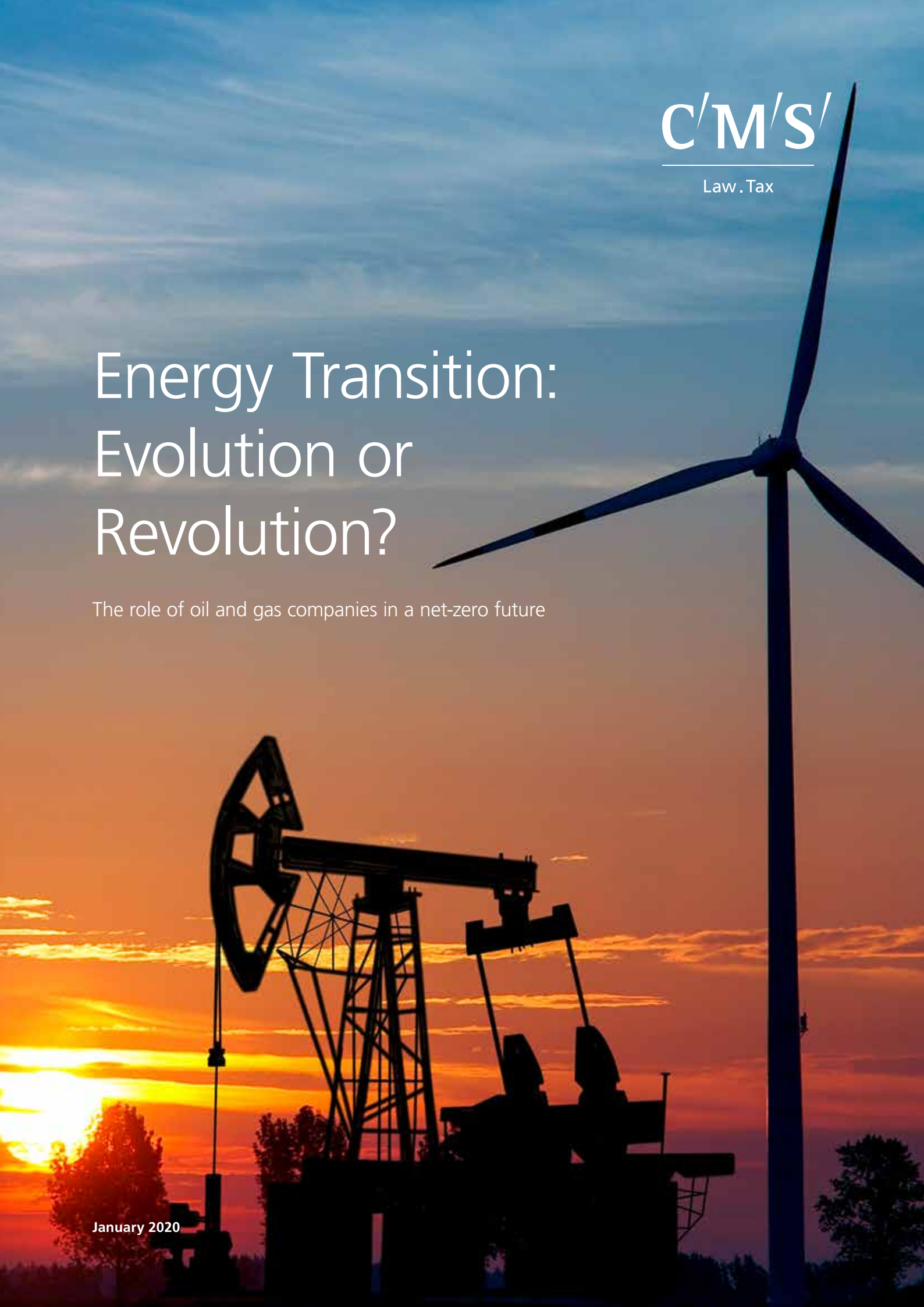
C/M/S/

Law.Tax

Energy Transition: Evolution or Revolution?

The role of oil and gas companies in a net-zero future



January 2020

Table of Contents

Introduction

The energy transition is upon us – Greta Thunberg and Extinction Rebellion continue to generate more headlines than Greenpeace and, in Europe at least, there is significant societal pressure to move from fossil fuels to renewable or alternative sources of energy.

What is the "Energy Transition"? There are many interpretations and this report does not seek to narrow the taxonomy. It would be premature and probably unhelpful to do that, as the transition needs to be looked at in many different ways. As a transition from fossil fuels to renewables. As a transition from high carbon intensity to low carbon intensity. As a transition from a fragmented energy sector to one in which the various strands (oil and gas, power, renewables, retail, transport, industry, heat and others) are unified in a single interconnected and integrated sector. As a transition from a sector that met the needs of our past industry to one that takes full advantage of recent innovations and the technological possibilities these unlock. The key is to have a sector that is optimal and right for the way in which society and industry are organised in the future, and that rises to our collective social and environmental priorities.

The energy transition has been one of the key areas occupying time at board level for many of our oil and gas clients. The age of oil and gas will not last forever and the transition will happen, but it is generally accepted by global institutions such as the World Bank and the IEA that this will take time. Oil and gas will continue to play an important (if decreasing) part in the energy mix for decades to come. For many the key question is whether and how they transition themselves into broader energy companies and respond to the fundamental shift in the oil and gas industry. For many, an economic case is necessary to play a full part in transition.

While oil and gas companies can decarbonise their own operations and look to invest in alternative energy, society as a whole has the most important role – we are all reliant on hydrocarbons in practically every aspect of our lives, not just in relation to energy use but also the products we use and the houses we live in etc.

CMS has recently undertaken new research on the oil and gas sector, looking at a diverse mix of 15 of the world's largest international oil and gas companies, including key regional players, supermajors and national oil companies to assess whether they are now looking at and changing their strategies, and investing in a more diverse energy portfolio.

Our research suggests that nearly all the oil and gas companies in our sample are addressing the energy transition due to a combination of multiple drivers and pressures in the market. Yet this is still some way from becoming the norm, with only three percent of those companies' CAPEX being committed to alternative and new energy portfolios.

All the big players are doing this to some extent, and many of the medium-sized companies in the oil and gas sector are likely to follow suit in the following years and decades. We also see this forcing change upon the supply chain, which generally has been slow to react to the energy transition.

Norman Wisely
Partner, Energy
T +44 1224 267163
E norman.wisely@cms-cmno.com

Munir Hassan
Partner, Energy
T +44 20 7367 2046
E munir.hassan@cms-cmno.com

Overview and key findings

CMS commissioned research consultancy Capital Economics to assess and evaluate how far some of the largest international oil and gas companies are committed to new and alternative ways of generating energy or otherwise responding to the energy transition.

We examined the energy transition strategies of 15 of the world's largest international oil and gas companies.

Shell, BP, ExxonMobil, Chevron, Total, ConocoPhillips, Eni, Equinor, Repsol, Pemex, Lukoil, Petrobras, Saudi Aramco, China National Petroleum Corporation, Petronas

These 15 companies represent

USD 2.7trn annual revenues | **USD 250bn** net income | **USD 228bn** capital expenditure

51m
barrels of oil equivalent per day of production

400bn
barrels of oil equivalent per day of proven reserves

These 15 companies represent **50%** of global oil and gas production and **23%** of proven global reserves between them

The current situation

— The strategies of the oil and gas majors we researched towards the energy transition vary considerably. The European majors (especially Repsol and Shell) have so far made more progress than their American counterparts (such as Chevron, ExxonMobil and ConocoPhillips), while national oil companies (such as Pemex, Lukoil and CNPC) are more constrained in their ability to diversify, often due to more stringent government policies and regulatory frameworks within which they operate.
— In 2018 the majors in our sample invested USD 6.6bn into renewables, equivalent to roughly three per cent of their combined 2018 CAPEX budgets. Companies with larger oil reserves are typically less diversified in renewable energy.
— Wind and solar technologies are the most common renewable investment among the oil and gas majors, while very few have stakes in hydroelectric and geothermal energy sources. The exceptions are Repsol and Lukoil in hydroelectric, and Shell, Chevron, Pemex and CNPC in geothermal.

Key drivers and challenges

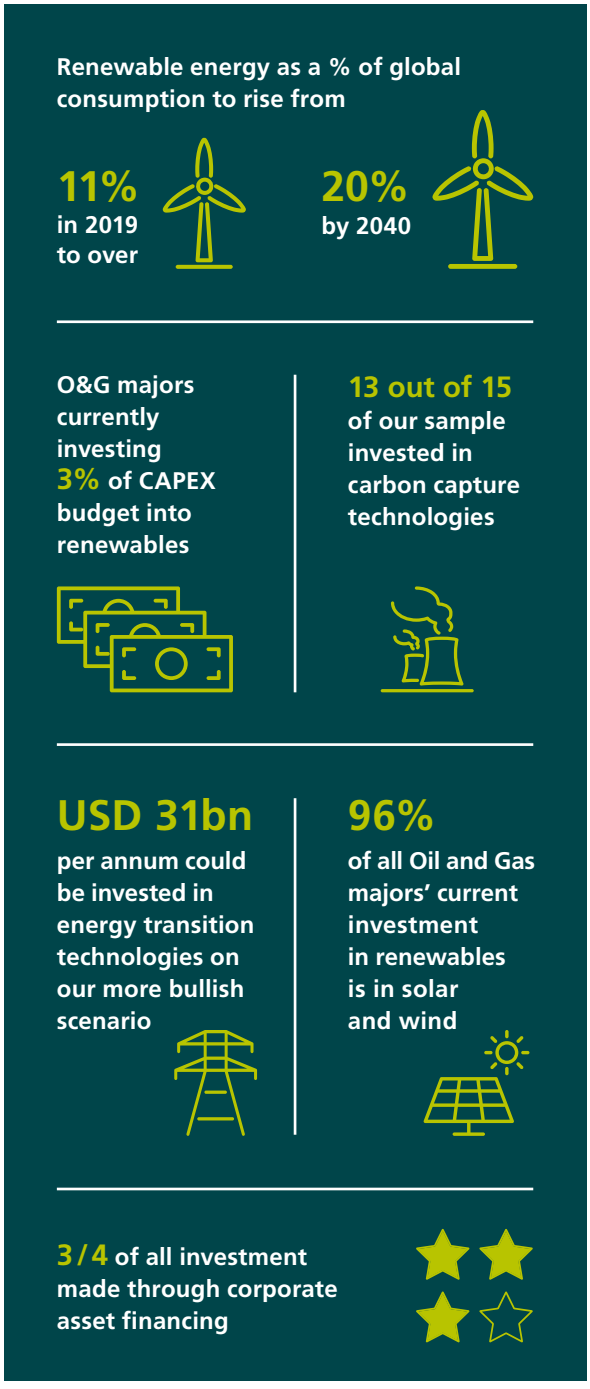
— The declining costs of renewables, investor and customer pressure, and government regulations are all major drivers of the current energy transition, alongside a new risk allocation strategy, given the oil price volatility and strong geopolitical risk related to traditional oil and gas production and location of such resources.
— Changing regulatory environments, competition from renewable energy firms and uncertainty surrounding returns from renewables are challenges that could restrict such future investment by the industry.

The outlook

— Overall, the oil and gas majors' journey in the current energy transition is still in its infant stages, and there is much uncertainty about the trajectory going forward, although the overall direction of travel is clear
— Under our more conservative 'Existing policies continue' scenario, our sample of oil and gas companies could potentially increase their investment into renewables from USD 7bn currently to USD 10bn by 2030
— However, under our more ambitious 'Rapid energy transformation' scenario, this investment figure could rise to USD 31bn by 2030, which would be equivalent to 10% of their total combined annual capital expenditure.
— Internal Rate of Return – a comparison between oil and gas and renewables indicates that the IRR on oil and gas is above renewables. However, in time, due to the decrease in demand for oil and gas and because the energy transition impact will rise, the difference in the IRR may become smaller.

Four main strategies addressing the energy transition

1. Emissions reduction and improving efficiency
2. Portfolio diversification
3. Integration of renewable technologies into oil and gas companies
4. Continued focus on oil and gas



What is the current 'energy transition'?

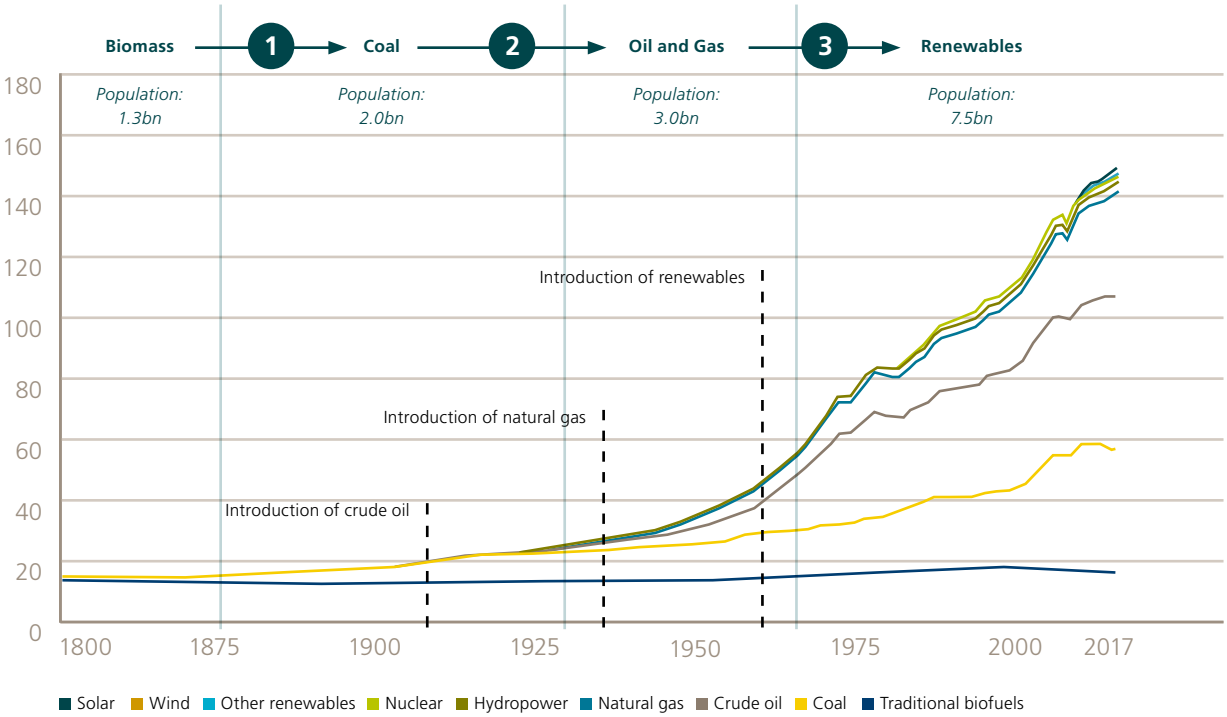
The term "energy transition" refers to a long-term, structural change in all components related to the production, conversion, delivery and use of energy. The global energy system has repeatedly been transformed over the last two hundred years as innovation and scientific discovery has led to significant changes in the use of primary energy sources. The current energy transition is not a simple shift from oil and gas to renewables but rather a transformation of the way that energy is produced and consumed on a global scale, from carbon intensive to low carbon sources, as part of which oil and gas companies are looking to expand their current energy mix and contribute towards lower emissions.

What is driving oil and gas companies to react to energy transition?

There are many pressures and complexities forcing traditional oil and gas majors to rethink their strategies and expand their current energy mix. Some of these are inter-related e.g. consumer pressures which threatens to damage corporate brands and similar pressures on investors and their investment decisions. Our research has identified the following eight key drivers:

Over the last 200 years there have been energy disruptions every 50 to 60 years on average, with each transition marked by a discernible driver

Global primary energy consumption (thousand terawatt-hours per year)



Coal displaced wood as it unlocked a new demand source – steam power – effectively enabling the world to industrialise

The transition to oil and natural gas was driven by transportation, in the transition from horses to cars

The most recent transition has been driven largely by climate change and pollution

Sources: Capital Economics and Lazards

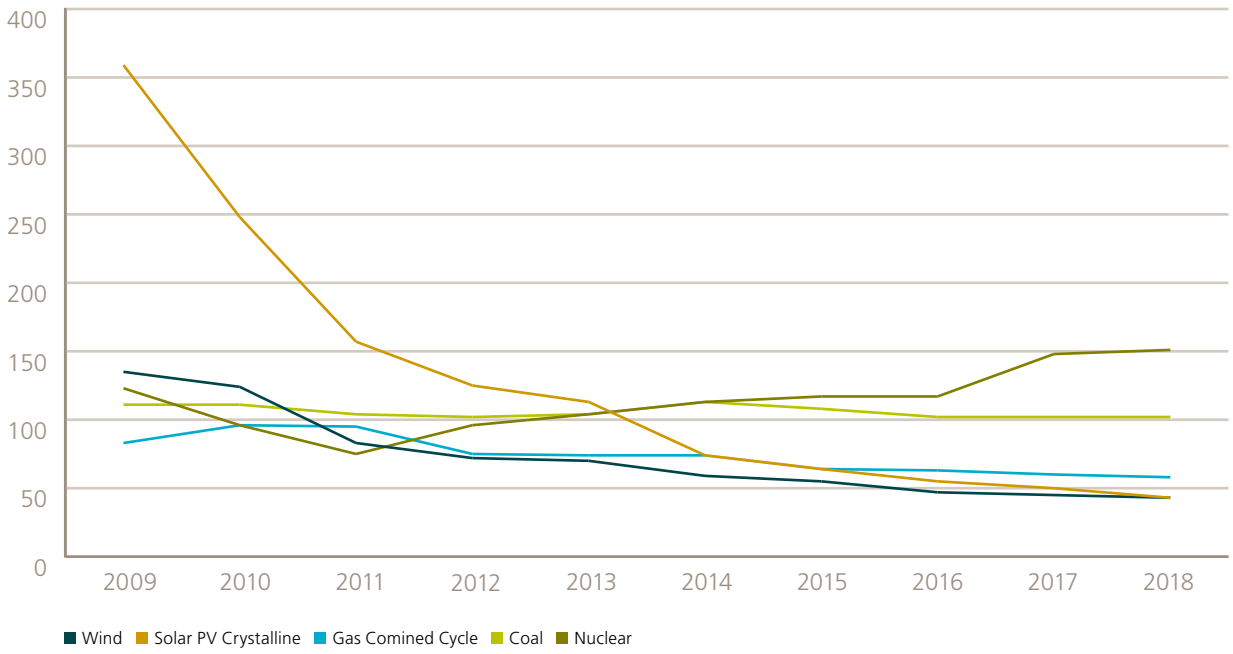
1. Declining cost of renewables

Technological advances and increased investment have dramatically reduced the cost of renewables. This means that they are now a more attractive option for oil and gas companies looking to diversify and expand their energy portfolio. In some locations and markets, solar and wind can now beat conventional generation on cost without subsidies, making the purely business case for renewables more attractive. For example, Total is planning to become a leader in the solar industry leveraging the expertise of its affiliates Total Solar, SunPower, Total Eren and Total Quadran. Similarly, developments in battery technology offer a genuine alternative to the internal combustion engine for transport. This downward trajectory for costs is expected to continue over the next decade. However, for so long as the sale of hydrocarbons remains more profitable, the economic drivers will continue to impact how oil and gas companies view investment into areas such as renewables.

Investment in some renewables has become attractive purely on financial terms. Given the projected increase in demand for renewables, that is likely to continue and inspire a number of venture capital-style initiatives by the oil majors.

There have been significant cost declines for alternative energy generation technologies, which has been both a driver for the industry as well as a challenge

Unsubsidised levelised cost of energy (USD / megawatt hour)



The price of solar technologies is currently over eight times cheaper than it was a decade earlier

At the same time, decreasing costs have placed the oil and gas industry in a more competitive environment against other power companies that are purely focussed on renewables

Wind and solar have become cheaper than more traditional forms of electricity sources. This has underpinned many oil and gas major's strategies to integrate renewable technologies into their oil and gas operations

Sources: Capital Economics and Lazards

2. Investor pressure addressing climate change

An increasing proportion of investors are putting pressure on the listed oil majors to address the problems of climate change. Environmental factors partly determine the risk-return relationship in investment, and since the Paris Agreement of 2016 this pressure has increased. For example, in 2017 ExxonMobil agreed to shift its stance on how it reports exposure to climate change following pressure from investors.

After the last oil price crisis in 2014–2015 investors have drastically reduced their appetite for large scale exploration budgets, which are typically capital intensive and high risk, hence companies must look at investments with lower risk, shorter breakeven cycles such as renewables even more so than previously. The question is whether investors will continue to feel confident pushing the oil and gas companies to move from their core business on a significant scale.

3. Customer pressure to make the transition

There is a growing social movement calling for faster and more decisive action to combat climate change. Companies hope that by taking an active part in the energy transition they will protect – perhaps even expand – their customer base which in turn, benefits shareholders.

There has typically been more pressure from investors in Europe than the US, and many of the majors have objected to investor's calls for more climate-related accountability

Selected investor initiatives and shareholder votes for major oil and gas companies

PASSED	Assess portfolio for climate risks (2015)	**BP** **Equinor** **Shell**	
PASSED	Publish an assessment of portfolio risks under a 2 degree scenario (2017)	**ExxonMobil**	
WITHDRAWN	Report on 2 degree analysis and strategy (2018)	**ExxonMobil**	
PASSED	Set and publish targets in step with the Paris Agreement (2018)	**Shell**	
REJECTED	Set targets to reduce Scope 3 emissions in step with the Paris Agreement (2019)	**BP** **Chevron** **Equinor**	**ExxonMobil** **Shell**
PASSED	Improve disclosures around strategy and investment consistent with the goals of the Paris agreement (2019)	**BP** **Chevron** **Equinor**	**Shell**

Source: Wood Mackenzie

4. Increased government regulation

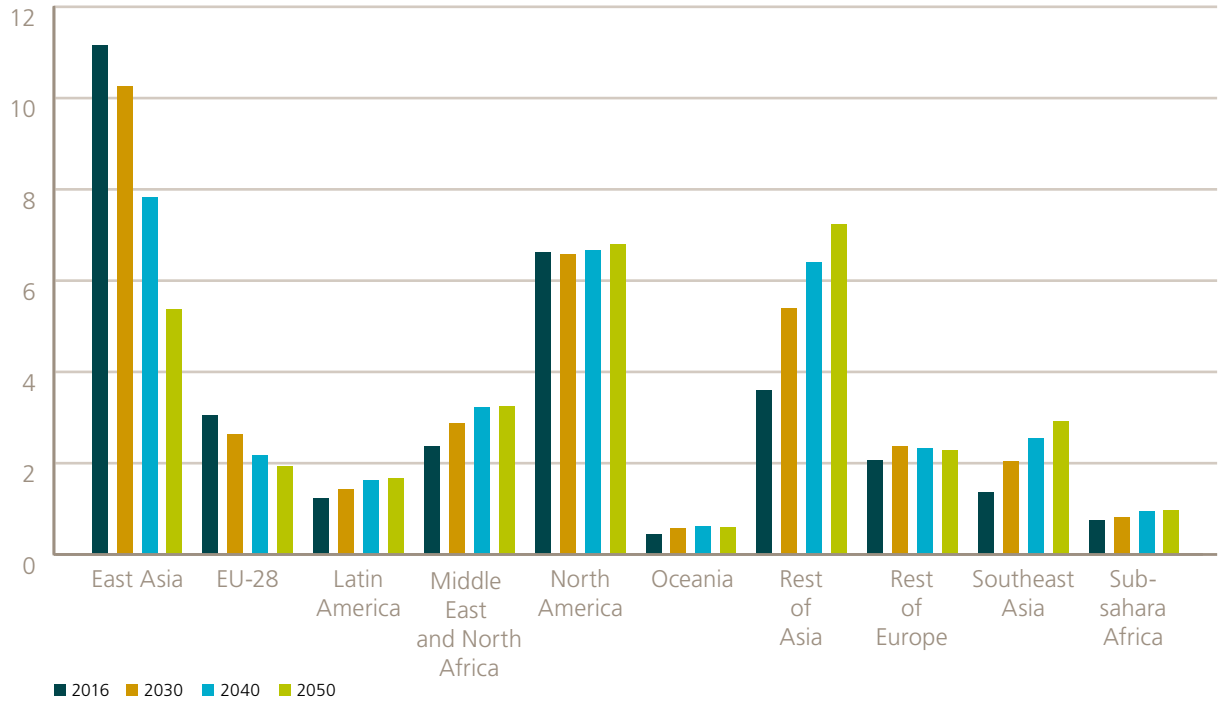
Partly in response to public demands, governments have implemented new policies and regulations to reduce emissions. For example, in the UK the sale of new diesel and petrol-engine cars will be banned from 2032. In Central and Eastern Europe (CEE) there has been a clear shift of focus towards renewables. A few years ago renewables were an expensive and subsidised source of electricity, while today governments and majors in the oil and gas field are refocussing on renewables, battery storage, and electric vehicles. Carbon taxation worldwide is likely to increase.

5. Government support of alternative technologies

In some cases, government subsidies have driven investment in newer growth markets, making otherwise uneconomic activities justifiable. However, as the cost of renewables has declined, this support has become less important. In some cases, oil and gas companies are the major investor in one country, and they benefit from existing know-how of the market as well as a strong reputation which they can easily build on when expanding the business into the electricity sector.

Public pressure as well as government regulations will lead to an overall decline in global CO_2 emissions in the future. Yet this reduction will be driven by China and the EU

Total carbon dioxide emissions by region (thousand metric tonnes per year)



China currently accounts for roughly one third of global CO_2 emissions. Even under a more conservative 'business-as-usual' outlook, the nation is on track to cut emissions by half over the next 30 years

However, if only current policies persist, the efforts at reducing emissions by China and Europe will only slightly offset the rise in CO_2 emissions by the rest of the world over out until 2050

Sources: Capital Economics and International Renewable Energy Agency (IRENA)

6. Information disclosure requirements

Governments are increasingly demanding companies to identify, quantify and disclose the financial impact of climate-related risk in their organisations. This in turn provides the raw material to fuel investor, customer and governmental pressure for the move towards alternative energy.

7. A desire to mitigate reputational damage

Oil and gas majors are also acutely aware of the reputational damage that not responding to the energy transition may cause. As a result, many companies have announced bold new initiatives, although the practical impact of those initiatives remains limited and the importance of investment in renewables within total CAPEX is often still small.

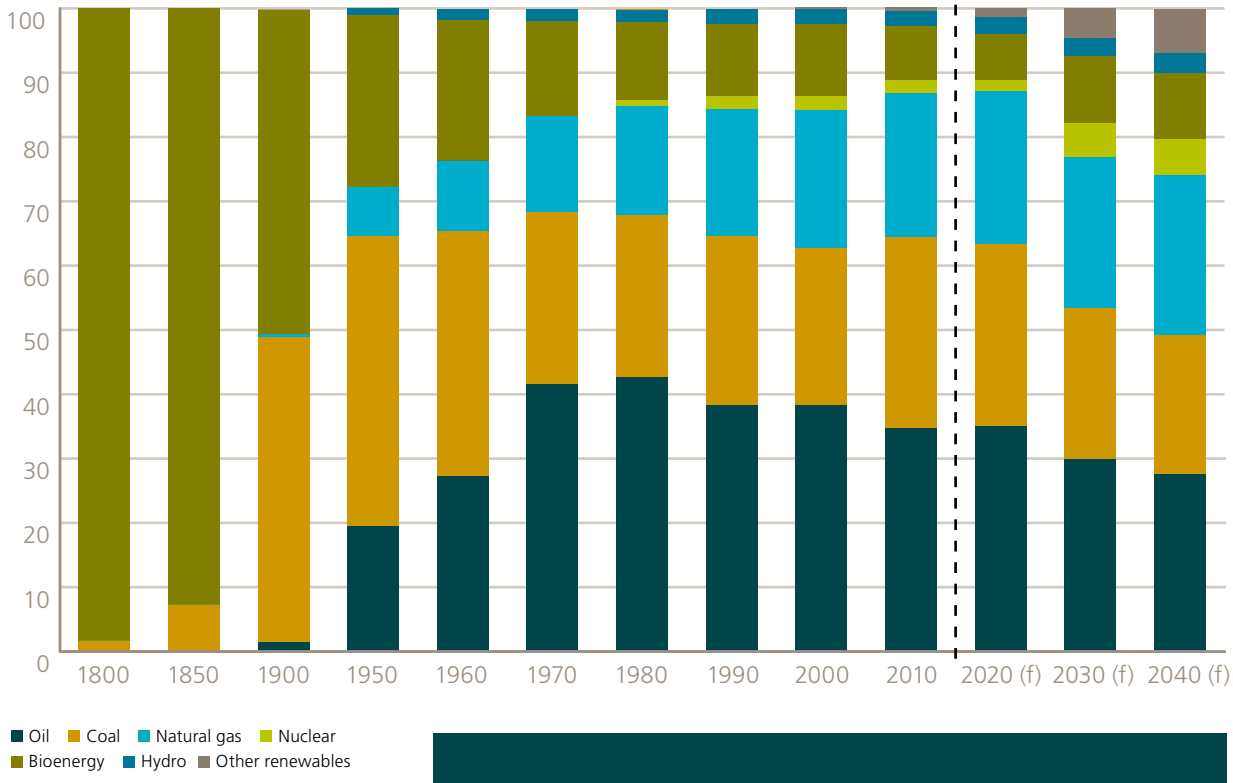
8. Uncertain outlook

The speed of the transition to a less fossil-fuel dependent global economy remains uncertain. This means that the majors will need to reposition themselves strategically to be successful under a wide and evolving set of future risks and challenges.

New energy sources do not replace old ones, they supplement them. While the share of renewables is set to double, oil and gas will continue to dominate the global energy mix.

New energy sources do not replace old ones, they supplant them. While the share of renewables is set to double, oil and gas will continue to dominate the global energy mix

Share of global primary energy consumption by type of fuel (per cent)



Sources: Capital Economics and the International Energy Agency. Note: Forecasts from the International Energy Agency are under their 'New Policies Scenario'

According to the International Energy Agency (IEA), the share of renewable energies in the global energy mix is expected to increase sharply, from 11% today to more than 20% by 2040

Interview:

Paul Fulton and Niny Borges – *Equinor*

Equinor is an ambitious energy group operating in 30 countries and is active in oil, gas, wind and solar power. It is the largest operator in Norway, and a growing force in renewables. Paul Fulton heads the legal team for renewables, and Niny Borges, Vice President Legal, heads the legal team for exploration globally.

The group is partly owned by the Norwegian government and its low-carbon strategy aligns with that governments' long-term plans. ***"Although we are partially state-owned, we operate as an independent stock exchange-listed company and we have a governance structure which enables us to develop our policies independently,"*** says Niny Borges.

Equinor fully supports the Paris Agreement and wants to be a leader in energy transition.

"There are three ways we can do that," explains Paul Fulton. ***"First, by trying to decarbonise our own oil and gas (O&G) production, for example with the electrification of some fields on the Norwegian continental shelf production to reduce our own emissions.***

"Secondly, by growing our renewables business, which is mostly offshore wind and some solar and thirdly, through decarbonisation initiatives more widely, which means supporting the Oil and Gas Climate Initiative (OGCI) and looking at carbon capture and storage (CCUS). There is also potential in the hydrogen value chain, removing CO_2 from gas and replacing it with hydrogen. In addition, we are lobbying to support a global carbon price.

"Renewables are a key element in our long-term strategy. Some initiatives are at early stages, for example our work in the hydrogen value chain, but our offshore wind activities are growing. We are the second largest gas supplier in Europe and replacing coal with natural gas and renewables helps cut CO_2 emissions."

Even on the most bullish forecasts for a shift to renewables, fossil fuels will remain important for decades.

"Energy demand globally is predicted to increase until about 2050 and there will still be a need for fossil fuels, although the energy mix will change," says Borges. ***"In our own oil and gas exploration business we are looking for resources with a lower carbon footprint."***

Equinor's approach to renewables combines several strategies. It is electrifying some of its oil and gas portfolio operations via cable in Norway, but also looking at wind turbines to provide power directly to oil installations.

"We are trying to use our competitive advantage as an offshore player to move into offshore wind," says Fulton. ***"We now have operations off the Norfolk coast in the UK and in Germany, and we recently announced plans for a facility off New York in the US and the world's largest offshore windfarm called Dogger Bank off the coast of the UK. We also have floating wind technology that is needed in deeper-water areas, such as off Scotland."***

The technology is moving fast, which poses its own challenges. ***"Few companies have our floating windfarm technology, but the technology changes quickly and we need to incorporate the new developments in our bids if we are going to win. It is also important to become more efficient, for example by reducing the cost of servicing wind turbines,"*** says Fulton.

CCUS and solar are also important for Equinor, as Fulton explains: ***"We have been storing CO_2 for years from two of our gas fields offshore Norway. Now we are looking at other industries where it is hard to cut CO_2 emissions, such as cement or fertilizers, where the need for high temperatures or the chemical process itself is a problem. If funding is secured, an investment decision for our Northern Lights project could be made in 2020. More generally, our venture capital arm keeps us in touch with new technology and business models."***

"And we have also been investing in solar," adds Borges. ***"Our Brazilian Apodi project started in 2018 and supplies 162MW of electricity to the grid in Ceará State."***

Beyond wind and solar, the group is interested in newer technologies. ***"If we look at hydrogen, you can produce hydrogen from water through electrolysis, or extract CO_2 from methane. We are looking at the latter approach, but this is still at an early stage,"*** explains Fulton.

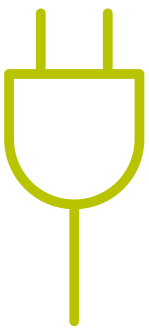
A variety of diversification strategies

It is clear from our research that 'energy transition' means different things to different oil and gas companies. We examined the energy transition strategies of 15 of the world's largest oil and gas majors, which represent half of global oil and gas production and hold 23% of the world's proven global reserves.

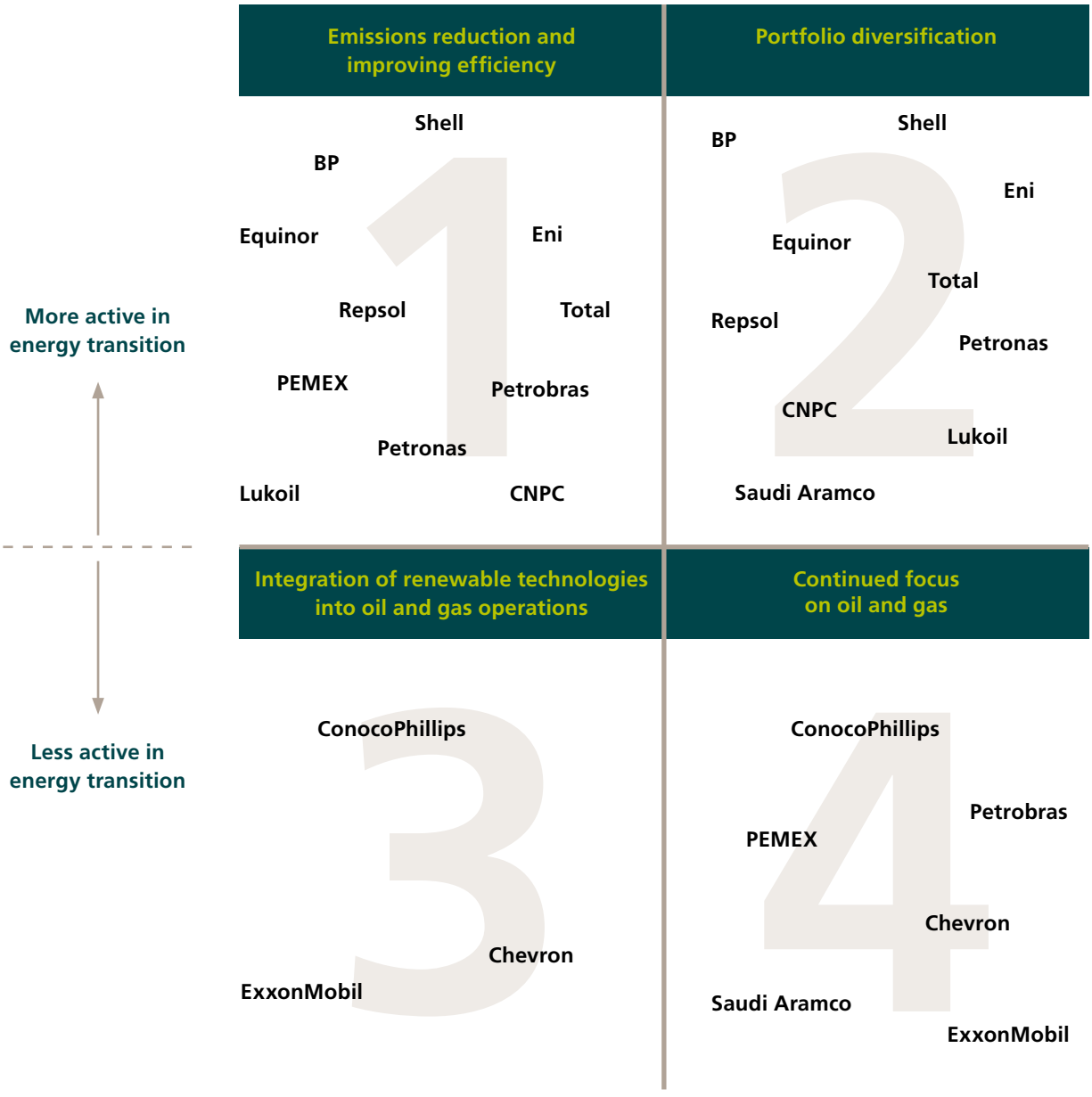
The traditional business models of oil and gas companies are said to be facing an existential threat. Estimates of peak oil and gas demand differ, but most put it sometime over the next ten to twenty years. This suggests that oil and gas majors may no longer be able to rely solely on oil revenues for the indefinite future. In the Middle East a combination of oil price crash (which had a negative impact on Gulf states economies) and the proliferation of international agreements aimed at reducing reliance on fossil fuels and slowing climate change (principally the 2016 Paris Agreement on Climate Change and the United Nation's Sustainable Development Goal) has required the Gulf states to reconsider their energy mix, and their continued reliance on conventional energy sources. Governments in the Middle East region are encouraging the move towards an energy mix, being driven in part by their NOCs.

One problem is that while the activities of the industry as a whole account for roughly three per cent of global economic output, they also, if one takes into account scope 3 emissions , account for more than 50% of the global greenhouse gas emissions associated with energy consumption. If only emissions from their own operations are taken into account, this figure is massively reduced meaning society as a whole has a key role to play. Oil and gas companies therefore face the challenging task of trying to meet growing demand for energy in a more competitive environment at the same time as reducing their operating emissions and reducing emissions in their value chain. Meanwhile renewable energy is expected to be the fastest-growing source of energy over the next two decades, increasing five-fold by 2040. This means that more of the energy demand will need to be met from renewable energy sources or society will need to adapt to lower its energy needs so as to meet its climate change goals.

Against that backdrop, the energy diversification strategies of the oil and gas majors vary considerably from one company to the next. Companies have different attitudes to risk, different relationships with their customers and investors, operate in different geographies and have different types of expertise.



The European oil and gas majors have so far made greater strides towards the energy transition than their American counterparts



We can classify the oil and gas majors' attempts to navigate the energy transition into four main strategies. Most are working to reduce the carbon footprint of their operations. Some are embracing the energy transition and re-balancing their portfolios away from a traditional oil and gas model and investing in renewables technologies as part of a broader energy mix. Some companies are using renewable energy to help power their other business streams, and others are maintaining the status quo and have done very little so far.

Of course, many companies are following more than one of these strategies. For example, Italy's Eni is both reducing emissions and diversifying its portfolio of assets, and the US group Chevron is integrating renewable technologies into its business while remaining focused entirely on its oil and gas operations.

We found that our sample of 15 oil and gas majors are addressing the energy transition through four main strategies:

Four main strategies of oil and gas majors in responding to the energy transition

1. **Emissions reduction and improving efficiency**
2. **Portfolio diversification**
3. **Integration of renewable technologies into oil and gas operations**
4. **Continued focus on oil and gas**

1. Emissions reduction and improving efficiency

Many oil and gas majors have set themselves emissions targets in respect of their own operations, and some (e.g. Shell) have tied executive pay to those targets. Internal operational changes are required to address the challenges of energy transition e.g. regular audits, upgrading equipment, implementing energy management systems.

Examples of investments to reduce emissions include carbon capture and storage (CCUS) initiatives that store carbon dioxide from fossil fuels. Spain's Repsol has a dedicated team focusing on the development of new biofuel and carbon capture technology. Repsol has also issued a EUR 500m certified green bond, proceeds from which will be used to finance energy efficiency investments in the company's refinery facilities.

The majors can also boost the efficiency of oil and gas operations by reducing their own consumption of energy. This is also true for national oil companies, for example Malaysia's Petronas is actively reducing the use of gas flaring and venting.

2. Portfolio diversification/ Expanding the energy mix

Research points to renewables offering the most attractive opportunities for oil majors to diversify and add value to the group's overall business, with solar, wind and electricity technologies being the most popular to invest in and acquire. In 2017 BP acquired a 43% stake in Lightsource BP, Europe's largest solar developer, and Total's recent investments now include solar, wind, marine energy, energy storage, distributed energy tech, hydrogen, biofuels and chemicals. Another example is BP's recent acquisition of the UK's largest electric vehicle charging company, Chargemaster. However, transition for oil and gas companies has also included moving into the power generation business, often banking on their own production of natural gas. The OMV Group through OMVPetrom in Romania, the largest oil and gas producer in south-east Europe, invested over EUR 500m in 2012 in a high efficiency co-generation power plant of 860MW, while the state controlled Romanian gas producer, Romgaz, is building two such high efficiency, low CO_2 emissions CCGT plants of over 1,000MW.

A number of oil majors are also setting up partnerships with innovative start-ups. If this is undertaken in a diversified manner it can provide exposure to a wide range of low-carbon technologies at relatively low risk.

For example, BP Ventures has invested over USD 400m in a portfolio of over 40 entities since 2006. In the US, Chevron launched a USD 100m venture capital fund in 2018 that has invested in an electric vehicle charging network, novel battery technology and direct capture of carbon dioxide from the air. Meanwhile France's Total has invested USD 200m in 20 start-ups, and Norway's Equinor plans to invest up to USD 200m over four to seven years in growth renewables companies.

Among the national oil companies, Saudi Aramco leads the way and has a USD 200bn partnership with Softbank in the solar energy field, and in April 2019 Petronas acquired Amplus Energy Solutions, one of India's largest rooftop solar power producers.

Other examples of portfolio diversification include retail, trading, transport and energy storage. Some companies are also diversifying more heavily into their natural gas operations/LNG networks.

Wind and solar is the most common investment across our sample of oil and gas majors

			Investment in a range of renewable technologies					
	Company	**Country**	**Wind**	**Solar**	**Hydroelectric**	**Geothermal**	**Biofuels**	**Carbon Capture**
1	Repsol	Spain	✓	✓	✓		✓	✓
2	Shell	Netherlands/ UK	✓	✓		✓	✓	✓
3	BP	United Kingdom	✓	✓			✓	✓
4	Equinor	Norway	✓	✓			✓	✓
5	Eni	Italy	✓	✓			✓	✓
6	Petronas	Malaysia		✓				
7	Total SA	France	✓	✓			✓	✓
8	Lukoil	Russia	✓	✓	✓			✓
9	Chevron	United States	✓	✓		✓	✓	✓
10	Pemex	Mexico	✓	✓		✓	✓	
11	Petrobras	Brazil	✓	✓				✓
12	ExxonMobil	United States	✓	✓			✓	✓
13	Saudi Aramco	Saudi Arabia	✓	✓				✓
14	ConocoPhillips	United States						✓
15	CNPC	China	✓	✓		✓	✓	✓
Total			**13**	**14**	**2**	**4**	**10**	**13**

Only 2 of our sample of 15 oil and gas majors have invested in hydroelectric technologies, compared to 13 for carbon capture technologies

Source: Capital Economics

3. Utilising renewables/electricity generation to help the core oil and gas business

Some oil and gas majors are decarbonising their upstream and downstream activities to create their own energy supply from renewables. This can include the use of wind and solar power in remote areas to power oil production, or the use of renewables to power the oil refining process. The continuing reduction in the cost of many renewables means that this strategy can reduce operating costs as well as emissions. In addition to renewables, in many mature production areas with marginal output, distant from the natural gas transport system, companies are using "gas to power" to produce electricity for their own operational consumption and selling the excess electricity to the grid.

US companies, which otherwise often lag in their transition to decarbonised energy solutions, are notable here. In 2018 ExxonMobil announced that it would use renewable energy to produce oil in West Texas. Under an agreement with Denmark's Ørsted, the US company will buy 500MW of wind and solar power in the Permian Basin. Similarly, in 2019 Chevron signed a 12-year agreement to supply its West Texas Permian electricity from a wind farm.

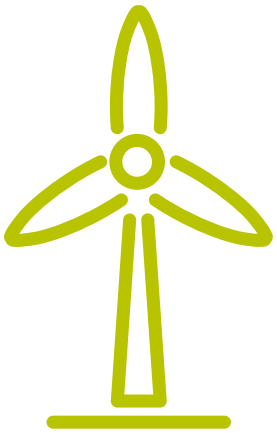
Other examples of this strategy have seen Eni focusing on the hybridisation of renewable energy systems with existing energy processes at its sites, and Petronas initiating Projek Sinaran, in which solar panels are installed at its upstream and downstream assets to complement their electricity usage. Much of CNPC's limited investment in renewables is integrated into its oil operations, for example with carbon capture initiatives in China's oil fields.

4. Continuing to focus on the traditional oil and gas model

Although the research shows that most of the oil and gas majors are investing in renewables to a greater or lesser extent, hydrocarbons look likely to remain the core of their businesses for many years to come. This is particularly true of companies from Asia and the US, and for smaller oil and gas players seeking to profit from the partial exit of the oil majors. The shift to renewables is far less pronounced when companies are less influenced by the drivers identified above e.g. when there is little or no investor pressure, reduced impact from regulatory change, or if they have particularly large oil and gas reserves. The same applies to developing countries that have huge coal reserves that will always form a base supply alongside oil and gas e.g. Indonesia, Vietnam.

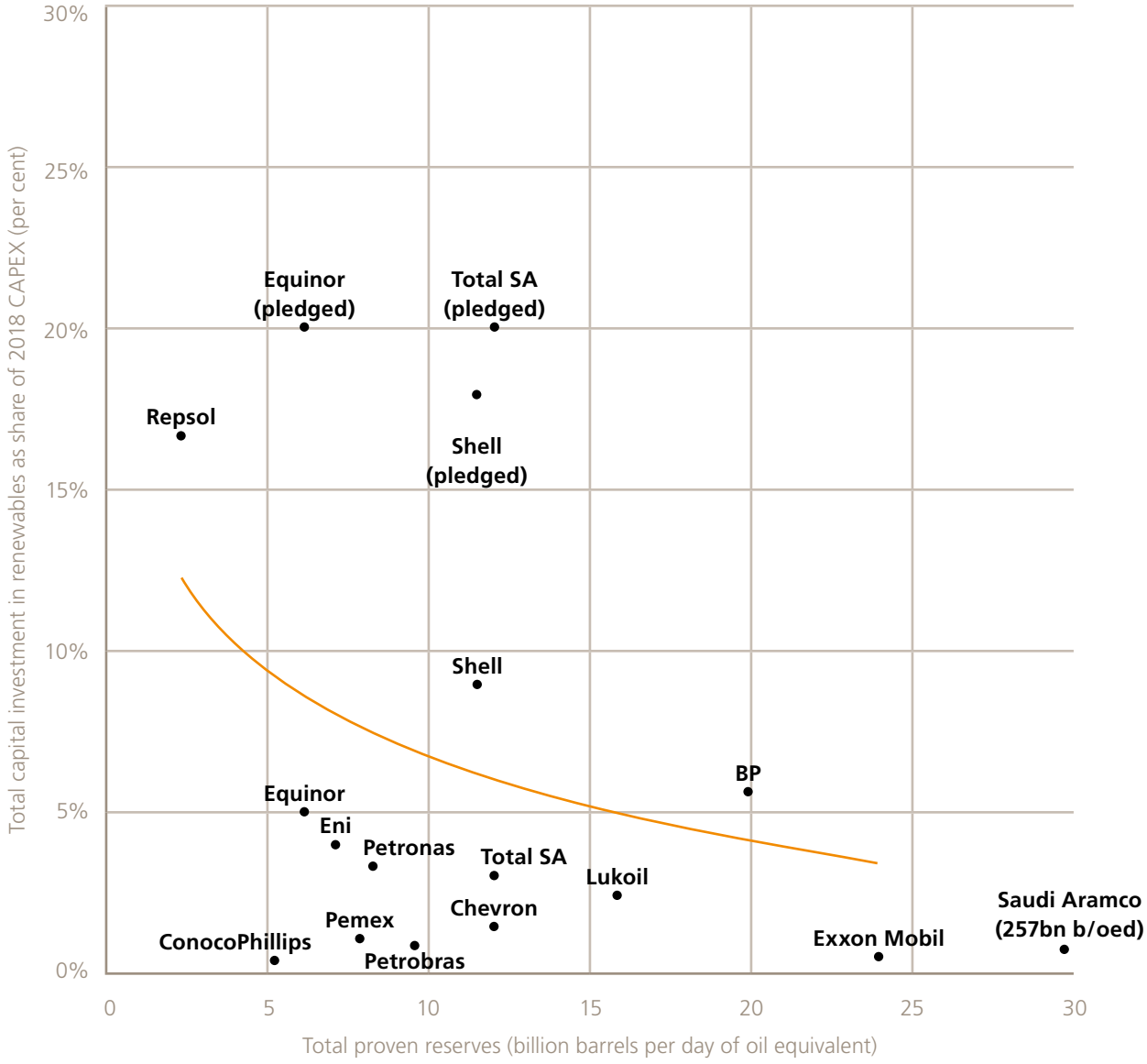
In August 2019 Brazil's Petrobras announced that it would no longer invest in renewable energy projects such as biodiesel, although it would continue with R&D. In Mexico, policy is now focused on boosting the flagging Pemex rather than supporting renewable energy growth. This will make it difficult for Pemex to reach its long-term clean energy target.

The reality is that oil is generally still more profitable than renewables. As the profitability of renewables investment is proven, strategies in this group of companies may change, but there will remain less incentive to diversify when a company has large oil reserves.



Companies with larger oil reserves are typically less active in the energy transition

Relationship between corporate investment in the renewable energy sector and level of proven oil reserves



Sources: Capital Economics and individual company annual reports

The role of National Oil Companies (NOCs) in the energy transition

NOCs are particularly prevalent in the Middle East with Saudi Aramco, Qatar Petroleum, Kuwait Oil Company, Abu Dhabi National Oil Company (ADNOC) and Oman Oil / Petroleum leading the way. There are many positive examples of NOCs in the region expanding into new areas of energy, in particular renewables.

Many national oil companies have additional pressures that limit the potential for them to focus on lower carbon emissions. These may include the need to fund fuel subsidies or social programmes and the target of maximising tax receipts in their home countries – issues which at a national level and in the short term, may be equally important as the need to respond to the energy transition.

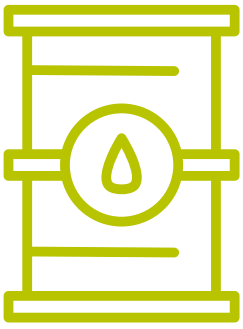
The institutional features of individual countries – political stability, rule of law and regulatory quality – also influence the ability and effectiveness of national oil companies to adapt to the energy transition in their home countries. There is a relationship between countries' scores on these institutional indicators and how engaged their national oil companies are in the energy transition. Those national oil companies with lower scores tend to be less engaged in the process, while those with higher scores are inclined to be more active in climate-related issues and policies.

Saudi Arabia/Saudi Aramco

Saudi Aramco is encouraging a move to renewable energy. We understand that it is using renewables to power unconventional gas wells in Wa'ad Al-Shamal. Aramco believes that the cost avoidance and life cycle cost savings achieved by implementing such renewable energy solutions are significant and will add value to Saudi Aramco and its projects in the future.

Saudi Arabia recently tripled its renewable energy target and has successfully tendered for large-scale projects in wind and solar energy. In February 2019, the government invited tenders for its first major wind and solar projects, scheduling a decision in April, which was subsequently suspended. It recently invited banks including HSBC Holdings Plc, JPMorgan Chase & Co. and Credit Suisse Group AG to pitch for a role in helping Aramco to identify renewable acquisition targets.

Under an economic reform programme launched in 2016, known as Vision 2030, Saudi Arabia is seeking to use non-oil means to generate much of its additional future energy needs to avoid running down oil resources and to diversify its economy.



Oman/Petroleum Development Oman (PDO)

PDO announced that it has awarded a contract to build a landmark 100MW solar photo voltaic Independent Power Producer (IPP) project to a joint Japanese-Omani consortium. The Marubeni Consortium, comprising the Marubeni Corporation (Japan) as the lead founder, Oman Gas Company S.A.O.C, Bahwan Renewable Energy Company LLC and Modern Channels Services LLC, won the bidding process. The plant will provide power for PDO's interior oil and gas operations and be the first of its type in Oman. It will also be the world's first utility-scale solar project to have an oil and gas company as the sole wholesale buyer of electricity.

ADNOC

In line with the UAE's commitment to manage the risk of climate change, ADNOC is researching and developing a series of breakthrough projects and technologies, such as Al Reyadah – a joint venture with a local renewable energy company Masdar – which focuses on exploring and developing commercial-scale projects for carbon capture, usage and storage. Al Reyadah's first project, with Emirates Steel Industries, will utilise and sequester 800,000 tonnes of CO_2 each year. In October 2019, ADNOC signed a Memorandum of Understanding with BASF, Borealis and Adani for the world's first carbon dioxide-neutral petrochemical site fully powered by renewable energy at a cost of USD 4bn in India.

Expanding the current energy mix and alternative technologies for oil and gas majors

As well as "established" renewables such as wind and solar, the oil and gas majors are investing in a wide range of alternative technologies, from carbon capture to biofuels.

1. Carbon capture and storage

Carbon capture and storage ("CCUS") involves the capture, transport and storage of CO_2 produced by fossil fuels during electricity generation or industrial processes. Combined with renewable biomass, it can even be carbon negative, removing carbon from the atmosphere.

CCUS has been used for several decades in enhanced oil recovery, for example by ConocoPhillips at its operation at Buckeye East in New Mexico. In 2018 the company purchased 300,000 tonnes of CO_2 for injection. Equinor is also a world leader in carbon capture. It has integrated the technology into two plants accounting for 23m tonnes of permanently stored carbon dioxide.

Quest CCUS is the world's first commercial-scale CCUS facility applied to oil sands operations, which is operated by Shell on behalf of the Athabasca Oil Sands Project, its shareholder. Quest CCS has already captured and safely stored four million tonnes of CO_2, ahead of schedule and at a lower cost than anticipated.

In August 2019, Chevron launched one of the world's largest carbon capture and storage projects, injecting CO_2 into a deep reservoir under an island off Western Australia at its Gorgon LNG project. The facility will reduce Gorgon's emissions by 40% over the life of the project which was a condition of the overall project being authorised by the state government.

Chevron Ventures is an investor in Carbon Engineering, a Canadian clean energy company involved in Direct Air Capture. DAC technology addresses climate change in two complementary ways. It can remove CO_2 from the atmosphere and also deliver large-scale negative emissions by permanently and safely storing CO_2 underground. Additionally, through integration with CE's Air to Fuels technology, DAC can also reduce emissions from transport by converting atmospheric CO_2 into ultra-low carbon fuels to power existing vehicles and planes without any modifications.

2. Biofuel

Biofuels are a replacement for fossil fuel made from biomass, including agricultural crops, commercial and industrial waste. The two most common biofuels are bioethanol and biodiesel, which are both used to power vehicles. These currently account for just 3% of the world's energy usage, and there are technical, economic and environmental barriers to their wider adoption.

However, several oil majors have invested in biofuels. Pemex has a contract with a Mexican biofuels producer to buy 18–20m litres of ethanol annually to replace more polluting fuels. Repsol has a technology lab focusing on the development of new biofuel and carbon capture storage technology, and Total is ramping up its own biofuel production.

The formation of the Raízen joint venture (Shell holds 50%) in Brazil in 2011 was the Anglo-Dutch group's first move into large-scale biofuel production. Raízen is one of the world's largest sugar-cane ethanol producers and operates an integrated process from sugar-cane production to fuel distribution under the Shell brand.

Outside Brazil, Shell continues to invest in new ways of producing advanced biofuels, using sustainable feedstocks, such as waste products or cellulosic biomass. In 2017, for example, Shell completed the installation of a demonstration plant at the Shell Technology Centre Bangalore, India, that uses a technology called IH.

BP has also been active in biofuels and has had a strong position in that market for some time. In 2017 it entered into a joint venture with Brazilian company Copersucar, a leader in the commercialisation of sugar and ethanol, for the operation of the fuel terminal in Paulínia, São Paulo. This investment significantly expanded BP's commercial presence in Brazil, although its involvement in biofuels in Brazil dates back to 2008, when it became the first international company to invest in biofuels from sugarcane. The company generates 1,000GWh per year of electricity using sugarcane bagasse, enough energy to supply 1.3m people. BP also recently concluded a 50/50 JV with agricultural commodities company Bunge to combine their biopower and biofuels businesses in Brazil.

In relation to aviation, BP has collaborated with Finland's Neste to explore opportunities to increase supply of sustainable aviation fuel. In April 2019 the two companies announced an agreement to deliver sustainable aviation fuel to airline and airport customers in Sweden. The fuel that Neste produces comes from non-palm renewable and sustainable raw materials. It can reduce up to 80% of greenhouse gas emissions over its lifecycle compared to conventional jet fuel.

3. Transport (EV and Hydrogen)

Energy transition in the transport sector is projected to be big business with a number of oil and gas companies investing into this sector. This includes investment into EV charging infrastructure, utilities and battery technologies, and hydrogen fuels for road, marine and even air transport.

Integrated oil and gas companies with downstream businesses tend to be the first movers in developing charging points for electrical vehicles, tapping into their existing infrastructure for traditional fuel stations, competing with supermarkets and large office buildings.

In 2017, the number of EVs passed 3m, according to the International Energy Agency and by 2030, the IEA predicts the number of EVs on the road will have expanded to 125m. One consultancy, Wood Mackenzie, predicts that EV charging infrastructure investment in the US will exceed USD 18bn annually by 2030. However, the oil and gas companies are largely investing in the charging infrastructure in Europe. According to BNEF, 79% of the public charging infrastructure in Europe is operated by utilities and oil and gas companies whereas in the US, 62% of the market is dominated by purely EV operators and the market is controlled by equipment manufacturers in China. Some of the oil and gas majors driving onto the EV road include Shell which purchased Greenlots, an EV software and services company in North America. Shell is reputedly investing about USD 1bn a year into EV deals including the acquisition of 30,000 charging stations in Western Europe as well as a USD 31m investment into EV charging start-up Ample in 2018. BP made headlines with its acquisition of Chargemaster, the UK's largest electric-charging network, for GBP 130m.

Hydrogen is likely to be a major component of a future low carbon energy system, where it can bring significant benefits as a low carbon route to energy supply, and through providing services to energy networks. When combined with carbon capture and storage, hydrogen production can provide a route to low or even negative greenhouse gas emissions. Primarily hydrogen is seen as a possible low carbon alternative for heating, either using the existing gas network or through purpose built hydrogen networks. Hydrogen is also seen as a possible low carbon transport fuel especially for heavier vehicles such as buses, trucks, vans and even boats. The main action in this respect is the development of hydrogen fuel cells with the global hydrogen and fuel cells market currently estimated to exceed USD 11m by 2025.

Geographically, the Americas region dominates the global hydrogen and fuel cells market, supported by government policies and tax incentives. Asia Pacific (China, Japan, and South Korea) is another major market for hydrogen and fuel cells. With a rising population along with increasing disposable income in the region driving demand, hydrogen is recognised as the best replacement for other conventional fossil fuel energy sources that are used to reduce carbon emission by efficiently meeting electricity needs. Oil and gas companies such as Exxon Mobil are investing in hydrogen in Asia (Singapore). In Europe, the Hungarian MOL oil and gas company recently announced a partnership with Slovakia's InoBat to develop hydrogen-related projects in Central and Eastern Europe. The sourcing and supply of hydrogen will be the main focus of the partnership.

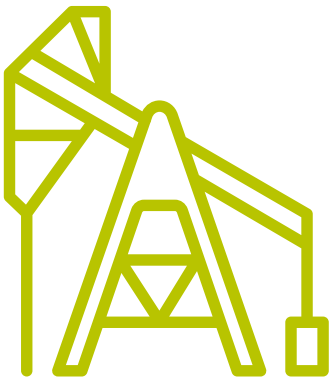
Trading and Retail Business

Oil and gas companies have long had a trading arm which they are now using to extend deeper into the retail markets. Their strong branding is key to winning the trust of consumers and a global footprint and financial scale allows them to deliver projects in a cost-effective manner. Their established track record in energy trading gives them deep experience of how to deal with issues similar to those that arise in the retail sector. However, the retail sector is not without its complications be it adjusting to lower profit margins or the need to manage complex customer relations.

That does not deter some oil and gas major from entering the retail space. Shell's investment in First Utility (now renamed Shell Energy) is a good example of this. Shell acquired energy supplier First Utility in 2018 and has switched all its UK residential customers to 100% renewable electricity. In France, Total made a similar acquisition when it bought Direct Energie, making Total a major electricity retailer in France.

Other diversification from using petroleum

Petroleum has long been the default fuel for transport but given the societal shift away from petroleum-based products aforementioned, several governments across the globe have introduced a ban on all petrol and diesel cars by 2030. As a result, alternatives need to explored including natural gas, hydrogen, propane, ethanol and biodiesel.



Legal issues to consider when investing into alternative technologies

Renewable technologies

Of the 15 majors sampled for this report, 93% have invested in solar and 87% have invested into wind generation assets. Some of the renewable technologies inherently fit more closely with the structures used in the oil and gas sector. Notably, development, construction, operation and decommissioning of an offshore wind project echo many of the phases one typically sees in an offshore oil and gas installation. However, there are notable differences with this and other renewable technologies such as:

— **Different system risks –** it is well known that solar and wind have limitations when the sun does not shine, and the wind does not blow. Forecasting and managing an intermittent power stream (independent of the fluctuations on the wholesale power market price) is important to consider, whether that stream is used to power core oil and gas assets or provide a new source of revenue.
— **A whole new regulatory regime –** having been used to a mature and heavily tailored regulatory regime of the relevant country in which it operates, investment in renewables requires an understanding of a very different, sometimes still developing regulatory regime of another country and another sector. For example, what consents, permits and authorisations are required and by when will vary from technology to technology, sometimes by size of the station as well as by location. Knowing the local requirements and the intricacies of the regulatory framework is key to success.
— **Different ways of financing projects –** while some smaller scale renewables can and often are capitalised off a company's balance sheet, the multi-million developments like offshore wind farms often come with a hefty CAPEX price (compared to a low OPEX price) tag. For oil and gas companies less familiar with the market standards of financing renewables assets (on project finance terms, portfolio basis etc.) this requires a shift in approach and acceptance of risks positions that may seem less familiar. Moreover, some risks, like a more limited insurance offering, means that boards of oil and gas companies need to adapt some of the risk allocation approaches to fit with the market models that are standard in the renewables sector.
— **Different ways of earning returns –** Upstream oil and gas companies are primarily used to selling a product per barrel at a market price (albeit they do invariably hedge sales). The long term PPA structures of the renewables sector with revenues coming from multiple sources, supported at times by floor prices offer a different approach.

Decarbonised transport

For a sector that dominates the fuels used in transport today, the energy transition represents a significant change and growth opportunity (as well as a risk). Oil and gas companies investing in EV charging are at the forefront of changes to the fuel stations which will need to diversity from petrol and diesel fuels to include biofuel and EV charging options. Similarly, hydrogen fuel cells for larger transport vehicles and fleets are also in sight for many companies.

Oil and gas companies looking to diversify into decarbonised transport have a number of issues to consider:

— **Business models for EV charging –** some chargers will be rapid whereas others will be slower and require the customer to spend more time in the fuel station. What makes more commercial sense for a company will depend on location, customer base and grid upgrade opportunities available to it. For example a higher charge for a rapid charger may be offset by shopping opportunities if the customer

spends more time at the fuel station. Alternatively the grid connection limitations may dictate what is feasible.

- **Picking the winning charger –** as EVs are developing so is the charging infrastructure. There are a number of charging models in the market at present which will in time need to converge in the same way as has happened with fuelled vehicles. Investments in EV charging must therefore consider the trends in the markets and work closely with EV and chargepoint manufacturers to avoid the risk of stranded/obsolete assets.
- **Navigating the regulatory landscape –** each of the fuels used in the energy transition mix (electricity for EVs, hydrogen fuel cells, biofuels and conventional fuels) each come with their own regulatory requirements, including from a safety perspective. As the transport transition evolves, oil and gas companies will need to become familiar with the regulatory regimes that apply to each of these fuels.

Hydrogen for heating and cooling

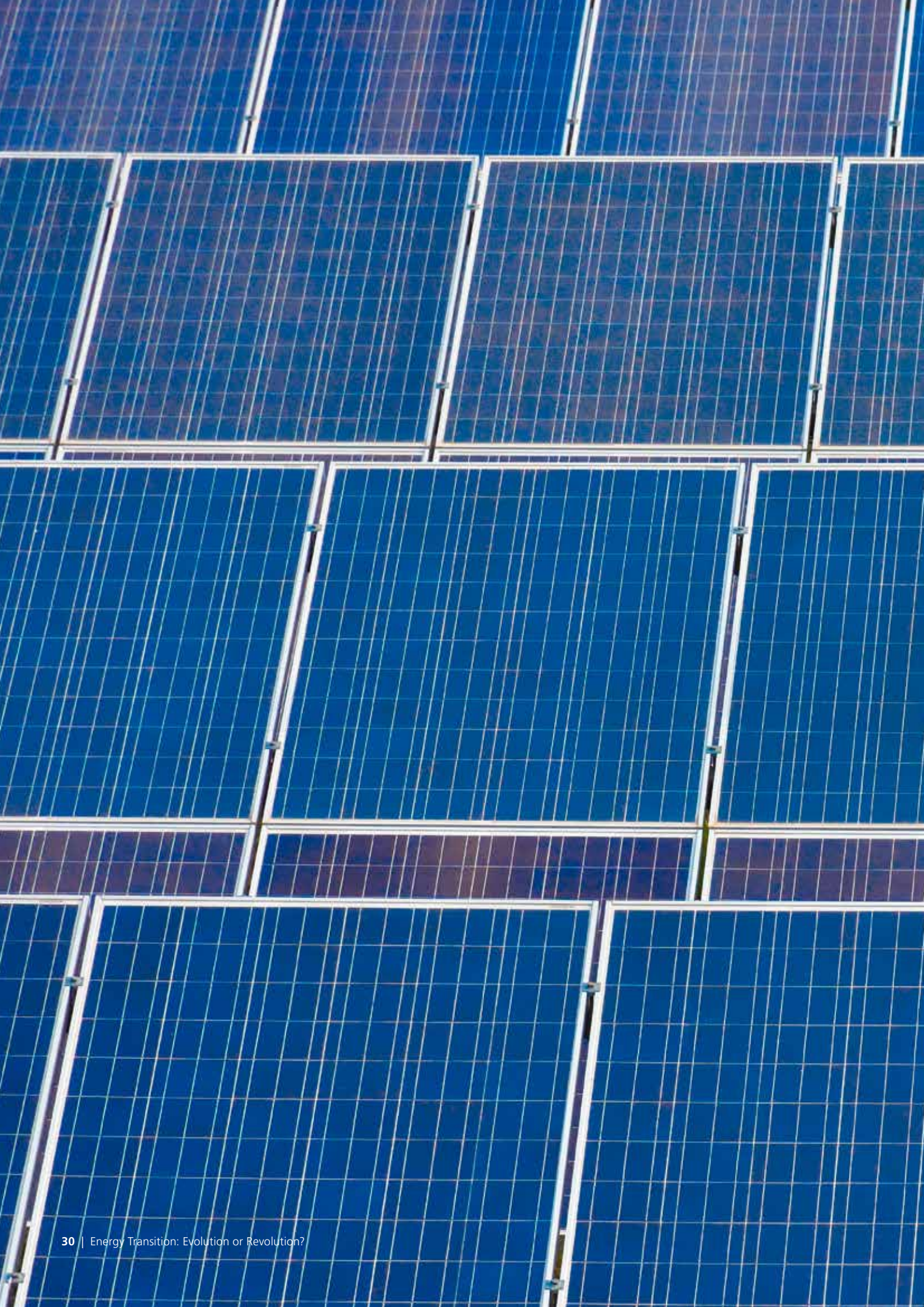
A number of oil and gas companies are investigating production of hydrogen. Much of the growth in hydrogen so far has been stimulated by government support (e.g in the Americas). Presently, hydrogen is formed through methane reformation (and to decarbonise it into 'blue' hydrogen requires capturing the CO_2 from the methane and storing with CCUS). Alternatively, renewables could help bring down the cost of making 'green' hydrogen through electrolysis, as is being trialled by Equinor and Orsted. In northern hemisphere countries hugely reliant on natural gas for its heating systems, replacement of the gas network with a hydrogen network would be another major shift for the oil and gas companies working in this sector. There are common themes that apply when considering investing in this sector:

- **Securing demand –** companies such as Russia's Gazprom are considering hydrogen as a replacement fuel for its gas transport network to Europe. However, at its destination the domestic appliances and infrastructure are not yet adapted to take a hydrogen-dominant fuel source. As such in considering whether to adapt or construct a hydrogen network, consideration needs to be given to who will be able to use it.
- **Regulatory barriers and adapting the current networks –** in the absence of a hydrogen network code or take-or-pay contracts the sale, transport and offtake of hydrogen need to be carefully analysed to create bespoke contractual frameworks.
- **Storage facilities –** as with natural gas, hydrogen for the heat network would be pumped from some distance away. Consequences of supply failing are all too stark. So like with methane gas storage, hydrogen storage will also need to be developed and the associated infrastructure built.

CCUS technologies

Each of our interviewees sees CCUS as a key part of the energy transition. It is already a technology which many oil and gas companies (87% of our sample) have been investing in, with Shell's CCS plant Quest storing over 1m tonnes per annum already and Equinor's two plants accounting for 23m tonnes of permanently stored CO_2. However, moving CCUS from its use in enhanced oil recovery to long term storage is somewhat different:

- **Regulation and policy to drive commercial deployment –** tax regimes like 45Q in the US have pushed oil and gas companies to keep the CO_2 in the ground. Similar policy drivers are needed in most other countries.
- **Cross-chain risks –** because CCUS infrastructure involves a number of industries coming to work



together (capture plant, industrial processes, transport network, storage operator), an oil and gas company investing in this sector will need to consider which part of the project it wants to be involved in and due diligence the other parts of the chain that it will be depend on. This is all the more important if revenues in one part of the chain depend on outcomes in an unrelated part of the chain. For this reason, the contractual framework for CCUS requires careful consideration.

— **First mover advantage –** the Global CCS Institute notes that in 2020 there are 51 CCUS facilities globally (19 in operation, four under construction, and 28 in various stages of development) with an estimated combined capture capacity of 96m tonnes of CO_2 per annum. Clearly for the energy transition to revolutionize the planet, far more CO_2 must be captured. However, the first mover advantage gives those companies willing to take the risks, the greater returns and ability to build out the new networks. This seems to be the lesson learnt by companies like Shell who say that building a second Quest project would be 30% cheaper.

Retail and networks

With oil and gas companies like Total becoming major electricity retailers, in this case through the acquisition of Direct Energie in France, using the trading arm of the business to expand into the retail and distribution networks businesses is another trend. How different is this to the core oil and gas business? Some of the points to consider are:

— **Consumer engagement –** unlike core activities such as extraction and processing, a retail energy business is customer facing and requires a solid understanding of consumer protection legislation as well as how to keep consumer's trust (and business). In countries where consumers may choose their supplier, customer services and cost become key to success.
— **Fine margins –** the retail sector traditionally has lower profit margins (exacerbated by entry of challenger market entrants as was seen in the UK).
— **Where the regulatory buck stops –** as the interface between consumers who pay for additional policy measures through their bills and the other parts of the network depending on retailers to ensure their cost recoveries, the regulatory burden lies often with the energy suppliers.

Energy storage

The requirement for storage in an increasingly renewables-driven, intermittent and non-dispatchable energy system is clear. Oil & gas companies have invested in storage in a variety of ways:

— Investments into storage development companies, such as Shell's acquisition of sonnen, the German residential battery storage company in February 2019.
— Investments in storage technology companies, for example, Total owns the battery manufacturer Saft.
— Direct investments in projects, for example, Equinor has developed a co-located battery alongside its Hywind floating offshore wind project and Shell is investing in a utility scale storage project at its Bacton gas terminal site.

Issues to consider when investing in this sector depend on the type of investment, however, common themes include:

— **Technology –** Li-Ion batteries are currently the focus, but there are a number of other technologies with different characteristics, e.g. more suitable for inter-day storage.
— **Revenue streams –** the commercial case for storage projects tend to rely on a revenue stack of system services, capacity services and trading revenues. However, these are jurisdiction and application specific and, as each such market is finite, potentially subject to cannibalisation.
— **Regulatory fit –** global energy markets were not designed with storage in mind and therefore there are various degrees of regulatory uncertainty to address.

Investment decisions

The oil and gas majors in our sample invested approximately 3% of their 2018 capital expenditure into renewables but within that figure there was huge variation from company to company, especially at the regional level.

European oil and gas companies invested an average of 6.2% of CAPEX compared with just 0.8% on average in the rest of the world (including the US). Over the past 15 years Europe has certainly been the leader in renewable investment but since 2012 it has been overtaken by China. Since 2004 Europe has invested USD 960bn and China USD 740bn. By contrast, investment by the US has been USD 470bn.

At one extreme is Spain's Repsol, which had capital investment in renewables amounting to 16.7% of its 2018 CAPEX and at the other is China's CNPC whose investment in renewables amounted to just 0.3% of its 2018 CAPEX. The top five places in the table are currently all taken by European headquartered companies, with Malaysia's Petronas, in sixth place, being the highest-placed non-European company, investing 3.3% of its 2018 CAPEX. The highest placed US major is Chevron in ninth place with just 1.5% of CAPEX going to renewables and diversification investments.

Wind and solar are the most common renewables investments across our sample 14 of the 15 companies have invested in solar and 13 in wind. Only the US's ConocoPhillips has failed to invest in either. Unsurprisingly then, wind and solar together account for 96% of all investment in renewables by oil and gas majors.

By contrast, hydroelectric power has attracted investment from just two of our sample, and geothermal from four. Carbon capture is also a popular destination for investment, with all but two of our sample investing in that technology.

Interview:

Will Webster – *Oil & Gas UK*

Oil and Gas UK is the leading representative body for the UK oil and gas industry. Its members are companies active in the UK continental shelf, and its aim is to strengthen the long-term health of the industry. Will Webster is OGUK's Energy Policy Manager.

"Our assessment of energy transition started by focusing on the impact of new technologies like electric vehicles or the reducing cost of batteries, but now it goes far wider and includes societal demands and meeting broader government objectives," he says.

"This is going to be a decades-long process, industry has spent much of the last year on OGUK's Roadmap 2035 and our sector has much to offer across a range of alternative energies in terms of technology expertise and finance. By 2035 many of our businesses will change significantly and some will be unrecognisable."

Webster sees the view that projections that 80% of global energy consumption in 2040 will still be coming from fossil fuels as a ***"business as usual"*** scenario, rather than being Paris Agreement compliant.

"If you look at the UK, oil and gas now accounts for 75% of primary energy and based on the CCC projections we see that falling to about 50% by 2040 and 33% by 2050. Some – perhaps most – of that remaining contribution will be decarbonised gas."

Against that backdrop, OGUK member companies are following a mix of strategies relating to their core business and non-traditional ventures. The sector's headline diversification efforts have focused on offshore wind, but includes strategies as varied as electric vehicle charging and forestation projects. However, he expects the next frontier to come from carbon capture and hydrogen technologies.

"CCS and hydrogen are adjacent to oil and gas production, and will become very prominent" Webster suggests.

There are a number of factors behind this shift. ***"There is already a financial driver behind emissions reduction, but also an ambition to be best-in-class in terms of carbon intensity. Regulatory pressure is another driver, but there is a real wish to demonstrate that it is part of the solution in order for the sector to retain wider support."***

Continued access to finance is also a consideration. ***"There are increasing pressures on business around disclosure of potential impacts of climate change and related legislation."*** he adds.

The O&G sector still faces the challenge of external scepticism about its commitment to energy transition, although Webster sees that as unwarranted. ***"Although every company is different, they all understand what they need to do to attract employees and investment."*** he argues.

In fact the O&G producers may be among the best-placed organisations to implement the necessary solutions. ***"The engineering capability required is very much in O&G territory and the need to raise capital and invest is what our sector is used to doing. It is very much the same skillset and supply chain, particularly in areas like offshore wind."***

One issue is the requirement to develop a regulatory model in areas such as CCS where contractual frameworks need to be constructed.

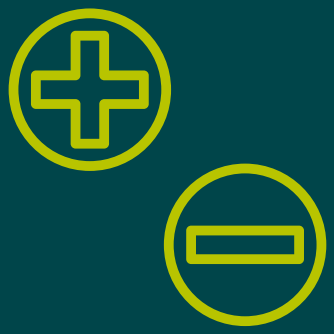
There are also legacy issues to address. Flaring by O&G producers is an emotive subject. According to Webster there are incentives to reduce it, but safety concerns mean it is unlikely to be eliminated. ***"Flaring is covered by emission certificate requirements that are increasingly expensive and that provides a financial incentive to minimise flaring. But there will always be a need for flaring or venting on safety grounds."***

Of course, if the world is going to make the energy transition, the necessary change also needs to come in Asia and Africa and, according to Webster the UK oil and gas sector has a role to play there too.

"Many UK companies are global, and their experience can provide a model for other countries. For example, the UK is a leader in offshore wind and there will be similar opportunities globally. Hydrogen and CCS are essential to the energy transition, and they are ultimately both about processing gases and liquids and putting them through pipelines."

But Webster argues that the real key lies in giving consumers choices that make economic as well as environmental sense.

"We need to offer consumers the choice of low-carbon technologies that offer an equivalent or better, product or service."



What does the future of the oil and gas sector look like?

Many of the oil and gas majors featured in our research have already made significant investments and commitments to diversification into alternative energy portfolios for many years to come.

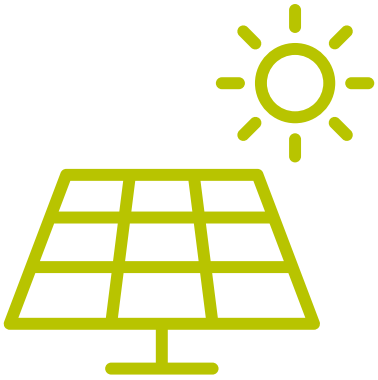
In 2016 Shell announced a new energy investment budget of USD 200m a year, but by December 2018 that figure had risen to USD 4bn a year, equal to 18% of Shell's 2018 annual capital expenditure. Eni's four-year plan is to invest EUR 1.4bn in renewable systems and initiatives by 2022, and Repsol has committed to invest EUR 2.5bn in renewable energies between 2018 and 2022, equal to roughly 17% of that company's annual CAPEX spend.

In the Middle East in particular there are some ambitious targets with the UAE Government launching the "Energy Plan 2050" which aims to dramatically increase the use of "clean" power sources, with the added economic benefit of allowing the UAE to de-risk its exposure to fluctuating carbon based commodity markets. The Energy Plan 2050 has a number of ambitious goals, with much greater emphasis on renewable, nuclear and clean energy sources. It aims to cut carbon dioxide emission by 70% and improve energy efficiency by 40%.

Saudi Arabia is also pushing forward with renewable energy targets for its Vision 2030, it has invited 60 companies that pre-qualified to submit bids for six solar energy projects with a combined capacity of 1.5GW. Successful applicants include 28 companies from Saudi Arabia and global corporations, such as American photovoltaic manufacturer First Solar, as well as China Machinery Engineering Corporation, Korea Electric Power Corporation and Japan's Sumitomo Corporation.

We wanted to look further ahead and put the oil majors' choices into the wider context of future energy demand.

Using International Energy Agency (IEA) data we present two scenarios below for future energy demand. Both have implications for the long-term future of oil companies, as revenue growth from oil either tails off or goes into sharp reverse. Under both scenarios therefore the oil majors will need to consider adapting their business models and investment strategies for the next decade.



Scenario 1:

Existing policies continue

- Forecasts for underlying renewable energy demand based on IEA's 'New Policies Scenario'
- Demand for renewable energy will increase at an annual average rate of 3.6%
- Current investment of our sample of fifteen remains constant, at 2.3% of global investment in renewable energy between 2018 and 2030

Scenario 2:

Rapid energy transition

- Forecasts for underlying renewable energy demand based on IEA's 'Sustainable Development Scenario'
- Demand for renewable energy will increase at an annual average rate of 5.5%
- Current investment of our sample of fifteen gradually increases, from 2.3% of global investment in renewable energy in 2018 to 5.9% of the global share in 2030

Scenario 1:
Existing policies remain a key driver

This scenario incorporates existing policies and announcements and sees oil demand growth slow towards zero by 2040, but remain an important element in overall global energy usage. This scenario sees strong growth in demand for energy, in particular from emerging economies, and low-carbon technologies meeting more than 80% of the increase in global demand.

Under this scenario the demand for renewable energy increases at an average rate of 3.6% between 2018 and 2030. The oil and gas majors are assumed to maintain their current pace of investments as a share of the total investment i.e. 2.3%. The result is an increase in annual investment in renewables to USD 10bn by 2030.

This scenario is assisted by the adoption of new policies within some of the major Asian energy users. For instance, in Korea the Government has undertaken a reform of the energy sector, moving away from coal and nuclear and moving towards renewables and LNG. An ambitious goal of raising the renewable portfolio to 35% by 2040 is in place whereas currently renewables make up less than 10%. This scenario would allow for oil and gas majors to increase investment in energy dependent economies.

Scenario 2:
Rapid energy transition

The 'Sustainable Development Scenario', outlines an integrated approach to achieving internationally agreed objectives on climate change where the energy transition is more rapid. Oil demand begins to contract during the 2020s and the pace of decline accelerates thereafter. The emissions trajectory under this scenario is in line with the long-term objectives of the Paris Agreement and the power sector deploys low-emissions generation faster. Renewables provide the main route to universal energy access on a global scale.

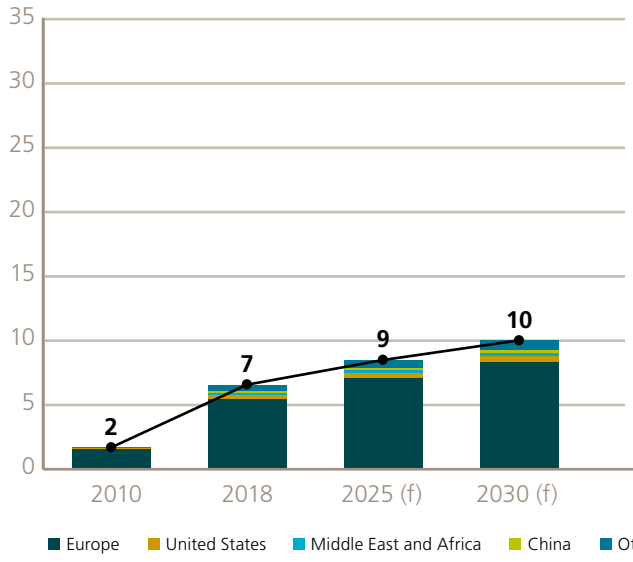
Under this scenario, demand for renewable energy is expected to grow at a much higher average rate of 5.5% per year between 2018 and 2030. Oil and gas majors are also assumed to increase their investment in renewables more rapidly, from the current 2.3% to 5.9% by 2030.

The result is an increase in annual investment in renewables to USD 31bn by 2030.

Our assumption is that most of the European oil and gas majors will have spent roughly 20% of their total capital expenditure on renewables by 2030. We can say that it is very likely that Shell, BP, Total and Repsol will have invested the most in this area by 2030.

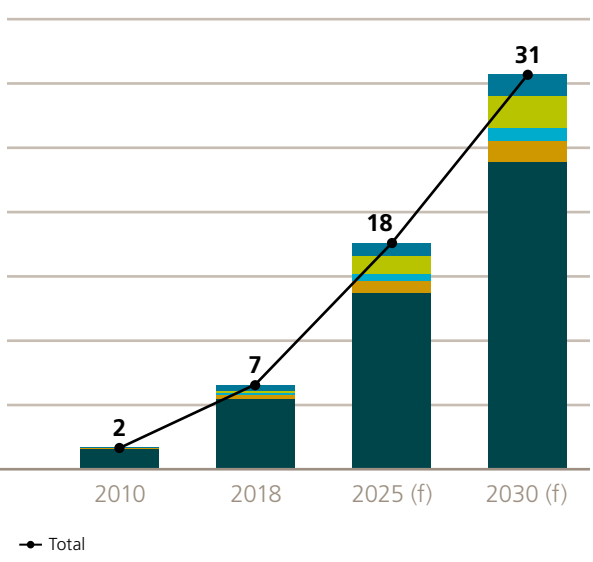
The future pace of renewable investment by oil and gas majors is uncertain, yet even if the energy transition persists at its current pace, the trajectory for future investment is upwards

Total projected investment in renewable energy by sample of 15 major oil and gas companies, under Capital Economics' 'Existing Policies Continue' scenario by country / region (USD bn)



If existing policies regarding investment in the energy transition persist at the current pace, investment in renewable energy by the oil majors could reach USD10bn by 2030. This would be roughly equivalent to 3.2% of their annual budgets

Total projected investment in renewable energy by sample of 15 major oil and gas companies, under Capital Economics' 'Rapid energy transition' scenario by country / region (USD bn)



If oil and gas majors ramp up their commitment to the energy transition, their total investment in renewables could reach almost USD 31bn by 2030, equivalent to 10.0% of their total capital expenditure on average

Sources: Capital Economics, International Energy Agency and individual company reports

Interview:

Joanna Coleman – *Shell*

Shell is an international energy company that aims to meet the world's growing need for more and cleaner energy solutions in ways that are economically, environmentally and socially responsible. Jo Coleman is its UK-based Energy Transition Manager.

"Shell has three strategic ambitions, and one of them is thriving through the energy transition," says Coleman. ***"The others are building a world-class investment case and having a strong societal licence to operate. Arguably, thriving through the energy transition is essential to them as well."***

In terms of the group's business, what has changed over the past ten years? ***"There has been a shift from being oil dominated to more heavily invested in gas,"*** says Coleman. ***"Then, post 2016 Shell launched a New Energies business. We would ultimately like to see the power component of that grow to the scale of our oil and gas businesses today."***

Within ***"New Energies"*** the group is focusing on electrification and new fuels. ***"A successful energy transition requires the electrification of end-use demand to rise from about 20% currently to at least 60% of the energy system. That affects transport, home heating and industry,"*** she explains.

Asked about the view that 80% of demand will still be met through fossil fuels in 2040, Coleman responds: ***"Well I hope that's wrong! Shell aims to play its part and contribute to the global effort to tackle climate change and meet the goal of the Paris Agreement. One way is to help customers choose lower-carbon options."***

Energy transition certainly impacts the traditional business, reducing O&G emissions and changing the chemicals business. Shell has had emissions reduction and intensity targets for a long time, and the focus now is on reducing the intensity of methane emissions to below 0.2% by 2025.

Some of the change comes from process improvements in areas like chemicals and O&G production, for example replacing high-bleed, pneumatically operated controllers with low-emission alternatives, as well as using infrared cameras to scan for methane emissions. Shell is also trialling producing hydrogen from renewable electricity at its Rhineland refinery rather than solely relying on unabated natural gas.

Shell's investments in electrification include wind power in the Netherlands and the US, and it is looking to enter the UK wind market. Following its entry into the home energy retail market in 2018 it is supplying all customers with 100% renewable electricity. A newer development is the launch of PassivSystems of B-Snug, a hybrid heat pump for homes which currently use oil or LPG that will reduce emissions and bills.

Electrification also extends to new fuels, with Shell Recharge providing 50kW and 150kW charge-points on garage forecourts, and Shell-owned NewMotion offering smart-charging to homes and businesses. Interest in hydrogen is growing for industry and home heating and it is increasingly used in transport. There are three Shell hydrogen refuelling stations around London, and in the US California already has trials of hydrogen heavy-duty vehicles.

The group's commitment to energy transition extends to nature-based solutions such as forestation projects. A project was launched earlier in 2019 in the Netherlands that allows customers to offset their fuel emissions by investing in nature, and in October this was extended to UK customers using the Shell Go+ app.

But, for Coleman, the biggest challenge is the lack of an economy-wide carbon price.

"Electric vehicles only make sense because of the high fuel duty on petrol and diesel – in effect a proxy for a carbon price. We need to get the balance between carrot and stick right. In the same way, industrial decarbonisation needs an incentive and protection against higher carbon imports. Over time we should see that subsidies will drive down costs as deployment increases – basically what we have seen with offshore wind."

Coleman sees CCS as part of the solution globally. Shell's Canadian CCS plant Quest stores over 1 million tonnes per annum, and the company has learnt a lot: ***"If we built the same thing again it would be about 30% cheaper,"*** says Coleman. In the UK the group is working with partners on CCS projects to decarbonise industry as well as produce clean power and hydrogen on Teesside and in Scotland. It is also working with industry and the government to deliver a commercial framework and policy.

"The technology works. Now it's about regulation and policy to drive commercial deployment," says Coleman.

The UK is home to many of Shell's energy transition projects. ***"It's a market that we know well and the UK has strong ambitions, so it is a good place to deliver solutions. It needs tangible policy steps and 2020 will hopefully see more of these put into place."***

But the group is also proud of its role in energy transition outside its home markets. ***"Our Energy Access Programme aims to bring access to reliable energy for 100 million people by 2030. We are working with small-scale companies that are already active, such as Husk Power Systems in India and SolarNow in East Africa, and which we can help to scale up. It's very much proven technology in new markets, such as decentralised solutions, solar and mini-grids."***

Challenges to the transition

Despite now being firmly on the agenda for many oil and gas majors, there are many challenges that can dissuade them from investing in renewables and alternative portfolios, and which make such investment decisions potentially more difficult and / or less profitable.

Changing the regulatory environment and tighter standards

The fact that the regulatory environment is changing so quickly is a problem for oil and gas majors adapting to the energy transition. They have to contend with the introduction or removal of subsidies, and new or different targets for clean energy and emissions, all varying from country to country.

Often this scenario is exacerbated in many developing economies that instigate laws and regulations that are either not supported through implementation, are able to be challenged by individual government authorities or are changed without any due thought or process. For instance, in Indonesia, the revocation of regulations that were designed to encourage investment in renewables have left renewable investors with a degree of uncertainty around the economic viability of certain projects.

Competition from incumbents and others trying to enter new energy markets

In the renewables arena the oil and gas majors face a large number of competitors, including established companies such as electricity generators and new companies. For example, the big utility companies – along with Equinor – are the main operators of offshore wind in the North Sea.

Renewable technologies have challenges

Renewables are often intermittent e.g. wind power only generates electricity when the wind is blowing; solar power when the sun is shining. Diversification into these areas poses new challenges for oil and gas companies, and often requires additional investment in the technologies necessary to effectively manage the energy generated by renewables e.g. for storage.

Changing technologies

The pace of technological advancement means that there is still considerable uncertainty about which technologies will emerge as the winners. A decade ago BP invested heavily in wind and solar only to discover that they quickly became outdated and the company had to write-off those investments. BP shut down its

separate alternative energy headquarters in London in 2009. The company also closed a range of solar power manufacturing plants in Spain and the US as the then BP CEO, Tony Hayward, publicly questioned whether solar could ever become competitive with fossil fuels.

Uncertainty of returns

The pace of technological change, number of competing interests, and changing government regulations all combine to create uncertainty about the scale of future returns on many investments in renewables. This makes such investment a challenge for oil and gas companies' accustomed with a different business model, who are used to greater certainty from technologies that they understand, fewer competitors and a more stable regulatory environment.

Practical issues

Some countries have practical problems to face. For example, electric vehicles face challenges in Brazil considering the distances involved and the poor quality of many roads and electricity distribution systems.

Even technology driven countries such as Singapore face practical issues for instance, whilst there is a push for electric vehicles there is a lack of or an insufficient number of recharging points in apartment blocks to service such vehicles. For oil and gas companies they are venturing into new areas which they do not know as well as their core expertise and focus, therefore requiring additional expert advice.

Conclusion

Although the global energy system has been transformed several times over the last two hundred years, we are experiencing a new wave that combines the dawn of new (renewable) energy sources with consumer led pressure to reduce greenhouse gas emissions and mitigate the adverse impacts of climate change.

However, before banishing the best days of the oil and gas industry to a nostalgic past, we must take an honest look at what the industry is doing to respond to the existing landscape. Oil and gas will continue to play an important but decreasing part in the energy mix for decades to come and the oil and gas majors must respond as to how quickly they will transition themselves into broader energy companies.

In this report we have identified just some of the key ways in which the oil and gas majors we have focused on are adapting. Not all will take the same path or proceed as the same pace. We have also identified the characteristics that allow some to be more nimble than others.

They all share a key characteristic. One of the greatest strengths of the oil and gas industry has been its ability to think and plan long-term. With the average lifespan of an oil field at 30–40 years, that is the time period this industry is comfortable dealing with. This means that oil and gas companies are currently planning for well into the middle of this century and while the day to day details may require dynamic shifts, the strategic thinking that underpins the decisions being made today is undertaken with the long-term goals in mind. This strategic approach to thinking about future challenges and opportunities is what makes this energy transition exciting for those in the oil and gas sector as well as those welcoming oil and gas majors into their new and growing areas and technologies. Combining the start-up drive and enthusiasm with the long-term experience and clout of the established players is where the next successes for the energy sector will happen, and, hopefully, still address the important questions around mitigating the adverse impacts of climate change.

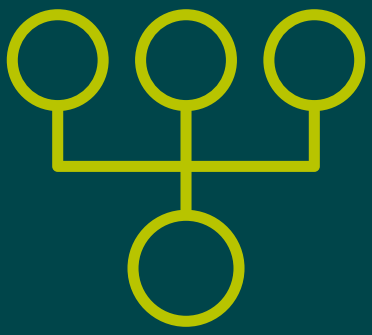
As we said at the start, the oil and gas companies can de-carbonise their own operations and look to investment in alternative energy, but we and society as a whole must play a role. We are all reliant on hydrocarbons in every aspect of our lives, not just in relation to energy and, for many, an economic case also needs to be made before they agree to play a full part in transition. How we transition our habits matters just as much.

Methodology

CMS commissioned Capital Economics to assess the significance of the major oil and gas companies diversifying into renewables, and to provide economic analysis to assess the outlook for investment by these oil and gas companies in the energy transition globally.

Our report and findings are based in part on an extensive literature review, which includes a review of individual company reports, financial statements and the stated strategies of our sample of fifteen oil and gas majors. In addition, we drew on respected public sources to inform our views on the current state of, and future longer-term trends in, the global energy mix including the International Energy Agency (IEA), BP, and the International Renewable Energy Agency (IRENA). We also used data from the World Bank and the United Nations to help underpin our regional economic analysis.

Our forecasts for the outlook of investment in renewable energy are underpinned by two scenarios put forth by the International Energy Agency (IEA). We used our analysis of the current levels of investment in renewable energy by our sample of fifteen major oil and gas companies, as well as assumptions regarding the speed of transition, to generate plausible projections for future diversification.



About CMS

CMS is a top six global law firm, with 70+ offices in 40+ countries. With a global team of over 4,800 lawyers, we have world-class bench-strength. CMS boasts one of the leading energy groups, advising on some of the largest and most complex energy projects across the globe. Our sector expertise means we have the ability to work with clients at all stages of their lifecycle. We produce regular cutting-edge sector reports. To access these please visit https://cms.law/en/gbr

The Americas

Bogotá
Lima
Mexico City
Rio de Janeiro
Santiago de Chile

Europe

Aberdeen
Amsterdam
Antwerp
Barcelona
Belgrade
Berlin
Bratislava
Bristol
Brussels
Bucharest
Budapest
Cologne
Duesseldorf
Edinburgh
Frankfurt
Funchal
Geneva
Glasgow
Hamburg
Istanbul
Kyiv
Leipzig
Lisbon
Ljubljana
London
Luxembourg
Lyon
Madrid
Manchester
Milan
Monaco
Moscow
Munich
Paris
Podgorica
Poznan
Prague
Reading
Rome
Sarajevo
Seville
Sheffield
Skopje
Sofia
Strasbourg
Stuttgart
Tirana
Utrecht
Vienna
Warsaw
Zagreb
Zurich

Algiers
Casablanca
Johannesburg
Luanda
Mombasa
Nairobi

Africa

Dubai
Muscat
Riyadh

Middle East

Beijing
Hong Kong
Shanghai
Singapore

Asia-Pacific

C/M/S/ Law-Now™

Law . Tax

Your free online legal information service.

A subscription service for legal articles
on a variety of topics delivered by email.
cms-lawnow.com

CMS locations:
Aberdeen, Algiers, Amsterdam, Antwerp, Barcelona, Beijing, Belgrade, Berlin, Bogotá, Bratislava, Bristol, Brussels, Bucharest, Budapest, Casablanca, Cologne, Dubai, Duesseldorf, Edinburgh, Frankfurt, Funchal, Geneva, Glasgow, Hamburg, Hong Kong, Istanbul, Johannesburg, Kyiv, Leipzig, Lima, Lisbon, Ljubljana, London, Luanda, Luxembourg, Lyon, Madrid, Manchester, Mexico City, Milan, Mombasa, Monaco, Moscow, Munich, Muscat, Nairobi, Paris, Podgorica, Poznan, Prague, Reading, Rio de Janeiro, Riyadh, Rome, Santiago de Chile, Sarajevo, Seville, Shanghai, Sheffield, Singapore, Skopje, Sofia, Strasbourg, Stuttgart, Tirana, Utrecht, Vienna, Warsaw, Zagreb and Zurich.

---

cms.law