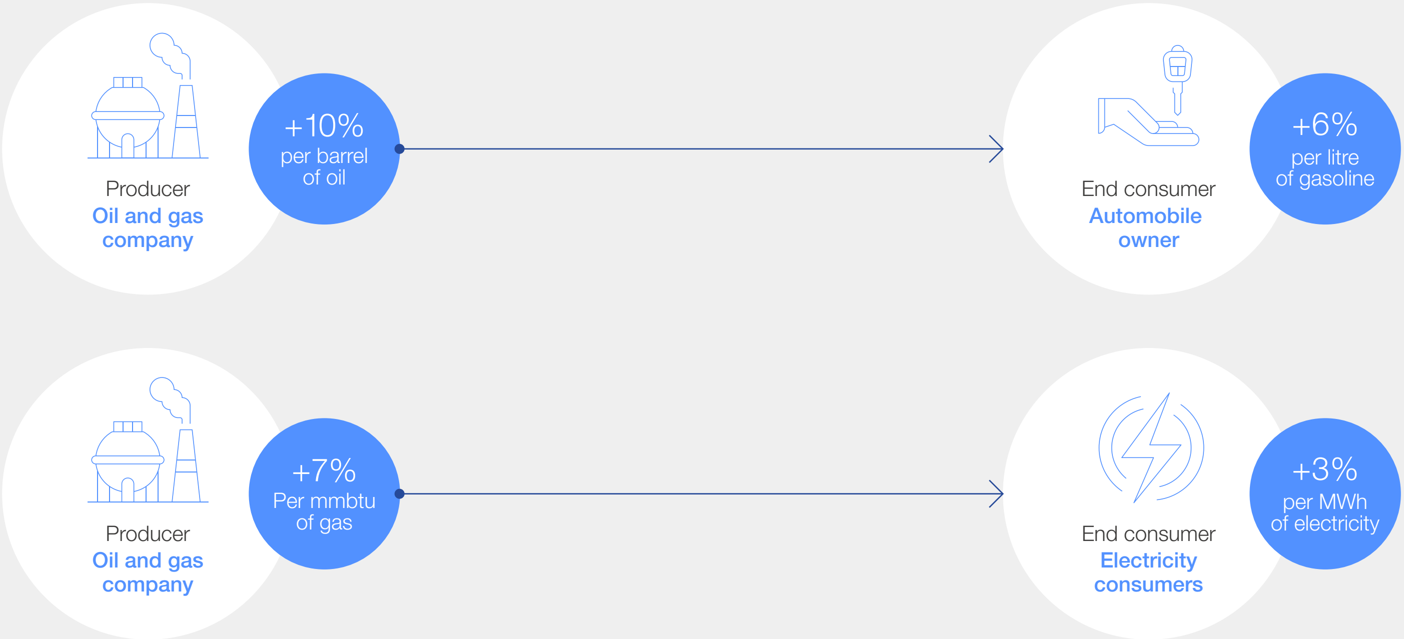
Demand

The ability of oil and wholesale gas buyers to absorb a green premium of 7-10% remains untested at scale as low-emission oil and gas represents less than 1% of global supply.[468] A 10% increase in production costs leads to 3-10% green premium for end users.[469] Historically, the market has shown limited price elasticity of demand, indicating that it can absorb the required green premiums.

Government intervention will be needed to safeguard lower-ncome households affected by rising fuel prices.

However, green premiums to end consumers will disproportionately affect developing countries and emerging economies, which are importers of oil and gas, especially without sufficient policy support.[470]

FIGURE 70 **Estimated B2B and B2C green premium**



Source: Accenture analysis based on IEA and EIA data

To achieve early breakeven and sustained demand for low-emission products, the oil and gas industry will need to identify the right market -sector clusters. Examples include petrochemical feedstock in Asian markets, heavy transport, fuel and gas as a transition fuel for power in South-East Asia. In the long term, especially in developed countries, markets will shift towards low-emission substitutes like biofuels, clean hydrogen-based fuels for transport and renewable energy for power as they become cost-competitive. There is an opportunity for oil and gas companies to also diversify as the market for these substitutes grow. For example, Shell plans to offer biofuel-based SAF for aviation customers from its Rotterdam plant by 2025.[471] Strategic collaborations with downstream consumers will also be vital as the companies diversify. A key development includes bp and car rental service provider Hertz planning to work together on installing a network of EV charging solutions in North America to service the car rental customers.[472]

Increased transparency on emissions can improve demand signals for low-emission oil and gas. Some standards, guidelines and frameworks exist currently to standardize the MRV of emissions across the oil and gas value chain. The Oil & Gas Methane Partnership 2.0 (OGMP 2.0) provides a robust, measurement-based reporting framework for industry's methane emissions.[473] The Global Reporting Initiative (GRI) Sector Standard for Oil and Gas, effective from 2023, provides a reporting framework and disclosure guidelines for sustainability topics including GHG emissions.[474] The International Group of Liquefied Natural Gas Importers' (GIIGNL) MRV and GHG Neutral Framework provides consistent definitions and emissions measurement approach for LNG cargoes. The first LNG cargo aligned to this framework was supplied by Shell to Taiwan's state refiner CPC in January 2023.[475]

> Markets will shift towards low-emission substitutes like biofuels, clean hydrogen and renewable energy as they become cost competitive.

Policy

The oil and gas industry is strategically vital for regions and nations due to its role in ensuring energy security. Therefore, effective policies and regulations are crucial for decarbonizing the sector. To reach net-zero targets, a comprehensive blend of policies is essential. These policies should incentivize the adoption of zero-methane and zero-flaring technologies while promoting CCUS implementation across the oil and gas value chain. Policy tools to support this effort may include incentives for low-emission technologies, technology standards, methane MRV guidelines, methane taxation, flaring bans and R&D funding.

While key producing regions have announced emissions targets, action plans and MRV guidelines, more action is required to translate these policies into tangible implementation and widespread adoption. Countries like Norway, the US and Canada are leading the way by demonstrating ambitious policy commitments to address oil and gas emissions.

Existing policy landscape

TABLE 12 **Policy summary**

Enabler	Policy type	Policy instruments	Key examples	Impact
Technology	Mandate-based	Direct taxes/ fees	– Methane fee under the IRA[476]	Oil and gas facilities to be charged $900/tonne of methane, rising to $1,500/tonne from 2026, incentivizing legacy assets to deploy methane abatement technologies.[477]
		Targets	– Canada's target to reduce methane emissions from oil and gas[478] – Nigeria's targets to eliminate routine flaring and fugitive methane emissions[479]	Canada: reduce methane emissions oil and gas by 75% by 2030 vs 2012 level. Nigeria: elimination of routine gas flaring by 2030 and a 60% reduction in fugitive methane emissions by 2031.[480]
		National roadmaps	– National Methane Action Plan – the EU, the US, Norway and Canada[481]	Multiple policy measures including reduction targets, methane tax, MRV guidelines etc. covering methane emissions from all sectors including oil and gas. Out of over 100 countries who have signed the Global Methane Pledge, only around 30 countries have a methane action plan in place.
		MRV guidelines	– Colombia's national MRV standards[482]	Technical standards and guidelines for fugitive and flaring emissions MRV for upstream oil and gas operations.[483]
	Market-based	Carbon price	– EU-ETS[484]	Incentivizes oil refiners to reduce emissions.
	Incentive-based	International collaboration	– US and United Arab Emirates' Partnership to Accelerate Transition to Clean Energy[485]	Joint efforts to reduce methane and CO_2 across oil and gas value chain by increased investments in low-emission technologies.
Infrastructure	Incentive-based	Infrastructure capacity expansion plans	– Norway government electricity capacity upgrade targets to support electrification of LNG assets[486]	Targets grid expansion and renewables capacity by 2030 to support electrification of Norway's only LNG plant.[487]
Demand	Mandate-based	Standards and frameworks	– GIIGNL framework for GHG neutral LNG MRV[488]	Standardized MRV framework followed at international level followed by all players across the LNG value chain.
Capital	Incentive-based	Direct technology funding	– IRA methane emissions reduction programme[489]	Approximately $1.6 billion provided to US Environmental Protection Agency (EPA) to provide financial assistance to oil and gas facilities for methane reduction technology deployment.[490]

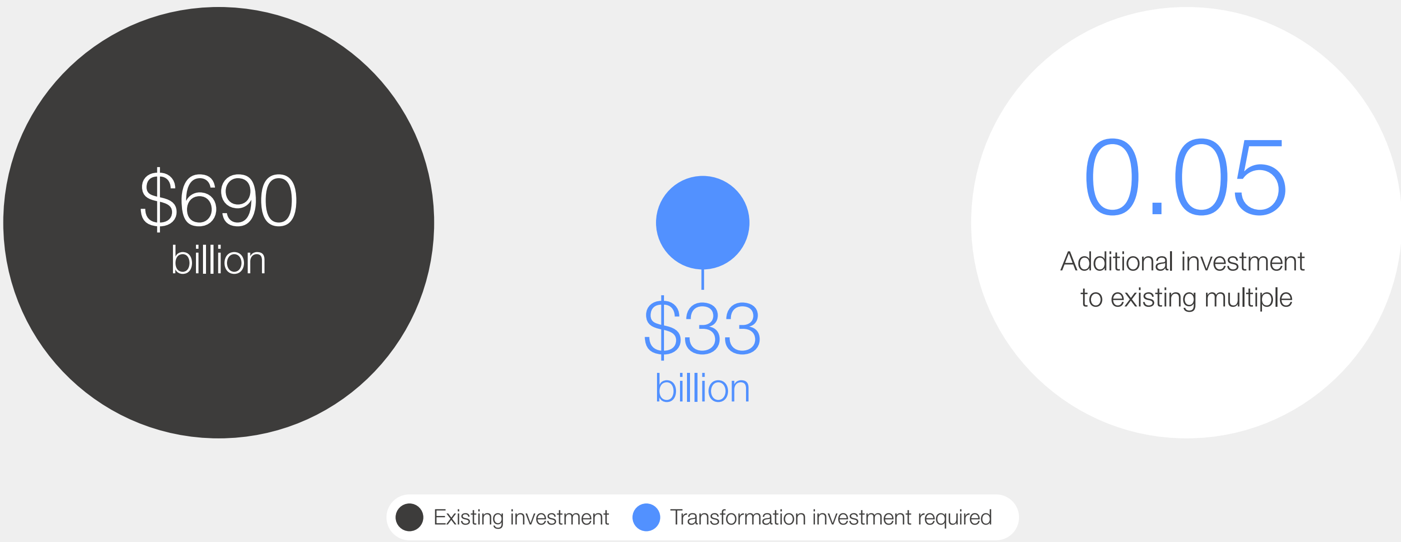
Capital

The oil and gas sector is well-positioned to invest in sectoral decarbonization. Oil and gas will need to re-direct capital towards deploying low-emission technologies across the value chain, including methane and flaring reduction technologies, upstream electrification, CCUS for gas processing and transforming refineries.[491] Investments required by 2050 can reach up to $880 billion or $32 billion in annual investments.[492] This represents only 4-6% of the total annual CapEx of the industry, and with industry average profitability of 20%[493] and WACC of 9%,[494] the industry is in a good position to fund its additional CapEx by self-generated cash flows.

For example, Petrobras plans to invest $4.4 billion in low-carbon initiatives in the upcoming five years, which represents 6% of total CapEx. Of that $4.4 billion, $2.1 billion will be invested in low-carbon solutions for new upstream projects.[495]

The business case for investment is attractive in upstream, where the sale of captured methane generates sufficient returns for investors. The business case for investing in refining needs to be strengthened, as technologies remain in the early stage and returns remain uncertain.

FIGURE 71 **Additional investment required to existing investment ratio**



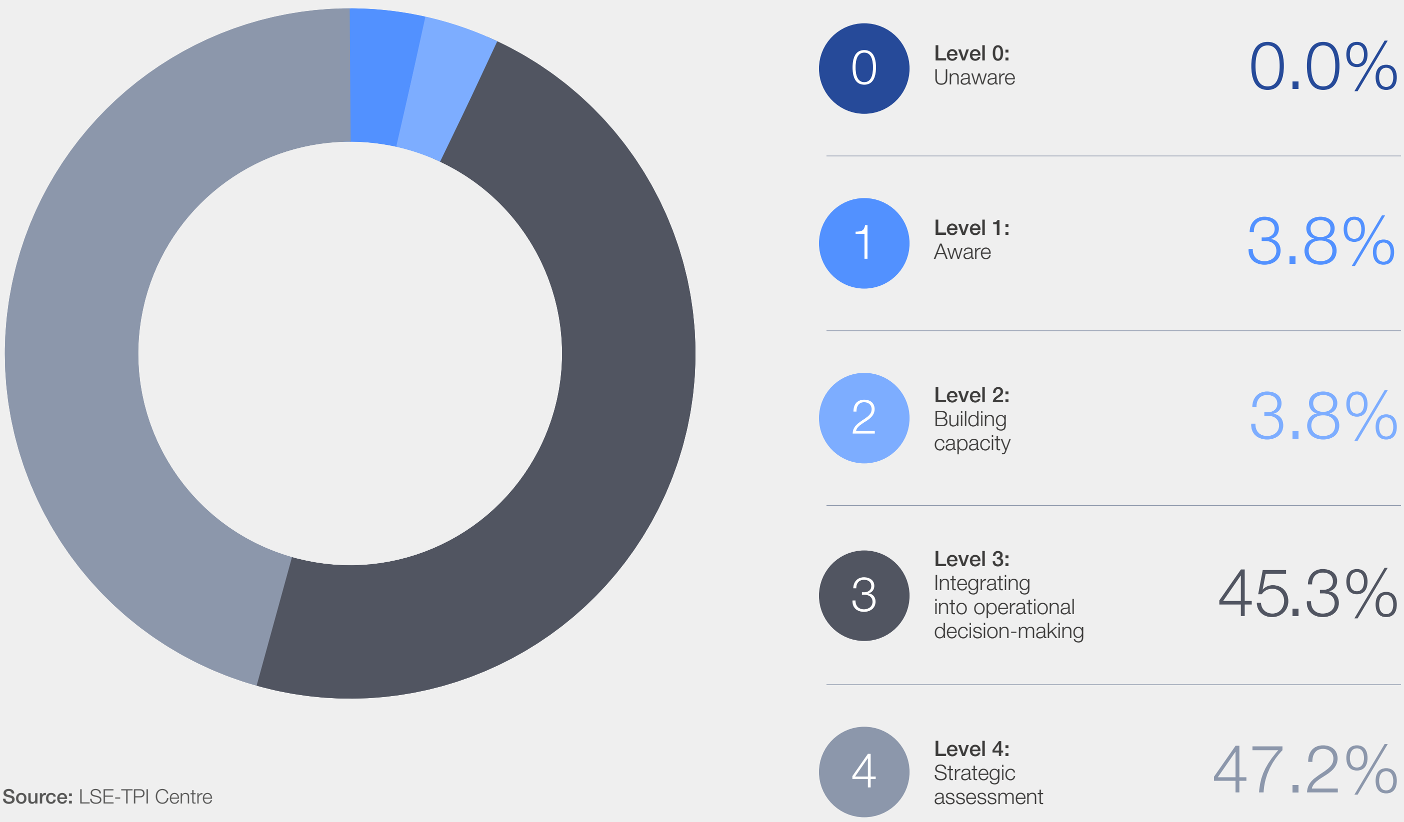
Source: Accenture analysis based on IEA, DNV, Global CCS Institute

Oil and gas supermajors, large independents and most national oil companies are well capitalized to fund their decarbonization efforts. Smaller players will rely on industrial collaboration and government support in some regions for raising the required capital. Investors and policy-makers will also play a crucial role for creating the right enabling conditions for investment. The geographic distribution of oil and gas producing nations and existing infrastructure aids the transition as CapEx need not be concentrated in a particular geography.

Approximately 92% of large publicly-traded oil and gas companies consider climate change as a key consideration for their strategic assessment and integrate it into their operational decision-making.[496] Meanwhile, 4% of companies are building basic emissions management systems and process capabilities. Finally, 4% of companies acknowledge climate change as a business issue.

FIGURE 72

Distribution of companies in the oil and gas sector according to the management of their GHG emissions and of risks and opportunities related to the low-carbon transition



Source: LSE-TPI Centre

Endnotes

436. IEA, *World Energy Outlook*, October 2022, https://www.iea.org/reports/world-energy-outlook-2022.

437. Accenture analysis based on: IEA, *Emissions from Oil and Gas Operations in Zero Net Transitions*, May 2023, https://www.iea.org/reports/emissions-from-oil-and-gas-operations-in-net-zero-transitions.

438. Accenture analysis based on: IEA, *Spectrum of the well-to-tank emissions intensity of global oil production 2018 and 2019*, https://www.iea.org/data-and-statistics/charts/spectrum-of-the-well-to-tank-emissions-intensity-of-global-oil-production-2019; https://www.iea.org/data-and-statistics/charts/spectrum-of-the-well-to-tank-emissions-intensity-of-global-gas-production-2018.

439. IEA, *Key World Energy Statistics*, September 2021, https://iea.blob.core.windows.net/assets/52f66a88-0b63-4ad2-94a5-29d36e864b82/KeyWorldEnergyStatistics2021.pdf.

440. Accenture analysis based on IEA, OECD and Global CCS Institute data.

441. Accenture analysis based on data from IEA and EIA.

442. Accenture analysis based on: IEA, Fossil Fuels, https://www.iea.org/energy-system/fossil-fuels.

443. Transition Pathway Initiative, *Oil & Gas*, https://www.transitionpathwayinitiative.org/sectors/oil-gas.

444. Accenture Analysis based on: DNV, https://www.dnv.com/cases/carbon-emission-reduction-roadmap-for-refineries-135592, Global CCS Institute, https://www.globalccsinstitute.com/archive/hub/publications/201688/global-ccs-cost-updatev4.pdf; IEA, https://www.iea.org/reports/emissions-from-oil-and-gas-operations-in-net-zero-transitions.

445. Accenture analysis based on: IEA, *Emissions from Oil and Gas Operations in Zero Net Transitions*, May 2023, https://www.iea.org/reports/emissions-from-oil-and-gas-operations-in-net-zero-transitions.

446. Accenture analysis based on: Oil Climate Index Plus Gas, *2023 Data Update – Comparing Total Emissions*, https://ociplus.rmi.org/total-emissions.

447. Accenture analysis based on: IEA, *Methane Abatement*, https://www.iea.org/energy-system/fossil-fuels/methane-abatement.

448. Global Methane Pledge, *About the Global Methane Pledge*, https://www.globalmethanepledge.org/.

449. Accenture analysis based on: IEA, *Gas Flaring*, https://www.iea.org/energy-system/fossil-fuels/gas-flaring.

450. World Bank, *Zero Routine Flaring by 2030*, https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030/endorsers.

451. Accenture analysis based on: IEA, *Methane Abatement*, https://www.iea.org/energy-system/fossil-fuels/methane-abatement.

452. Accenture analysis based on: IEA, *Fossil Fuels*, https://www.iea.org/energy-system/fossil-fuels.

453. Accenture analysis based on data provided Global CCS Institute.

454. Accenture analysis based on: DNV, *Carbon Emission Reduction Roadmap for Refineries*, https://www.dnv.com/cases/carbon-emission-reduction-roadmap-for-refineries-135592.

455. UNEP, *UN Announces High-Tech, Satellite-based Global Methane Detection System*, 11 November 2022, https://www.unep.org/news-and-stories/press-release/un-announces-high-tech-satellite-based-global-methane-detection.

456. Reuters, *Exclusive: Exxon Halts Routine Gas Flaring in the Permian, Wants Others to Follow*, January 2023, https://www.reuters.com/business/energy/exxon-halts-routine-gas-flaring-permian-wants-others-follow-2023-01-24/.

457. Hart Energy, *Electrifying Permian bpx Energy Touts Emissions Reductions*, 28 March 2023, https://www.hartenergy.com/ep/exclusives/electrifying-permian-bpx-energy-touts-emissions-reductions-basin-204578.

458. Saudi Aramco, *Sustainability Report 2022*, https://www.aramco.com/-/media/downloads/sustainability-report/report-2022/2022-sustainability-report-en.pdf.

459. TotalEnergies, *Sustainability Report 2022*, March 2022, https://totalenergies.com/sites/g/files/nytnzq121/files/documents/2022-05/Sustainability_Climate_2022_Progress_Report_accessible_version_EN.pdf.

460. Accenture analysis based on data from Global CCS Institute.

461. Accenture analysis based on data from IEA and EIA.

462. Accenture analysis based on data published by University of Wyoming, Georgia Institute of Technology.

463. Accenture analysis based on: Georgia Institute of Technology, *Membrane Technology Could Cut Emissions and Energy Use in Oil Refining,* 16 July 2020, https://www.sciencedaily.com/releases/2020/07/200716144736.htm.

464. IEA, *Net Zero by 2050*, May 2021, https://www.iea.org/reports/net-zero-by-2050.

465. Accenture analysis based on: IEA, *CCUS Projects Explorer*, 24 March 2023, https://www.iea.org/data-and-statistics/data-tools/ccus-projects-explorer.

466. Accenture analysis.

467. ExxonMobil, *ExxonMobil Announces Acquisition of Denbury*, 13 July 2023, https://corporate.exxonmobil.com/news/news-releases/2023/0713_exxonmobil-announces-acquisition-of-denbury.

468. Accenture analysis.

469. Accenture analysis based on data from IEA and EIA.

470. Accenture analysis based on data from bp Statistical Review 2022 and fossil fuel imports data from World Trade Organization.

471. S&P Global, *Shell to Deliver First SAF from Rotterdam Plant from 2025*, 4 May 2023, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/agriculture/050323-shell-to-deliver-first-saf-from-rotterdam-plant-from-2025.

472. bp, *Hertz, bp Collaborate to Accelerate EV Charging in North America*, 27 September 2022, https://www.bp.com/en/global/corporate/news-and-insights/press-releases/hertz-bp-collaborate-to-accelerate-ev-charging-in-north-america.html.

473. Oil & Gas Methane Partnership, *The Oil & Gas Methane Partnership 2.0*, https://ogmpartnership.com/.

474. GRI, *Universal Standards*, https://www.globalreporting.org/standards/standards-development/universal-standards/.

475. Reuters, *LNG Industry Body Sees First Carbon Neutral Cargo Delivery to Taiwan*, 25 January 2023, https://www.reuters.com/business/energy/lng-industry-body-sees-first-carbon-neutral-cargo-delivery-taiwan-2023-01-25/.

476. IEA, *Inflation Reduction Act*, 8 November 2022, https://www.iea.org/policies/16317-inflation-reduction-act-2022-sec-60113-and-sec-50263-on-methane-emissions-reductions.

477. Bipartisan Policy Center, *Inflation Reduction Act*, 4 August 2022, https://bipartisanpolicy.org/blog/inflation-reduction-act-summary-energy-climate-provisions/.

478. IEA, *Canada's Methane Strategy*, 10 February 2023, https://www.iea.org/policies/17015-faster-and-further-canadas-methane-strategy.

479. IEA, *Emissions in Upstream Operations in Nigeria*, 28 November 2022, https://www.iea.org/policies/16952-guidelines-for-management-of-fugitive-methane-and-greenhouse-gases-emissions-in-the-upstream-oil-and-gas-operations-in-nigeria.

480. IEA, *Methane Abatement*, https://www.iea.org/energy-system/fossil-fuels/methane-abatement.

481. CCA Coalition, *National Methane Action Plans*, 2022, https://www.ccacoalition.org/resources/national-methane-action-plans.

482. GEF, *Colombia's 2030 MRV Strategic Vision*, https://www.thegef.org/sites/default/files/web-documents/10121_PIF.pdf.

483. IEA Policy Database, *National Level MRV Mitigation Actions*,15 February 2022, https://www.iea.org/policies/14772-resolution-1447-2018-monitoring-reporting-and-verification-system-for-mitigation-actions-at-the-national-level.

484. European Commission, *EU Emissions Trading System (EU ETS)*, https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets_en.

485. IEA, *PACE: UAE-U.S. Clean Energy Strategic Partnership*, 24 April 2023, https://www.iea.org/policies/17310-pace-uae-us-clean-energy-strategic-partnership.

486. IEA, *Norway 2022 Energy Policy Review*, https://iea.blob.core.windows.net/assets/de28c6a6-8240-41d9-9082-a5dd65d9f3eb/NORWAY2022.pdf.

487. Highnorth News, *Norwegian Government Approves Electrification of Melkøya LNG Plant in Northern Norway*, 9 August 2023, https://www.highnorthnews.com/en/norwegian-government-approves-electrification-melkoya-lng-plant-northern-norway.

488. GIIGNL, *GIIGNL Releases MRV and GHG Neutral Framework,* November 2021, https://giignl.org/giignl-releases-framework-for-transparent-emissions-reporting-and-neutrality-declarations/.

489. EPA, *Methane Emissions Reduction Program*, https://www.epa.gov/inflation-reduction-act/methane-emissions-reduction-program.

490. IEA, *Inflation Reduction Act 2022: Sec. 60113 and Sec. 50263 on Methane Emissions Reductions*, 2022, https://www.iea.org/policies/16317-inflation-reduction-act-2022-sec-60113-and-sec-50263-on-methane-emissions-reductions.

491. IEA, *Emissions from Oil and Gas Operations in Net Zero Transitions*, May 2023, https://iea.blob.core.windows.net/assets/2f65984e-73ee-40ba-a4d5-bb2e2c94cecb/EmissionsfromOilandGasOperationinNetZeroTransitions.pdf.

492. Accenture analysis based on: DNV, *Carbon Emission Reduction Roadmap for Refineries*, https://www.dnv.com/cases/carbon-emission-reduction-roadmap-for-refineries-135592; Lawrence, Irlam, Global CCS Institute, *Global Costs of Carbon Capture and Storage*, June 2017, https://www.globalccsinstitute.com/archive/hub/publications/201688/global-ccs-cost-updatev4.pdf; IEA, *Emissions from Oil and Gas Operations in Net Zero Transition*, May 2023, https://www.iea.org/reports/emissions-from-oil-and-gas-operations-in-net-zero-transitions.

493. Accenture analysis based on S&P Capital IQ data.

494. Stern NYU, *WACC Data*: *Cost of Equity and Capital*, January 2023, https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/wacc.html.

495. Petrobras, *Strategic Plan 2023-27*, https://petrobras.com.br/quem-somos/estrategia?p_l_back_url=%2Fresultado-da-busca%3Fq%3Dstrategic%2Bplan%2B2023.

496. Transition Pathway Initiative, *Oil & Gas*, https://www.transitionpathwayinitiative.org/sectors/oil-gas.

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