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Energy Transition and Natural Gas: Reviewing the Role of Natural Gas in the Energy Transition – Lessons from the UK and EU

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Abstract: *The scramble to achieve net zero emissions by 2050 and fulfil their end of the bargain of the Paris Agreement, has seen governments race to phase out fossil fuels and embrace renewable energy technologies. Indeed, the hype to net zero has almost been equated to an outlaw of fossil fuels, due to levels of CO2 emissions linked to their production and consumption. Paradoxically, more than 80% of current global energy comes from fossil fuels, with 24% from natural gas. Despite a proliferation of recent policy support and prioritisation of renewable energy technologies investments, there yet remains a huge gap in energy supply as intermittent and unreliable supply from wind farms are unable to provide base load energy or cope with demand, with renewable energy providing just 13% of global electricity. Relatedly, rising energy prices, energy shortages and geopolitical disruptions such as the Ukraine war have unveiled just how vulnerable global energy systems and energy policies are. The research reviewed the role of natural gas during the energy transition. Importantly, it echoed a renewed understanding of the UK and EU governments, of the role of natural gas during energy transition, and advances the argument to support natural gas development as a complementary strategic energy choice for a realisation of net zero policy. The findings suggest that natural gas provides essential bridge fuel to net zero whilst reducing emissions through fuel switching to replace coal, helping to provide secure, reliable, and affordable energy during and after the energy transition. It also provides energy companies the cash flows required to fund their energy transformation strategies, featuring prominently in energy company portfolios beyond 2050. In the UK, replacing each barrel of oil equivalent (boe) of imported natural gas with domestic production could save 59KgCO2 emissions. From 2005 to 2023, this equated to 86 million tons of CO2, and 36 million tons (from 2019 to 2023), but this opportunity was lost due to growing LNG imports in the last decade and government policies which restricted fossil fuels indiscriminately. The research finds that further opportunities exist to reduce CO2 via fuel switching from coal to natural gas, globally. It is thus recommended that government policies which constrict the development of new energy from natural gas must be reviewed and natural gas investments must be supported like renewable energy projects. Natural gas and renewable energy are no competitors as far as the energy transition and net zero are concerned; they are joint energy assets to deliver the energy transition and a neglect of one source by policymakers could be detrimental to an attainment of our clean, secure, and affordable energy aspirations.*

Key Words*: *Net zero, energy transition, natural gas, energy security, decarbonisation, affordable energy, climate change, fuel switching

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1. INTRODUCTION

1.1 Contextual Background

Oil and gas have played a dominant role in world energy for centuries since human civilisation. They have been the primary source of energy for global economies; supporting many industrial sectors such as agriculture, healthcare, aviation, transportation, manufacturing to name a few. Nonetheless, in its 21st century, the world is resolved to tackle global warming; to curb the adverse impacts of climate change – which it mostly blames on fossil fuel consumption and is now poised to transition its energy systems to attain net zero emissions by 2050. Simply, oil, gas, coal – indeed everything fossil fuel must go; and very quickly, to make way for greener renewable or low carbon energy (UN Climate Change Conference -UK, 2021), (Newell et al., 2022), (Reuters, 2022) and (UNCC/ COP28, 2024).

Fundamental to net zero ambitions is the Paris Agreement of 2015 to which world leaders have pledged to curb rises in global temperatures to no more than *1.5°C* and achieve carbon neutrality by 2050, a move which has birthed a flurry of national and international regulations and campaigns which target the oil and gas sector to dissuade consumption of fossil fuels, constrict supply and cripple new investments. Put differently, the Paris Agreement has spurred a generous proliferation of energy policies aimed at dissuading any social or commercial attachment to fossil fuel.

Progressively, the situation has become pervasive in our modern society that an association with the terms "oil", "gas", "coal" or in short "fossil fuels" could be construed as irresponsibility, a powerful wave which has seen some major oil and gas companies change their names and or business purpose to rid themselves of these "evil" words, for a refuge in a safe haven; the now responsible word "energy" (BP, 2021), (Shell, 2020), (TotalEnergies< 2021); (Chevron, 2021) and (ExxonMobil, 2022), in apparent efforts to, among other things:

- Spare themselves the wrath of powerful political and environmental actors with great, yet sometimes invisible, influences over their businesses
- Avail themselves to access funds from growing "green" financial markets
- Commit to creating "ethical" value; the people, planet, profit concept of Environment, Social and Governance (ESG).

At the same time, despite the euphoria of an energy transition, the portfolios of the now energy companies have consisted of and are dominated by oil and gas in their current operations and longer-term strategic plans. For example, Chart 1 shows that the big 5 energy companies' operations from 2019 to 2050 are still dominated by oil and gas, with TotalEnergies' portfolio being 60% fossil fuels in 2050. In 2030, Shell's portfolio consists of 90% oil and gas; BP 60% oil and gas; and TotalEnergies 85% oil and gas. At the same time, oil, gas, and coal continue to dominate global energy systems, currently supplying over 80% of world energy with 24% from natural gas (BP Plc 2022).

On the other hand, the share of renewable energy supply in global energy has grown to 13% and new investment in green energy technologies have risen to $226 billion up to the second quarter of 2022 (BloombergNEF, 2022). But what does this mean for fossil fuels, especially the significance of natural gas?

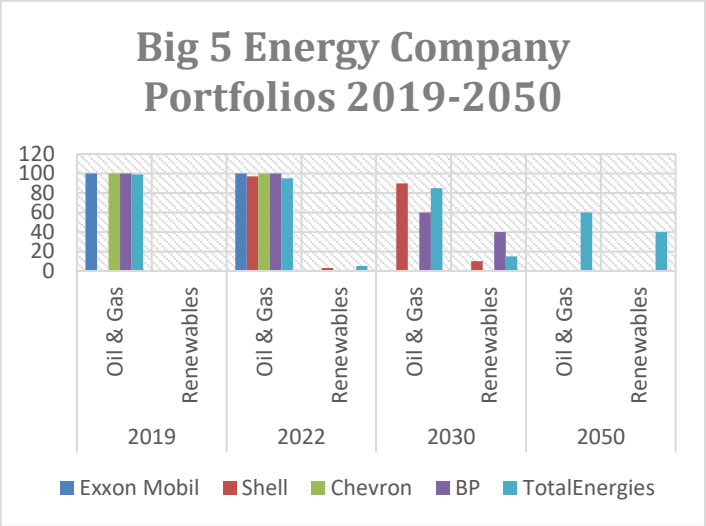


Chart 1 shows energy company activities are dominated by commitments to oil and gas at present and up to 2050. Despite renaming their purpose in their annual statements, increased discussion of commitment to greener energy, renewable energy is not expected to be their major cash flow earner even by 2050.

Chart -1: Relative share of oil and gas and renewable energy in the portfolios of the Big 5 International Energy Companies from 2019 to 2050.

Source: Adapted from BP (2020); Shell (2021); TotalEnergies (2021); Chevron (2021); ExxonMobil (2022

Now, more than ever, the global oil and gas sector has witnessed crippling energy policies and laws targeted at reducing new investments, in favour of an expansion agenda for "green", "alternative" or simply "sustainable" energy technologies and the UK is no exception. For example, due to pressure from environmentalist groups and a green transition, the UK stopped the sale of new oil and gas explorations licenses for its North Sea oil and gas since 2019 (North Sea Transition Authority [NSTA], 2022) until 2023 when it issued hundreds of new licenses and legislated to require the NSTA to invite applications for new production licenses each year (Gov.UK/ Prime Minister's Office, 2024; Gov.UK/ DESNZ, 2024).

The pressures of energy transition have seen tremendous increases in new investments in alternative energy sources (BloombergNEF, 2022), and divestment/ write-off of oil and gas assets (Forbes, 2020; New York Times, 2021). Some have construed these developments as the permanent end

of the oil and gas industry, and in their imaginations, it seems that oil and gas are outlawed. Such notions of a demised oil and gas industry and a demonisation of the sector are precipitated by a perpetration of ambitious energy policies to cut back production and consumption of oil and gas (UN Climate Change Conference -UK, 2021). But what are the implications of such characterisation of energy transition and its attendant energy policies, especially as oil, gas and coal are still yet the world's most prolific and reliable energy sources at a time of rising energy prices, growing energy shortages and security concerns mount (BP Plc, 2022).

The transition is causing structural changes to energy systems, with a notable shift in energy policy, to embrace clean energy that is fit for the next centuries, but it seems also to be disrupting the world's understanding of the role of natural gas and fossil fuels in general in a balanced global economy. Yet, evidence suggests that oil and gas continue to fill a significant void in global energy supply, providing a much-needed respite for ailing global economies, businesses, households, etc. and livelihoods in the aftermath of COVID-19, with such role expected to continue as the world seeks to reinvent itself through digital technology, repair shattered economies and invest in alternative energy infrastructure (BP Plc, 2022). But might the paradox of a trilemma of clean energy, energy affordability and energy security suggest a continued significance, yet, for natural gas?

1.2 Research Aim Significance and Methods

Drawing on evidence from the UK and Europe, the current research reviews and characterises the role of natural gas in the UK and EU and examines the impacts on global warming of investment in, and consumption of, natural gas during the energy transition.

1.3 Research Significance Gap and Novelty

The subject of energy transition has been topical in energy research, but the extant literature still fails to address the role of natural gas during the energy transition. Research has concentrated around an acceleration of the energy transition through the discontinuation of fossil fuels consumption (Leach 1992; Solomon and Krishna 2011; Chen et al. 2019; Blazquez, Fuentes and Manzano 2020), the role of green energy technologies in the energy transition (Gallo et al. 2016; Kovac, Paranos and Marcius 2021), tools for modelling energy transition (Li et al., 2015), (Chang et al., 2021), behavioural changes needed for a transition (Steg, Perlaviciute and Van der Werff 2015; as well as the impacts of the energy transition (Barnes, Krutilla and Hyde 2010; Carley and Konisky 2020; Dupont, Germain and Jeanmart 2021; Dolores, Macchiaroli and De Mare 2022; Sun et al. 2023; Hanson 2023).

Related to the present research, Losz, and Elkind (2019) noted the near-term case for natural gas, recounting its cleaner properties compared to coal, but doubts a significant role for the resource during the energy transition without green technologies to address associated emissions. On the other hand, Bugaje et al. (2022) advocate a just energy transition by challenging energy transition arguments which disregard the role of natural gas. Nevertheless, despite closeness of their work to this research, a gap still exists on the illustration and assessment of the impact of natural gas production and consumption on global warming on one hand and an estimation of the value of natural gas to global energy companies and energy supply during the transition, on another. At a time when the subject of energy transition seems polarised and there are stern national policies and views about fossil fuels in general and a natural tendency to dismiss the discourse about a future of oil and gas, the current study does not only help to shape the meaning of energy transition but fills the gap in our knowledge about the potential role of natural gas, to aid a just, pragmatic and realistic transition to greener energy systems. Furthermore, in a period of potential hysteria to ditch oil and gas, the study draws on empirical evidence and evaluates the relevant clauses of the Paris Agreement to illuminate and support national and international discourse on energy policy creation to better deliver cleaner energy, energy security and affordability in less disruptive ways. Finally, the research bridges the gap in literature on the role of natural gas in energy systems in a period of energy transition.

1.4 Research Methods

Quantitative secondary data was sourced to support the research. Data on UK natural gas imports and associated CO2 emissions from 2022 to 2023 were sourced from the North Sea Transitional Authority (2023) and Department for Energy Security and Net Zero (DESNZ 2024). Data on fossil fuel dependency was sourced from Gov.UK (2023), EU natural gas dependency rates in 2000 and 2020 as well as EU oil, gas and coal imports in 2020 were sourced from Eurostat (2022). Data on energy companies' portfolios from 2019 to 2050 was sourced from the relevant energy companies' financial statements for the respective years. Finally, data on global net anthropogenic emissions were sourced from the IPCC (2022).

To address the research aim, all the data sourced were analysed using descriptive statistics utilising frequencies and percentages to describe and present the data. Whilst this method is uncomplicated and easy to implement and follow in research, its real strength lies in its ability to enable the summarising of data in a valid and meaningful way (Mishra et al. 2019; Mishra et al. 2019a). Given the aim of the current research, the identified methods were sufficient and fitting as they enabled presentation of the role of natural gas in the energy transition using discrete data as evidence, in an uncomplicated way, an approach that renders the research more understandable to a wider audience who may not be skilled in complex inferential statistical techniques (Mishra et al., 2019), (Mishra et al., 2019a). The use of percentages in EU energy policy debate has been documented by Segers (2008) in the calculation of

percentage of renewable energy in 2020 in European Commission (EC) energy policy documentation. More recently, a similar approach was adopted in the research by Solomon et al. (2023) to investigate the standardisation of methods to assess energy quality.

The rest of the paper is organised as follows. Section 2 reviews the meaning and argument for energy transition, as well as the roles of natural gas in the energy transition with references to the UK and EU, section 3 discusses the important realities of natural gas to energy companies, section 4 illustrates the impact on global warming of the renewed understanding of the role of natural gas in the energy transition and section 5 concludes the report with recommendations.

2. NATURAL GAS AND ENERGY TRANSITION

2.1 Energy Transition: Meaning and the Scientific Case

Global energy systems have been based around fossil fuels since the industrial revolution. Oil, gas, and coal currently account for over 80% of primary energy. Meanwhile, research by the IPCC (IPCC 2021 p.4) states that human activities have caused an excessive warming of global climates, at unprecedented levels, with warning that further temperature increase of 1.5°C, with severe consequences for life and the environment, is likely by 2050 if no action is taken to mitigate it. Coincidentally, the greatest share of CO2 emissions responsible for global warming has been linked to fossil fuel consumption. According to the IPCC (2022), Chart 2, CO2 emissions from fossil fuels and industry, on average, accounted for over 60% of net anthropogenic emissions of greenhouse gasses over the last three decades (IPCC 2022 p.11). To address the climate concern, the UN in 2015 created the Paris Agreement to commit its members to address global warming challenges. The UK and EU are signatories.

Specifically, Section 2 (1a) of the Agreement states:

"This Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;" (UN 2015 p. 3)

Further, sections 3 and 4 require members to determine and implement "ambitious mitigation measures" and actions to curb greenhouse gas increases as soon as possible, with a common reference to 2050 (UNCC, 2022; UN 2015). Research and many other actions have followed the PA and suggested that achieving lower greenhouse gas emissions, also termed decarbonisation requires a fundamental change in the global energy systems, to transition from fossil fuels. This position was affirmed at COP26 (2021), COP27 (2022) and recently COP28 in November 2023, with a deadline to achieve carbon neutral emissions by 2050, the so-called net zero ambition (UN Climate Change Conference-UK 2021; UN Climate Change/ COP28 2024).

According to the IRENA (2018: 10) "Keeping global temperature rise below 2 degrees Celsius as per the Paris Agreement requires the global energy system to undergo a profound transformation, from a system based largely on fossil fuels to one that enhances energy efficiency and is based on renewable energy" (IRENA 2018 p.10). This idea defines the ethos of energy transition, a term which has been made synonymous with "decarbonisation", "net zero" among others and has birthed a raft of policies by governments and organisations worldwide, which target an eventual phasing out of oil, gas, and coal, and meet global energy demand with supply from renewable or simply green energy, but at what costs?

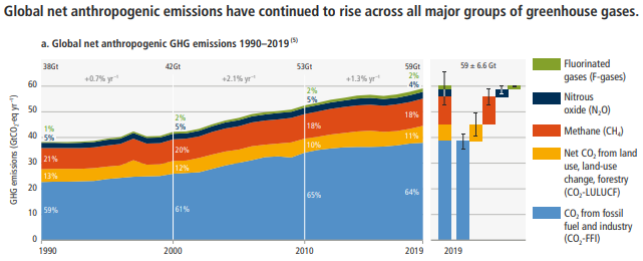


Chart -2: Global Net Anthropogenic Emissions from 1990 to 2019, suggesting emissions are highest from fossil fuels.

Source: IPCC (2022, p.11)

2.2 Natural Gas as a Transitional Fuel: Reasons and realities – UK Story

In a report published in 2011, namely The Golden Age of Natural Gas, the IEA underscored the immense role that natural gas would play in the transition to sustainable energy futures, globally (IEA 2011). The IEA, in this publication believed that natural gas would serve as bridge fuel to achieving a cleaner, and now low-carbon energy future. Ten years on, the role and importance of natural gas in energy transition have become even more important.

Global energy systems are currently driven by fossil fuels (Table 1), with significant contribution from natural gas with yet a prominent role in transitional energy policies and strategies of nations. Consequently, despite current energy transition priorities, plans and investments, countries such as US, Canada, UK, etc. have been cited to be making significant new investments in [natural gas and oil to the tune of $126 billion between 2020 and 2021 alone (Non-Proliferation, F.D.F.F, and Treaty Initiative. (2021). undoubtedly, these countries are pursuing ambitious strategies towards achieving net zero by 2050. Yet they are exploiting the full spoils of natural gas and oil at present and craving the blessings of a plentiful supply with further wishes for more home-grown gas. But what is the nature of

the role of natural gas in energy transition, and why does gas seem so important?

Table 1: Examples of Current Global Dependence on Fossil Fuels

Country	Share of Energy from Fossil Fuels
United Kingdom	75%
Germany	76%
United States	81%
Japan	86%

Source: Gov.UK/ Prime Minister's Office (2023)

In a recent policy paper, in April 2022, the UK government unveiled its British Energy Security Strategy in which it promised "Secure, clean and affordable British energy for the long term" (DBEIS 2022). Focusing mainly on renewable energy – mainly solar and wind, nuclear energy, and hydrogen, the strategy aimed to attract investments to build a greener energy system to reduce its reliance on imported energy. This plan aligns with the government's "Ten Point Plan for a Green Industrial Revolution" (HM Government (2020) and its net zero strategy (HM Treasury 2020) and it has been recorded that the UK has attracted some £40 billion investments in green technologies over the last two years only.

Nonetheless, the government also has natural gas central to its net zero and greener future strategy and its description of the role and importance of natural gas below is striking and imperative:

"Gas is currently the glue that holds our electricity system together and it will be an important transition fuel. We are taking a balanced approach to this unique subterranean asset. There is no contradiction between our commitment to net zero and our commitment to a strong and evolving North Sea industry. Indeed, one depends on the other" (DBEIS 2022).

Natural gas seems an asset, indeed, for the UK. Currently, more than 40% of energy is generated from natural gas. Nevertheless, only half of the country's consumption is produced domestically, with the rest imported (DBEIS 2022; DBEIS (2022a). Currently, the government anticipates that natural gas will continue to play an important role in the UK's energy security strategy and cleaner energy commitments, expected to contribute, in the government's "ideal" cleaner energy plans 25% of energy supply by 2050 (DBEIS 2022; (Gov.UK/ Prime Minister's Office 2024; Gov.UK/ DESNZ 2024). In a renewed affiliation to fossil fuels, driven by necessity and reality, the Conservative Government which previously banned fossil fuels extraction (Offshore Technology 2021; DBEIS 2019) made a U-turn to reconsider its previous policy and renewed its pledge to invest and extract every bit of it for reasons of UK energy security, a renewed understanding of oil and gas as a necessary catalyst to reaching to net zero and a fresh quest to export energy by 2040 (DBEIS 2022b; (Gov.UK/ Prime Minister's Office 2024; Gov.UK/ DESNZ 2024). In September 2022, the government launched a new oil and gas licencing round, the 33rd Licencing Round, which opened on 7th October 2022, to offers some 100 new oil and gas licenses to develop over 898 blocks and part-blocks with plans to hurry production from priority oil and gas fields (NSTA 2022). According to the government, the policy change will ensure Britain's energy security and drive its energy transition agenda (DBEIS 2022b; Offshore Technology 2022a). In 2023, hundreds of new licences were awarded, and a legislation passed to require the North Sea Transition Authority to issue new oil and gas licenses each year in a bid to revive the sector (Gov.UK/ Prime Minister's Office 2024; Gov.UK/ DESNZ 2024).

The upstream oil and gas regulator, now known as the NSTA has stated that the oil and gas sector in the UK is playing a "crucial role in areas like carbon storage and hydrogen development", supporting the nation's energy security and energy transition but still meeting its CO2 emissions targets as agreed in the North Sea Transition Deal in 2021 (NSTA 2022). The UK imports significant proportion of its energy as natural gas in LNG form but developing its own natural gas has been cited by the NSTA to cut emissions from its imports by half (NSTA 2022). Relatedly, the Climate Change Committee's analysis has shown that domestic production of natural gas in the UK could cut its emissions from imported gas from LNG by 75% (Gov.UK/ DESNZ 2024).

The current and future role of natural gas traces the following arguments.

Natural gas and oil are major sources of energy company finance for energy transition. Energy companies whose income primarily comes from oil and gas exploration and production are primary agents of energy transition [See for example, Neptune Energy's portfolio is 75% gas and 25% oil (Neptune Energy 2022). Indeed, a scan of the top 5 global energy companies reveals that oil and gas constitutes the major cash flow earner for those companies, even beyond 2050.

Natural gas is the largest source of electricity generation in the UK, like most other countries – providing more than 40% of reliable and affordable energy choice to homes and businesses (DBEIS 2022; Neptune Energy 2022)

Intermittent energy supplies from renewable energy make natural gas essential. Although the global renewable energy industry has grown, it contributes just 13% of global electricity generation, leaving a colossal gap which needs to be filled by other energy sources. That notwithstanding, an IEA tracking report predicts that the EU's REPowerEU initiative to wean itself off Russian gas and the US's recent Inflation Reduction Act could add significant generation capacity to renewable energy, but also warns that despite these interventions, current levels of investments are lower than required to achieve the predictions of its "Net Zero Emissions Scenario by 2050" where renewables grow from 29% in 2021 to 60% in 2030 (IEA 2022). Consequently, there is currently a gap in what has been termed a mere rhetoric and actual commitment to action (The Guardian 2021).

Natural gas is a cleaner energy and affords a more reliable, cheaper, and safer supply (IEA 2022a:7). It is a bridge fuel to delivering net zero. According to the IEA (2019:4,7), supporting switching from coal-fired power plants to natural gas-powered plants to meet energy demand could save up to 1.2 gigatonnes of CO2 and such natural gas-enabled CO2 savings have already been made by the natural gas industry since 2010. In the UK, 23 million

homes directly or indirectly rely on gas for heating and or electricity (Neptune Energy 2022).

Even with a successful achievement of the world's ambitious energy transition plans there is still a void in global energy supply which "clean" energy sources are unable to fill (BP Plc 2022). Such gap must be filled to avert a worsening energy-transition induced energy crises such as energy shortages, rising energy bills, etc. Gaps in future supply are anticipated to be bridged by natural gas even beyond 2050 in net zero scenarios (IEA 2022: 73).

Presented above, perhaps, defines just a glimpse of the extent of the strategic need for natural gas in global energy systems, even under the realities of Net Zero. Section (3.1) reviews some large energy companies' views and lend further credence to the foregoing insights about the role of natural gas and fossil fuels in global energy systems during the transition.

3. THE ROLE OF NATURAL GAS: ENERGY COMPANIES' ACCOUNT AND REALITIES FROM THE EU

3.1 The Role of Natural Gas: Energy Companies Account and Realities

BP's chief executive, on the company's new strategy for becoming an integrated energy company (IEC), provides an essential clarity on what energy transition means for its portfolio and cash flows and provides an authoritative affirmation of the role of natural gas and oil, in the energy transition period – a statement which sheds immense light on the meaning and implication of the energy transition as well as the significance of oil and gas during the energy transition.

Hydrocarbons are and will be pursued by major energy companies, for decades to come and it seems that the destinies of cleaner energy and hydrocarbons are intertwined. Energy majors, believe they must exploit revenues from hydrocarbons to support investments in lower carbon energy, as emphasised by BP's CEO:

"…Many will see our plans for lower production and understandably ask if we are turning our back on oil and gas. Let me be clear: we are not. Hydrocarbons will be integral to bp for decades to come. They are a core part of our strategy. In fact, they enable the strategy. They fuel our transformation.

What is changing is that BP will no longer be predominantly a hydrocarbon company. It will be an integrated energy company – with hydrocarbons one part of a more balanced portfolio." (BP, 2020)

Similar leanings define the strategy of TotalEnergies's. The CEO in stating his company's strategic portfolio for 2030and 2050 indicated the following.

"For us at TotalEnergies, we are transforming into a broad energy company. Our Company's production and sales mix will be evolving from predominant oil production today such that by 2030: 50 percent gas; 35 percent oil and liquid biofuels; 15 percent electricity, mostly renewable. By 2050, the mix will be 40percent renewable power, 40 percent gas and 20percent liquid products." (Sweet Crude Reports, 2021).

For TotalEnergies (2021, p6), natural gas is the "enabler of the energy transition in power and industry"

According to Shell (2021):

"Our Upstream pillar delivers the cash and returns needed to fund our shareholder distributions and the transformation of our company and provides vital supplies of oil and natural gas which the world needs today."

It would seem from the foregoing that the energy companies, despite great uptake of the energy transition still do and will have their focus on natural gas and oil production for the foreseeable future.

3.2 Europe's Gas Supply Crises: A Renewed Understanding, Blind Spots of Net Zero Ambitions and a Quest for Foreign Fossil Fuel

Europe is poised for her green goals; meeting the targets of net zero and fulfilling her climate change ambitions are a top priority and fossil fuels - natural gas, crude oil, and coal - are enemies whose growth, investment and consumption must not be curtailed.

This resolve is inspired by the dire evidence from the "climate science" by the experts at institutions such as the IPCC, UNFCC, etc. to arrest temperature rises and various other advice, including from the International Energy Agency (IEA) for the world to end funding for fossil fuels by end of 2021 (The Guardian 2021).

"Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" (UN 2015:3) is the subject of Article 2 (1) c of the PA. Yet, a recent Communique of the energy and environment ministers of the G7 countries stated: "We note with concern the scale of private finance currently still supporting non-Paris aligned activities especially in the fossil fuel sector" (G7 2022:22).

Consequently, in their bid to urgently realign financial flows with Article 2 (1) c, the G7 nations pledged to use their influence as shareholders of Development Finance Institutions (DFIs), including Multilateral Development Banks (MDBs) to align these institutions' operations to the goals of the Paris Agreement before COP27 (G7 2022:22). Significantly, the G7 ministers agreed to end public funding of foreign oil, gas and coal development projects and shift such funds to clean energy investments (G7 2022: 22). According to The Guardian (2022a), this decision could shift an estimated $33 billion (£26 billion) from fossil fuel investments to clean energy sources.

Europe has been touted as a true leader of the net zero and energy transition, but an apparent preoccupation with emissions reduction policies exclusively seems to have magnified its blind spots regarding the creation of a

resilient energy policy capable of insulating Europe from potential energy crises. According to the European Institute of Security Studies [EUISS] (2020), Europe's energy policies did not anticipate disruption to supply. Meanwhile, Europe is a net importer of energy and Russia is its main supplier of crude oil, natural gas and solid fuels. In 2020, the EU's energy dependency rate was 83.6% (65.7% in year 2000) for natural gas; 96.2% (92.8% in year 2000) for crude oil and 57.5% (56.3% in year 2000) for overall energy as in Chart 3. Table 2 presents the sources of EU energy imports.

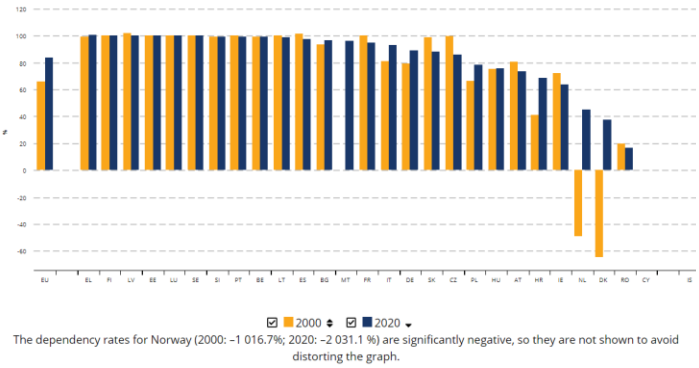


Chart -3: EU Natural Gas Dependency Rate for Years 2000 and 2020 (% of net imports in gross available energy, based on terajoules)

Source: (Eurostat, 2022)

Table -1: EU Energy Imports in 2022 by Source

	Oil (%)	Gas (%)	Solid fuel (%)
Russia	29	43	54
United States	9	-	16
Norway	8	29	-
Saudi Arabia & UK	7	-	-
Kazakhstan & Nigeria	6	-	-
Algeria	-	8	-
Qatar	-	5	-
Australia	-	-	14

EU energy import sources in 2020 indicate significant overall reliance on Russia. Source: (Eurostat 2022)

Coincidentally, a confluence of factors has spurred a global energy crisis which in the IEA's Fatih Birol's words "is especially perilous in Europe, which is at the epicentre of the energy market turmoil" (IEA 2022b). Spurred by increased energy demand for post COVID-19 recovery amid tightening fossil fuel supply caused by the Russia-Ukraine war, tightening global funding for new fossil fuel development in line with the goals of the PA, disappointing renewable energy output (EUISS 2020), the void in global energy and Europe, in particular –including the UK is monumental. Rising energy prices across the world has, thus, meant a perfect storm in the energy markets for most countries in Europe.

In response, the EU undertook measures to address the consequential energy poverty, rising energy bills and collapse of industries. These include the reclassification of natural gas operations as environmentally sustainable activities in the EU's taxonomy for sustainable activities in sharp contrast to its previous verdict that natural gas was not sustainable. This policy change now means that from January 2023, new development of natural gas projects will be eligible to receive funding (European Commission 2022), a policy reversal which loudly echoes the EU's renewed understanding of the significance of natural gas towards net zero and an instructive reality and direction about the future of natural gas in the energy transition.

Accordingly natural gas is now a recognised sustainable fuel which, along with nuclear energy, will play a central role in the EU's net zero pathway (European Commission 2022), but the EU must import, in order continue to access its natural gas needs and until now, Russia has been its major supplier. Yet, with uncertainty over continued supply from Russia, the EU must look elsewhere. Consequently, the EU in 2022 asked African producers to increase energy exports to Europe, pledging an investment of more than £26 billion in natural gas pipeline from Africa to Europe – the agreement which has been touted as hypocritical of EU politicians, in a significant publication by media house FP News (2022) titled *"Gas for me but not for thee"*.

Relatedly, the IEA (2022b) produced a 10-Point Plan for the EU to reduce its reliance on Russian gas. Instructively, investment in natural gas to optimise supplies is a priority for bridging a critical energy supply gap. The IEA recommends for the EU to:

> "*…maximise gas supplies from other sources; accelerate the deployment of solar and wind; make the most of existing low emissions energy sources, such as renewables and nuclear; ramp up energy efficiency measures in homes and businesses; and take steps to save energy by turning down the thermostat*" (IEA, 2022b)

3.3 The Role of Natural Gas: Emerging Insights

Chart 4 illustrates the relative demand for fossil fuels and renewable energy in the UK, with dominance by fossil fuels. Demand for natural is largest, and yet domestic production of gas is insufficient to fill supply. Over 38% of UK energy in 2021 was imported (DBEIS 2022a). Of this, more than 90% was fossil fuels, mainly oil and natural gas. Meanwhile, Norway supplied the largest share of the UK's natural gas and crude oil imports by 63% and 25% respectively with others from the USA and Russia. According to the DBEIS (2022a), renewables contributed 39.6% of UK energy in

2021 whilst natural gas contributed 42% of UK electricity generation. Globally, this figure sits at just 13%, with natural gas at 24% as noted by BP Plc (2022). Overall, fossil fuels contribute over 80% of the world's much needed energy and despite such respite, disruptions to energy markets and the post COVID-19 recovery have meant growing energy shortages and rising prices. It is unsurprising that the UK, Canada, USA, Norway, and Australia would spend $126 billion on new oil and gas development projects from 2020 to 2021, which for critics, undermines their claims to be leaders in addressing the climate change crises (Non-Proliferation, F.D.F.F, and Treaty Initiative 2021). Nonetheless, one would argue that these nations require access to available sources to provide secure, affordable, and reliable energy which, natural gas and oil appear to offer. It would seem, after all, that ambition in prescribing NDCs and reality are two separate ideals, and the energy transition is a process, rather than an event and that nations, despite their wildest pledges would have to work out their nationally determined contributions (NDCs) realistically, systematically and pragmatically towards lower-carbon energy systems which would evolve with time.

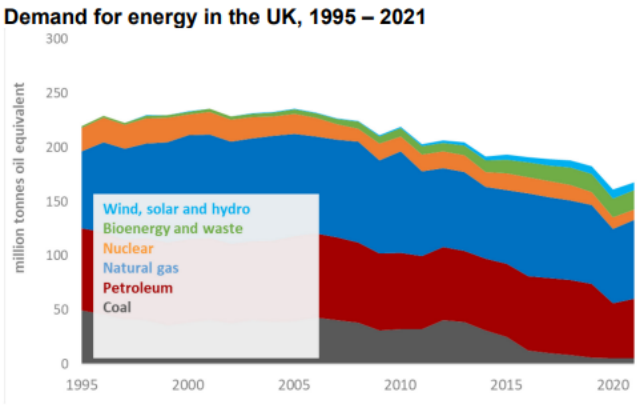


Chart -4: UK Demand for Energy from 1995-2021

Source: DBEIS (2022a)

Whilst significant progress could be made towards growing renewable energy contributions leading to 2050, natural gas could still dominate world energy – including the UK's and EU's, and the combined relevance of all fossil fuels could be marked for the reasons outlined in this paper. According to the IEA (2021), fossil fuels could provide over 60% of energy by 2050 and the growth in natural gas demand is estimated to surpass all other fossil fuels. It further states that, by 2050, even under its net zero emissions scenario, over 50% and 70% respectively, of natural gas consumption will be required for low-carbon hydrogen production and in facilities equipped with CCUS (IEA 2021: 73). It could be argued, thus, that energy transition and sustainable energy future may not be equated to the demise of fossil fuels, but that there are beneficial roles that natural gas, especially could play in the period leading to global energy transitions.

In addition, the architecture of modern societies is built around industrialisation, with an infinite longing for digital innovation by the second. Such pace of social change, along with a hunger for economic growth and industrialisation in developing nations and a scramble to build back stronger from the impact of COVID-19, could only be satiated by a colossal gobbling of energy, the sheer scale of which clean energy sources are unable to provide at their current levels of investment, output and reliability. Research has suggested that key industrial processes and products which will drive significant global economic activity will be difficult to decarbonise and alluded to significant continued role of natural gas and other fossil fuels (Lomborg 2020; Barrett et al. 2021; FP News 2022; Ohlendorf and Schill 2020; Davis et al. 2018; Erat et al. 2021; Telli et al. 2021)

Furthermore, investments in renewable energy technology, have been noted to be below levels capable of supporting global energy demand levels in a sustained fashion. According to the IEA's Chief Economist, Fatih Birol, "More and more countries are coming up with net zero plans, which is good, but I see a growing gap between the rhetoric [from governments] and the reality" (The Guardian 2021). Realistically, natural gas and cleaner fossil fuels could remain significant energy to solve difficult energy security problems during the energy transition and even beyond.

"Clean electrification is a central element in all scenarios in this Outlook, but it is not possible to electrify everything. Even in the NZE, electricity comprises less than 50% of total final energy consumption in 2050: in the APS and the STEPS the comparable figures are 31% and 26%. Liquid, gaseous, and solid fuels of various types will continue to make a major contribution to the global energy mix through to 2050" IEA (2021:73)

For energy companies, natural gas now provides and will continue to be the dominant cash flow earner which would enable them to transform into the energy companies they dream of becoming as noted by TotalEnergies 2021; BP (2021); Shell (2021) and Chevron (2021). For these companies, despite investment in renewable energy being a top priority, they have also declared unequivocally, that natural gas and oil will continue to play significant roles in their portfolios of the future in a more balanced energy system. Current energy market disruptions from geopolitical events, notably the war in Ukraine, rising energy prices, energy shortages due to post-COVID recovery and its induced rising energy demand continues to shine the spotlight on natural gas as enabler of energy security affordability and exploiting this resource in large quantities could help to deliver energy affordability, security, and reliability.

Evidently, natural gas is not only a bridge fuel for the energy transitions, but also a principal cash flow earner for international energy companies in the period leading to the energy transitions and beyond. It is also a clean energy source to complement government and industry efforts to actualise both net zero and the energy transition plans.

4. IMPACT OF THE NEW ACKNOWLEDGEMENT OF THE ROLE OF NATURAL GAS ON GLOBAL WARMING

Over 50% of UK energy is from gas and more than 38% is imported (DBEIS 2022; DBEIS 2022a). In the period leading to 2050, a growth in power demand is expected due to increased electrification (Li, Heymann and Marechal 2023; Sakamoto et al. 2021), which in turn creates even a stronger need to fill the gap in energy supply.

Meanwhile, a study by the North Sea Transition Authority (NSTA) in 2023 discovered that the average carbon intensity of domestic gas production in the UK was nearly four times lower, at 21KgCO2 per barrel of oil equivalent (boe), than imported gas from LNG with carbon intensity of 79KCO2/boe (NSTA 2023) as demonstrated in Chart 5. By extension, an investment in, and exploitation of natural gas in the UK or domestically within the EU would not only fill the growing energy supply gap from growing electrification among other factors in the energy transition period but could also potentially save 59KgCO2/boe.

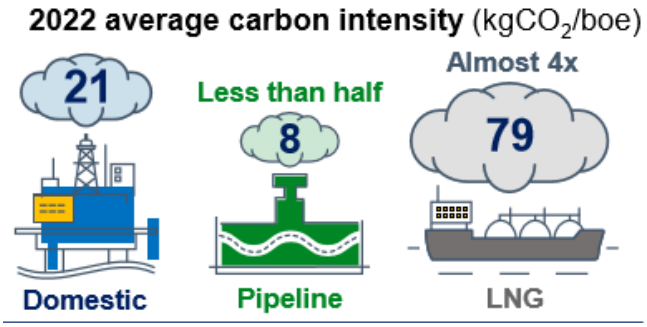


Chart 5 illustrates the carbon intensities of domestic UK gas production vis-à-vis imports via LNG and pipeline. From the Chart, domestic gas production is associated with only 21 KgCO2/boe, and only just about a quarter of the carbon intensity of imported gas via LNG with 79KgCO2/boe.

Chart -5: Average Carbon intensity of domestically produced and imported gas in the UK

Source: North Sea Transition Authority (2023)

Chart 6 presents the UK's LNG imports. From the analysis, 1.5 billion barrels of oil equivalent of LNG were imported from 2005 to 2023. This equates to 115 million tons of CO2, with 48 million tons being emitted between 2019 and 2023. This equates to 115 million tons of CO2, with 48 million tons being emitted between 2019 and 2023.

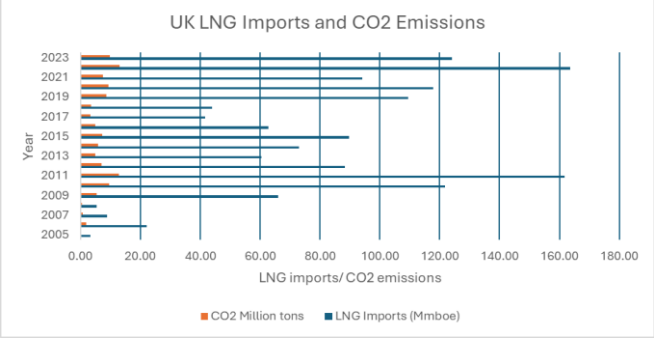
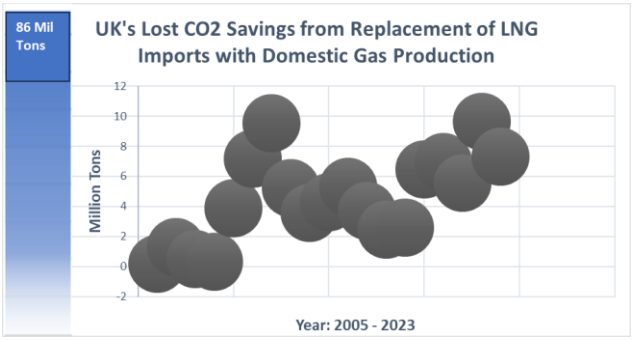


Chart -6: UK LNG imports and CO2 emissions from 2005 to 2023

In line with the NSTA (2023) methodology, this research estimates that the UK could have reduced its carbon footprint by 86 million tons (Chart 7) had all 1.5 billion BOE been produced domestically, supporting an argument for more rather than less home-grown UK natural gas in line with HM Treasury (2013) and confirming the literature on how natural gas enables the energy transition as demonstrated in the literature by Aguilera and Aguilera, (2020) Muhammad et al. (2021), Safari et al. (2019), Chikanayev (2023) and (Bugaje et al. (2022). From Chart 6, an upward trajectory of LNG imports can be observed, making the case for new development of natural gas from shale and the UK North Sea credible due to the availability of established gas infrastructure.



Chatrt 7 shows that the UK lost an opportunity to limit its carbon dioxide increases by 86 million tons due to rising volumes of imported LNG and reducing home-grown natural gas. A total of 86 million tons of CO2 could have been cut just by replacing LNG with domestic natural gas. This evidence illuminates the opportunity for shale gas and conventional natural gas to enable the energy transition as their consumption aligns better with CO2 reduction and the Paris Agreement than imported LNG in this in case.

Chart -7: UK's Lost CO2 Savings from Replacement of LNG Imports with Domestic Natural Gas Production

Natural gas emits less CO2 compared with coal plants for electricity generation. A study by Wilson and Staffell (2018) found overall UK carbon emissions reduced 6% in 2016 through fuel switching from coal to natural gas. The study among other things concluded that fuel switching could save 1 Gigatons of CO2 (1GTCO2) emissions per year (Wilson and Staffell, 2018). In 2023, coal provided 2.7%% of fuel for electricity generation in the UK (Department for Energy Security and Net Zero, 2024) and offers opportunity to save the associated CO2 emissions through fuel switching for natural gas, contributing significantly to Net Zero. A report by the International Energy Agency (2023) found that demand for coal in 2022 had reached an all-time-high of over 8.2 billion tons because they were cheaper and readily available compared to gas.

In other words, during the energy transition, whilst there remains a gap in energy supply, a transitional energy strategy which seeks to constrict the expansion of natural gas investment, a potentially practical replacement for coal, could be detrimental to the ambition of net zero carbon emissions by 2050, in so far as coal demand exists and further opportunities to expand domestic gas to reduce CO2 emissions from imported gas are unexploited. A more sustainable energy strategy during the transition ought, rather, to encourage natural gas exploitation to target the

reduction of coal consumption and thus the higher levels of CO2 associated with it. Progressively, natural gas demand in turn could, at the right juncture, be replaced when renewable energy technology is mature and able to fill demand for energy which was filled by supply from natural gas.

Thus, the new acknowledgement of the role of gas as a necessary source of energy during the transition could (1) support a just energy transition for all in line with UN's climate objectives, (2) ensure affordable and secure energy in line with UK government objectives, and (3) unlock cleaner energy progressively to meet present energy needs, whilst the world transitions its energy systems to a zero-carbon base pragmatically by 2050.

5. CONCLUSIONS

Energy transition, sustainable energy, and low-carbon energy have all dominated research and energy discourse in the last decade. However, energy policies seen during this period as direct result of the PA and the race to net zero by 2050 seem to have distorted the meaning of energy transition and marred an understanding of the role of natural gas during the energy transition. This phenomenon which has led to the proliferation of energy policies appears to constrict growth in supply of natural gas and oil in general.

The research reviewed the role of natural gas during energy transition. Importantly, it evaluated various Articles of the PA as the bane, in part, of vulnerabilities in global energy systems and the transition to cleaner energy. It also echoed a renewed understanding of the UK and EU governments of the role of natural gas during energy transition and shed light on the importance of gas to energy companies.

The findings suggest that national gas is a cash flow earner for energy companies during the transition. Natural gas could serve as bridge fuel to a cleaner energy future. It is concluded in the light of these that natural gas is an enabler of the energy transition, limiting carbon dioxide emissions when it replaces more carbon intensive fuels. For example, in the UK, 59KgCO2 will be saved for every 1 BOE of imported LNG that is replaced with domestic gas production. The findings, thus, provide impetus for policymakers to create sustainable energy policies that could support the energy transition through (1) progressive and pragmatic fuel switching and CO2 savings, from coal to natural gas consumption and (2) expansion of domestic natural gas production and consumption to reduce the relatively higher CO2 volumes associated with imported natural gas through LNG.

It is thus recommended that energy policies which constrict the production of natural gas must be reviewed, especially where infrastructure exists. An enabling investment climate ought to be created for an exploitation of natural gas equally as renewable energy because energy security and energy decarbonization should not be mutually exclusive.

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