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To cite this article: Eilidh Hughes & Aiora Zabala (29 Sep 2023): Net zero by choice? Oil and gas industry motivations for the energy transition and public policy in Scotland, *Climate Policy*, DOI: [10.1080/14693062.2023.2262439](https://doi.org/10.1080/14693062.2023.2262439)

To link to this article: <https://doi.org/10.1080/14693062.2023.2262439>



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# Net zero by choice? Oil and gas industry motivations for the energy transition and public policy in Scotland

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## ABSTRACT

Many oil and gas (O&G) companies began, in recent years, to increase their renewable and low-carbon energy (R&LCE) operations – crucial for climate mitigation. In Scotland, renewable electricity generation has tripled since 2009. However, this progress remains insufficient to meet carbon reduction targets. More effective public policies are needed to accelerate this trend while meeting energy needs and retaining energy industry employment, which is essential for a just transition. This study analyzes drivers of O&G industry investment into R&LCE to understand how government intervention can steer corporate decision-making. We develop and apply a conceptual framework of drivers of decisions for such investments. We conducted semi-structured interviews with 12 individuals in strategic positions working in O&G companies in Scotland, which are exemplary of similar O&G-intensive regions in the global North. We find that the energy transition narrative within the industry mostly supports developing R&LCE projects that build on existing O&G assets and expertise, such as blue hydrogen and carbon capture and storage. Industry-wide narratives encourage investment in R&LCE across the sector, not only in companies facing the most scrutiny. The findings suggest the need to tailor public policy to increase the pressure of drivers of change, including increasing restrictions on access to financial capital for O&G, emphasizing narratives that promote R&LCE, and working to lower the costs of accessing expertise and retraining employees in R&LCE technology. Transitioning employment without job loss through retraining workers synergizes private and social interests, so an emphasis on (re)training and education for capacity building can be an immediate successful policy approach for a just transition.

## Key policy highlights:

- Diverse factors influence O&G companies' decision-making on R&LCE.
- O&G industry perceives government support (fiscal and non-financial, like knowledge-exchange networks) is important to drive private investment in R&LCE.
- Industry paradigm evolving towards a more favourable view of the energy transition.
- Industry perceives the need to continue O&G production alongside emissions-reduction technology (CCS and blue hydrogen).
- Key factors to facilitate the transition are individual leadership and retraining to retain employment.


## ARTICLE HISTORY

Received 14 November 2022  
Accepted 19 September 2023

## KEYWORDS

Renewable energy;  
corporate climate strategies;  
public policy; voluntary  
measures; private  
motivations

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/14693062.2023.2262439>

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## 1. Introduction

Energy supply is one of the most significant contributors to global GHG emissions (IPCC, 2023), making shifting away from fossil fuels key in addressing climate change. The oil & gas (O&G) industry is responsible for a significant fraction of greenhouse gas emissions, directly and indirectly in production and consumption. Governments have responded to climate change by implementing policies to enable and accelerate the energy transition away from fossil fuels and towards renewable & low-carbon energy (R&LCE) while meeting energy needs and retaining quality employment.

In the UK, the Climate Change Act 2008 was amended in 2019 to commit the government to reduce the UK's carbon emissions to net zero by 2050 (BEIS, 2019; UK Parliament, 2019), with Scotland planning to achieve it by 2045 (Scottish Parliament, 2019). Scotland is central to the UK's energy transition plans because it produces 82% of the UK's O&G (Dowens, 2021). Renewable energy here includes that which is generated from non-exhaustible resources like wind, solar, hydro and tidal power (Fattouh et al., 2018; REN21, 2020). Low-carbon energy is defined here to include that which is generated from finite sources that emit less CO<sub>2</sub> than traditional fossil fuels, such as blue hydrogen and nuclear, and technology that reduces the amount generated by carbon-emitters, such as Carbon Capture and Storage (CCS) at gas-fired power stations (Dickel, 2020; Lu et al., 2019). O&G companies have promoted the latter as an intermediate stage in the energy transition (Van de Graaf, 2018) to maintain the gas revenues, some claim, needed to pursue further R&LCE (e.g. Shell, 2018).

The energy transition represents opportunities for Scotland, but it also risks injustices, in part because local communities heavily reliant on the O&G industry are vulnerable to industry relocations and job losses (Hirsch, 2020). Since O&G reserves were first discovered and exploited in the North Sea in the 1960s and 1970s (Shepherd, 2015), O&G has been core to the local and regional economy (Kemp, 2013), with Aberdeen dubbed 'The Oil Capital of Europe' (Innes & Monios, 2018). The industry boomed throughout the 1980s and weathered several oil price slumps, including in 2015 (Shepherd, 2015), which led to a significant downsizing of the sector (Innes & Monios, 2018). Scotland's O&G reserves were once lauded as a source of economic opportunity and strength, but their exploitation has become more contested (Evensen et al., 2023; Ostfeld & Reiner, 2020). Recently proposed developments, such as the Cambo oil field near Shetland, have triggered controversy, suggesting that O&G companies operating in Scotland might struggle to continue exploiting the resources they have relied upon for decades.

While R&LCE has long garnered the interest of O&G companies (Chaiyapa et al., 2018), only in recent years they have begun increasing their operations in R&LCE substantially (Pickl, 2019). It is generally accepted that in the early stages of R&LCE development, government support is necessary: public policies broadly understood, both financial and institutional measures, including facilitating access to expertise and networks. However, some scholars argue that this stage (the 'valley of death' before commercial viability) has passed (Van de Graaf, 2018) and that intervention (public policy) is no longer required for R&LCE technology adoption, assuming that markets will pull technology diffusion (ibid.). Government support for R&LCE in Scotland comes through numerous channels, e.g. The North Sea Transition Deal (2021) between the UK Government and OGUK and the £26 million from the Scottish Government to fund the Aberdeen Energy Transition Zone, both pledging investment in R&LCE (BEIS and OGUK, 2021; Scottish Government, 2021; BBC News, 2021). Further financial and practical support is available through government-affiliated industry and regulatory bodies, such as the Oil and Gas Authority (OGA, 2021), and institutions like the Net Zero Technology Centre (NZTC), funded by governments and industry (NZTC, 2021). The recent rapid progress observed in voluntary R&LCE activities (in Scotland, at least) could suggest that the private sector might have taken the lead in the transition. Given significant public investment in the energy transition, it is important to understand what motivates the industry in this transition, in order to strongly justify this public investment and design effective public policies.

To this end, we analyze the motivations of O&G companies to increase their R&LCE operations. We aim to (1) identify the diversity of factors influencing O&G companies' decisions to increase their R&LCE operations (*Factors*); (2) explore to what extent O&G companies would voluntarily choose to increase such operations in the absence of public policy and law (*Voluntary choice*); and (3) identify the main barriers to increasing private investment from O&G companies in R&LCE, where policy can support (*Barriers*). Understanding the

motivations of O&G companies to increase investment in R&LCE can inform more effective policy to facilitate a just energy transition and aid the exploration of a paradigm change towards an increase in such operations. To address these aims, we develop a conceptual framework of drivers or motivations for O&G companies to increase R&LCE operations and present the findings of 12 semi-structured interviews with professionals from 11 firms (global engineering, consultancy, exploration, or operating) with relevant decision-making capacities within the O&G industry in Scotland.

Many O&G companies working in Scotland have been vocal about their new operations in R&LCE, setting out targets in their public strategy documents and widely publicizing the success of their green projects (e.g. Equinor, 2020; Shell, 2018), albeit this publicity may not reflect their dominant operations. Public documents articulate the reasons for transition that companies wish to advertise. However, research suggests that there may be further, non-disclosed or implicit motivations for engaging with R&LCE (Chaiyapa et al., 2018). Understanding these motivations is important to advance the energy transition (Steg et al., 2021) and identify levers to make it more just. ‘Implicit motivations’ refer here to drivers that guide company decisions, but are not necessarily referred to outside specific circles, e.g. government or industry groups. Hereafter, ‘motivations’ refers to both implicit and advertised ones.

Previous studies that have engaged with experts on the energy industry in Scotland focused on understanding the view from government or were conducted before the shock to the energy transition induced by COVID-19 (Cowell et al., 2017; Hirsch, 2020; McEwen & Bomberg, 2014; Okereke & Russel, 2010). These studies analyzed broader carbon emissions reductions across business activities by energy-intensive companies and the role of devolution in energy. Other studies have analyzed O&G as a subsidiary sector (Hellsmark & Hansen, 2020; Normann, 2015). We build upon these studies and focus on O&G businesses that are actively engaged in the shift towards R&LCE.

## 2. Conceptual framework of motivations for the O&G industry to invest in R&LCE

Our research began by conducting a qualitative review of the academic literature to identify major drivers or factors discussed across the range of motivations for the O&G industry to invest in R&LCE as a voluntary environmental action (details in Appendix A). Drivers are understood here in the behavioural sense, as the conditions that motivate change. While the concept of drivers is inspired by literature on broader voluntary environmental measures (see Kolstad, 2011), studies specifically about the drivers and motivations for the O&G industry to increase operations in R&LCE are rare. Therefore we have synthesized these drivers from a diverse body of literature.

We structured these factors by theme to create a framework of drivers that influence decisions for O&G company investments into R&LCE (Table 1). The framework illustrates the diversity of decision-making factors a firm could consider when deciding whether to increase R&LCE operations. We divided these drivers into two categories, adapted from the classification by Okereke and Russel (2010): (1) *external* to O&G companies, including government action, and (2) *internal* to O&G companies, affecting operations from within. Given our research focus on government action, we disaggregate related factors in the framework. For each driver, Table 1 explains the mechanism(s) of how it can encourage R&LCE operations and indicates supporting literature.

The drivers are articulated in the framework as positive – driving R&LCE uptake intentions and decisions. In most cases, if the driver is absent, it can be inferred that it may, instead, deter investment (i.e. drivers become barriers). For example, where O&G reserves are perceived to be significant (rather than limited; driver a.), or if R&LCE operations are not perceived as profitable relative to current O&G operations (e.g. green hydrogen production; driver b.). We discuss each driver below (further details in Appendix A).

An O&G companies’ known reserves (driver a.) have been found to have an inverse relationship with its investments in R&LCE (Pickl, 2019). In Scotland, oil production slowed since 2009 (BP, 2020), and this is reflected in higher UK imports of fossil fuels (Thomas, 2020). Regarding relative profitability (driver b.), the wind is the largest source of electrical R&LCE (Scottish Renewables, 2021), which fell in cost per kilowatt-hour between 2010 and 2018, and is now competitive in many markets (IRENA, 2019; REN21, 2020). Perceptions over the relative profitability of this and other R&LCE may vary, but the trend is robust, although counteracted by the volatility of O&G prices and supply due to international events. Difficulty in accessing capital (driver c.) for

**Table 1.** Drivers of increased private operations from O&G firms in R&LCE (Source: the authors).

Driver	Mechanism to motivate private R&LCE investment	References
<b>1 EXTERNAL</b>		
a. O&G reserves and energy security	<ul style="list-style-type: none"> <li>Limited O&amp;G reserves.</li> <li>Reduced domestic oil production and increased import of fossil fuels, motivating the government to encourage private investment.</li> </ul>	Marques et al. (2010), Van de Graaf (2018), Pickl (2019), Hartmann et al. (2021).
b. Relative profitability of R&LCE	<ul style="list-style-type: none"> <li>Falling costs of R&amp;LCE and expected growth.</li> <li>Perceived profitability in R&amp;LCE generation.</li> <li>Falling profitability of current O&amp;G operations.</li> </ul>	Okereke and Russel (2010).
c. Access to capital	<ul style="list-style-type: none"> <li>Increasing evidence about the risks from anthropogenic climate change, motivating investors to place ESG conditions for funding of high-emission ventures.</li> </ul>	Van de Graaf (2018).
d. Public opinion and reputation	<ul style="list-style-type: none"> <li>Customer demand for R&amp;LCE.</li> <li>Maintaining a Social Licence to Operate among local communities and the wider public in a context of growing public awareness.</li> </ul>	Okereke and Russel (2010), Prno (2013), Chaiyapa et al. (2018).
e. Government law and policy		
<i>Government measures to restrict carbon emissions and the use of fossil fuels</i>	<ul style="list-style-type: none"> <li>Government measures to increase the costs of producing fossil fuels.</li> <li>Threat of government measures to restrict carbon emissions.</li> </ul>	Porter and van der Linde (1995), Okereke and Russel (2010), Aguirre and Ibikunle (2014), Nilsen (2017), Van de Graaf (2018).
<i>Government measures to support R&amp;LCE</i>	<ul style="list-style-type: none"> <li>Initial support to help new technology to avoid the 'valley of death'.</li> <li>Continued support to encourage large-scale R&amp;LCE implementation.</li> <li>Certainty of policy continuity.</li> </ul>	Weiss and Bonvillian (2009), Marques and Fuinhas (2012), Cowell et al. (2017), Chaiyapa et al. (2018), Nemet et al. (2018), Van de Graaf (2018).
<i>Government discourse and networks</i>	<ul style="list-style-type: none"> <li>Normative pressure from the government.</li> <li>Strong policy networks among government, NGOs and the energy sector.</li> </ul>	McEwen and Bomberg (2014), Cowell et al. (2017), Hirsch (2020).
<b>2 INTERNAL</b>		
f. Firms' existing expertise, capital and assets	<ul style="list-style-type: none"> <li>O&amp;G engineering and project management expertise largely transferable to R&amp;LCE development and implementation.</li> <li>Access to financial capital for R&amp;LCE development and deployment on a commercial scale (as opposed to other players, such as start-ups).</li> <li>Having O&amp;G assets that can be repurposed for R&amp;LCE production within the same spaces and communities that hosted O&amp;G production.</li> </ul>	Rugman and Verbeke (1998; 2000), Kolk and Pinkse (2008), Weiss and Bonvillian (2009), Nilsen (2017), Fattouh et al. (2018), Zhong and Bazilian (2018), Peng et al. (2019).
g. Environmental citizenship*	<ul style="list-style-type: none"> <li>A company's expressions of environmental concern across its business.</li> <li>Moral imperatives of action on climate change.</li> </ul>	Ershaghi (2019), Hartmann et al. (2021).

(Continued)

**Table 1.** Continued.

Driver	Mechanism to motivate private R&LCE investment	References
h. Shareholder demands	<ul style="list-style-type: none"> <li>• Shareholder demands for greener business practices.</li> <li>• Personally environmentally-concerned shareholders using their professional position to engage in activism.</li> </ul>	O'Rourke (2003), Van de Graaf (2018).

\*A firm's voluntary implementation of environmental measures, such as disclosure policies or sustainability in the workplace.

traditional O&G exploration and production ventures may steer O&G companies to diversify. Public opinion (driver d.) about energy production's contribution to climate change is becoming more prominent and may influence decisions for several reasons, including to ensure the acceptability of ongoing or new operations (Chaiyapa et al., 2018), meeting customer green demand (Kolstad, 2011) and the need for a firm to maintain their Social License to Operate (Jijelava and Vanclay, 2017).

Regarding government role (driver e.), companies may adopt voluntary actions to either dissuade regulators from establishing compulsory rules or to gain a competitive advantage if laws are implemented (Aguirre & Ibikunle, 2014; Kolstad, 2011; Okereke & Russel, 2010). Certainty of policy continuity is vital to encourage energy companies to participate in R&LCE support programmes (Aguirre & Ibikunle, 2014). Normative pressure from the government may have also helped to set the stage for R&LCE in Scotland, through narratives describing 'imaginaries of an energy independent and "green" nation' (Hirsch, 2020, p. 2) embedded in energy and innovation strategies, for example. Narratives and discourses are used here in the Foucauldian sense: narratives are the way people tell stories, and discourses are the broader way of thinking expressed through language. Both narratives and discourses help humans construct meaning and knowledge about the world. These are expressed and operationalized in spoken and written language (reports, strategies or laws). Lastly, strong policy networks between government, NGOs, and the energy sector can also help foster the energy transition (Cowell et al., 2017; McEwen & Bomberg, 2014).

Internally, O&G companies possess engineering and project management expertise (driver f.) that is highly transferable in many cases to R&LCE development and implementation (assets that could be repurposed), and access to the financial capital to develop and deploy R&LCE technology on a commercial scale (Peng et al., 2019). An O&G company's expressions of environmental concern (driver g.) have been correlated with its willingness to invest in R&LCE (Hartmann et al., 2021). Finally, shareholder demands (driver h.) evolving towards greener considerations can influence firm decisions (Kolstad, 2011; O'Rourke, 2003; Van de Graaf, 2018).

Overall, these factors may interact to drive private action for the energy transition (York & Bell, 2019). Drivers internal to the firms may be affected by external drivers, including government law and policy, and the later influenced by the other external drivers (e.g. energy security, market considerations and public opinion). All drivers may combine to favour a paradigm shift within O&G companies towards more investment in R&LCE (see Appendix A).

A paradigm, first introduced by Kuhn (1962/2012), is a set of commonly held beliefs about how a phenomenon functions, which informs and legitimizes related work (Bakken, 2019). The knowledge that underlies paradigms may be factual, but it is framed to form narratives. A change in paradigm (or in discourses and narratives) does not necessarily bring about change in behaviour although it is often a key step towards it. While originally used to refer to schools of scientific knowledge, Bakken's (2019) application of paradigms to the energy industry is useful in examining how and why a shift to R&LCE is happening within O&G companies. The 'incumbent paradigm' (Bakken, 2019, p. 184) in society and the O&G industry can be interpreted as energy being essential for ensuring a good standard of living for all, and therefore that there is a moral imperative to ensure that energy comes from the cheapest sources, assumedly fossil fuels. However, this paradigm is being replaced by another one (although still lagging emerging paradigms among other actors, such as epistemic communities): that GHG emissions and the resulting climate change have large-scale social and environmental impacts, disproportionately affect poorer people, and therefore energy needs should be met with R&LCE (Bakken, 2019). This



raises the question of how that paradigm shift is occurring in O&G companies and the influence of government action.

### 3. Methods

We gathered primary data from 12 semi-structured interviews with contractors and senior employees working for a range of O&G companies operating in Scotland. Semi-structured interviews are chosen because they allow researchers to gather in-depth information from a group of individuals with specialized expertise and insight, including about implicit motivations. This methodology ensures that themes are covered consistently across respondents, while also allowing them to speak freely about related topics (Gibson & Brown, 2009) with sufficient depth and flexibility. Also, using interviews makes this research more directly comparable with previous studies on investment in R&LCE in Scotland, which often have used a similar approach (Cowell et al., 2017; Hirsch, 2020; McEwen & Bomberg, 2014; Okereke & Russel, 2010).

#### 3.1. Sampling and interviews

The goal of our sampling approach was to elicit views from a wide diversity of professionals in a position to reliably identify drivers of change within the O&G industry. The sensitivity of industrial decisions (sometimes confidential or politically delicate) and concern over public image are known limitations to conducting interviews in the sector (Chaiyapa et al., 2018). This adds remarkable value to the sample we gathered.

The Interviewees included four respondents identified via researcher contacts, and eight accessed through a thorough process of identification via an online professional network and profiles leading to 44 invitations. Potential participants were selected through a body for energy professionals and from companies in OGUK's directory ('Oil & Gas UK'; OGUK 2021), which engaged in R&LCE or looking to move into the sector in Scotland according to their public mission. Respondents included employees of medium- and large-scale operators across the business chain of O&G operations, and have various disciplinary backgrounds (see Appendix B).

Questions were articulated based on the research aims with a view to eliciting drivers from the conceptual framework. However, most questions did not mention specific drivers, to mitigate bias (see Appendix B). The interview protocol briefly described the study and asked the core interview questions and baseline demographic questions. Respondents were asked to speak to their individual perspective and opinion regarding the sector and their company.

#### 3.3. Analysis

We transcribed all interviews and shared the transcripts with participants to allow them to correct any mistakes and withdraw any confidential information that might have been shared in error. No substantive information was changed. We then coded qualitatively the transcripts (using nVivo 12 Pro), developing a codebook with 34 themes under which the content of the interviews was categorized (DeCuir-Gunby et al., 2011). The codes were developed as a combination of deduction (from the conceptual framework) and induction (from the themes raised in the interviews). This allowed as much of the relevant interview content to be included in the analysis as possible.

Where a statement pertained to two or more codes, we referenced it under all that were appropriate (DeCuir-Gunby et al., 2011). Coding allowed us to identify common themes across participants, in addition to those that were unique to individuals. This coding was reviewed, and transcripts analyzed twice. During the first review, the codes were adjusted to better reflect the data. The second review was undertaken to enhance internal validity and reliability, by ensuring that data were analyzed consistently across the interviews.

For reporting results, quotes were selected because they reflect patterns of views across the data succinctly. Fragments in square brackets are by the authors, to abbreviate, clarify or anonymize. The views reported are not necessarily those of the authors, and can be at odds with ambitious climate policy discourses; we describe them with the aim of understanding the diversity of opinions that must be navigated in climate policy.

## 4. Results and interpretation

To report the results, the next subsections follow the conceptual framework, distinguishing between external and internal drivers. We associated each qualitative code with one of the three research goals, as well as with one or more driver in the conceptual framework (Figure 1; columns 'Goal' and 'Related driver' respectively). We estimated how frequently each concept was mentioned in the interviews (Figure 1; last two columns). All participants' responses were considered equally.

Respondents highlighted a wide range of factors contributing to or preventing R&LCE investment, including many discussed in the literature. The most cited drivers encouraging investment, in overall mentions, were R&LCE profitability; government law and policy involvement and collaboration; access to capital; O&G companies' existing capital and assets; and environmental citizenship and personal fulfilment. Notably uncommon at

Goal	Qualitative code	Related driver								No. of interviews with code (n=12)	References overall
		External				Internal					
		a	b	c	d	e	f	g	h		
(1) Factor	Profitability of R&LCE		■	■					■	12	60
	Personal fulfilment of staff				■			■		11	23
	Access to capital			■						10	21
	Existing assets and capital						■			10	31
	Reputation: improving public image generally				■					10	22
	Existing expertise						■			9	21
	Industry peer pressure or direction		■			■				9	14
	Desire to ensure or maintain presence in certain markets	■	■			■				8	13
	Environmental citizenship							■		8	28
	Lack of future profitability of O&G	■	■				■			8	14
	Desire to have a diverse portfolio		■							6	7
	Shareholder / partner demands							■		6	9
	Reputation: maintaining access to communities				■				■	4	4
	Energy security	■							■	3	5
Staff retention / recruitment					■	■	■	■	3	5	
(2) Voluntary choice	Government involvement in R&LCE needed					■				12	94
	Collaboration between government and industry					■				11	45
	Net-zero targets: reaching them likely / unlikely / misguided					■				11	29
	Normative pressure from government					■				8	22
	R&LCE led by industry					■				7	9
	Role of government measures against fossil fuels		■			■				7	12
	R&LCE led by government					■				6	10
	Government involvement in R&LCE not needed								■	2	3
	R&LCE held back by government processes / inaction					■				9	18
	Lack of or delayed profitability of R&LCE					■				8	16
(3) Barriers	Continued need for O&G	■	■				■			7	22
	Limited infrastructure						■			4	10
	Public unwilling to take on R&LCE / responsibility for energy transition				■					4	9
	Technology not yet market-ready		■			■				4	7
	Uncertainty about future needs and market; risk too great		■							4	11
	Difficult for small companies to enter R&LCE market						■			3	3
	Difficulty in obtaining funding for R&LCE			■						3	3
	High levels of reserves or low risk of stranded assets	■							■	2	3
Barriers to obtaining planning permission						■			0	0	

**Figure 1.** Codebook and frequency results (Source: the authors). Drivers are external: (a) O&G reserves and energy security, (b) Profitability, (c) Access to capital, (d) Public opinion and reputation, (e) Government law and policy; and internal: (f) Existing expertise, capital and assets, (g) Environmental citizenship, (h) Shareholder demands. (Study) goals are those stated in the Introduction: (1) factors influencing decisions to increase R&LCE operations; (2) the role of public policy/ government involvement vis-a-vis fully voluntary choice; (3) explicit barriers to private investment.



the time of the interviews, were concerns regarding energy security and shareholder demands. These may have heightened due to recent global developments in energy supply and public policy, such as the disruption in O&G provision from Russia.

In what follows, some codes are excluded as they were infrequently mentioned by participants or were given little importance. They are included in [Figure 1](#) for completeness. The drivers in the following subsections are not necessarily exclusive, and quotations may be relevant to multiple themes.

Across all drivers, it transpired that a paradigm shift is occurring in the O&G industry with regards to the dominant attitude towards R&LCE. Several participants suggested that this change in narrative had become more powerful in recent years, e.g.:

[I]t became really clear in 2019, if you look at BP's Economic Outlook from 2019, you'll see a real key shift, [...] the world all seem to go 'Wow, this is real now, it's not just for fun or daydreaming about anymore', [...] everybody seemed to, all at once, go 'Yeah, this is real, let's do something about it', and [my employer is] part of that. (E5)

Several reasons may have influenced this shift, which seems mutually reinforcing with R&LCE investment drivers. Arguably, a change in dominant narratives increases stakeholder confidence in the business opportunities that the energy transition offers.

#### 4.1. External drivers and barriers

##### 4.1.1. O&G reserves and energy security

The interviews revealed little evidence suggesting that hydrocarbon reserves are a significant consideration – hydrocarbon levels in North Sea oil reserves were not discussed by any participants who were not prompted to consider it. When asked about the relevance of reserves to R&LCE decision-making, J10 and E11 emphasized that O&G will still be required throughout the energy transition for both traditional uses and R&LCE. As discussed later, the continued need for O&G as part of deploying R&LCE forms an important part of the new discourse within the industry.

Regarding stranded assets, some companies appeared to have worked with the assumption of being able to exploit all of their existing assets alongside R&LCE operations, and perhaps continue to do so:

[W]hen you look at the case of stranded assets, [reserves] that you've got on your portfolio, [...] but are unlikely to ever be produced, [...] in the [UK] sector we were operating [on the assumption of] 100% [of our reserves being produced]. (J10)

Energy security was a minor consideration and only for some. It was also used to justify the continued need for O&G, rather than a motivation for investment in R&LCE (B2, I9 and J10).

##### 4.1.2. Relative profitability of R&LCE

The importance of R&LCE profitability to increase industry operations was explicitly mentioned by all interviewees: '*[W]e definitely will not be doing projects which are not economic, that's for sure*' (H8).

Unsurprisingly, it was clear among respondents that investment in R&LCE by O&G companies depended on its profitability, relative to alternative operations (including business-as-usual). They agreed, either implicitly or explicitly, that R&LCE is an area of current and future growth, which will have '*some tremendous winners*' (C3). While voluntary measures for R&LCE were once perceived as a cost for the O&G industry (an exercise in corporate social responsibility), views in the energy sector appear to have shifted to seeing R&LCE as an opportunity to capitalize upon (Okereke & Russel, 2010):

[A]ll the clients are talking about energy transition, [...] offshore wind is growing [...] whilst [O&G] is diminishing, [...] clean energy is now our number one strategic target area. (K12)

Respondents were enthusiastic about the financial opportunities that R&LCE offers, but they also unanimously believed that O&G will still be required in the future energy mix. Accordingly, a continued need for O&G is part of their new paradigm:

[Independent advisors on climate change are] not saying that the economy is a zero-carbon [or] a zero-[O&G] economy, [...] there is still a need, even in 2050, for [O&G] to exist. (J10)

Continuing with O&G operations was generally viewed as a source for investment in R&LCE, hence supporting rather than hindering the energy transition: *'[T]he only way we will pay for the CCS is through the profits [from] [O&G]'* (H8). No other participants were as explicit, but several suggested that, while R&LCE will be profitable in the future, funds from O&G are required for the initial investments.

Participants also portrayed using natural gas as *'almost like a pseudo-energy transition'* (E11) due to its lower emissions relative to coal and oil. A transition pathway widely accepted within the O&G industry intertwines the need for hydrocarbons and R&LCE development, as follows: natural gas is useful to produce blue hydrogen and can provide revenue while the infrastructure for hydrogen is established (I9 and E11). Once the latter integrates into the energy mix and electricity production from renewable sources increases, green hydrogen production can be expanded (G7).

This use of natural gas as part of the energy transition has been criticized outside the O&G industry, with Ueckerdt et al. (2021, p. 391) arguing that building hydrogen capacity at the expense of electrification through renewable sources, could risk 'a lock-in of fossil-fuel dependency'. The consistency of the pro-hydrogen narrative among the employees interviewed, in the face of differing views outside the industry, suggests that this forms part of the new paradigm within the industry, encouraging R&LCE development while justifying continued O&G activities.

#### 4.1.3. Access to capital

All interviewees but two discussed concerns over access to capital in the energy transition. They suggested that a threat to O&G venture funding was forcing companies to change their operations to fulfil Environmental, Social and Governance (ESG) requirements:

[W]e are linked to the big pension funds, we need to be kept that way, and you can't do that if you're not ethical and [...] not seen to be genuinely looking to change. (D4)

Participants did not necessarily distinguish between investing in emission reduction for O&G projects and in R&LCE; ESG requirements may simply mandate that hydrocarbon projects include energy efficiency measures, rather than restrict funding for O&G projects (F6 and E11). In line with the argument above, this implies that the dominant paradigm in the O&G industry encompasses both O&G and R&LCE, and investment firms' current ESG requirements may contribute to justify continued O&G production.

The cost of capital for O&G projects, rather than its availability, may drive investment in R&LCE more notably. Capital for the latter is often cheaper (E11), and *'more marginal [O&G] projects [...] will not be developed'* (F6). This may increase investment in R&LCE on profitability grounds, should financial capital for O&G projects become too expensive.

#### 4.1.4. Public opinion and reputation

Nearly all participants referred to the role of the public in the energy transition. Some emphasized that their employers were keen to engage with civil society to inform their strategies and activities (E5, G7 and H8). Others suggested that public perception was important for maintaining their Social License to Operate (D4, G7, I9, J10 and K12), which was considered at a national or European level, rather than with regards to relations with local communities close to energy production. Overall, this implies a very superficial approach to procedural justice (which requires inclusive representation in decision making; Santos Ayllón & Jenkins, 2023), but that public pressure still influences O&G companies:

[P]ublic perceptions are forcing a change of behaviour amongst the [O&G] community: for example, [a large international operator] bought its way into offshore renewables, [only] because they needed to get a green presence. (K12)

Interviewees from smaller companies revealed that public pressure to switch to R&LCE was not limited to large global operators:

[P]eople who love the Earth and [environmental non-profit organisations], go after [large international O&G companies], but [...] there is going to come a time where mid-sized companies will be exposed. (E11)

Accordingly, public pressure can affect the activities of O&G companies (Thiri et al., 2022) even if they are not directly in the public eye. This could explain why the change is occurring at a sector-wide level rather than simply affecting each company as they come under public pressure directly.

In parallel, participants' references to personal fulfilment suggest an influence of social norms internalized by staff:

I'm a believer in the next generation, [...] and who's caring about them? In the current government it doesn't feel [...] like anybody [does]. But at least [my employer does]. (E5)

Therefore, societal discourse is not merely external to the company; it can also affect internally, as discussed below.

## 4.2. Governmental law and policy

All participants emphasized that government intervention is essential to facilitate investment in R&LCE by O&G companies (as represented by a high frequency of all categories of government drivers in Figure 1).

### 4.2.1. Restriction of carbon emissions and fossil fuel use

Perhaps unsurprisingly, measures that make high-emission activities more expensive are a major factor for O&G companies to consider R&LCE. Discussing the short term, participants focused on actions to increase energy efficiency of O&G operations. In the longer term, many suggested that expected high carbon prices influenced investment in R&LCE:

[C]arbon pricing has moved significantly within the last, [...] 12, 24 months [...]. It could be foreseeable that [...] you're either going to be pushed towards reducing those emissions in order to continue [towards] your planned cessation of production [...], or you pull that cessation of production forward. (J10)

While decommissioning O&G operations does not necessarily lead to investing in R&LCE, the Porter Hypothesis suggests that regulations push companies to innovate and invest in more environmentally friendly ventures (Porter & van der Linde, 1995). When combined with financial support from the government, measures to restrict GHG emissions seem to have effectively shaped companies' behaviour through an impact on profits:

It is good that the government is pushing through regulation to say, 'you have to start moving towards no local emissions', and at the same time, encouraging the market by investing in it. If they weren't doing that it would be too easy for profit-driven companies to just say 'we'll do it in the future, [...] when the technology is there, and when the other more value-added opportunities aren't there to compete against it'. (E5)

This suggests that in the absence of government intervention, O&G companies would choose to invest less in R&LCE, clearly informing the second study aim. However, participants were wary of measures perceived as excessively hostile towards O&G production; it was said explicitly that policies that made O&G significantly less profitable may push them to shift their operations to other countries (I9), akin to a so-called 'pollution haven' phenomenon. This desire to balance policies for the energy transition with support for continued O&G operations permeated many interviews. Accordingly, in this emerging paradigm, balance and collaboration between government and industry – '*not a confrontational, adversarial approach*' (B2) – is an important aspect of the energy transition, even if companies accept that some emissions restrictions are necessary.

### 4.2.2. Support for R&LCE

Government measures to support the development, deployment, and uptake of R&LCE were considered vital. Three participants working for companies developing new R&LCE technology emphasized the particular role of government support in progressing fledgling technology due to the risk of investing in unproven technology which might not succeed (A1, J10 and K12). This aligns with the importance the private sector gives to government support for new technologies towards commercial viability (Weiss & Bonvillian, 2009). For smaller companies, this funding can be essential to develop and demonstrate new R&LCE and, '*because of that demonstration, they will be able to attract investment*' (K12).

When discussing government support for more established R&LCE technology, nearly all participants stated that without it, many or all of these projects would not proceed, although they stressed that this did not mean the companies themselves were dependent on the support (G7 and H8). These two observations appear somewhat contradictory. However, they suggest a perception that government support has encouraged companies to invest in certain R&LCE projects that would not be of their interest otherwise.

All but one interviewee mentioned the importance of active collaboration between government and industry, with some emphasizing that it is critical for effective policies encouraging energy companies to maintain their presence in Scotland. A respondent suggested that the industry can do certain projects independently (such as emission reduction projects on offshore installations) triggered by carbon pricing and internal drivers alone. However, to encourage large-scale R&LCE ventures (with the potential for long-term production capacity), government support was perceived as imperative:

[Without] support from government, [the] industry would probably do nothing, [...] it's based entirely upon input from government to get the right behaviours and support the right opportunities. (J10)

Several participants cited the UK's political stability and the consistency of energy law and policy (as of 2021) as reasons for why Scotland is an attractive location for energy projects, in line with Aguirre and Ibikunle (2014):

[My employer]'s mantra is to try and invest in a jurisdiction [where] you know policies will be [...] stable, and it's not [...] one government coming in today with one policy, and then [...] the same government wakes up tomorrow, policies are changing. (E11)

Participants were broadly appreciative of the Scottish government and emphasized the positive impact of its support. However, most also suggested that lengthy processes or inaction were restricting R&LCE project implementation. This was a particular concern regarding the conversion of aging O&G assets into R&LCE production facilities, and the rigorous project approvals protocol. One participant (B2) suggested that this protocol is designed for O&G projects with a potential to cause significant pollution if they go wrong, but when applied to R&LCE projects, it delays approval needlessly, because R&LCE projects have, arguably, lower potential to cause environmental damage. This view alludes to difficulties arising from a legal framework designed for O&G now used to govern R&LCE. While significant funds and policy support have been made available for R&LCE, several interviewees highlighted that laws related to offshore construction and practices hold R&LCE deployment back (B2, I9 and J10). In response to our third research aim, this suggests leverage for the government to review and update regulation as appropriate.

#### 4.2.3. *Government discourse and networks*

Institutional discourse (the narratives used in written and oral communications, conveying values and desirable goals, among others) and support for policy and information networks facilitate knowledge sharing among industry actors (Cowell et al., 2017; McEwen & Bomberg, 2014). Besides financial measures, all participants mentioned the importance of energy policy networks and consultations to encourage interest and investment. For example, regarding the NZTC in Aberdeen:

[N]ot only does it help to get the financial assistance but [...] they're building the network, [...] so that we can then seek out expertise, innovation, [and] technology, to carry out these projects, because it's all frontier really, [...] it's good that there's the government support to [...] get past that and start applying it. (E5)

Several participants expressed the influence of conversations had within the industry, often through these networks (A1, D4, E5, F6, I9, E10 and K12):

[T]he trick is to push in the direction that we've seen over the past several years [when] conversations intensified about switching from fossil fuels to renewable generation. (F6)

Communication via these networks, steered by adequately designed discourses that favour R&LCE (Cowell et al., 2017; Hirsch, 2020) can shape the industry's dominant paradigm. It can normalize and encourage investment in R&LCE, as O&G companies strive to stay competitive.

### 4.3. Internal drivers and barriers

#### 4.3.1. Existing expertise, capital, and assets

The firm-specific advantages to further R&LCE investment that appeared most salient were the presence of existing expertise, capital, and assets. Expecting less future O&G demand, companies are exploring the potential of converting their existing O&G assets into R&LCE facilities, and these assets may determine the type of projects in which companies invest:

[T]owards the end of the value chain of [O&G] is, what do you do with your assets that you have? [...] [I]t's very attractive to be able to [use] them for something else. And in the UK [...] CCS and hydrogen are the obvious candidates. (I9)

Some interviewees also discussed the attractiveness of using R&LCE such as wind turbines to power O&G operations, lowering costs through reducing emissions and fuel use (B2, D4, G7 and J10). However, asset-related decisions taken by O&G companies alone are, arguably, unlikely to promote the full range of R&LCE required for the energy transition, particularly commercial-scale renewables projects. As discussed above, participants also argued that companies may invest revenue generated by O&G production into R&LCE (A1, G7, H8 and I9), increasing the amount of private investment available. This contributes, in the emerging paradigm, to justify the O&G industry's presence in the R&LCE sector.

Further, many O&G competencies were seen to be transferable to R&LCE, so specific company expertise can give a competitive advantage in certain R&LCE technology sectors, such as hydrogen:

[I]t fits with our existing skillset, all the engineering that we employ, [...] the whole infrastructure of our business doesn't really need to change much to get involved in that space, it's very much akin to what we already do with [O&G] projects. (B2)

However, consistent with Zhong and Bazilian (2018), some noted that not all O&G skillsets are transferable to R&LCE:

[I]f we look at the [numerous] people in [my employer]'s office, [...] maybe [1/6] of them might have transferable skills, [...] you're looking at some real niche skills around chemicals or subsea reinjection [...], so it's not a huge amount actually. (D4)

Therefore, as the energy transition progresses, investment is likely to be required to help former O&G workers to re-skill for R&LCE or another sector. This would align with the need to redefine quality employment for a just transition (García-García et al., 2020).

#### 4.3.2. Environmental citizenship

Several interviewees suggested that environmental commitments in their employers' strategies have a material impact on day-to-day activities, including investments in R&LCE:

[My employer] is ensuring that they're delivering per their own strategy, [...] updating the parameters that they normally use to make go/no-go decisions for any investment, and including decarbonisation is a key part. (G7)

Accordingly, a company's expression of environmental citizenship in its strategy appears to have a tangible effect on business decisions. Many participants said things reflecting environmental citizenship (D4, E5, G7, I9 and J10), such as *'the climate change imperative'* resulting in *'the need for the sharp focus on decarbonisation'* (A1).

Some participants discussed how their own personal fulfilment drove them to work in the energy industry, sometimes specifically in R&LCE. This suggests that individuals' sense of environmental citizenship and personal motivations can also steer operations:

I had always been a committed environmentalist. [...] I got the opportunity to transition [...] into the renewable part of the business four years ago. [T]he renewable part of [my employer] then was so small and [...] like a start-up mentality. And I remember folks saying to me, 'What are you doing? You are throwing away your education, your career, etc., for something that's so uncertain [...]'. I thought, well, these are the principles I have, this is why I came in [...] and it definitely wasn't easy for the first few years, but gradually, we've grown the business up, I've been part of shaping [it] up, I'm really privileged and humbled to be part of it from the beginning. (C3)

This statement aligns with ample evidence of O&G leaders and experts' personal motivations to shift to the renewable sector in Norway (Rauter, 2022). It also suggests that the emerging paradigm and pro-environmental views of staff are mutually reinforcing, strengthening the imperative for companies to invest in R&LCE.

### 4.3.3. Shareholder demands

Participants rarely mentioned shareholder demands, but some implied that their influence was important to high-level business decisions (F6, G7 and I9). One participant suggested that their employer's core business was defined by shareholders:

[I]f we did want to diversify or pivot, we would have to rewrite all of our agreements around the establishment of the company. So [...] although there are options there, it's what our investors are telling us, [...] they want us to be focused on [O&G] and this is the core of our business. (I9)

Implicitly, shareholder demands like the one illustrated in the quote can have a lock-in effect, compelling a company to remain in O&G rather than change its focus to R&LCE (although as indicated in Table 1, the role of shareholders can be the opposite).

## 5. Discussion

Our first research aim was to identify the diversity of factors influencing decision-making on R&LCE within O&G companies, of which we found a wide variety. To deploy a sufficient range of R&LCE on a large scale, it must be more profitable than O&G in the long term. Government law and policy notably influence O&G companies, particularly through fiscal measures (e.g. carbon pricing and subsidies) and non-financial support for R&LCE projects. Government discourse and networks (the narratives used in formal communications, and the platforms and other initiatives to connect experts) are also important in steering the paradigm within the industry. These facilitate sharing and accessing expertise, influence social norms, and prompt the industry to see competitive advantages in the transition.

Regarding our second aim of exploring the extent to which O&G companies would voluntarily increase R&LCE operations in the absence of public policy and law, the findings suggest that they would not invest to the same extent without such government policy. It is rational for companies to explore efficiency measures to reduce costs. Yet from the interviews, it appears unlikely that O&G companies would have pursued independently significant technological innovation or large-scale R&LCE projects (e.g. quote by E5 in subsection '4.2.1. Restriction of carbon emissions and fossil fuel use'). In the absence of government policies to aim to limit carbon emissions many companies would not have innovated, in line with the Porter Hypothesis (Porter & van der Linde, 1995). Interviewees also argued that institutional support for R&LCE (such as providing subsidies and enabling networks) has been integral to increase capacity, and it will continue to be essential throughout the transition.

The third aim sought to identify barriers to private investment in R&LCE. Our results indicate a perceived continued need for O&G production alongside emissions-reduction technology. This perception diminishes the incentives for O&G companies to invest in R&LCE. Companies are still able to access capital for O&G in accordance with ESG requirements, and the implementation of some R&LCE is intertwined with O&G, such as blue hydrogen. These two aspects lessen the perceived pressure to replace O&G production and thus contribute to justify decisions to continue O&G production.

### 5.1. Policy implications

The energy transition presents major opportunities also for the O&G industry, but it is deeply disruptive to their traditional work too. This potential disruption hinders this powerful group from taking a favourable position towards ambitious mitigation targets in negotiations. The emergent O&G paradigm explored in this research gives indication that negative perceptions about this disruption due to a clean energy transition are diminishing. These negative perceptions are further reduced with R&LCE innovation that fits well with existing O&G



assets and expertise, such as blue hydrogen, CCS, and the use of renewable energy to reduce emissions in hydrocarbon production (like transport electrification or switching electricity sources).

In parallel, interview results regarding several drivers suggest there is an overall belief that O&G operations may continue, and that extant assets may be exploited to fund the energy transition, particularly blue hydrogen and CCS. The continued emphasis on CCS appreciated throughout the interviews highlights an emerging challenge. Based on this belief, companies are able to justify long-term O&G production, which could hamper the advance of R&LCE. This focus represents a rather narrow transition pathway, anchored in what wider evidence suggests are second- (or third-)best strategies; following IPCC (2022, 2023) reports, CCS solutions show lower potential and higher costs to mitigate emissions in the energy sector than, e.g. energy efficiency and renewable sources. For a rapid clean energy transition to occur, there is thus a need to counteract the narrative that the transition requires a middle step via CCS and natural gas. This suggests a need for intervention to restrict O&G production while also facilitating R&LCE expansion. An emphasis on diversification, reorientation, and technological phase-out (Andersen & Gulbrandsen, 2020; Mäkitie et al., 2019) can encourage a stronger support for the leap required for fast emission reduction. Such intervention could be aided, among others, by renewed government narratives that diminish the acceptability of continued O&G production. Another barrier relates to government processes and regulations deemed to be outdated (like lengthy project approvals), which hinder private investment in R&LCE in some circumstances and may need to be revised and tailored to R&LCE.

The interview evidence also highlighted the importance of individual leadership in R&LCE initiatives within the O&G industry. Self-aware professionals may undertake activities they believe in, i.e. expanding R&LCE activities, despite colleagues in their working environment not supporting or informally disapproving of these activities due to uncertainty, risk, or different values (e.g. quote by C3 in '4.3.2. Environmental citizenship'). Such individuals are pivotal in the pioneering stage of innovation diffusion, arguably when innovators are subject to criticism and extra scrutiny (like in the above quote). Initiatives for social or professional recognition of individual pioneering work can help in this area. Although this stage fades out as R&LCE efforts become more normalized.

## 5.2. Further research

The findings point to further areas of research to better inform public policy for a just energy transition. Our results show that government support and collaboration are crucial from the perspective of the industry. The next step is to investigate the effectiveness of specific interventions to encourage deployment of R&LCE technology that is independent of O&G production (e.g. R&LCE not suited to utilizing existing O&G assets or expertise, like onshore wind, solar farms; or decentralized systems like domestic solar or electric cars for battery storage). Such technologies may need more government support than emission mitigation technologies favoured by the O&G sector such as CCS and blue hydrogen. Further diversity of perspectives can also be uncovered, such as whether the emphasis on drivers differs by firms' level of engagement with R&LCE. Perspectives of industry representatives are also highly dynamic, they continue shifting. Understanding their evolution over time is ever more relevant in a context of rapidly evolving global narratives around energy security and sustainability, influenced by global political events, such as conflicts affecting international O&G trade and energy policy, and increasingly ambitious international agreements on climate change mitigation. Also, understanding the impact of such views on decisions, i.e. the attitude-action gap, merits further attention: actions by private firms may be preceded by a change in internal narratives (which influence intentions), so there may be a lag (or a gap) between this change and the firm acting upon it.

## 6. Conclusion

Our results suggest a favourable disposition within the Scottish O&G industry to increase investment in R&LCE on several levels. This is driven particularly by considerations of R&LCE profitability, utilizing existing expertise, capital and assets (notably market-based drivers), and by the personal motivations of industry workers.

However, in response to the central research question, understanding the motivations of O&G companies to increase investment in R&LCE, the results also suggest that this appetite for R&LCE expansion is perceived to have largely been achieved through government intervention and, to an extent, public pressure; industry representatives perceive the government as crucial for the industry to increase R&LCE operations. Regarding two key elements of a just energy transition, while energy security (access) is not perceived as a challenge by interviewees, job loss is a known concern for communities in Scotland, and interviewees hint at the potential to transfer and retrain workers in new R&LCE operations, which in turn would avoid impacting wider employment (Scheer et al., 2022).

This research highlights areas where government policy could influence private investment in R&LCE: incentivizing investors to focus on non-O&G related R&LCE, facilitating training (to address concerns over continuity of employment) and access to specialist expertise, and tailoring narratives (i.e. the language used in written and oral communications) to shape the ongoing paradigm shifts through networks. In particular, industry priorities exist about skill transfer, and these align with societal priorities to avoid disruption to employment in relevant communities. Therefore, this area can be an immediate strategy where government intervention supports a transformational and ultimately just energy transition.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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