# Consensus Forecasts on Long-Term Demand for Fossil Fuels

December - 2021


The Al-Attiyah Foundation

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# INTRODUCTION

## CONSENSUS FORECASTS ON LONG-TERM DEMAND FOR FOSSIL FUELS

As the world begins to recover from the COVID-19 pandemic, a fundamental change is unfolding in the global energy system. Climate policy and advancing energy technologies are having an increasing impact alongside the short-term pandemic impacts and the usual long-term effects of economic growth and demographics. However, some agencies' scenarios estimate little to no change in energy demand trajectories and mix, whereas others project a significant change.

How do long-term projections compare between the world's leading energy institutions? What is the impact on long-term demand for oil and gas according to their assessment?

Energy Industry Report

This research paper is part of a 12-month series published by The Al-Attiyah Foundation every year. Each in-depth research paper focuses on a prevalent energy topic that is of interest to The Foundation's members and partners. The 12 technical papers are distributed in hard copy to members, partners, and universities, as well as made available online to all Foundation members.

# EXECUTIVE SUMMARY

- Most reference and evolutionary scenarios forecast global primary energy demand to peak by 2050, whereas energy transition scenarios project demand to peak earlier, by 2030. As per most scenarios, fossil fuel consumption in 2040 is similar to, and in some scenarios higher than 2019 levels. In contrast, energy transition scenarios estimate demand for fossil fuels to have declined dramatically by 2040, with the exception of gas.
- Long-term oil demand will continue to be driven by the transport sector. However, regulatory policies and technological advancements that accelerate electrification will pose a significant and increasing risk to global oil consumption.
- Reference scenarios estimate a peak in oil demand of 99 Mbbl/d – 100 Mbbl/d by 2040, mainly led by road, shipping and aviation, due to the slow electrification of these segments and gradual uptake of alternative liquids. Whereas, evolutionary scenarios project a peak demand of 97 Mbbl/d – 103 Mbbl/d by 2030.
- Energy transition scenarios have assessed oil demand to have peaked in 2019 after which demand will gradually decline up to 2050, encouraged by new technological advances in the transport sector and ongoing changes in mobility.
- Long-term gas demand will be led by regulatory policies that encourage coal-to-gas switching in the industrial and power sector across Asia. Gas faces stiff competition from alternative fuels such as hydrogen, and renewables. However, the long-term role of gas could be extended through the deployment of carbon capture, use and storage (CCUS) in the industrial and power sector.
- Gas consumption was about 3.9 TCM in 2019. Reference scenarios project gas demand to peak between 4.6 TCM – 5.1 TCM/y by 2045, mainly driven by the power sector in North America, the Middle East, and the CIS, in addition to demand from the industrial sector across South Asia, China, and Southeast Asia. Whereas, evolutionary scenarios project an earlier peak in 2040. Energy transition scenarios forecast peak gas demand of 4.1 TCM between 2030 – 2035, after which it begins to decline as a result of increasing electrification and renewable generation.

- Long-term coal demand is increasingly under pressure from climate focused regulatory policies, coal-to-gas switching policies, and renewables. The outlook for coal is dependent on whether demand growth in the power and industrial sectors across Asian emerging markets will be able to offset decline in developed markets. China and India will play an essential role in determining its future.
- Coal demand during 2015-19 hovered around 157 EJ/year. Reference scenarios forecast long-term coal demand to decline to between 118 EJ – 131 EJ in 2050, whereas evolutionary scenarios forecast demand to reach between 87 EJ - 100 EJ in 2050. In 2020, coal demand decreased by 4% YoY and according to most energy transition scenarios, this trend will continue until 2050, but it may have been a temporary pandemic-induced blip given that coal demand rebounded strongly in 2021.
- Across all scenarios, the decline in long-term demand for coal will be led by the industrial and power sectors across China, North America, and Europe. However, a much wider range of outcomes is projected in India and other Asian emerging markets. Evolutionary scenarios estimate India's coal demand to peak in 2035, after which it is projected to decline until 2050, due to declining use in the power sector.

# INTRODUCTION

The global energy sector is at an important stage. Global markets continue to be pressured by the weight of the COVID-19 pandemic; new energy sources such as renewables, low-carbon gases, and alternative liquids continue to grow rapidly. The energy sector is more interconnected and greener than ever, and continues to be so through new technological advancements that are changing energy consumption patterns across various sectors, industries, and geographies.

In every analysis, estimation, and projection, the speed of change in the energy sector is counteracted by the stubbornness of the status quo. At the same time, the rapid and uneven economic recovery from the COVID-19 pandemic is putting major strains on parts of the global energy sector, with rising prices of gas, coal, and electricity.

Despite the increasing penetration of renewable and electrification of transport, 2021 saw a large rebounds in fossil fuel (oil, gas, and coal) consumption. And for this reason, this year also saw the second largest increase in global $CO_2$ emissions in history.

The pressure to change the global energy system will increase in the coming decades. The energy sector is responsible for ~75% of the global $CO_2$ and other greenhouse gas (GHG) emissions, which have already pushed global temperatures $1^{o}C$ higher since the pre-industrial age[i].

The energy sector is at the heart of the solution to climate change; however, various fuel sources are inseparable from the livelihoods and aspirations of the world's population, which is projected to increase by 2 billion in 2050[ii]. Combined with rising incomes this will push demand for energy services higher, forcing frontier and emerging markets economies to navigate the energy transition from what has historically been an energy and emissions-intensive century.

Long-term energy projections vary based on their underlying assumptions, methodologies, and modelling techniques. This paper provides an apple-to-apples comparison of 16 different projections from various energy companies, industry and research institutions; and analyses the full scope of changes to the global energy sector.

Throughout the paper we use a consistent category system, which sorts projections under three different scenarios:

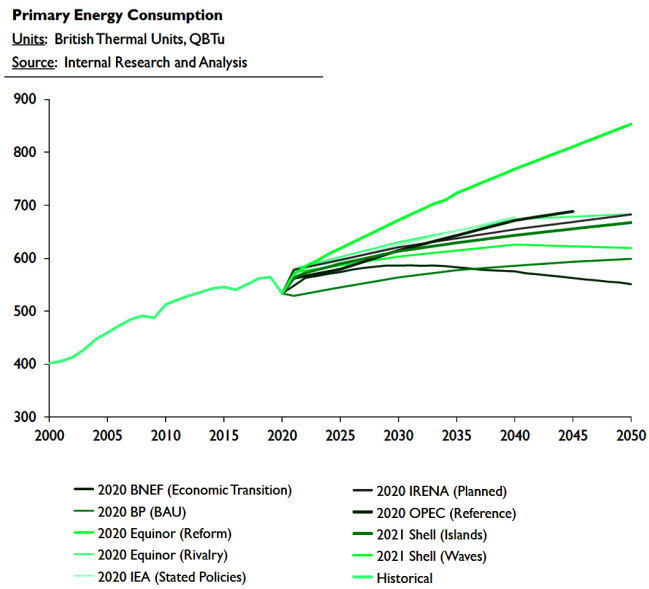
- Reference scenarios: assume limited or now new regulatory policies. These scenarios include OPEC (Reference), Equinor (Rivalry), BP (BAU), BNEF (Energy Transition)
- Evolutionary scenarios: take into account new polices and technologies according to ongoing recent developments. These scenarios include IEA (Stated Policies), IRENA (Planned), Equinor (Reform), Shell (Waves), and Shell (Islands)
- Energy Transition scenarios: are devised to take into account limiting global temperature rise below $1.5^{o}C$ - $2^{o}C$. These scenarios include IEA (SDS), IEA (NZE), IRENA (Transforming), Equinor (Rebalance), BP (Rapid Transition), BP (Net Zero), and Shell (Sky 1.5).

Global primary energy consumption currently stands at 557 EJ/y and has increased by 2% / year between 2009 – 2019, before declining by 4% YoY in 2020[iii]. The COVID-19 pandemic is expected to have a lasting impact on long-term energy demand, partly by reducing global economic output, and partly due to long-term changes in consumption patterns and mobility.

Global mobility and transport were the hardest hit during the pandemic. Energy demand, specifically for fossil fuels, continues to be affected by remote working, restrictions on business travel, lockdowns curtailing mobility, flight bans and restrictions, and the slow resumption of mass tourism. Nevertheless, demand for transport fuels other than aviation kerosene is already equal to or higher than pre-pandemic levels.

Reference, evolutionary, and energy transition scenarios, including their individual projections, envision a wide range of futures for energy consumption, which is also dependent on their respective population and GDP projections.

Figure 1 Long-Term Primary Energy Demand by Reference and Evolving Scenarios




| Table 1 Selected Population Projections | | | | |
|---|---|---|---|---|
| Scenarios | | 2030 | 2040 | 2050 |
| Reference and Evolutionary Scenarios | OPEC (Reference) | 8.5 bn | 9.1 bn | |
| | BP (BAU) | 8.5 bn | 9.1 bn | 9.6 bn |
| | BNEF (Energy Transition) | 8.4 bn | 9.1 bn | 9.6 bn |
| | IRENA (Planned) | 8.3 bn | | 9.3 bn |
| | Shell (Waves) | 8.5 bn | 9.4 bn | 9.7 bn |
| | Shell (Islands) | 8.5 bn | 9.1 bn | 9.7 bn |
| Energy Transition | IEA (NZE) | 8.5 bn | 9.1 bn | 9.6 bn |
| | IRENA (Transforming) | 8.3 bn | | 9.3 bn |
| | BP (Rapid Transition) | 8.5 bn | 9.1 bn | 9.6 bn |
| | NP (Net Zero) | 8.5 bn | 9.1 bn | 9.6 bn |
| | Shell (Sky 1.5) | 8.5 bn | 9.1 bn | 9.7 bn |

| Table 2 Selected GDP Projections (at Market Exchange Rate) | | | | |
|---|---|---|---|---|
| Scenarios | | 2030 | 2040 | 2050 |
| Reference Scenarios | Equinor (Rivalry) | US$ 122 trillion | US$ 147 trillion | US$ 172 trillion |
| | BNEF (Energy Transition) | US$ 113 trillion | US$ 154 trillion | US$ 204 trillion |
| Evolutionary Scenarios | IRENA (Planned) | US$ 150 trillion | | US$ 272 trillion |
| | Equinor (Reform) | US$ 125 trillion | US$ 155 trillion | US$ 188 trillion |
| Energy Transition | IRENA (Transforming) | US$ 152 trillion | | US$ 178 trillion |
| | Equinor (Rebalance) | US$ 124 trillion | US$ 152 trillion | US$ 185 trillion |

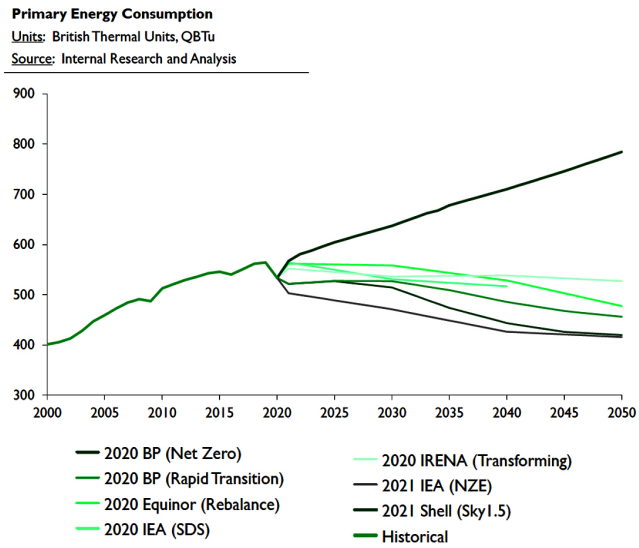
Reference and evolutionary scenarios such as IEA (Stated Policies), OPEC (Reference) and Equinor (Rivalry) forecast primary energy demand to increase to 550 EJ/y by 2050, mainly driven by improvements in energy intensity[iv]. In addition to this, these scenarios estimate global economic growth and energy demand to return to pre-pandemic levels by 2022.

# INTRODUCTION

Demand is expected to increase by 0.5% / year before peaking in 2040, after which is begins to decline by 0.3% / year till 2050[v].

In terms of energy transition scenarios, the IEA (SDS) and Equinor (Rebalance) project primary energy demand to peak around 434 EJ/y in 2030[vi]. In contrast to reference and evolving scenarios, demand growth will be muted because of decarbonisation and green initiatives. Between 2030 – 2050, demand will gradually decline by 0.7% / year till 2050.

Figure 2 Long-Term Energy Demand by Energy Transition Scenarios




As per most reference and evolutionary scenarios, fossil fuel consumption in 2040 is similar to, and in some scenarios higher than 2019 levels. Whereas, energy transition scenarios, estimate demand for fossil fuels to decline dramatically, with the exception of gas, which is the only fossil fuel that grows across most of the scenarios, including some ambitious energy transition scenarios. Renewable energy sees substantial growth across all scenarios, particularly in aggressive decarbonisation scenarios.

Despite the regional variation in demand, the long-term demand for coal is projected to decline across all scenarios.

Long-term demand for gas is projected to increase by 35% - 50% under various reference and evolving scenarios. However, as per different energy transition scenarios, its demand varies significantly by 2040.

Long-term demand for oil increases modestly across most reference and evolving scenarios; however, in most energy transition scenarios, oil demand declines by 20% or more by 2040.

Almost all scenarios forecast an increase in power generation by 2040. In some energy transition scenarios, the electrification of industries, such as transport and heating will lead to higher levels of power generation. In other scenarios, gains in energy efficiency will result in low levels of demand. Fossil fuels continue to account for a significant portion of the global power mix across most reference and evolving scenarios by 2040.

Coal use in the power sector remains constant across most scenarios, whereas oil use approaches zero across most by 2040. In contrast to oil, demand for grows considerably across most reference and evolving scenarios. Energy transition scenarios estimate fossil fuels, mainly coal to significantly diminish by 2040.

# CONSENSUS FORECASTS ON LONG-TERM GLOBAL DEMAND FOR OIL

Throughout the 20th century, oil has been the world's leading source of energy, taking over from coal at the end of 19th century. Its future demand trajectory will be determined by consumer lifestyle choices, technology changes, and regulatory policies, which will eventually determine its use in the transport and the refining industry.

In 2020, the COVID-19 pandemic caused a historic crash in global demand that did not last very long. Despite the absence of major policy changes from OPEC+ producers combined with rapidly changes in consumer behaviour, global oil demand may continue to increase for years to come.

However, in terms of petroleum products, demand may return to pre-pandemic levels as fuel efficiency gains and the increasing penetration of electric vehicles continues to capture robust growth in mobility across emerging markets. Regardless of regulatory initiatives that limit the use of plastics and encourage the development of a circular economy, demand for petroleum products may continue to grow in the future. In terms of geography, emerging markets continue to dominate petroleum products consumption, in comparison to developed markets, where increasing vehicle use, and per capita consumption is much higher.

Over the coming years, OPEC+ producers from the Middle East will lead the growth in global supply, mainly through expanding production capacities. In the future, the Middle Eastern OPEC+ producers may recover their lost supply market share, which would be a significant shift from the last five years, when the United States dominated global oil supply.

Global oil consumption currently stands at 88 Mbbl/d, which accounts for 31% of the global energy mix. Historical consumption has increased by 1.5% / year between 2009 – 2019, after declining sharply by 9% YoY in 2020[vii].

In 2021, oil markets have experienced a robust recovery in demand but continue to face an upside risk from high levels of uncertainty posed by the COVID-19 pandemic. Demand could peak earlier than pre-2019 projections, given the increasing focus of regulatory policies on renewable energy; and if changes in consumer choices and mobility trends produced by the COVID-19 pandemic become well established.

Despite a strong rebound in oil consumption in 2021, this hasn't led to a vis-a-vie increase in investments in new supply infrastructure. Upstream expenditure has increased by 8% YoY to US$ 350bn in 2021 but remains well below the pre-pandemic levels[viii]. The balance of investment across the upstream segment is slowly shifting towards state-owned companies.

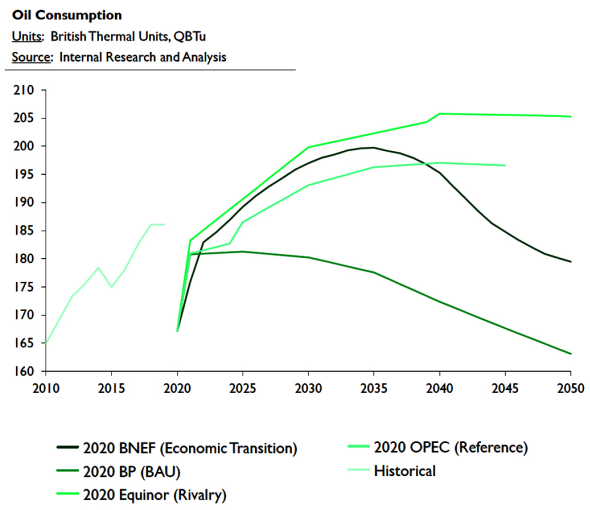
IOCs are under pressure from their shareholders to diversify their capital expenditure plans in order to mitigate the liability risk from a permanent decline in oil prices, in contrast to NOCs such as ADNOC and Saudi Aramco that are betting on expanding their upstream production. The differences in outlook by upstream producers will present a new set of challenges for the oil & gas value chain and will effectively test each players' projections and positions in the long-term.

Given the diverse range of analysis, there is a consensus among most scenarios that the volatility and decline observed in 2020 will

be short-lived. Oil demand will continue to be driven by the transport sector. However, if regulatory initiatives materialise, such as fuel efficiency standards, and efficiency improvements through the accelerated electrification of transport, then long-term demand could become less significant, mainly for light-duty, passenger vehicles, and rail transport.

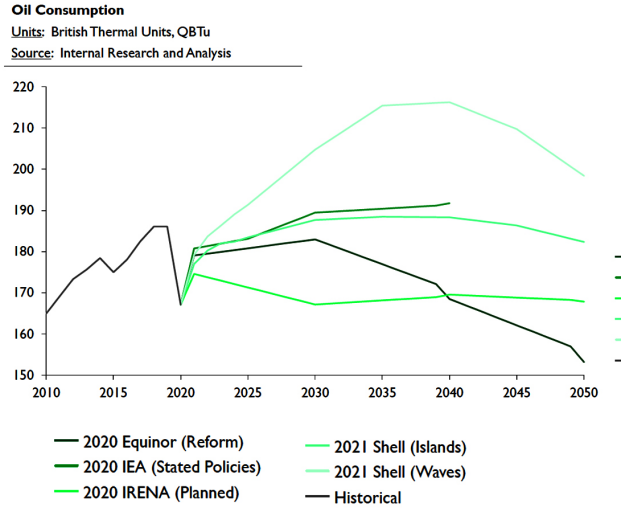
In addition to this, demand will likely persist in the long-term for oil and petroleum products used by heavy-duty vehicles, shipping, aviation, and the refining industry given their comparative advantages to alternative liquids. At the same time, demand growth will be driven by emerging markets, compared to developed markets that will experience a decline in consumption levels over the next decade.

Figure 3 Global Long-Term Demand for Oil by Reference Scenarios




Reference scenarios such as OPEC Reference, Equinor (Rivalry), and BNEF (Economic Transition) estimate a peak demand of 99 Mbbl/d – 100 Mbbl/d by 2040[ix]. The growth in demand will be led by road, maritime, and aviation transport, combined with the slow electrification of these segments and slow uptake of alternative liquids. At the same time, these projections assume a slow penetration of battery storage technologies and forecast electric vehicles to overtake internal combustion engines by 2040. Across these scenarios, oil demand is predicted to flatten by 2050 at a consumption level that is much higher than today without showing signs of a future decline.

Figure 4 Global Long-Term Demand for Oil by Evolutionary Scenarios

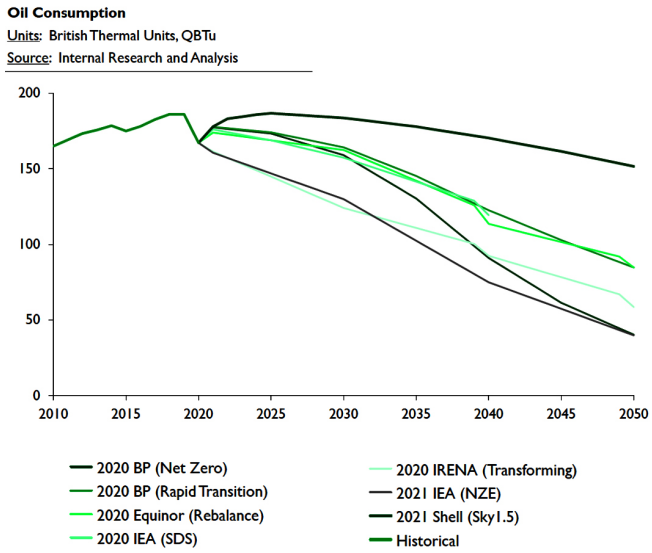



Evolving scenarios project an earlier peak in demand, with Shell (Waves) forecasting oil demand to peak to 97 Mbbl/d by 2030 and the IEA Stated Policies forecasting demand to peak to 103 Mbbl/d by 2030[x]. Demand for oil in the road transport increases to 6 Mbbl/d[xi], and the shipping, aviation, and refining sector will collectively consume 8 Mbbl/d. With demand flattening by mid-2030s it begins to decline very slowly leading into 2050.

Energy transition scenarios such as the IEA (SDS), Equinor (Rebalance), BP (Rapid Transition), and BP (Net Zero) have concluded oil demand peaked in 2019 and will gradually decline to 24 Mbbl/d – 47 Mbbl/d by 2050[xii]. The decline in demand will be driven by new

technological advances, which will encourage the ongoing changes in mobility and lead to significantly lower consumption of oil in the transport sector.

Figure 5 Global Long-Term Demand for Oil by Energy Transition Scenarios




Shipping and aviation operators will increasingly adopt alternative fuels, battery storage technologies, and digitalised systems in order to decarbonise their operations. Global efforts to tackle $CO_2$ and GHG emissions will lead to widespread efforts to reduce oil consumption; however, long-term demand by both industries is estimated to remain flat between 2020 – 2030.

Biofuels, LNG, and synthetic fuels from hydrogen are the main alternatives to marine and aviation fuel consumption in the shipping and aviation sector. Despite regulatory standards such as ICAO-CORSIA and IMO 2020 encouraging the use of alternative fuels, these standards have had a limited impact on their uptake in both sectors.

Currently, ~2% of the global liquids demand is met by conventional and advanced biofuels, and hydrogen-based fuels, the remainder being met by oil and natural gas liquids[xiii]. As more countries announce their net-zero targets and renew their climate pledges, the use of non-petroleum liquid fuels will grow.

However, demand will continue to be strong in the refining and petrochemical sector, which produces plastics and various other materials used in the production of vehicles and other industrial goods. Energy transition scenarios estimated refinery consumption to average 38 Mbbl/d by 2050.

Although the world seems to be moving somewhere between the reference and evolutionary scenarios, in the short-term there are strong forces pointing towards the energy transition scenarios, given with recent net-zero announcements by various countries at COP26. Depending on which pathway unfolds, oil and petroleum products will continue to be consumed in the future. This will encourage new investments in oil production, in order to mitigate the natural decline in oil producing fields.

In summary, there is a consensus across most scenarios, that future demand for oil will continue to be driven by the transport sector. Regulatory policies and technological advancements that accelerate the electrification of the transport sector pose a significant risk to oil demand. Despite demand for oil and petroleum products being stable in the long-term for shipping and aviation, there sectors too will face a growing policy-led challenge from alternative liquids such as biofuels and synthetic fuels made from hydrogen.

# CONSENSUS FORECASTS ON LONG-TERM GLOBAL DEMAND FOR GAS

Gas is the fastest growing fossil fuel today, accounting for 27% of the global energy mix[xiv] and 23% of the global electricity mix. The fuel source will continue to provide environmental benefits compared to oil and coal, specifically in terms of lower air pollutants at the point of use, and limiting global $CO_2$ emissions.

Gas markets are more globalised than ever, given the availability of unconventional gas (mainly tight and shale gas, and also coal-bed methane in some areas) and the flexibility of linking markets via LNG. As global trade increases, regional gas markets have become more interconnected, resulting in demand / supply shocks in one region impacting markets in other, which creates new supply security considerations for regulators.

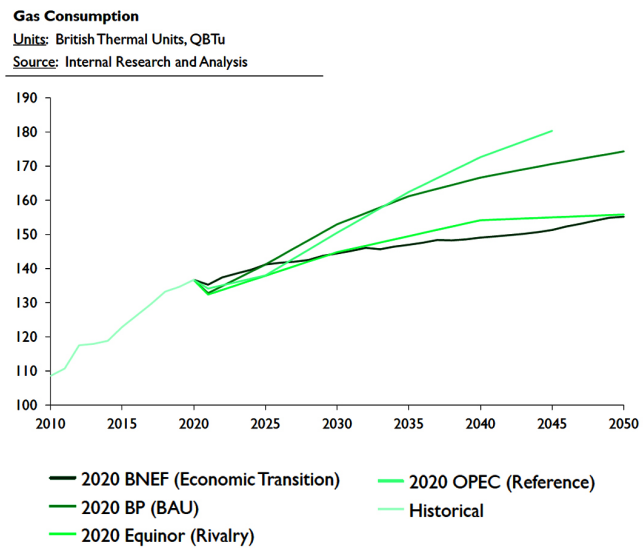
Global gas consumption currently stands at 3.8 TCM[xv]. Between 2009 – 2019, consumption increased by 3% / year, and declined by 2% YoY in 2020[xvi]. The decline was mainly concentrated in the first half of 2020 because of exceptionally mild weather across most regions and the COVID-19 outbreaks[xvii]. This was also the largest decline in annual consumption after 2009.

The record high gas prices observed in 2021 have highlighted the importance of gas as a clean fuel. Despite the diverse scenarios, there is a consensus that long-term demand will be driven by regulatory policies that encourage coal-to-gas switching policies in the industrial and power sector across South Asia, China, and Southeast Asia, in addition to the continuation of that trend in Europe and North America.

In the Middle East, gas continues to replace oil in the few remaining markets where oil-fired power generation is still significant (Saudi Arabia, Iraq and Kuwait), having in recent years largely displaced oil in Iran and Egypt. A few smaller markets such as Lebanon and Cyprus might also replace oil when pipeline gas or LNG becomes available. In Africa, newly developed gas in countries such as Tanzania, Senegal, Ghana, Côte d'Ivoire and Mauritania has replaced or will replace remaining oil generation, albeit this is small on a global scale.

At the same time, gas faces a stiff competition from renewable generation, with the latter currently accounting for 12% of the global power mix, with generation increasing by 15% / year between 2010 – 2020[xviii]. Conversely, the long-term role of gas in the global energy mix could be prolonged through the deployment of carbon capture, use, and storage (CCUS) in the industrial and power sectors. CCUS may also dampen the threat to long-term gas demand from low-emission fuels such as green hydrogen (i.e., produced from renewables), by encouraging the supply of blue hydrogen (i.e., produced from gas). Residential gas supply, particularly in North America and Europe, is also threatened by decarbonisation policies to convert heating to electricity. A blend of hydrogen (blue and/or green) and renewable natural gas (RNG) is an alternative for some situations.

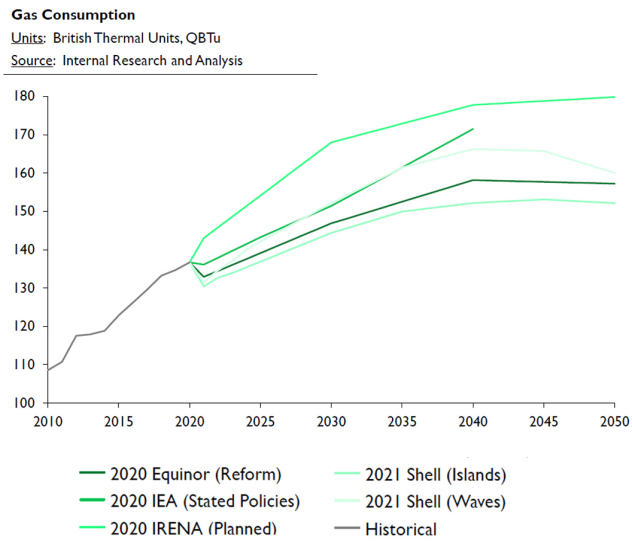
Figure 6 Global Long-Term Demand for Gas by Reference Scenarios




There is also a consensus among all forecasts that gas, which is well suited for high-temperature heat production in the industrial sector, will be challenged from electrification in space heating. In addition to coal-to-gas switching policies, growth in demand across Asian markets will be dependent on affordability, the development of new supply infrastructure, and new policies that encourage improvements in air quality and climate change mitigation. Almost all energy transition scenarios highlight the risk to gas markets from the adoption of low-emission fuel sources such as synthetic gas, biomethane (RNG), and hydrogen that could replace conventional gas.

Reference scenarios such as BNEF (Economic Transition), OPEC (Reference), and Equinor (Rivalry) forecast global demand to peak between 4.6 TCM – 5.1 TCM by 2045. The increasing demand will be mainly driven by coal-to-gas switching in the power and industrial sector across South Asia, China, and Southeast Asia. China will experience 4% / year increase in demand between 2020 – 2040, which will further drive demand for LNG and piped gas supply[xix]. After 2040, gas demand is projected to slightly decline by 2050.

Figure 7 Global Long-Term Demand for Gas by Evolutionary scenarios



# CONSENSUS FORECASTS ON LONG-TERM GLOBAL DEMAND FOR GAS

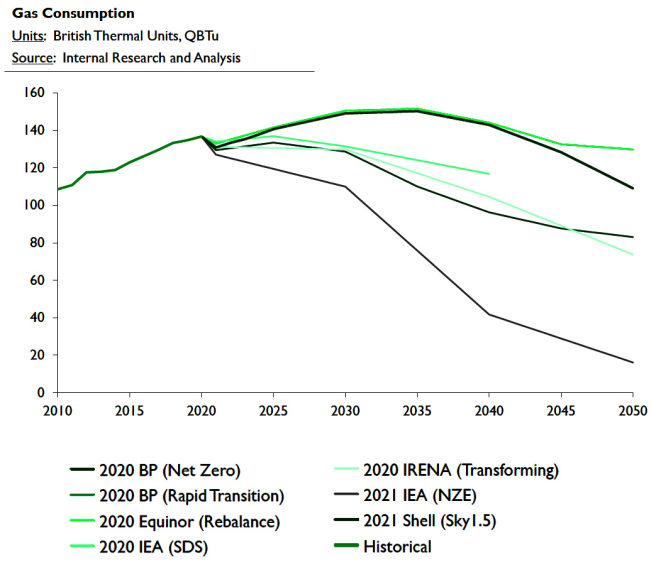
In terms of evolutionary scenarios such as Equinor (Reform) and Shell (Waves); global gas demand is expected to peak earlier in 2040 at 4.6 BCM; with exception of IEA (Stated Policies) that projects gas demand to peak to 5.1 BCM by 2050[xx]. Across these scenarios, demand for gas will be driven by Asian emerging markets, which will account for 15% of the global increase in demand by 2030[xxi]. The growth in these markets will replace declining demand across Asian developed markets such as Japan and South Korea. In addition to this, the industrial sector will account for 40% of the demand growth by 2030, mainly driven by light manufacturing in South Asia, China, and Southeast Asia[xxii].

Although most reference and evolutionary scenarios have similar demand trajectories, the breakdown of demand / supply will vary across regions, as some countries may expand supplies from local resources over imported LNG / piped gas. Despite North America and the Middle East experiencing an increase in demand for their exports, importers across Asia will favour indigenous supplies because of nationalistic policies that prioritise energy security. Europe and Asia also favour supply diversity, with Europe seeking to reduce reliance on Russia, and China seeking a mix of Central Asian and Russian gas with seaborne LNG. However, if there is a delay in new supplies, this could prolong demand for coal across these countries.

Energy transition scenarios, such as the BP (Rapid Transition), Shell (Sky 1.5), and Equinor (Rebalance) forecast peak gas demand of 4.1 BCM between 2030 - 2035[xxiii]. BP Rapid Transition and Shell 1.5 estimate demand to peak by 2035, whereas Equinor Rebalance projects an earlier peak by 2030.

Until then, global demand will be driven by its use in the power and industrial sector. At the same time, demand will continue to rise in South Asia, China, and Southeast Asia as regulatory policies encourage coal-to-gas switching in industrial and power sector. After 2035, demand ultimately declines as a result of increasing electrification in homes and industry, and renewable energy generation.

Figure 8 Global Long-Term Demand for Gas by Energy Transition Scenarios




In almost all reference and evolutionary scenarios, hydrogen poses a limited threat to the long-term demand for gas. For example, the IEA Stated Policies estimates that most of the green hydrogen produced in 2030 will be from surplus renewable energy resources near large demand centres across the United States, Europe, China, and Japan. IEA Stated Policies also projects that total green hydrogen demand in 2050 will be 15% of the current demand levels in the industrial and refining sector[xxiv]. In addition to this, CCUS technologies, particularly in blue hydrogen production, may extend the role of gas, which is estimated to be 24% of the global energy mix by 2050[xxv].

However, in the energy transition scenarios, the threat to gas markets in the long-term from low-carbon hydrogen is mixed. The IEA Net Zero Emissions forecasts that half of the low-carbon hydrogen produced in 2030 will be green hydrogen and the remainder will be blue hydrogen produced from coal and gas with CCUS. 33% of the hydrogen demand will come from the power sector, 25% from the industrial sector, 15% converted to hydrogen-based fuels, and the rest will be consumed by the residential and transport sector[xxvi].

In summary, almost all scenarios forecast long-term global demand growth for gas to be primarily driven by coal-to-gas switching policies in the industrial and power sector across South Asia, China, and Southeast Asia, and in addition to some extent in Europe and North America where gas has already increasingly overtaking coal in the power sector. According to the reference and evolutionary scenarios, demand for gas is projected to peak by 2040 – 2045, whereas energy transition scenarios project an earlier peak between 2030 – 2035.

Long-term gas demand will be exposed to risks from increasing penetration of renewables, improvements in energy efficiency, and the use of low-carbon hydrogen. In most reference and evolutionary scenarios, hydrogen poses a limited risk to global gas markets. Whereas in the energy transition scenarios, it is unclear how CCUS technologies will prolong or reduce demand for gas in the long-term, and how hydrogen may replace gas.

# CONSENSUS FORECASTS ON LONG-TERM GLOBAL DEMAND FOR COAL

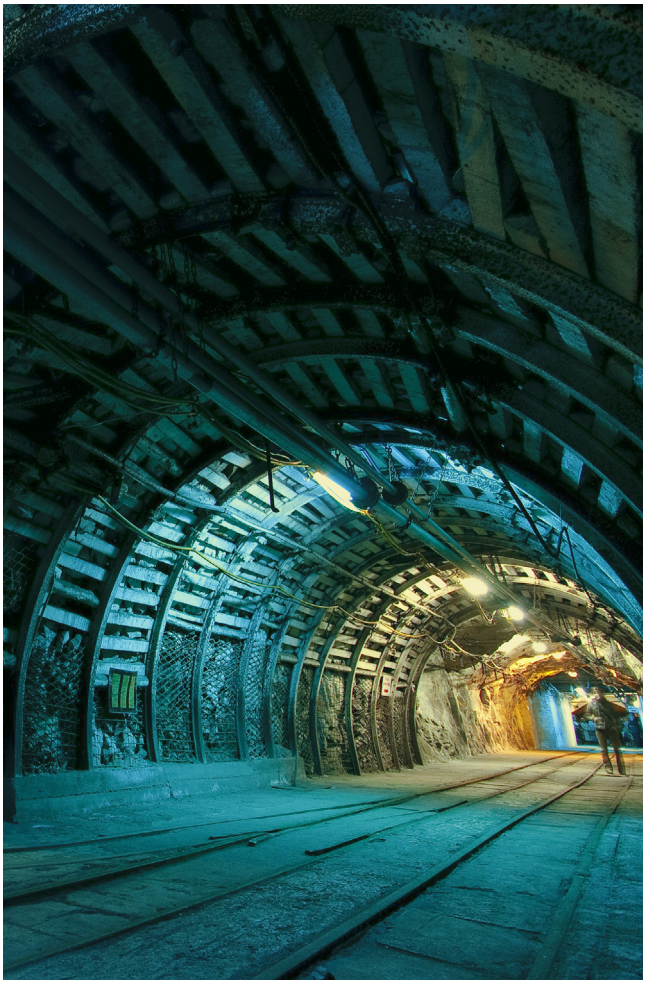
Coal is used for 35% of global power generation and plays an important role as a heat source in manufacturing and as a carbon source for iron ore reduction and steel production[xxvii]. Despite global concerns about improving air quality and reducing GHG emissions, coal will likely continue to be used in some countries that lack a concerted policy to replace it (such as Indonesia and Vietnam).

Global coal consumption currently stands at 151 EJ, which has increased by 1% / year between 2009 – 2019, before declining by 4% YoY in 2020. The decline was mainly strong in the first quarter of 2020 with coal consumption falling by 11% YoY due to mild weather, competitive gas prices, and COVID-19 related lockdowns in China[xxviii]. In the second of quarter of 2020, China's economy began to recover after an ease in lockdowns, but restrictive measures spread to other countries across Asia, which led to consumption declining by 8% YoY[xxix].

There is a consensus across most scenarios that long-term coal demand in the power sector is increasingly under pressure from global climate policies, coal-to-gas switching, and rapid growth in renewables. At the same time, the outlook for coal is dependent on whether demand growth in the power and industrial sectors across India and other Asian emerging markets will be able to offset its decline in North American and European developed markets. China and India are two economies that will play a crucial role in determining coal's future.

China is by far the world's largest consumer and producer of coal and will drive its demand in the future. Currently, 90% of coal demand in China is met through domestic production, but imports and arbitrage play an important role in setting market price, specifically around the country's coastal regions.

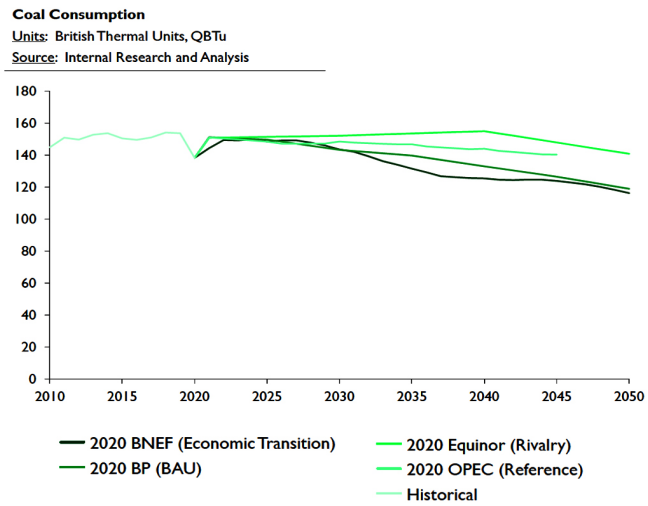
However, coal's dominant position in China's energy mix may decline in the long-term. In recent years, there have been major efforts to restructure the coal industry in China. For example, under the 13th Five Year Plan, China has tried to eliminate excess coal production capacity to achieve a better match between demand and supply, which has led to more than half of the coal mines, mainly the smallest, least productive and unsafe ones, to be shut down. As a result of these efforts, mining related deaths have declined by 80% and average mining costs have been reduced by 10%.



These reforms are not yet complete as efforts continue to focus on expanding coal production across productive areas, combined with integrating advanced mining technologies to boost productivity and safety, and encouraging local Chinese companies to engage in mergers and acquisitions in order to operate large production capacities. There is also a continuing focus on reducing environmental impact, which has led to major efforts in improving mine water processing, reducing mining overburden removal, and cutting methane emissions from operations.

Another key player in global coal markets is India. The country is the second largest importer of coal and is among a few countries where demand for coal will continue to increase until 2030, alongside the increasing use of renewables and nuclear energy. The share of fossil fuels in India's energy mix continues to be strong with coal accounting for 55% of the country's primary energy mix[xxx]. Given expectations for India's power demand to grow rapidly in the future and the need to expand energy access, coal is expected to play an important role in meeting the country's energy needs.

Figure 9 Global Long-Term Demand for Coal by Reference Scenarios



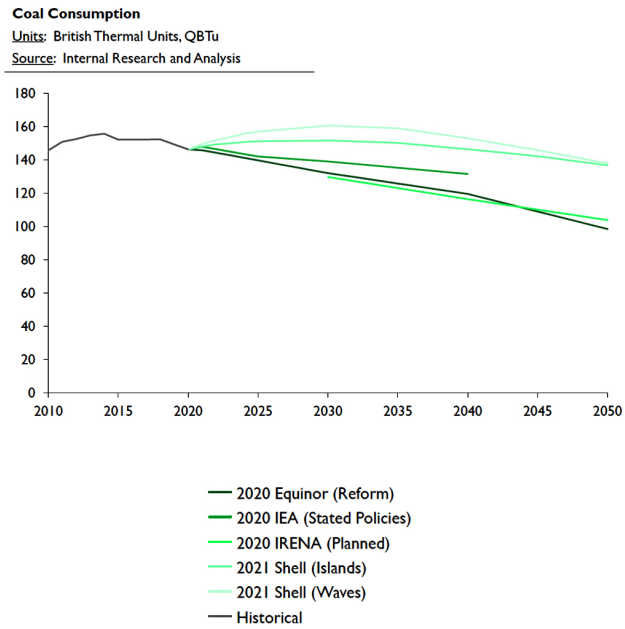

Reference scenarios such as BP (BAU), Equinor (Rivalry), and OPEC (Reference) forecast long-term coal demand to decline to 118 EJ – 131 EJ in 2050[xxxi]. China accounts for most of the fall in demand, followed by the United States and Europe. The decline in demand across developed markets will be partially offset by an increase in demand across India and emerging markets across South Asia and Southeast Asia, such that, by 2050 Asian emerging markets will account for 80% of the global coal consumption[xxxii]. The overall decline in coal consumption will be almost equally distributed between the power and industrial sector, though the power sector will account for 66% of the remaining coal demand in 2050[xxxiviii].

# CONSENSUS FORECASTS ON LONG-TERM GLOBAL DEMAND FOR COAL

Under most reference scenarios, China's coal demand is projected to decline by 2% / year to 59 EJ in 2050, mainly driven by a fall in coal imports due to restrictions and political pressures to support local production, and regulatory policies that encourage coal-to-gas switching in the residential, power, and industrial sector[xxxiv].

In contrast to China, most reference scenarios project India's coal demand to increase by an average of 2% / year between 2020 – 2050, with demand increasing to 36 EJ at the end of the forecast period. However, the overall share of coal in India's energy mix will decline in 2050, due to an increasing penetration of nuclear, gas, and renewables in the country's energy mix. The diversification of power generation in India will be driven by new renewable capacity under the country's ambitious renewable energy targets, which may limit the growth of coal, while a small number of new coal power projects are planned for construction in the coming years.

Figure 10 Global Long-Term Demand for Coal by Evolutionary Scenarios

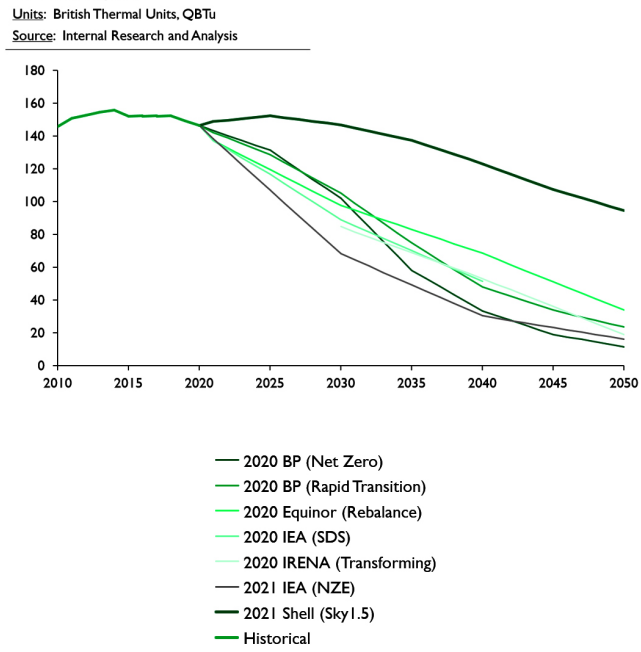



Evolutionary scenarios such as IRENA (Planned), IEA (Stated Policies), Equinor (Reform), and Shell (Islands) forecast demand to reach between 87 EJ - 100 EJ in 2050[xxxv]. Across these scenarios, the fall in China's coal demand will be accompanied by a 45% decline in demand across North America between 2020 – 2030, a 40% decline in Europe and a 25% fall across Japan, over the forecast period, mainly due to a fall in demand from the power sector[xxxvi]. In addition to this, coal demand in the industrial sector will also fall but at a much slower rate than the power sector.

After 2030, coal demand will gradually decline to 100 EJ in 2050, mainly due to a decline in demand from the power sector, as renewables contribute an increasing share of power generation, while coal use in the industrial sector falls by 10% between 2030 and 2050.

In China, there is a 30% - 35% reduction in coal demand from the power and industrial sector between 2030 – 2050 according to

Figure 11 Global Long-Term Demand for Coal by Energy Transition Scenarios



most evolutionary scenarios. However, in India, coal demand is expected to peak in 2035, after which it is projected to decline by 35% till 2050, due to its declining use in the power sector.

Energy transition scenarios such as IEA (NZE), IES (SDS), BP (Rapid Transition), BP (Net Zero), and Equinor (Rebalance) estimate coal demand to sharply decline to between 12 EJ – 41 EJ in 2050[xxxvii]. These scenarios project demand to fall by 55% to 2030, led by a 65% decline in coal use across the power sector and a 20% decline use across in the industrial sector[xxxviii]. The IEA (NZE) scenario estimates that in 2030, 10% of the coal used in the power sector and 3% of the coal used in the industrial sector, will be supplied to projects installed with CCUS technologies[xxxix].

In the long-term, coal demand is expected to decline by 90% in 2050 from 2020 levels, with 80% of the coal will be used at projects fitted with CCUS technologies in 2050[xl]. Most energy transition scenarios estimate that industrial facilities built after 2030 are zero-emission projects, and most facilities built before 2030 will be retrofitted with CCUS technologies or enable co-generation with bioenergy or hydrogen-based fuels. In 2050, most of the coal in the industrial sector will be used for chemical, iron, and steel production.

In summary, global coal demand has fallen dramatically between 2019 – 2020 and all scenarios forecast a downward long-term trend to continue. In 2020, coal demand decreased by 4% YoY and according to most energy transition scenarios, long-term demand will continue to decline at a similar rate.

At a regional level, there is a consensus across scenarios that long-term coal demand in the power an industrial sector is increasingly under pressure from climate focused regulatory policies, coal-to-gas switching, and renewables. Across North American and European developed markets, demand is estimated to decline by 90% - 95% in most energy transition scenarios, and by 73% - 78% across most evolutionary scenarios.

However, a much wider range of outcomes is projected across India and other Asian emerging markets. Energy transitions scenarios estimate coal demand to decline by 60% - 75% by 2050 across these markets.

A considerable range of variation in demand comes from India. Evolutionary scenarios that take into account current policies estimate India's coal demand to peak in 2035, after which it is projected to decrease till 2050, due to its declining use in the power sector.

# IMPLICATIONS

These are challenging times for fossil fuel producers. While there is no going back on the ongoing developments, yet companies engaged in the oil, gas, and coal industry must adapt to a changing environment.

Current regulatory commitments set us on a pathway of 2.7$^{O}$C warming, which clearly the misses the target of the Paris Agreement to limit global warming to well below 2$^{O}$C[xli]. At the recent COP26, governments continued to be pressured to increase their national commitments and expand greater demand and supply side measures in order to reduce emissions from their energy consumption and production.

However, a disorderly transition to a cleaner energy system, as envisioned by most reference and evolutionary scenarios, is characterised by a short-term increase in demand for fossil fuels followed by a sharp decline, and a significant increase in the cost of carbon, which makes business planning difficult for energy companies. At the same time, investors and stakeholders that have invested in energy companies that operate a large portfolio of fossil fuels assets, are fearful of asset destruction from ambitious evolving and energy transition scenarios.

In order to diversify their risks, global financial investors are moving their capital into sustainable funds and greener energy assets. In 2020, there was a 96% YoY increase in renewable energy investments, and 160 investment firms pledged to net zero emissions for their portfolios by 2050. If this trend continues, it will lead to an increase in the cost of capital for fossil fuel companies that are looking to maintain their investor base.

Therefore, fossil fuel companies must assess the impact of evolutionary and energy transition scenarios on their business operations, and conversely the impact of their businesses on the future projections by these scenarios, in addition to mitigating risks, and capitalising on the opportunities that are available. Specifically, fossil fuel companies must consider:

- how climate and energy transition risks posed by evolutionary and energy transition scenarios will affects the value of their assets in 2030 and 2050, and how they can respond to changing markets and regulatory requirements
- how oil, gas, and coal operations are impacting the climate, and whether their actions are in line with the values of their stakeholders and investors
- and, how new business strategies can be implemented to reduce physical, climate, and transition risk, without compromising commercial returns, and capitalise on market opportunities in the new energy sector.

Global energy firms and utilities such as BP, Shell, Total, Engie, and EDF, are now able to achieve the same, if not higher levels of equity financial returns from their investments in renewables, as they did when they invested in fossil fuel assets over the last three decades, and with less risk. Fossil fuel companies could focus on diversifying their operations by establishing a leading position in power generation, considered to be the core segment of the new energy economy, similar to what upstream is in the fossil fuels sector.

In addition to power generation, establishing a renewable energy division can also be profitable to fossil fuels companies in the short to medium-term, which can provide an important foundation in pursuing market opportunities in the rapidly emerging alternative fuels industry, such as hydrogen, biofuels, biogases, and solid biofuels that are increasingly challenging global oil, gas, and coal markets.

# IMPLICATIONS

However, for fossil fuel companies to be successful, they must pick the right geographies, technologies, and operate on an optimally efficient and effective business model. Companies that have diversified their operations with low-carbon energy sources have created significant wealth for their shareholders. For example, between 2016 – 2019, the S&P Global Clean Energy Index yielded an annualised return of 37%, in comparison to the S&P 500 Index that returned 15%. In contrast to this, the S&P Oil & Gas Exploration & Production Industry Index produced an annualised loss of 18% between 2016 – 2019.

Hence, these are challenging times for the fossil fuel players, which must position themselves for the risks and opportunities that may unfold according to most evolving and energy transitions scenarios.

## CONCLUSION

In the past, energy markets were characterised by relatively predictable demand trends, even with short-term imbalances, but today they are defined by disruption. The global energy sector will be increasingly challenged by the rise of renewables and alternative fuels, the imperative of tackling emissions, volatility in energy and commodity prices, and global regulatory policies to tackle climate change. The pandemic has injected further near-term uncertainty and does not fit easily into traditional models. And as such, carefully constructed forecasts and strategies over the last two years are likely to be changed in the short-term.

Reference, evolutionary, and energy transition scenarios are a set of different views that are developed to explore the implications of different assumptions and determine the robustness of possible future developments. Some of these are descriptive – what may happen under certain assumptions – and others are prescriptive, what should happen to achieve particular goals.

Rather than telling policymakers and executives at energy companies what to do, these scenarios should allow them to test their key assumptions and factors, that they understand will shape the energy sector. These scenarios are also designed to address the trilemma of regulatory policy action in achieving environmental sustainability, energy security, and energy equity.

Every policy option has some cost associated with it, and some irreversibility. The cost of one scenario in comparison to another must be considered not only in terms of capital

investments and its impact on economic growth; but also the overall environmental benefits and the avoided cost from climate change. Therefore, there is not a single projection or set of scenarios that is better than the others, but a wider view needs to be embraced when assessing the overall implications of each projection and scenarios.

These scenarios are likely to change the way decision makers in the energy value chain make choices in understanding the real impact of their actions in the long term. Underestimating fossil fuel demand can lead to shortages and high prices, damaging the economy; over-estimating it can lead to stranded assets and crashes in prices.

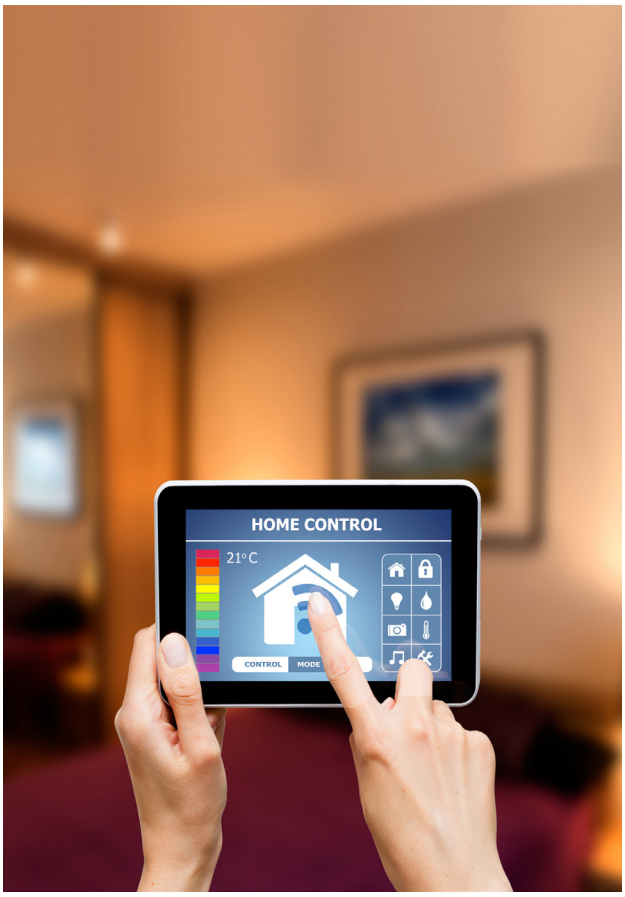
All three groups of scenarios highlight how the fossil fuel industry is shifting from supply driven markets that are shaped by resource scarcity and price dynamics – to ones where the end customer has much greater decision power on which sources of energy will win.

Most scenarios suggest coal demand to have peaked, oil demand to peak between 2030 – 2040, and gas demand to peak between 2040 – 2045. As a result of these projections, energy companies and resource holders are facing a phenomenon of "peak value" and the associated challenge of managing stranded assets.

At the same time, the locus to capture value in the energy sector is increasingly moving closer to end-users. Energy solutions and offerings are responding to electrification, which is driven by innovations in technology, business models, entry of new players, and new regulatory policies and incentives that encourage greener and efficient energy consumption.

Conversely, end-users are becoming more selective in their energy choices, forcing producers to become more customer-focussed in order to capture new demand-side value creation and market opportunities.

However, the transition to a reliable, affordable, and sustainable energy system will create new links between profitability and sustainability. It will open new doors for the energy value chain, in order to pivot between maintaining the traditional and creating new value streams. At the same time, there are various opportunities for fossil fuel companies to capitalise on, in how energy is produced (renewables, biofuels, hydrogen, etc.), how it is consumed (smart energy technologies and sustainable products) and how it is managed (efficiency and energy storage systems).



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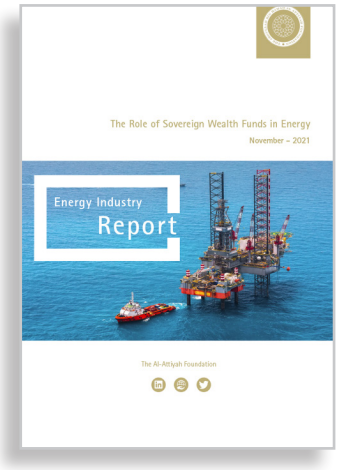


November – 2021

## The Role of Sovereign Wealth Funds in Energy

Sovereign Wealth Funds (SWFs) have a key role to play in the energy sector. Their investment decisions are of vital importance in determining the pace of the ongoing energy transition and mitigating climate change. Conversely, the changing energy landscape also presents a significant risk to their portfolio allocations.

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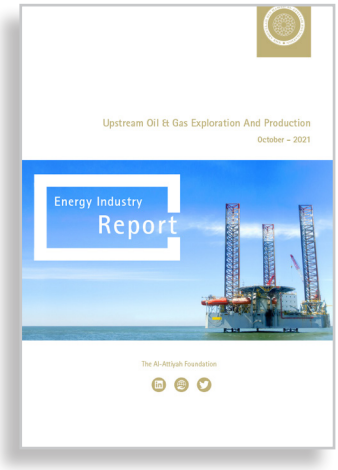


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## Upstream Oil & Gas Exploration And Production

The COVID-19 pandemic led to a major drop and rebound in global oil and gas prices. But uncertainty is growing about the direction for future hydrocarbon demand and pricing.

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## The Role of Sovereign Wealth Funds in Energy

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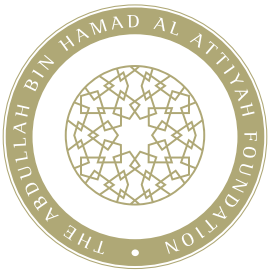


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