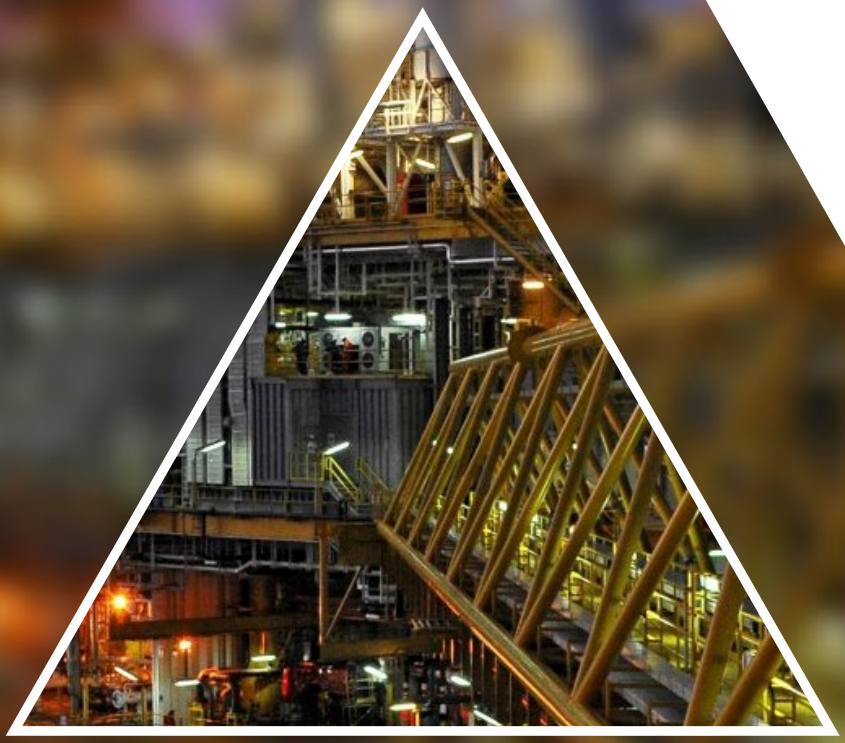
Baringa
Brighter together

After COP26, What Next for the Oil and Gas Industry?



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1 Introduction

Representatives of the 197 countries that are parties to the United Nations Framework Convention on Climate Change world will gather in Glasgow for the 26th meeting of the Conference of the Parties, or COP26 as it is better known.

They arrive at the meeting informed by the IPCC Sixth Assessment that human activity, principally the burning of fossil fuels, has led to global warming of 1.1°C, with changes to the climate seen in every region on earth. The IPCC states that limiting warming to 1.5°C is still possible, but only if we make strong, rapid, and sustained reductions to emissions now.

Agreements made in Glasgow will have a significant impact on the climate for generations to come. The emissions targets set will define the changes required to the world energy system and have direct consequences to oil and gas companies.

In this paper, we set out our insights on the challenges that climate change and the world response present to the oil and gas industry and make recommendations on how companies can analyse their physical and transition risks, mitigate their operational emissions, and create low-carbon businesses, such that they can thrive through the energy transition.

❷ What the UN IPCC Sixth Assessment Means for Oil and Gas

2.1 What Does the UN IPCC Sixth Assessment Say?

In August 2021, the Intergovernmental Panel on Climate Change (IPCC) released its Sixth Assessment Report on the physical science of climate change [1].

The IPCC is known for its meticulous scientific analysis and consensus building with all of its members before reports are published. This makes its findings significant, and they inform governments and policy makers around the world.

The Sixth Assessment Report provided unequivocal evidence that:

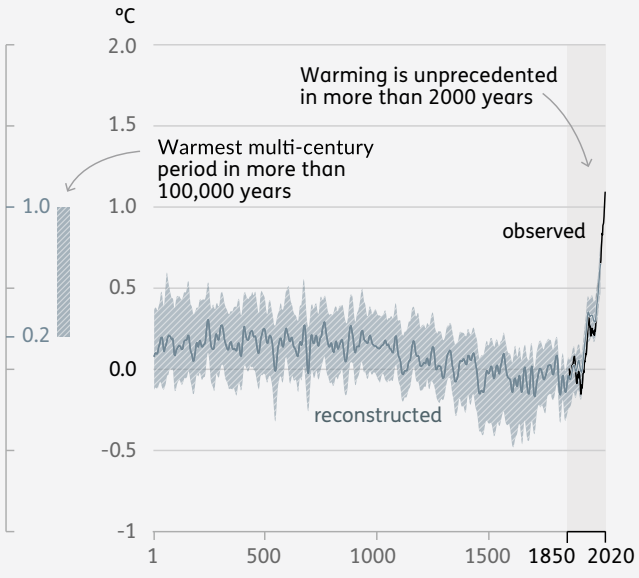
- Human activities are indisputably causing climate change and making heat waves, heavy rainfall, and droughts more frequent and severe.
- Changes in the climate are widespread, rapid, intensifying, and unprecedented.
- Climate change is already affecting every region in multiple ways. The changes we are experiencing will increase further warming.
- There's no going back from some changes in the system. However, some could be slowed, and others could be stopped by limiting warming.
- Unless there are immediate and large-scale greenhouse gas emissions reductions, limiting warming to 1.5°C will be beyond reach.

Today oil, coal, and gas account for more than 80% of world energy consumption [2]. As we combust those fossil fuels to create energy, we release carbon dioxide and methane into the atmosphere. The IPCC reports that CO_2 concentration is at its highest for at least two million years.

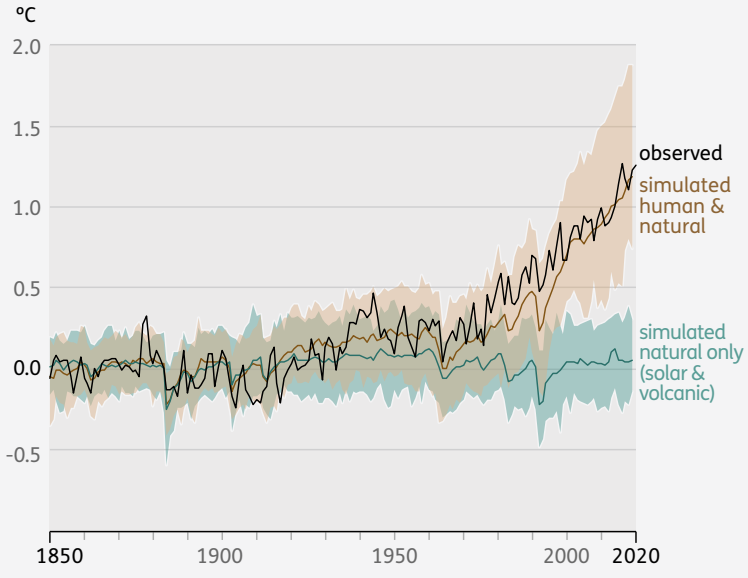
Carbon dioxide and methane are greenhouse gasses – gasses that absorb and radiate heat. Increases in atmospheric carbon dioxide and methane have already caused the earth's mean temperature to rise by 1.1°C, with greater warming in many land regions, such as two to three times higher in the Arctic [3].

Figure 1: Changes in global surface temperature relative to 1850–1900 [1]

a) Change in global surface temperature (decadal average) as reconstructed (1-2000) and observed (1850-2020)



b) Change in global surface temperature (annual average) observed and simulated using human & natural and only natural factors (both 1850-2020)

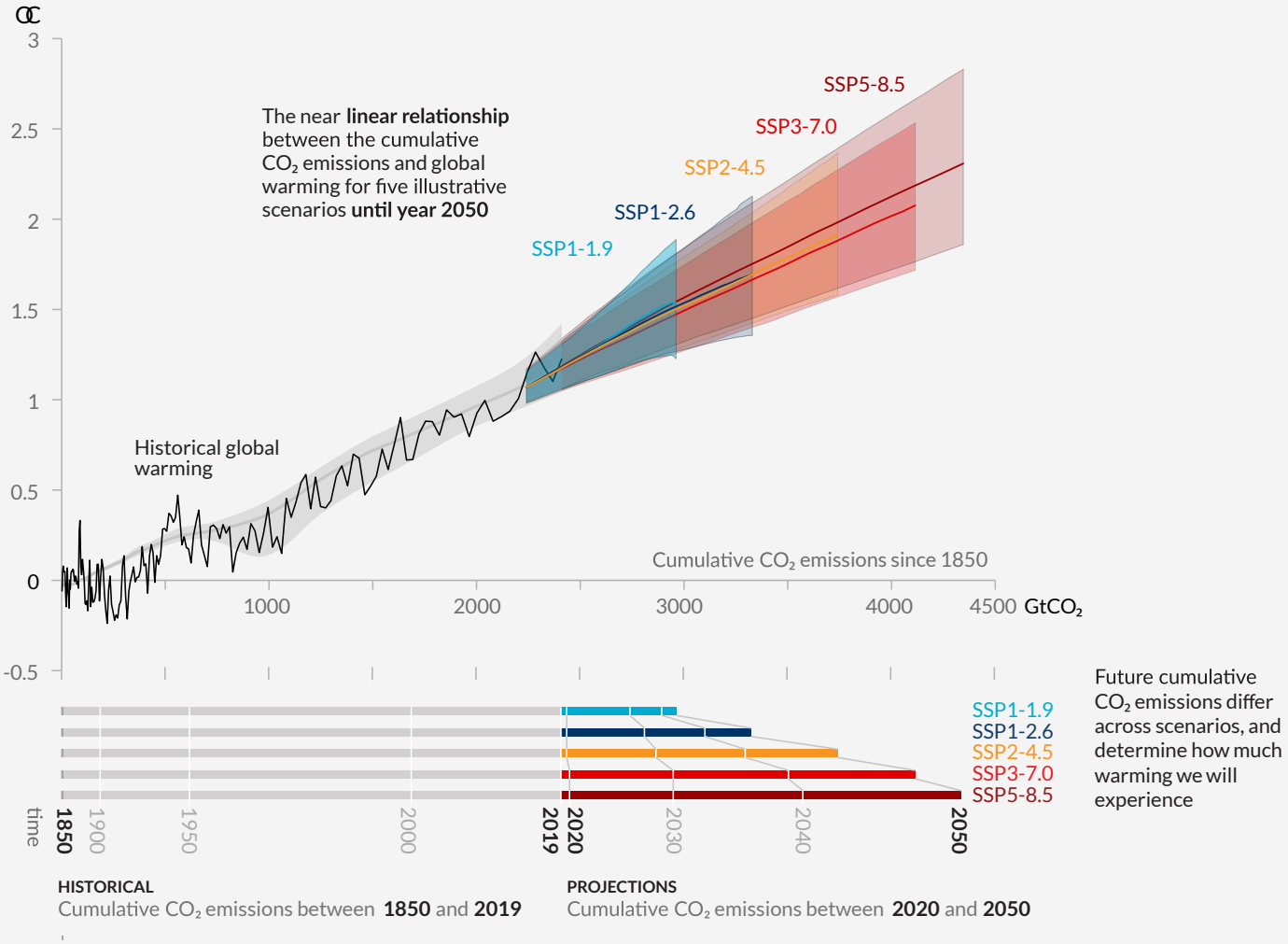


Many changes in the climate are already being observed. They include increases in the frequency and intensity of extreme heat, heavy rainfall, droughts, and fire weather, as well as warming and acidification of the ocean [1].

Future emissions will cause additional global warming, and with every additional amount of global warming, changes to the climate intensify. If we do not act, temperatures are expected to reach or exceed 1.5°C above pre-industrial levels by 2040, 2.0°C above pre-industrial levels by 2050, and 4.0°C by the end of this century [4].

To limit global warming requires limiting cumulative emissions and reaching a net-zero position. Limiting warming to 1.5°C is still possible if we make strong, rapid, and sustained reductions to CO_2 and methane now. This would not only reduce the consequences of climate change but also improve air quality.

Figure 2: Global surface temperature increase since 1850–1900 (°C) as a function of cumulative CO_2 emissions ($GtCO_2$) [1]



2.2 What Does it Mean for Oil and Gas?

These findings have some profound implications for companies involved in the extraction of oil and gas.

For the first time, the IPCC has reported that it is beyond doubt that the combustion of coal, oil, and gas is the cause of climate change. We expect that society will increasingly take a dim view of producers and consumers of these energy sources, which may lead to increased litigation targeted at companies whose business models are not aligned to Paris goals.

Physical risks are here already and will intensify. Many oil and gas assets were designed when the impacts of climate change were less well understood and are now facing risks that might impact safe operations or economics.

However, perhaps the most profound implications arise from the conclusion of the report that society must choose to address the energy transition risk now, or accept the risk of greater climate change later. Both choices bring significant consequences for governments, society, and the industry for decades to come.

2.3 Emissions Still Risk Making a Disorderly Transition More Likely

There is another implicit message in the IPCC report – that emissions are still rising, which makes a disorderly energy transition more likely.

This is important for oil and gas companies that plan for the long term. Understanding the range and likelihood of future scenarios for oil and gas is critical to the development of strategies and investment plans.

Leading organisations such as the IPCC, the IEA, and the UK CCC have developed pathways that show the emissions reductions required for organisations to be compliant with Paris goals. As an example, the IPCC says that emissions must reduce by 45% from 2010 levels by 2030, reaching net zero by 2050 in their 1.5-degree pathway, or by 25% from 2010 levels by 2030 in their below 2-degree pathway.

We can observe that all these pathways envisage an 'orderly' transition, where, following many decades of rising emissions, the world follows a managed energy transition with resulting emissions reductions.

However, despite government commitments to reduce greenhouse gas emissions and an increase in public awareness of climate change, carbon emissions are still rising. Those in 2021 are expected to be the highest ever [5]. A pattern is developing where each new pathway to achieve net zero by 2050 starts from a higher peak, and, with fewer years remaining, the magnitude of required annual emissions reduction increases.

Governments might take sufficient action to reduce emissions only if they are shocked into doing so, perhaps by a climate-related disaster in their country. At that point we envisage them taking radical steps to avert worse disasters, which are likely to trigger a rapid, 'disorderly' transition.

Should such a 'disorderly' transition occur, there is likely to be an abrupt change to the oil and gas market, such as the price of carbon abatement rising to \$500 t/CO_2e in 2050 (compared with \$350 t/CO_2e in an orderly transition).

To avoid being left with stranded assets, producers may therefore decide to produce existing reserves as rapidly as possible, precipitating a price collapse.

Such large swings in prices, costs, and taxes might make large parts of the fossil fuel industry uneconomic almost overnight.

❸ How the World is Responding

3.1 COP26 Will Drive Pressure on Governments to Increase National Commitments

In the 2015 Paris Agreement, the world's governments set a goal to limit global warming to well below 2.0°C, preferably to 1.5°C, compared to pre-industrial levels to avoid the worst impacts of climate change.

To achieve this goal, more than 125 countries representing almost 65% of global GDP have committed to reaching global peaking of greenhouse gas emissions as soon as possible, and a climate-neutral world by mid-century. The commitments, or national defined contributions (NDCs), of those countries with >1% share of global emissions are currently as follows:

Figure 3: National defined contributions of countries with >1% share of global emissions [6] [7] [8]

Rank	Region	Share of global emissions	2030 emissions reduction commitment from 2005 levels	Net-zero commitment
1	China	~27%	60–65% per unit of GDP. Peak emissions by 2030	by 2060
2	United States of America	~15%	50–52%	by 2050
3	European Union	~9%	44%	by 2050
4	India	~7%	33–35% in intensity	by 2070
5	Russia	~5%	51%	by 2060
6	Japan	~3%	45%	by 2050
7	Canada	~2%	50%	by 2050
8	United Kingdom	~1%	66%	by 2050
9	Brazil	~1%	43%	by 2060

These commitments are predicted to lead to warming of 2.7°C or more by 2100, falling short of the Paris goal. Therefore, as part of the 'ratchet' mechanism, governments are under pressure to increase their NDCs ahead of COP26.

According to the IEA [9], the power sector is responsible for 40% of global energy-related CO_2 emissions, followed by transport and industry both at 23%, and buildings at 5%. Governments are intervening in those sectors with both demand- and supply-side measures to deliver their NDCs.

As an example, most of the world's top countries by GDP – including China, Japan, Germany, the United Kingdom, France, Canada, South Korea, and the 12 states that adhere to California's Zero-Emission Vehicle Program – have proposed bans on petrol and diesel vehicles [10]. This demand-side measure has led to the world's largest vehicle manufacturers [11], including Volkswagen, Daimler Mercedes, General Motors, Ford, Volvo, and Honda, to announce that they will end production of fossil-fuelled vehicles and trucks.

On the supply side, 64 governments worldwide have introduced carbon pricing instruments covering over a fifth of global greenhouse gas emissions [12]. Carbon taxes (charges on the carbon content of fossil fuels) can be an effective tool for reducing emissions if designed well, as they increase the prices of fossil fuels and reduce them for lower-carbon alternatives [13].

For example, the government of Norway has announced an increase in the carbon tax rate from NOK 590 to NOK 2,000 ($237) per tonne CO_2e in 2030, providing a strong incentive to reduce emissions [14]. The impact on oil and gas production is clear, with Equinor committing to carbon-neutral operations in the same timeframe [15].

3.2 Regulators, Insurers, and Investors are Reassessing Their Portfolios

3.2.1 The Risk View

Over the last few years, the global financial services sector has become increasingly concerned with the risks from climate change – both physical and transition risks – and the potential financial instability that these risks could trigger.

In response, 95 central banks representing every major country in the world (including the Bank of England, the European Central Bank, and the US Federal Reserve) have united in a consortium known as the Network for Greening the Financial System (NGFS) and set coordinated standards intended to drive up climate change risk management capabilities across the financial services sector.

As a result, banks, insurers, and asset managers around the world are now starting to measure their counterparties' credit quality under a variety of 2-degree transition scenarios; the profitability of oil and gas companies is obviously a major focus for the banks.

For instance, in the recent Bank of England scenario analysis exercise – run by the UK's seven largest banks and eleven largest insurers – by 2050, oil and gas demand fell by as much as 60% and 75% respectively, the price of oil fell to $33/boe and gas to almost zero, while the carbon price rose to $900 per tonne in the UK and EU [16].

Baringa Partners supported more than half of the 18 participants in this recent Bank of England exercise, and our analysis suggests that, based upon their current business models, only 30% of Tier 1 oil and gas companies would survive such structural changes to the energy market.

Such analyses will inevitably work their way into the availability and affordability of finance for oil and gas companies, with profound implications for the viability of oil and gas producers.

3.2.2 The Net-Zero View

In addition to concerns about risk, shareholders are demanding that banks, insurers, and asset managers set net-zero targets for their lending and investment portfolios, with the result that banks, insurers, and asset managers around the world are joining initiatives such as the Net-Zero Banking Alliance and the Net-Zero Asset Owners Alliance and announcing net-zero targets. For example, NatWest have stated that they will "halve the impact of our financed emissions by 2030 and reach net zero before 2050".

And importantly for the oil and gas sector, these commitments by the financial services sector include their counterparties' Scope 3 emissions. Scope 3 includes emissions from customer combustion of sold products, which for oil and gas companies is typically ~90% of their total emissions.

As a result of these net-zero commitments, oil and gas companies may find that even if they are in the fortunate minority that appear relatively less impacted by climate risks, they may fall outside of lenders' and investors' net-zero commitments, and therefore become unable to raise the finance that they need, unless they can demonstrate clearly how they are pivoting their strategy to align with transition.

3.2.3 Higher Cost of Capital, Investor Activism, and Increased Requirements for Climate Disclosure

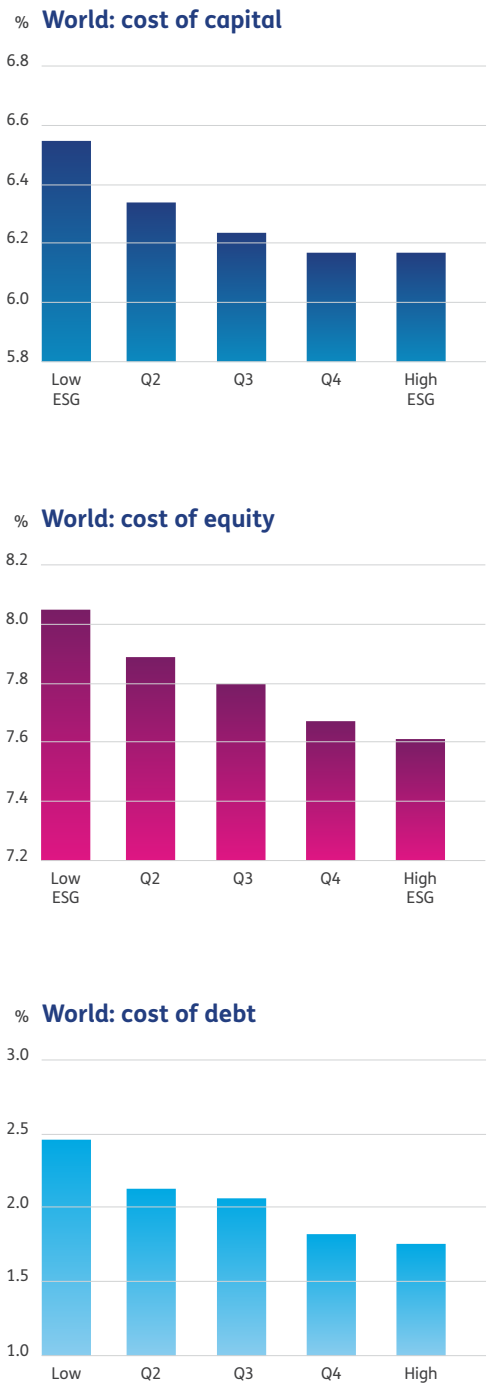
As a result, investors are moving their money into sustainable funds, with 2020 seeing a 96% increase of such investments from 2019. Larry Fink, BlackRock's chairman and CEO, said in his 2021 CEO letter, "I believe that this is the beginning of a long but rapidly accelerating transition – one that will unfold over many years and reshape asset prices of every type. We know that climate risk is investment risk. But we also believe the climate transition presents a historic investment opportunity" [17].

This investor sentiment is translating into lower cost of capital, equity, and debt for Paris-aligned companies, and higher for those who are not [18]. For example, an organisation with a net debt of $35 billion will attract additional interest charges of $175 million per annum.

While investors are actively engaging with oil and gas companies to help finance genuine emissions reductions and low-carbon energy investments, they are becoming increasingly sceptical of schemes, such as divestments or the creation of joint ventures, that move emissions off companies' books but do not make any real-world reduction at all.

Investors are also being increasingly active in using their votes to appoint board members who will lead companies through the energy transition and auditors who will report honestly on climate risks. For example, hedge fund Engine Number 1 was successful in having three of its nominees elected to the ExxonMobil's board, much against the company's wishes [19].

Figure 4: ESG scores related to cost of capital, equity, and debt [18]



3.3 Companies Not Perceived to be Doing the Right Thing May Have Difficulty Attracting Talent

In the UNDP's "Peoples' Climate Vote", in eight of the ten surveyed countries with the highest emissions from the power sector, majorities backed more renewable energy and more use of clean electric cars, buses, and bicycles [20].

This sentiment is reflected in the conclusions of a recent study that the bright minds of tomorrow want to pursue careers at Tesla, not ExxonMobil.

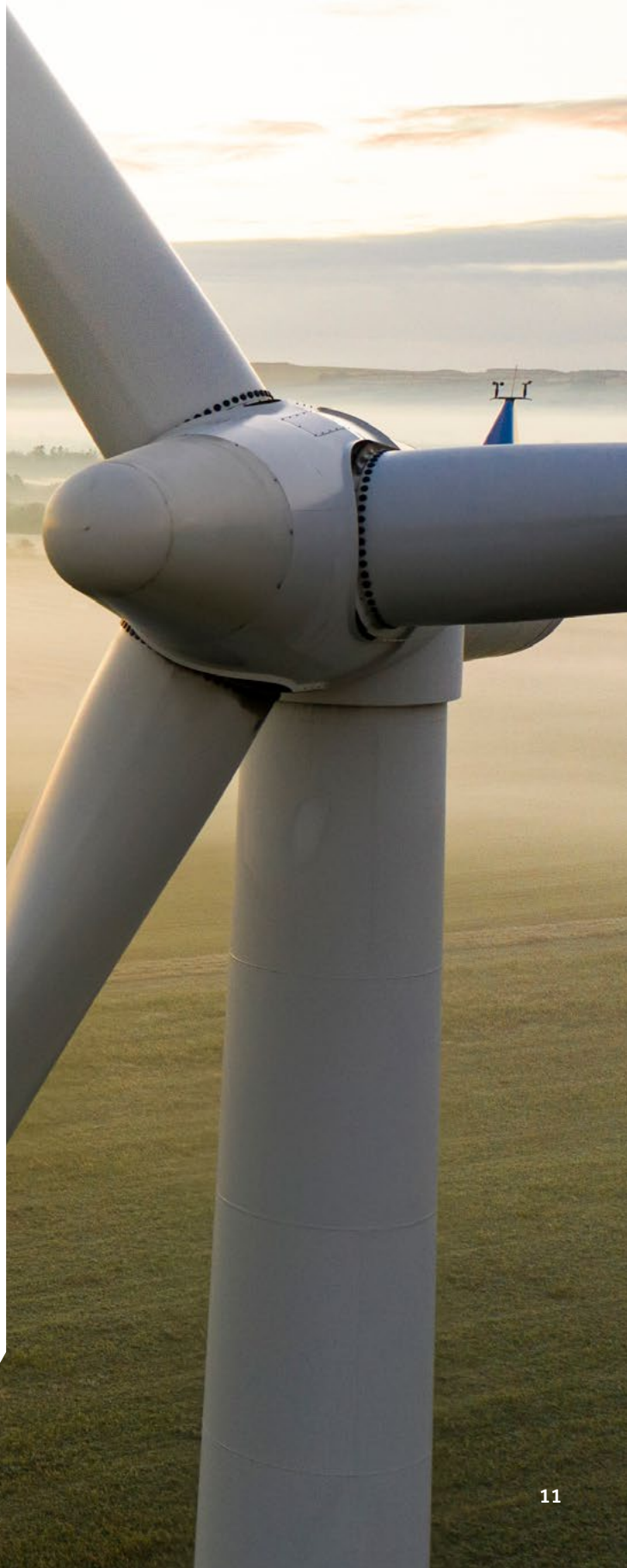
Sixty-two percent say a career in oil and gas is unappealing, according to a survey of 1,200 young Americans. Two out of three believe the oil and gas industry causes problems, rather than solves them, and they "question the longevity of the industry, as they view natural gas and oil as their parents' fuels" [21].

3.4 With the Burning of Coal, Oil, and Gas Proven to be the Cause of Climate Change, We Expect Litigation to Increase

Societies' concern is also reflected in increased litigation. Over the past two decades, climate lawsuits have been filed in 52 countries across North and South America, Europe, Asia Pacific, and Africa, primarily aimed at changing government policy or claiming compensation from fossil fuel companies for their contributions to global heating [22].

This litigation is becoming more successful; earlier this year a court in the Netherlands ruled that Shell has the duty of care (to combat climate change) under Dutch law and must reduce its CO_2 emissions by 45% by 2030, including Scope 3 emissions, in line with Paris goals [23].

Going forward, court judgements will be informed by the unequivocal scientific evidence from the Intergovernmental Panel on Climate Change that warming is driven by CO_2 and CH_4 emissions, making defence more challenging for companies who do not have Paris-aligned targets.



4 What Next for the Oil and Gas Industry?

4.1 A Framework to Systematically Address Climate Issues

Oil and gas executives are facing questions from governments, regulators, investors, customers, and employees on the impact of climate change on their business, the impact of their business on climate, and how to mitigate the risks and grasp the opportunities of the climate and energy transition. These include questions on:

1. How climate risk is affecting the value of assets over the next 30 years in different scenarios, and how to respond to additional market and regulatory requirements.

2. How oil and gas operations are impacting the climate, and what action to mitigate the impact are companies taking, congruent with their values and those of their customers and investors.

3. How strategies and business models are being adapted to reduce physical and transition risk and at the same time make commercial returns. What opportunities there are to change and what companies are investing in. How companies are engaging to demonstrate that they are taking climate and energy transition issues seriously and are changing to have a positive impact on society as well as protecting investors' capital and making commercial returns.

Through our engagements with clients across the energy sector, government, and industry associations, we have refined our climate strategy framework to systematically address these issues and opportunities. This covers:

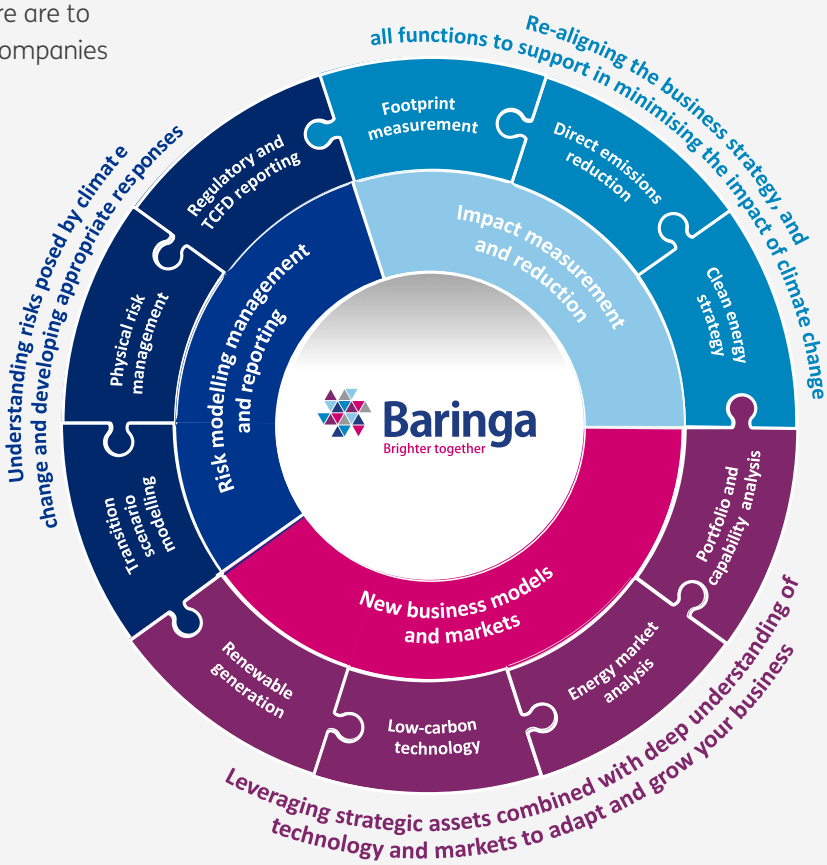
1. Risk management and reporting – including regulatory and TCFD reporting, physical risk management, and transition scenario modelling [26]. We help clients determine their climate risk and the value that will be lost from their business.

2. Impact measurement and reduction – including footprint measurement, direct emissions reduction, and clean energy strategy. We help clients answer how their operations are impacting the climate and what they should do about it.

3. New business models and markets – including renewable generation, low-carbon technology, energy market analysis, and portfolio and capability analysis. We help clients assess opportunities to adapt their strategy and business model to reduce physical and transition risk while making commercial returns.

We will now examine these three areas in more detail.

Figure 5: Baringa Partners climate strategy framework



4.2 Assessing Climate Risk and the Value That Will be Lost from Oil and Gas

4.2.1 Physical and Transition Risks are Here and Increasing

The production and transportation of hydrocarbons have inherent risk which oil and gas companies work relentlessly to mitigate. Onshore and offshore installations are designed to withstand extreme weather events. However, as the climate becomes more extreme, physical risks arise that could not have been anticipated in the past when these assets were designed. The cost of these climate risks is significant, with companies reporting costs of $500bn, and, in addition, $250bn of stranded assets to CDP. Examples include:

- Sea level rise, coupled with increased frequency and severity of storms, leading to installations being evacuated, production shut in, and revenue lost. ConocoPhillips estimates that if all Gulf Coast business unit production was shut down for 3 days, it would lead to $35m in lost revenue, based on the 2019 average realised price of $48.78/boe.
- Extreme drought. The western US has been facing exceptional drought conditions impacting water levels. Lake Mead, which feeds the Hoover Dam, is at its lowest level since records began. The onshore natural gas industry uses a lot of water for fracking, and many wells are in the areas affected by the droughts.
- Melting permafrost in the Arctic. When the North Slope was developed over 40 years ago, casing for wells was set directly into the permanently frozen soil. However, climate change is causing that soil to thaw, leading to well integrity issues.

Fossil fuel assets may no longer offer economic returns because of market shifts associated with the transition to a low-carbon economy [24], leading to transition risk. This is complex to assess, with many questions to answer:

- Will the transition be orderly or disorderly? Baringa models both orderly and disorderly scenarios. A disorderly transition where oil and gas demand might grow in the short term only to fall steeply later makes investment decisions difficult.
- What will be the future price of oil and gas in these scenarios? Should national oil companies decide to produce their hydrocarbons while there is still a market for them, how will that affect prices? The IEA forecasts crude oil to reach $35/bbl as soon as 2030 in their net-zero pathway.
- What will happen to the price of carbon? As noted, Norway is raising prices to $237 per tonne CO_2 in 2030. The Bank of England Late Action (disorderly scenario) forecast $30 per tonne in 2030, rising to $1,000 per tonne in 2050. Many oil and gas companies test their investment cases at only $100 per tonne.
- How will demand change? As the cost of renewable energy falls below the cost of hydrocarbons, and electric vehicles become cheaper than internal combustion engine (ICE) cars, economics may accelerate the transition faster than many anticipate. For example, Norway is seeking to phase out ICE cars by 2025, however, the current pathway shows sales on track to hit zero as soon as 2022 [25].

4.2.2 Our Unique Climate Change Scenario Model Enables You to Understand Your Climate Risk

Many oil and gas companies are unable to understand or evidence the climate impact of their investments, or the climate-related risks of the assets that they hold. They are also unable to demonstrate to their investors that their values align.

Our market-leading Climate Change Scenario Model was developed from 20 years of experience to enable you to do all of these things. It is the only climate change model that is:

- fully integrated, bringing together transition and physical risk;
- configurable, from scenario construction through to incorporating your assessments and adaptation strategies;

- 'zoomable', from global portfolio views to granular analysis of individual companies and single physical assets;
- comprehensive, covering all key sectors and assets classes, including equities, bonds, loans, and direct property holdings.

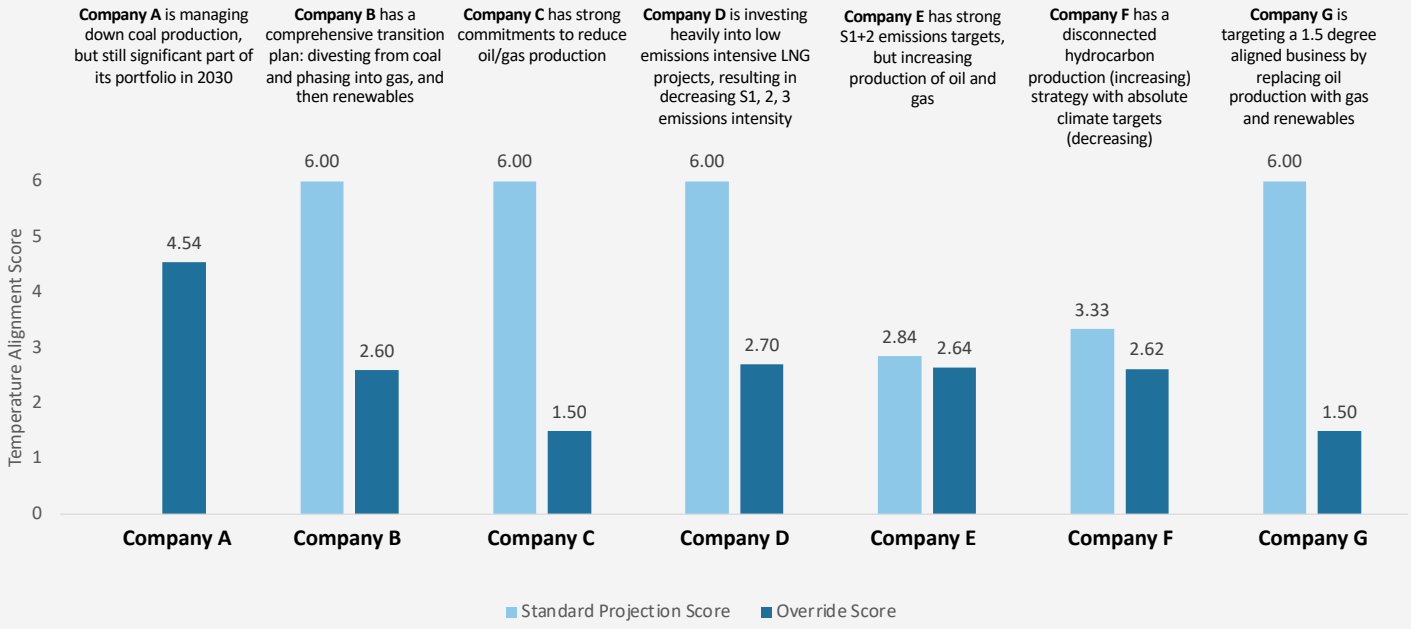
Our model delivers the data and analytics to transform the oil and gas industry response to climate change, showing you:

1. the climate-driven risks and valuation impact on your portfolio under different climate scenarios – enabling you to optimise asset allocation; and

2. the projected temperature impact of your portfolio – enabling you to evidence your current position and make commitments on how this will evolve to align to your own and your stakeholders' values.

In June 2021, BlackRock acquired the Baringa Climate Change Scenario Model to enhance their Aladdin climate platform. BlackRock and Baringa are now working together to set the standard for modelling the impacts of climate change and the transition to a low-carbon economy [26].

Figure 6: The Climate Change Scenario Model's temperature alignment scores, which show projected temperature impact of companies, based both on historical performance (standard projection score) and adjusted for their strategies and plans (override score)



4.3 How Operations are Impacting the Climate and What Should be Done about It

4.3.1 Integrating Emissions Management into Operational Management Systems Means We Account for the Carbon in Every Barrel

Now that the Sixth Assessment Report has proven the link between emissions and climate change, there is an imperative for all companies, regardless of industry sector, to reduce their own Scope 1 and 2 operational emissions.

This September, members of the Oil and Gas Climate Initiative, a group of 12 leading IOCs and NOCs that produce 30% of the world's oil and gas, committed to address operational Scope 1 and 2 emissions within the timeframe of the Paris Agreement from operations under their control. Yet only a handful of IOCs, mainly majors, have presented a clear vision of how they intend to get to net zero.

Baringa brings a comprehensive approach, including integrating emissions management into operational management systems, electrification, and carbon capture and storage.

Baringa's Oil and Gas Emissions Management Accelerator is a proven five-step methodology to integrate emissions management into operational management systems, meaning that we account for the carbon in every barrel, as we do for the profit from every barrel today:

1. The accelerator starts with establishing the minimum emissions potential (MEP) for each asset, systematically determining how well each asset could do if it were operating with the most efficient, brand-new equipment in perfect conditions – how we might operate on our best day.

2. The second step is monitoring, managing, and optimising – measuring performance and actively optimising to reduce emissions daily.

3. Where emissions exceed targets, the third step is to carry out a root cause analysis on breach events.

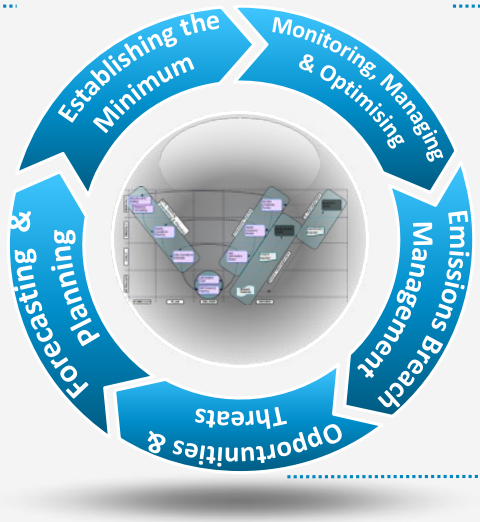
4. This informs the identification of opportunities and threats, creating a hopper of ideas that can be ranked with a margin cost abatement curve.

5. The final step is to plan and execute those activities that prevent breach events and drive down the MEP further.

Figure 7: Baringa's Oil and Gas Emissions Management Accelerator

1. Establishing Minimum Emissions Potential (MEP). How well could we do if we were operating with the most efficient, brand-new equipment in perfect conditions? Where do we currently operate on our best day?

5. Forecasting & Planning. Forecast emissions. Plan to mature & execute activities to reduce MEP and prevent breach events



2. Monitoring, Managing & Optimising. Measure performance & actively optimise to reduce emissions daily

3. Emissions Breach Management. Capture excess emissions & allocate them to a source. Carry out root cause analysis on breach events

4. Identify Opportunities and Threats. Fill the hopper for reducing emissions through PtLs, LIP Management, RCAs & daily discussions

Such operational excellence programmes have massive potential. Using infrared cameras to identify higher emitting sources and cost-effectively eliminate leaks as part of a leak detection and repair programme has enabled Equinor to lower its US onshore emissions by 80% between 2014 and 2018 to a class-leading methane intensity of 0.046 $kgCH_4$/boe, or 0.07% of production [27].

The IEA estimates that the oil and gas sector emitted 82 Mt of methane (around 2.5 $GtCO_2$-eq) in 2019 [28]. Cutting methane emissions by half this decade could stave off nearly 0.3°C of warming by the 2040s [29]. As every molecule no longer emitted can be sold, minimising emissions can be good business as well as part of a responsible company's licence to operate.

4.3.2 Electrification and Power from Shore

Combusting gas or diesel to power oil and gas assets is a significant source of operational emissions for the industry. Low-carbon electricity, generated from the grid or 'behind the meter' solar or wind lowers emissions, and, with a sufficiently high carbon price, is economically attractive.

For example, Equinor have commenced a programme to power Norwegian offshore assets from shore, reducing emissions by an estimated 460,000 tonnes of CO_2 per year for their giant field, Johan Sverdrup, saving >$100m in carbon taxes per annum when the carbon price reaches $237 per tonne [30].

4.3.3 Carbon Capture, Use, and Storage

Carbon capture, utilisation, and storage (CCUS) provides a major opportunity for oil and gas companies. Combined with power generation, CCUS provides a way to monetise gas assets, and, with government support on costs and a regulated revenue stream, CCUS projects can provide a fixed and stable return for many decades into the future. This is in addition to contributing to decarbonisation targets. With their expertise in subsurface, engineering, and major capital project delivery, we believe that oil and gas companies are ideally placed to deliver innovations into the growing market for CCUS solutions. In the UK alone, 70-180 $MtCO_2$ of capture per year is required to meet the national net-zero commitment [31].

Projects require government support and therefore take time to implement but should allow returns of 9–10% per year. These economics are optimised for projects with adjacency to carbon emitters, supplies of natural gas, and reservoirs for carbon storage, such as the industrial clusters in Teesside, South Humber, and Liverpool in the UK. We believe support is most likely to come from areas with the strongest commitment to decarbonisation (UK, Europe) or those with the strongest incentives to retain natural gas economies (US, Middle East).

Leveraging our climate change model and deep understanding of power markets, Baringa has advised governments and companies to develop business cases to decarbonise industry at the lowest cost.

4.4 Adapting the Business Model to Address Risk and Make Commercial Returns

4.4.1 Baringa's Approach to Assessing the Opportunity of the Low-Carbon Transition

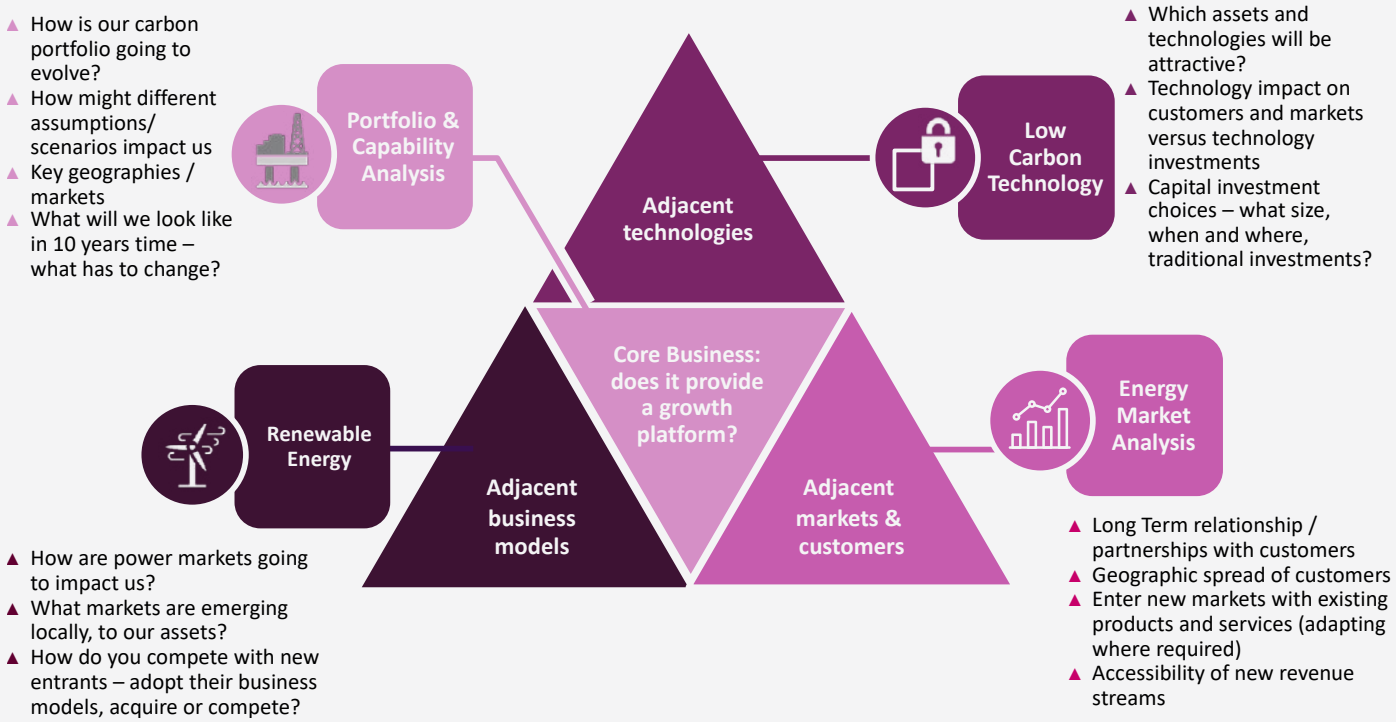
Given that customer combustion of oil and gas products (Scope 3) is the principal source of emissions for the industry, it follows that this business has to diminish for the world to meet its climate goals. So, what other opportunities exist for companies to make commercial returns?

Indeed, many 1.5°C temperature scenarios see demand for oil and gas falling at 3–6% per annum, similar to the production declines seen in conventional oil, which has led to the IEA concluding that no new oil and natural gas fields are needed [32]. This creates an opportunity for companies to make savings on hydrocarbon reserves replacement and either increase returns to their shareholders or build new businesses in renewable energy.

To scale up renewables supply requires financial strength and production capacity at a global level. We believe that, with their decades of engineering and project management expertise, focus on safe and efficient operations, skilled personnel, and a network of competent partners and suppliers, oil and gas companies are ideally positioned to build renewable energy businesses for the decades ahead.

The Baringa low-carbon transition opportunity assessment framework uses market trends across technology, innovative business models, new markets, and customers to determine credible growth opportunities in low-carbon power and storage through organic build, joint ventures, or acquisitions.

Figure 8: Baringa's low-carbon transition opportunity assessment framework



4.4.2 Baringa Analysis Indicates Energy Producers Can Make Similar Returns from Renewables as They Have Made from Oil and Gas, with Less Risk

With mass deployment and improvement, the prices of wind turbines and solar fell by 40% and 90% respectively in the last decade [33], and similar trends are to be found with energy storage and electrolysers (green hydrogen).

As ever-increasing amounts of renewable capacity are produced and installed, the supply chain learns how to become more and more efficient, making costs progressively lower. For example, a massive scaling up of China's renewable manufacturing capacity has helped reduce the cost of wind and solar power around the world [34].

Continued investment suggests this trend will continue and will take several of these renewable technologies well below the cost base for current fossil fuel power generation [35]. The global median levelised cost of solar is expected to reach the operating costs of fully depreciated coal and gas-fired electricity (around $30/MWh) in 2028, meaning that in many regions it will be cheaper to install a new solar farm than to continue to operate an existing gas power plant.

Our analysis of leading generation-focused global power companies focusing on renewable energy shows that they are achieving comparable financial performance to oil and gas investments, at ~10% ROACE. Therefore, we believe oil and gas companies can profitably enter this market.

Figure 9: Baringa analysis of low-carbon power producer financial performance

GENERATION | TRADING | RETAIL SUPPLY

Leading power producers are focusing on renewables, from development to operations, and demonstrating strong margins and ~10% ROACE

	Technology focus	Business model	Adj. Profit %[1]	Average capital employed[2]	ROACE[2]
Orsted	*Offshore wind*	Vertically integrated power utility	25%	$16bn	22% (Long term target: 10%)
Enel Green Power	*Hydro*, *Solar*, *Wind*		8%	$72bn	12%
Statkraft	*Hydro*, *Wind*		24%	$13bn	13%
Iberdrola	*Wind*, *Hydro*, *Nuclear*		10%	$62bn	7%
Brookfield Renewables	*Hydro*, *Wind*, *Solar*	Power generation with trading capability	25%	$26bn	12-15%[3]
BP	Oil and Gas		4% [4]	$165bn [5]	11% [5]

Orsted are targeting complex, high capex offshore wind with sophisticated development and commercial capability

Offshore wind focus	• Offshore wind - 9GW committed • Onshore wind - 0.8GW operational, US only • c.80% capital deployed to offshore 2019-25
Global footprint	• Leader in offshore wind in Europe and North America with significant pipeline in Asia
Large scale capital delivery expertise	• Capex per project of $1–5bn • Expected capex in 2019-25 of $30bn • Develop-build-own-operate-recycle model
Diverse & innovate routes to market	• Strong track record at securing projects through competitive auctions • Sophisticated commercial function executing a range of offtake solutions for customers, including corporate PPAs • Advanced provider of route-to-market services, e.g. 15-year balancing services contract with Triton Knoll wind farm
Strategic M&A track record	• Lincoln Clean Energy – onshore portfolio and expertise in US project financing • Deepwater Wind – 6.2 GW US offshore wind pipeline

Sources: Annual reports, investor presentations, analyst reports. Notes:1) Adjusted earnings, where disclosed in latest annual report; 2) Baringa analysis, calculated according to BP methodology, using 2018 results; 3) Targeted portfolio-weighted IRR; 4) BP Annual Report 2018 (p321): Underlying RC profit / Total revenues and other income; 5) BP Annual Report 2018 (p321)

Deeper analysis of the market and leading power producers' financial performance illustrates that power generation is the most lucrative part of the low-carbon power value chain, as upstream is in the oil and gas value chain.

We estimate the generation market size of low-carbon power generation to be c.$240bn on a net profit basis in the US and Europe alone, compared with the wholesale trading market at c.$35bn and the retail supply market c.$19bn. Therefore, we believe the focus of energy companies should be on establishing a leading position in power generation.

4.4.3 Picking the Right Geographies, Technologies, and Business Models is Critical

By focusing on carefully selected geographies, multiple technologies, and diversified contracting and price risk management strategies, we believe that oil and gas can earn equity returns on projects between 10% and 15%.

To achieve that level of return requires proactive asset management, including:

- Taking development risk
- Creating value from capital arbitrage
- Acting as aggregators and RTM providers
- Providing O&M wraps for infrastructure money

For a passive investor, without these measures, the long-term return on any individual generating asset will be much lower, in the mid to high single digits.

Our proprietary energy market fundamentals models help organisations make the right financial decisions on where and when to invest and divest in over 50 countries. Baringa has advised on the allocation of over £200bn of capital into renewables, with 70% of the largest infrastructure investors to deliver over 150GW of renewable energy investments, enough to power 180 million homes.

Figure 10 Baringa analysis of real projects in selected markets

		Great Britain	Spain	Brazil	Mexico	Australia QLD	US East Coast
Route-to-market / Technology valuated:		**Onshore wind**	**Solar**	**Onshore wind**	**Solar**	**Onshore wind**	**Offshore wind**
Long-term fixed price offtake	**Typical capex per project**	$130m	$35m	$115m	$45m	$130m	$2,800m
	Lifetime average power price received	$70/MWh	$60/MWh	$60/MWh	$38/MWh	$53/MWh	$52/MWh
	Levelised Cost of Energy	$54/MWh	$48/MWh	$56/MWh	$62/MWh	$56/MWh	$94/MWh
	Project IRR	10.1%	9.7%	12.6%	8.6%	8.5%	8.2%
	Equity IRR	14.5%	13.5%	3.1%	11.1%	12.5%	13.5%
Merchant (long-term commodity price exposure)	**Project capex**	$130m	$35m			$130m	
	Lifetime average power price received	$70/MWh	$60/MWh			$53/MWh	
	Levelised Cost of Energy	$58/MWh	$54/MWh			$61/MWh	
	Project IRR	12.1%	11.9%			9.8%	
	Equity IRR	13.8%	15.6%			10.2%	

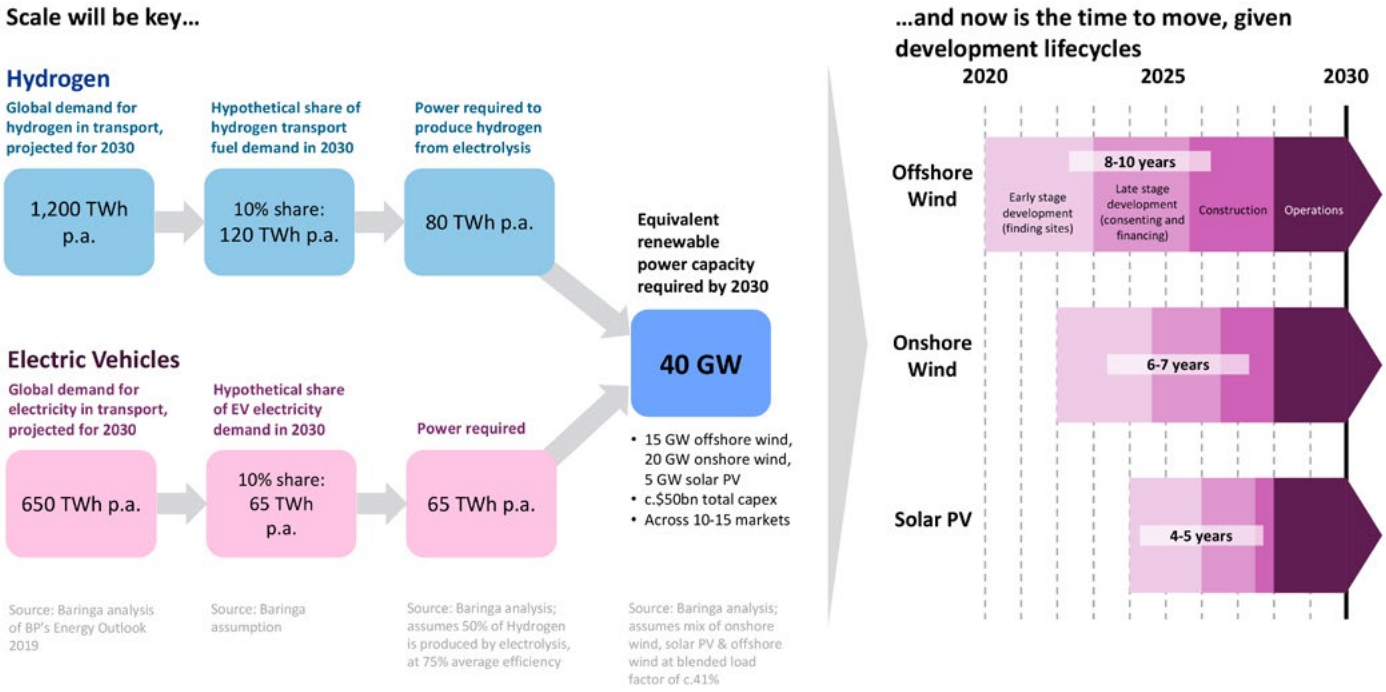
A key indicator of returns and project attractiveness – the gap between average market price achieved and the average cost of producing energy from the project over its lifetime

Notes: Average project sizes: Onshore Wind: 100MW; Solar PV: 50MW; Offshore Wind: 1,000 MW

4.4.4 Renewables is a Bridge to Green Hydrogen and Electric Vehicles

Establishing a renewables business can not only be profitable to oil and gas in the near term, but also provide a critical foundation to being a major player in the rapidly emerging green hydrogen fuel and electric vehicle markets. However, given the scale of generation required and the time needed to take projects from development to operation, companies must start now.

Figure 11: Renewables are a bridge to green hydrogen and electric vehicles



4.4.5 Hydrogen

We believe that clean hydrogen (blue and green/pink) has a critical role to play in decarbonising hard-to-abate sectors – firstly, displacing grey hydrogen in existing markets (fertiliser feedstocks, oil refining, petrochemical production), and secondly, for decarbonisation of steel, medium- and long-distance shipping, and aviation. In many of these markets, we believe clean hydrogen can attract a green premium in the short term. Hydrogen may also have a role in long-term energy storage, for example between summer and winter seasons. While we do not believe it will play a major role in short-distance transport as battery densities increase and costs come down, we expect the global market for hydrogen to grow by 15M to 88MT/ year by 2030, led by China, Europe, and Japan [36], and creating an imperative for a rapid scale-up of production.

Attractive countries and regions for clean hydrogen supply will be determined by the availability of the lowest-cost renewable energy at scale, low-cost gas coupled with favourable features for CCUS and infrastructure networks, and a tailwind regulatory environment for investors, for example, Australia, the Middle East, the United Kingdom, and the European Union.

These low-cost supplies could facilitate a global hydrogen market, however, a prerequisite for future global trade of clean hydrogen is low-cost conversion (and subsequent reconversion) of gaseous hydrogen into suitable products for deep-sea shipping. Liquefying hydrogen is more challenging than natural gas, so developers are exploring ammonia, liquid organic hydrogen carriers (LOHCs), and metal hydrides as alternative hydrogen carriers; some of these hydrogen derivatives are globally traded commodities today.

Blue hydrogen currently holds commercial advantage over green, but we expect renewable energy and electrolysers costs to fall as those technologies are developed at scale, and carbon abatement costs to increase, so that, beyond 2030, green hydrogen economics will be superior across many geographies.

Baringa's power and low-carbon modelling suite, covering 120 countries, is used extensively by strategy functions, policy makers, and investors, who base investment decisions on our market insights, including the cost evolution of low-carbon hydrogen supplies and the role of hydrogen in meeting net-zero targets.

4.4.6 Electric Vehicles

As battery densities increase and costs come down, we expect battery electric vehicles to dominate the global market for short-distance transport, in combination with hydrogen for medium and long distances. We expect 25% of the UK fleet of 32M cars to be electric by 2030, supported by c.450k public charge points, with similar adoption rates in Western Europe and China, and other geographies such as the United States and Southern Europe following afterwards.

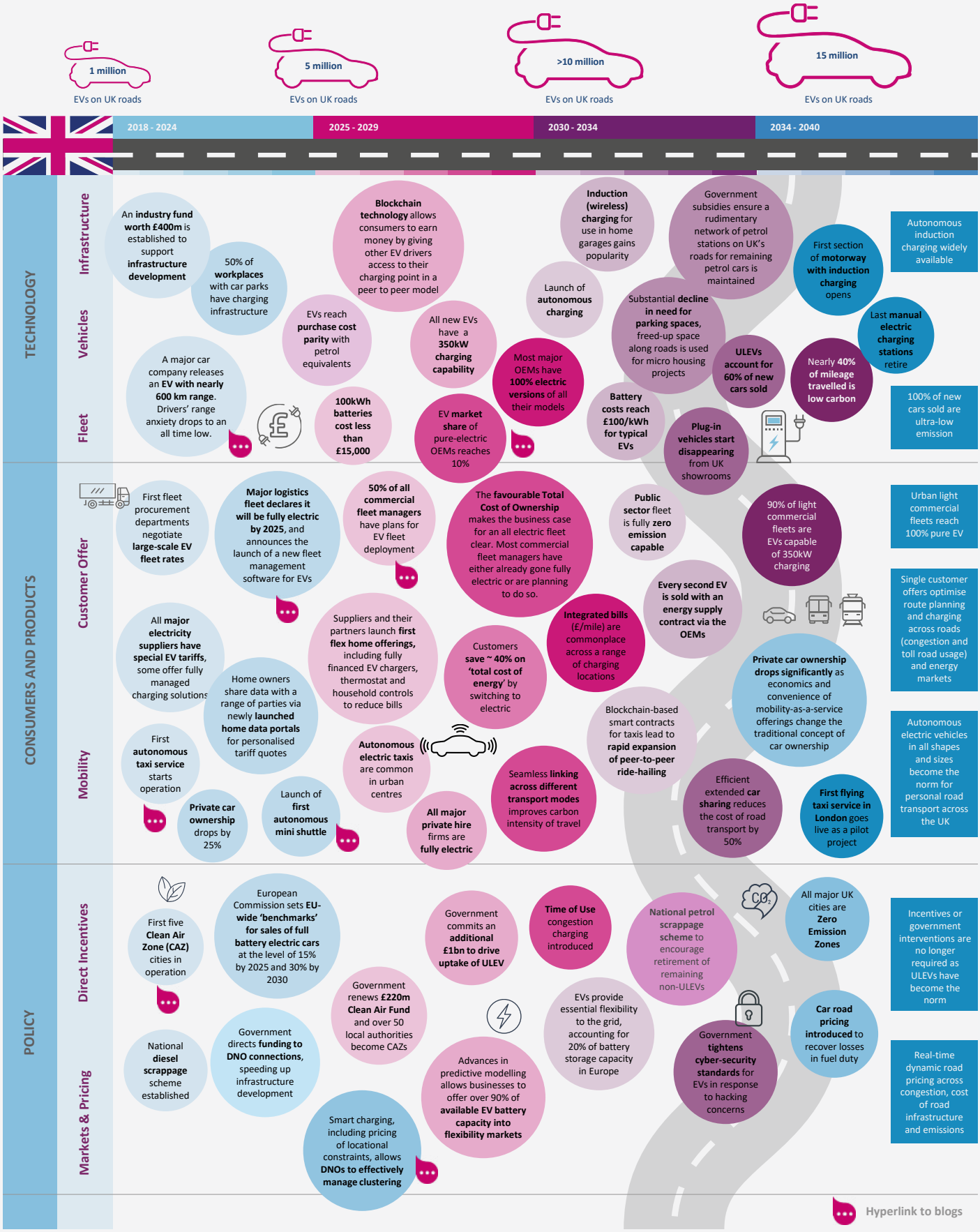
Large-volume automotive manufacturers including Volkswagen, Daimler Mercedes, General Motors, Ford, Volvo, and Toyota have announced they will match the production of fossil-fuelled vehicles with electrified ranges, and we expect that to accelerate transition to EVs in other markets also.

Owning electric vehicles fundamentally changes the needs of consumers and fleet and HGV operators and challenges the traditional ways oil and gas companies have made money from their retail operations. Oil and gas companies have traditionally provided fuel to the forecourt; will they provide electricity in the future? As charging patterns diversify, will they provide power to streetlamps, home chargers, or fleet depots? And what do these changing needs mean for the location of chargers and forecourts? How much will they move from oil and gas to electricity and other forms of energy such as hydrogen?

If oil and gas companies can assess the value chain elements they want to participate in, the vehicle types they want to cater to, the fuel and asset types they want to offer, and the geographies they begin this journey with, they can, in a structured and analytical manner, decide the transition their businesses need over the energy transition.

We believe that oil and gas companies are uniquely well positioned to provide an integrated service to retail, HGV, and fleet customers covering a range of alternative fuel requirements in the short, medium, and longer term. Baringa is advising companies on developing their EV business models and propositions across energy and other value chains, bringing our unique customer insight, global market analysis, and commercial modelling to support investment cases.

Figure 12: The future of electric cars in the United Kingdom



5 Summary and Conclusion

The IPCC Sixth Assessment has provided unequivocal evidence that human activity, principally the burning of fossil fuels, has led to global warming and climate change. Widespread, rapid, intensifying, and unprecedented changes to the climate are affecting every region and will increase with further warming.

While there is no going back on some changes, others can be slowed or stopped by acting to limit warming now.

Current government commitments set us on a pathway to 2.7°C warming, missing the goals of the Paris Agreement. Therefore, at COP26 there will be pressure on governments to increase their national commitments even further, and subsequently greater demand- and supply-side measures to be introduced to reduce emissions from the energy sector.

However, we observe that time is running out for an orderly energy transition. A disorderly transition, characterised by a short-term increase in demand for oil and gas, followed by a sharp fall and significant increase in the cost of carbon, makes planning for the oil and gas sector extremely challenging.

Fearful of fossil fuel asset destruction, investors, regulators, and insurers are reassessing their portfolios. Investors are moving their money into sustainable funds, with 2020 seeing a 96% increase of such investments over 2019, and 160 investment companies pledging to manage their portfolios to net zero by 2050 [37]. This is materially affecting the cost of capital and debt, investor votes on auditors, and board member appointments.

Companies not perceived to be doing the right thing may have difficulty in talent attraction and be subject to increased litigation.

We believe oil and gas companies must determine the impact of climate change on their business, the impact of their business on climate change, and how to mitigate the risks and grasp the opportunities.

The Climate Change Scenario Model delivers the data and analytics to tell you the climate-driven risks and valuation impact on your portfolio under different climate scenarios – enabling you to optimise asset allocation – and the projected temperature impact of your portfolio – enabling you to evidence your current position and make commitments on how this will evolve to align to your own and your stakeholders' values.

To deliver net-zero operational emissions in line with Paris goals, Baringa's Oil and Gas Emissions Management Accelerator is a proven five-step methodology for integrating emissions management into operational management systems.

Energy producers can make similar returns from renewables as they have made from oil and gas, with less risk. We believe the focus of energy companies should be on establishing a leading position in power generation as the most lucrative part of the low-carbon power value chain, as upstream is in the oil and gas value chain. We estimate the market size of this to be c.$240bn on a net profit basis in the US and Europe alone.

Leading generation-focused global power companies are currently focusing on renewable energy and are achieving comparable financial performance to oil and gas investments, at c.10% ROACE. Therefore, we believe oil and gas companies can profitably enter this market.

Establishing a renewables business can not only be profitable to oil and gas in the near term, but also provide a critical foundation to being a major player in the rapidly emerging green hydrogen fuel and electric vehicle markets. Given the scale of generation required and the time needed to take projects from development to operation, energy companies must start now.

Picking the right geographies, technologies, and business models is critical. Baringa's proprietary energy market fundamentals models help organisations make the right financial decisions on where and when to invest and divest in over 50 countries. Baringa has advised on the allocation of over £200bn of capital into renewables, with 70% of the largest infrastructure investors to deliver over 150GW of renewable energy investments, enough to power 180 million homes.

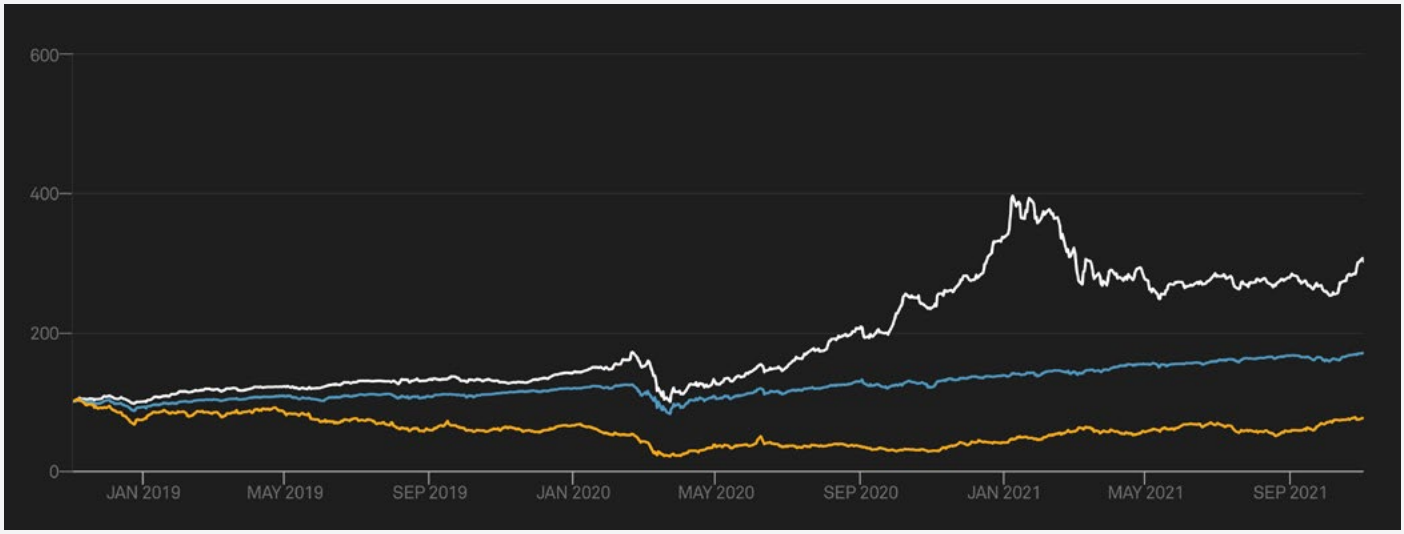
Companies that have transitioned to low-carbon energy have created significant wealth for their shareholders. Over the three years up to September 2021, the S&P Global Clean Energy Index annualised return was +37%, whereas the S&P 500 Index was +15%. In contrast, the S&P Oil & Gas Exploration & Production Select Industry Index annualised return was a loss of –18%.

These are challenging times for the oil and gas industry. According to Mark Carney, the UN special envoy for climate action and finance,

"Companies that don't adapt will go bankrupt without question. [But] there will be great fortunes made along this path aligned with what society wants" [38].

Baringa stands ready to help companies navigate that path.

Figure 13: S&P Global Clean Energy Index (white); S&P 500 Index (blue); S&P Oil & Gas Exploration & Production Select Industry Index (orange)



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Baringa
Brighter together

Baringa Partners

Baringa Partners is an independent business and technology consultancy.

We help businesses run more effectively, navigate industry shifts and reach new markets. We use our industry insights, ideas and pragmatism to help each client improve their business. Collaboration is central to our strategy and culture, ensuring we attract the brightest and the best. And it's why clients love working with us.

Baringa launched in 2000 and now has over 900 members of staff and 92 partners across our practice areas Energy & Resources, Financial Services, Products & Services, and Government & Public Sector. These practices are supported by cross-sector teams focused on Customer & Digital; Finance, Risk & Compliance; People Excellence; Supply Chain & Procurement; Data, Analytics & AI; Intelligent Automation & Operations Excellence; and Technology Transformation. We operate globally and have offices in the UK, Europe, Australia, US and Asia.

Baringa Partners have been voted as the leading management consulting firm in the Financial Times' UK Leading Management Consultants 2021 in the categories Energy, Utilities & the Environment, and Oil & Gas. We have been in the Top 10 for the last 14 years in the small, medium, as well as large category in the UK Best Workplaces™ list by Great Place to Work®. We are a Top 50 for Women employer, and are recognised by Best Employers for Race.

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