The Oil and Gas Industry in Energy Transitions

World Energy Outlook special report

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About this report

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Introduction

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The oil and gas industry is facing increasing demands to clarify the implications of energy transitions for their operations and business models, and to explain the contributions that they can make to reducing greenhouse gas (GHG) emissions and to achieving the goals of the Paris Agreement.

The increasing social and environmental pressures on many oil and gas companies raise complex questions about the role of these fuels in a changing energy economy, and the position of these companies in the societies in which they operate.

But the core question, against a backdrop of rising GHG emissions, is a relatively simple one: should today's oil and gas companies be viewed only as part of the problem, or could they also be crucial in solving it?

This is the topic taken up by the International Energy Agency (IEA) in this report, which builds on a multi-year programme of analysis on the future of oil and gas in the IEA *World Energy Outlook* (*WEO*) series.

This report does not aim to provide definitive answers, not least because of the wide diversity of oil and gas companies and company strategies around the world. It does aim to map out the risks facing different parts of the industry, as well as the range of options and responses.

"No energy company will be unaffected by clean energy transitions. Every part of the industry needs to consider how to respond. Doing nothing is simply not an option."

Dr Fatih Birol, IEA Executive Director

Three considerations provide the boundaries for this analysis. First, the prospect of rising demand for the services that energy provides due to a growing global population – some of whom remain without access to modern energy – and an expanding global economy.

Second, the recognition that oil and natural gas play critical roles in today's energy and economic systems, and that affordable, reliable supplies of liquids and gases (of different types) are necessary parts of a vision of the future.

And last but far from least, the imperative to reduce energy-related emissions in line with international climate targets.

These elements may appear to be in contradiction with one another, but this is not necessarily the case. The *WEO* Sustainable Development Scenario (SDS) charts a path fully consistent with the Paris Agreement by holding the rise in global temperatures to "well below 2°C ... and pursuing efforts to limit [it] to 1.5°C", and meets objectives related to

universal energy access and cleaner air. The SDS and the range of technologies that are required to achieve it provide a benchmark for the discussion throughout this report.

The other scenario referenced in the analysis is the Stated Policies Scenario (STEPS), which provides an indication of where today's policy ambitions and plans would lead the energy sector. These outcomes fall far short of the world's shared sustainability goals.

The focus of this report is therefore on accelerated energy transitions, the forces that could bring them about – whether from society, policy makers, technology, investors or the industry itself – and the implications that this would have for different parts of today's oil and gas industry.

Key findings

Balancing short-term returns with long-term licence to operate

The oil and gas industry faces the strategic challenge of balancing short-term returns with its long-term licence to operate. Societies are simultaneously demanding energy services and also reductions in emissions. Oil and gas companies have been proficient at delivering the fuels that form the bedrock of today's energy system; the question that they now face is whether they can help deliver climate solutions.

The analysis in this report highlights that this could be possible if the oil and gas industry takes the necessary steps. As such, it opens a way – which some companies are already following – for the oil and gas industry to engage with the "grand coalition" that the IEA considers essential to tackle climate change. This effort would be greatly enhanced if more oil and gas companies were firmly and fully onboard. The costs of developing low-carbon technologies represent an investment in companies' ability to prosper over the long term.

Global primary energy, electricity generation, final consumption and CO2 emissions by fuel, 2018

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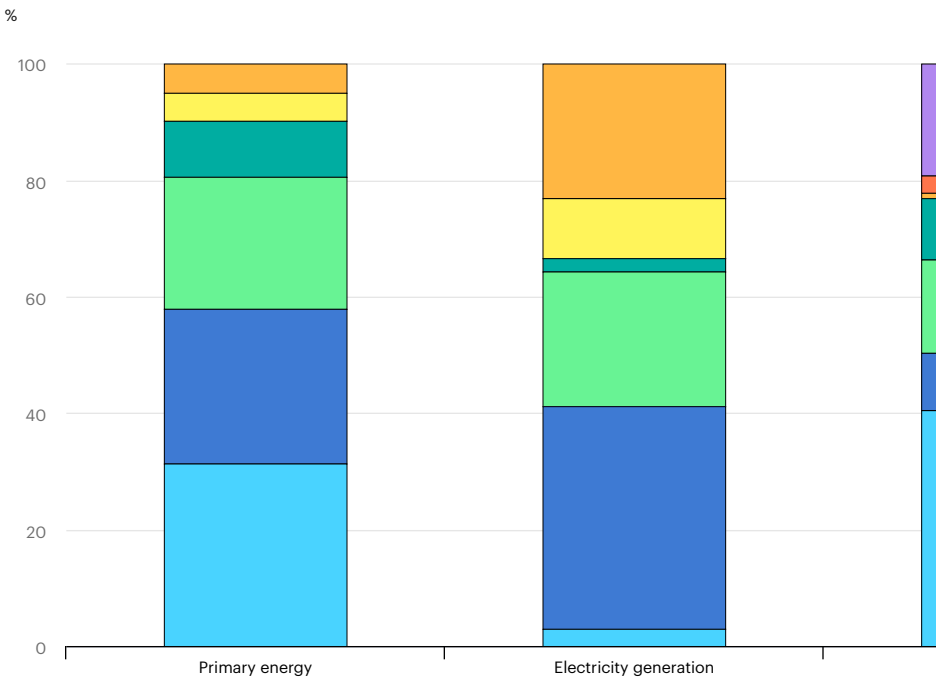

Oil Coal Natural gas Bioenergy Nuclear Renewables Heat Electricity

Every part of the industry needs to consider how to respond to clean energy transitions

No oil and gas company will be unaffected by clean energy transitions, so every part of the industry needs to consider how to respond. The industry landscape is diverse and there is no single strategic response that will make sense for all. Attention often focuses on the Majors, seven large integrated oil and gas companies that have an outsized influence on industry practices and direction. But the industry is much larger: the Majors account for 12% of oil and gas reserves, 15% of production and 10% of estimated emissions from industry operations.

National oil companies (NOCs) – fully or majority-owned by national governments – account for well over half of global production and an even larger share of reserves. There are some high-performing NOCs, but many are poorly positioned to adapt to changes in global energy dynamics.

Share of oil reserves, oil production and oil upstream investment by company type, 2018

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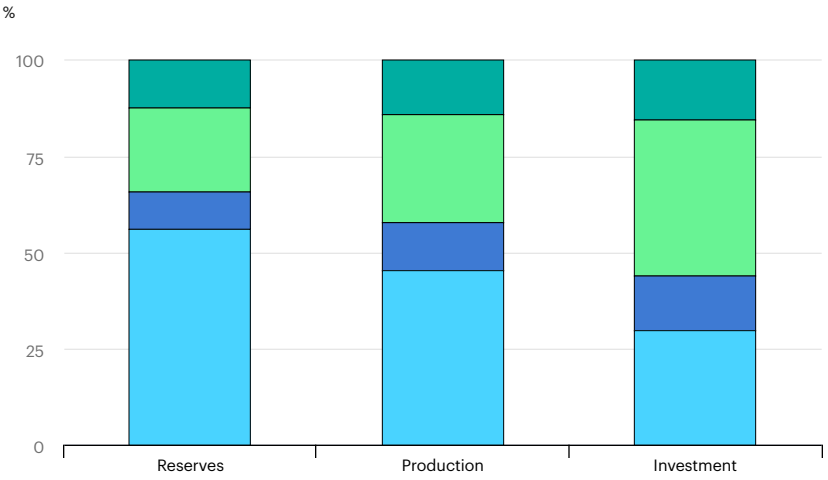

NOCs INOCs Independents Majors

Shares of gas reserves, gas production and gas upstream investment by company type, 2018

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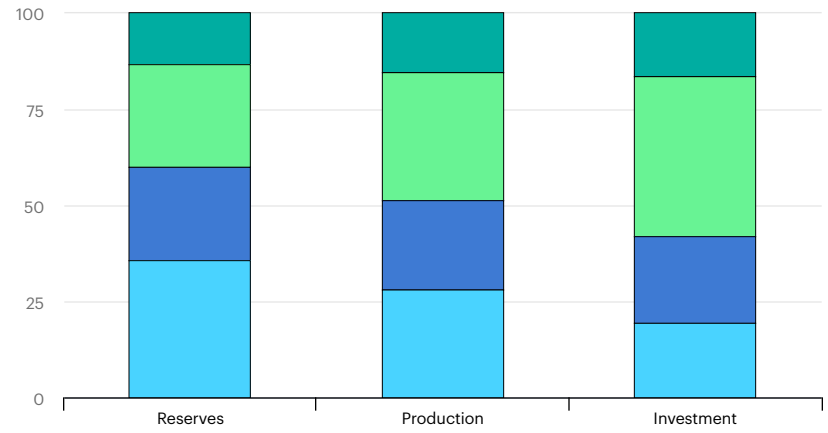
%



NOCs INOCs Independents Majors

Investments in low-carbon businesses represent less than 1% of oil and gas companies capital expenditure

So far, investment by oil and gas companies outside their core business areas has been less than 1% of total capital expenditure. For the moment, there are few signs of a major change in company investment spending. For those companies looking to diversify their energy operations, redeploying capital towards low-carbon businesses requires attractive investment opportunities in the new energy markets as well as new capabilities within the companies.

As things stand, leading individual companies spend around 5% on average on projects outside core oil and gas supply, with the largest outlays in solar PV and wind. Some oil and gas companies have also moved into new areas by acquiring existing non-core businesses, for example in electricity distribution, electric vehicle charging and batteries, while stepping up research and development activity.

A much more significant change in overall capital allocation would be required to accelerate energy transitions.

Capital expenditures on new projects outside of core oil and gas supply by large companies, absolute and as share of total capex, 2015-2019

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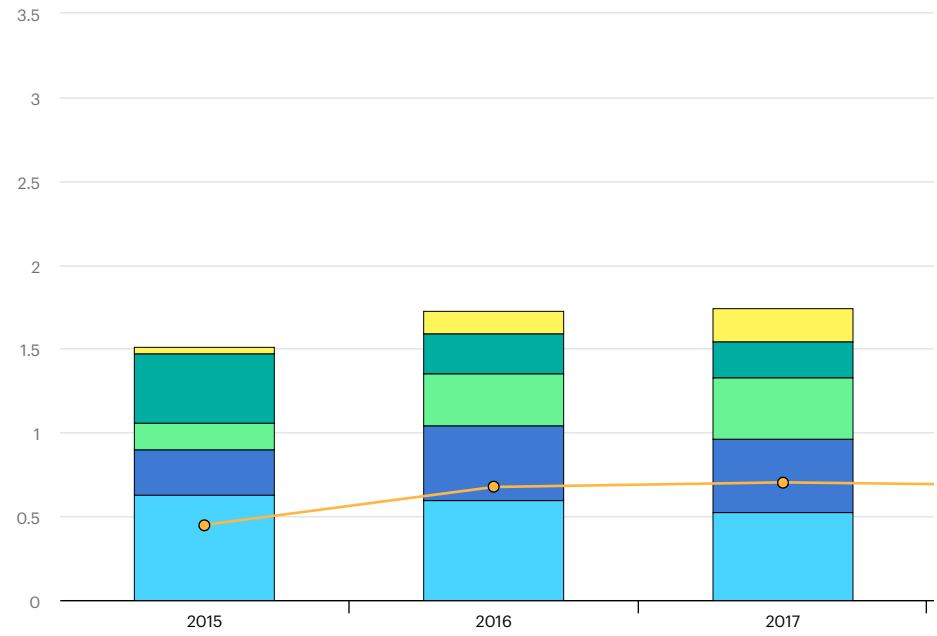

Solar PV · Offshore wind · Onshore wind · CCUS · Biofuels · Share of total capital investment (right axis)

Many solutions could help reducing the environmental footprint of the oil and gas industry

There is a lot that the industry could do today to reduce the environmental footprint of its own operations. Uncertainty about the future is a key challenge facing the industry, but this is no reason for companies to "wait and see" as they consider their strategic choices. Minimising emissions from core oil and gas operations should be a first-order priority for all, whatever the transition pathway.

There are ample, cost-effective opportunities to bring down the emissions intensity of delivered oil and gas by minimising flaring of associated gas and venting of CO_2, tackling methane emissions, and integrating renewables and low-carbon electricity into new upstream and liquefied natural gas (LNG) developments.

As of today, 15% of global energy-related GHG emissions come from the process of getting oil and gas out of the ground and to consumers. Reducing methane leaks to the atmosphere is the single most important and cost-effective way for the industry to bring down these emissions.

Changes in the average global emissions intensity of oil and natural gas operations in the Sustainable Development Scenario, 2018-2030

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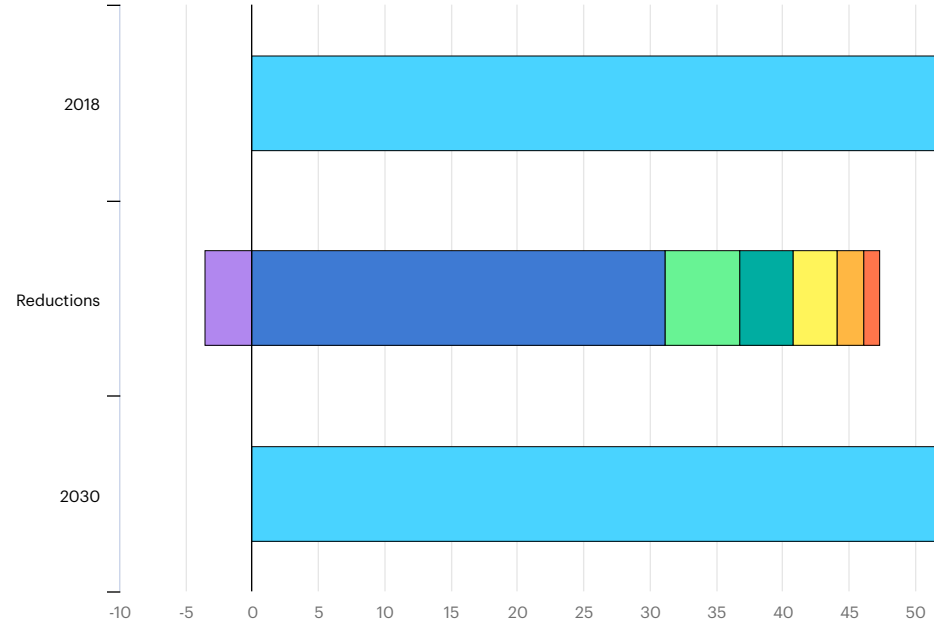
%



Emissions intensity · Methane reductions · Reduce flaring and venting Co2 · Efficiency improvements · Use of renewables in operations · Use of CCUS in refining · Oil to gas shift · Change in resources produced and refined · Net reduction

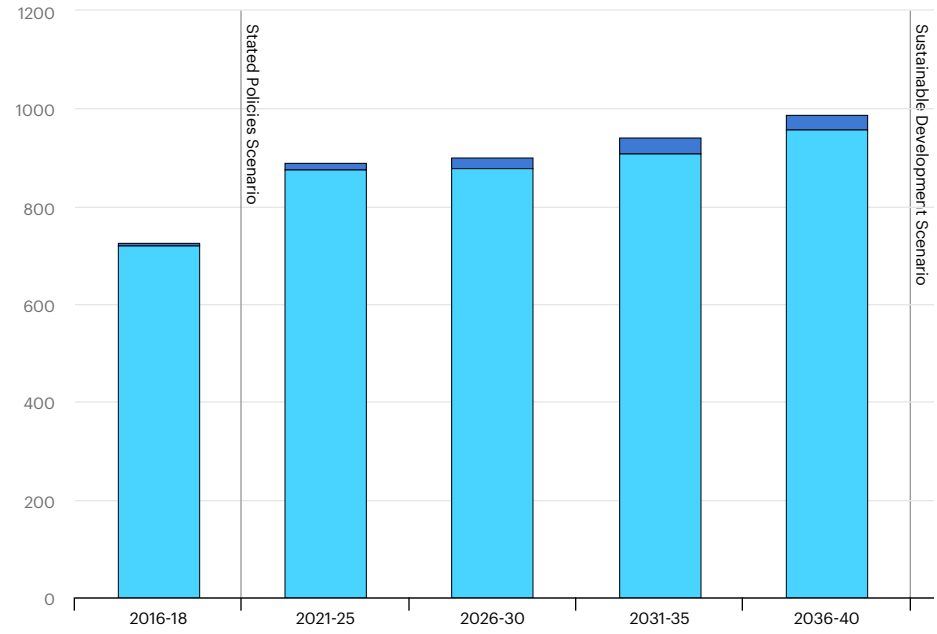
Electricity cannot be the only vector for the energy sector's transformation

Electricity cannot be the only vector for the energy sector's transformation. A commitment by oil and gas companies to provide clean fuels to the world's consumers is critical to the prospects for reducing emissions. The 20% share of electricity in global final consumption is growing, but electricity cannot carry energy transitions on its own against a backdrop of rising demand for energy services.

Bringing down emissions from core oil and gas operations is a key step in helping countries to get environmental gains from using less emissions-intensive fuels. However, it is also vital for companies to step up investment in low-carbon hydrogen, biomethane and advanced biofuels, as these can deliver the energy system benefits of hydrocarbons without net carbon emissions. Within ten years, these low-carbon fuels would need to account for around 15% of overall investment in fuel supply.

Capital investment in liquids and gases by scenario, 2019-2040 Open ⤢

billion dollars (2018)



High-carbon liquids and gases Low-carbon liquids and gases

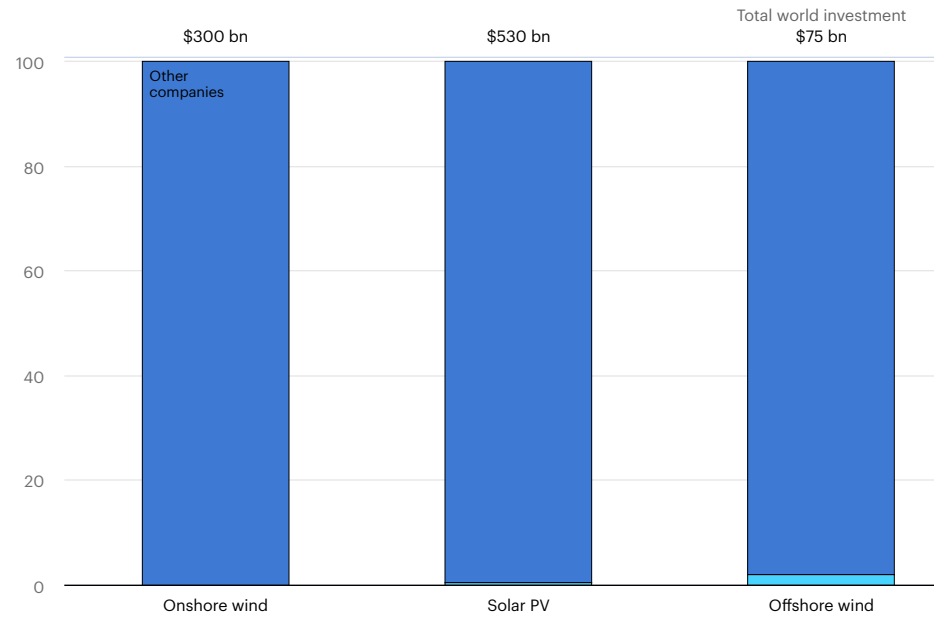
The oil and gas industry will be critical for key capital-intensive clean energy technologies to reach maturity

The oil and gas industry will be critical for some key capital-intensive clean energy technologies to reach maturity. The resources and skills of the industry can play a central role in helping to tackle emissions from some of the hardest-to-abate sectors. This includes the development of carbon capture storage and utilisation (CCUS), low-carbon hydrogen, biofuels, and offshore wind. Scaling up these technologies and bringing down their costs will rely on large-scale engineering and project management capabilities, qualities that are a good match to those of large oil and gas companies.

For CCUS, three-quarters of the CO_2 captured today in large-scale facilities is from oil and gas operations, and the industry accounts for more than one-third of overall spending on CCUS projects. If the industry can partner with governments and other stakeholders to create viable business models for large-scale investment, this could provide a major boost to deployment.

Share of global capital investment in selected low-carbon technologies (2015-2018) Open

%



Oil and gas companies Other companies

A fast-moving energy sector would change the game for upstream investment

A fast-moving energy sector would change the game for upstream investment. Investment in upstream projects is still needed even in rapid transitions, but the type of resources that are developed, and how they are produced, changes substantially.

Production from existing fields declines at a rate of roughly 8% per year in the absence of any investment, larger than any plausible fall in global demand. Consequently, investment in existing and some new fields remains part of the picture. But as overall investment falls back and markets become increasingly competitive, only those with low-cost resources and tight control of costs and environmental performance would be in a position to benefit.

Global oil demand in the Sustainable Development Scenario and decline in supply from 2019 to 2040

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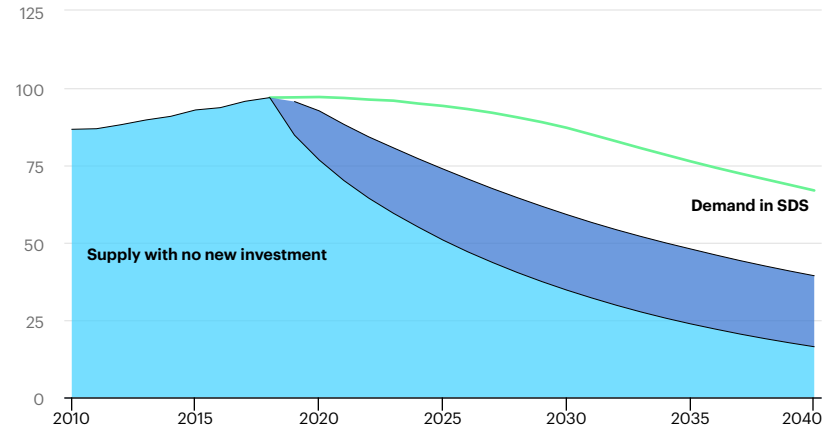

Supply with no new investment Supply with investment in existing fields Demand in SDS

Global gas demand in the Sustainable Development Scenario and decline in supply from 2019 to 2040

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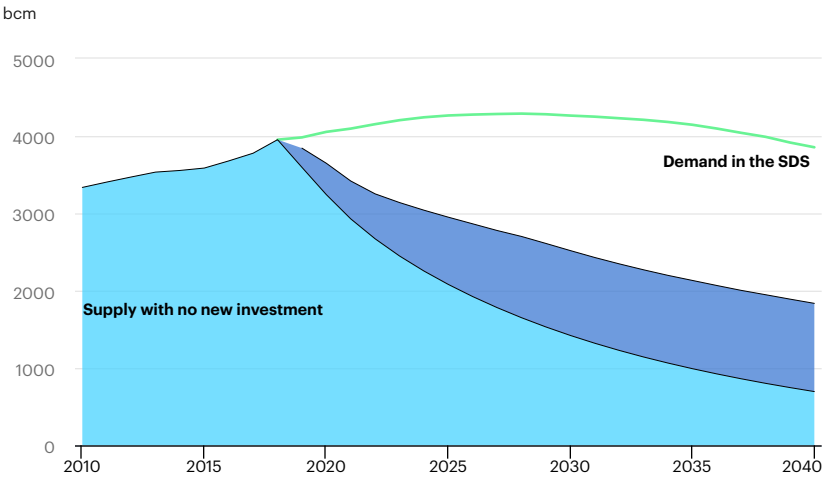


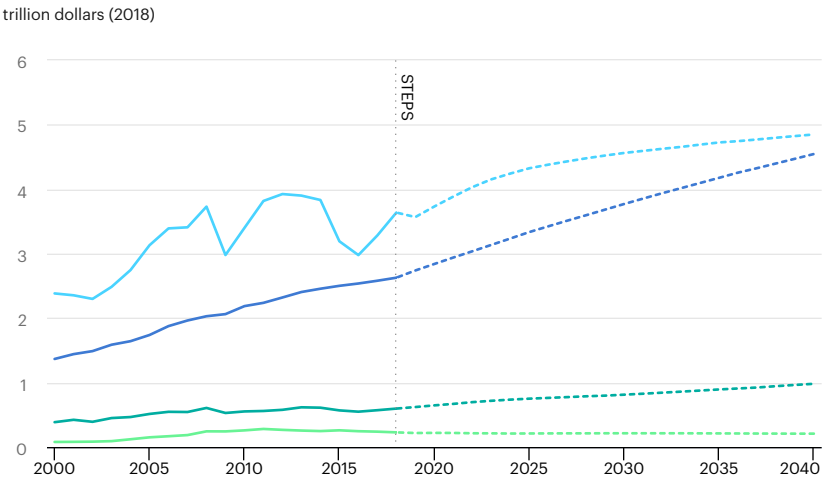
Supply with no new investment Supply with investment in existing fields Demand in the SDS

A shift from “oil and gas” to “energy”

A shift from “oil and gas” to “energy” takes companies out of their comfort zone, but provides a way to manage transition risks. Some large oil and gas companies are set to make a switch to “energy” companies that supply a diverse range of fuels, electricity and other energy services to consumers. This means moving into sectors, notably electricity, where there is already a large range of specialised actors and where the financial characteristics and scale of most low-carbon investment opportunities are (with the partial exception of offshore wind) a long way from traditional oil and gas projects.

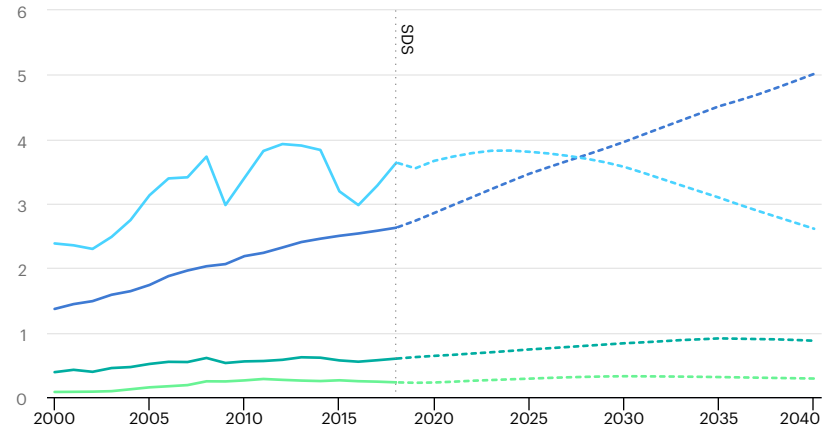
Electricity provides long-term opportunities for growth, given that it overtakes oil in accelerated energy transitions as the main element in consumer spending on energy. It also opens the door to larger and broader reductions in company emissions, relieving social pressures along the way, although investors will watch carefully the industry's ability to balance diversification with expected returns and dividends.

Global end-user energy spending in the Stated Policies Scenario, 2000-2040 **Open**



Oil Electricity Coal Natural gas

Global end-user energy spending in the Sustainable Development Scenario, 2000-2040 **Open**



Oil Electricity Coal Natural gas

NOCs face some particular challenges, as do their host governments

NOCs face some particular challenges, as do their host governments. The stakes are high for NOCs that are charged with the stewardship of national hydrocarbon resources, and for their host governments and societies that often rely heavily on the associated oil income. Changing energy dynamics have prompted a number of countries to renew their commitment to reform and to diversify their economies; fundamental changes to the development model in many major resource holders look unavoidable.

NOCs can provide important elements of stability for economies during this process, if they are operating effectively and alert to the risks and opportunities. Some leading NOCs are stepping up research efforts targeting models of resource development that are compatible with deep decarbonisation, e.g. via CCUS, trade in hydrogen or a focus on non-combustion uses of hydrocarbons.

Average annual net oil and gas income before tax of NOCs and INOCs by scenario, 2001-2040

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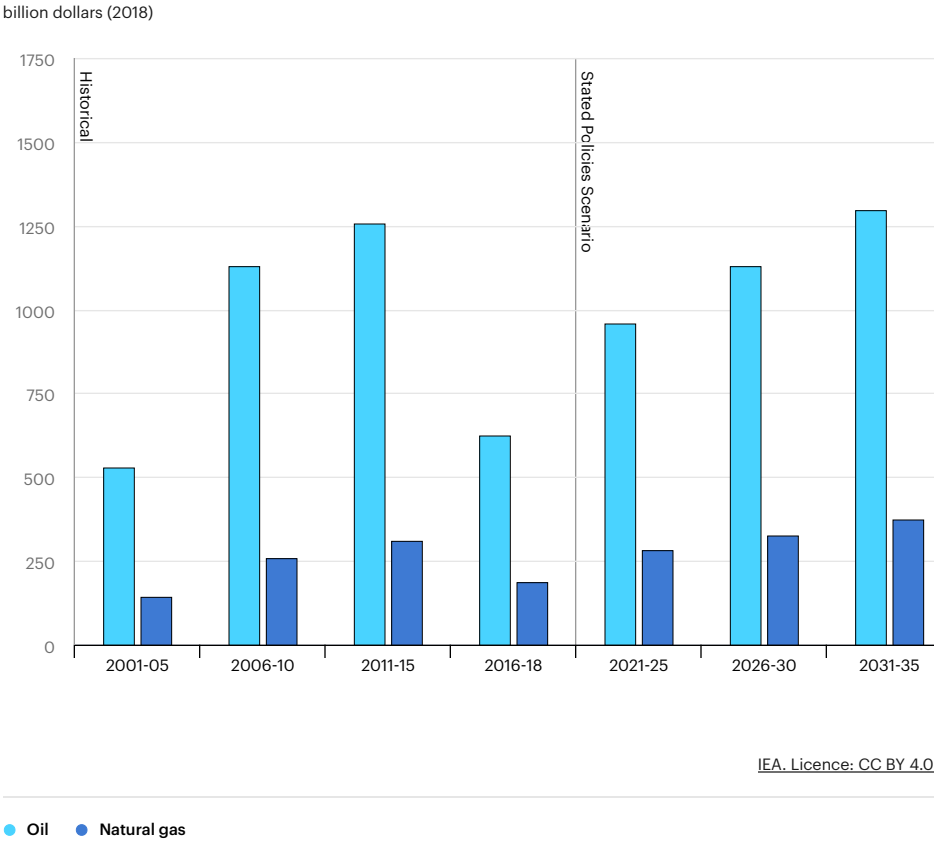

Without the oil and gas industry, the transformation of the energy sector will be more difficult and more expensive

The transformation of the energy sector can happen without the oil and gas industry, but it would be more difficult and more expensive. Oil and gas companies need to clarify the implications of energy transitions for their operations and business models, and to explain the contributions that they can make to accelerate the pace of change. This process has started and company commitments to reduce emissions or emissions intensities are becoming increasingly common.

However, the industry can do much more to respond to the threat of climate change. Regardless of which pathway the world follows, climate impacts will become more visible and severe over the coming years, increasing the pressure on all elements of society to find solutions. These solutions cannot be found within today's oil and gas paradigm.