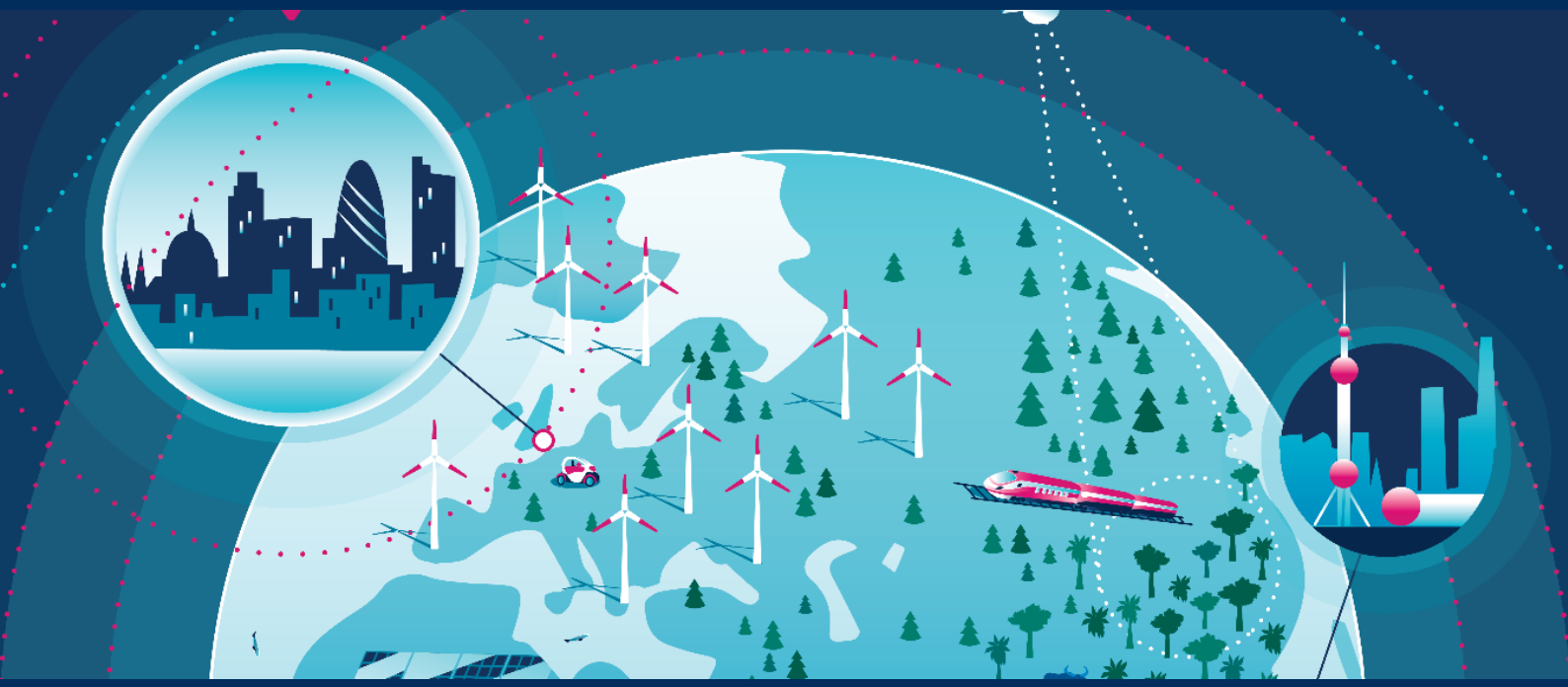
UK Export Finance and domestic jobs



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Key findings

UKEF support for renewables exports is likely to be more effective in supporting domestic jobs, than UKEF support for O&G due to two drivers:

1. **Job intensity:** Renewables are more labour intensive. That is, for every £ of investment in the industry, more jobs are required. Hence, for the same level of UKEF support (liability), UKEF can support 150% to 200% more jobs in the renewable energy industries than in the oil and gas industries.

2. **Additionality**: Compared to oil and gas supply chain companies, trade credit support is likely to be more critical to renewable energy companies. This is because they (i) typically have a smaller balance sheet and are hence less able to absorb risk, and (ii) engage in more capital-intensive projects (as a % of total project costs) abroad, which increases the likelihood of foreign projects requiring financing support.

By 2035, jobs supported by renewable exports are likely to exceed jobs supported by oil and gas exports. While oil and gas exports are likely to decline, there are growing renewable export opportunities that UKEF support could help unlock. To align with the Paris Agreement, global demand for wind and solar energy in 2040 will be roughly 7 and 20 times larger than today, with hydrogen and (battery) storage markets growing rapidly as well. The UK is well placed to capture meaningful market shares in these markets. With a supportive policy environment, the annual number of direct and indirect jobs supported by exports from renewable energy industries could grow from 2,000 today to over 42,000 by 2035, overtaking that of oil and gas exports.

UKEF support plays a relatively minor role in supporting oil and gas jobs in the UK, and withdrawing support is unlikely to have a meaningful negative impact on jobs supported in the industry. Direct and indirect jobs supported by the UK oil and gas industry have fluctuated substantially over the last decade, driven by domestic investment cycles. Ensuring a smooth transition as North Sea production decreases is important to avoid regional unemployment. However, this will primarily depend on smoothing production and investment cycles in the North Sea and re-training workers to join growing industries, rather than supporting exports. Even if UKEF continues its current level of support for oil and gas exports, the estimated 8,000 jobs it helps support is small relative to the 150,000 jobs currently employed directly or indirectly by the oil and gas industry and the approximately 50,000 jobs at risk from declines in domestic production.

Introduction

This note examines the strength of evidence suggesting UK Export Finance (UKEF) support for oil and gas is effective at supporting domestic jobs, by comparing it against the potential for supporting renewable jobs. As the energy transition gains pace, supported by rapid policy development such as the Chinese net zero target and sizeable green recovery packages, this note examines the role of export agencies in grasping growing opportunities. There is substantial evidence that investment in renewables supports a larger number of jobs than the oil and gas sector. Given this, this note highlights a feasible scenario where UK renewable exports could support more domestic jobs than oil and gas-related exports. Furthermore, this note argues that typically smaller renewable companies will benefit more from UKEF support than oil and gas companies.

UKEF has historically supported oil and gas exports at substantially greater scale than renewable exports, despite the growing scale of renewable export markets. Between 2013/14 and 2019/20, UKEF provided £6 billion in finance, such as buyer credit, loans and loan guarantees, for oil and gas projects including exploration, drilling, refining, LNG infrastructure, and fossil fuel power plants.[1] Over the same period, the total amount of UKEF support for renewables was £500 million. The implied prioritisation of oil and gas is difficult to reconcile with the UK's aim to provide climate leadership, and also represents a lost opportunity to help UK industry create jobs in a rapidly growing export market.

Supporting exports related to renewables aligns with the government's aim to support jobs that are viable in the long run. In a 2019 Parliamentary Inquiry, UKEF argued for the importance of supporting oil and gas-related exports to protect jobs around the country and smooth the transition.[2] Despite the legitimate concern around potential job losses in the sector, export support is unlikely to meaningfully improve the number of jobs in the sector. UKEF finance supports a relatively small number of oil and gas jobs, particularly when compared to the jobs lost and created during natural investment cycles in the sector. By contrast, UKEF support for renewables can be an important element of a wider policy package to help workers transition to jobs in a growing and more sustainable sector.

The lessons set out in this note are drawn from the UK, but hold more generally across many developed nations. Like UKEF, other export credit agencies (ECAs) support their domestic oil and gas industries. Indeed, the Mozambique LNG Project supported by UKEF also received support from ECAs from the US, The Netherlands, Japan, Italy, Thailand and South Africa.[3] Like the UK, countries like the Netherlands and Italy are setting ambitious climate goals (nationally and as part of the EU) and their ECA support for oil and gas creates a similar tension between the policy of different government agencies. Furthermore, like the UK, these countries have growing domestic renewable industries, which per £ or € investment, typically support more domestic jobs and are likely to benefit more from ECA support. Hence, the arguments made for the UK in this note are relevant and applicable to other countries.

[1] Based on UKEF written evidence for the 2013/14 to 2017/18 financial years, and calculations from 2018/19 and 2019/20 accounts. The reported value for UKEF support is measured by the maximum liability it assumes.
[2] For a transcript of the proceedings, see http://data.parliament.uk/writtenevidence/committeeevidence.svc/evidencedocument/environmental-audit-committee/uk-export-finance/oral/98536.html
[3] See https://www.theguardian.com/business/2020/jul/20/uk-could-face-lawsuit-over-1bn-aid-to-mozambique-gas-project

Box 1 UKEF and the role of export credit agencies

- **International trade involves risks for exporters and importers.** Most global merchandise trade has been financed on an *open account* basis, in which importers repay exporters after receiving the goods, without insurance or lending from third parties. In this context, exporters are implicitly supplying capital to importers and bear the risk of *non-payment*. Conversely, some trade is financed on a *cash-in-advance* basis, in which importers pay for goods before they are shipped and bear the risk of *non-performance* (Asmundson et al. 2010). These risks are also inherent in internal trade but are more salient for international trade due to differences in business and legal environments across jurisdictions.

- **These risks can be a barrier to trade and may require insurance or other financial products to reduce risk exposure.** For larger contracts, exporters and importers often seek to shift some of those risks to banks, insurers and other non-bank financial intermediaries. Importers may also need credit to help finance their initial expenditure. The ability to obtain credit influences the export performance of firms (Amiti and Weinstein, 2011). Manova (2012) showed that the cost of external finance may prevent firms, originally fit to export, to do so.

- **Commercial finance and insurance are not always available, or too expensive. S**ome projects carry political or commercial risks that commercial lenders and insurers are unable or unwilling to take. This leaves a gap in trade finance which public institutions such as ECAs and multilateral development banks (MDBs) help mitigate.

- **An ECA's objective is to fill the gap left by commercial financiers and insurers.** ECAs offer financing or insurance tied to exports. ECAs (like UKEF) can be revenue neutral by charging interest rates commensurate with the risk they face. Nevertheless, their expertise (typically offered for free) and ability to leverage the governments' balance sheet, can help domestic exporters access new markets and/or gain a competitive edge. Given their role in supporting national exports, most developed counties have an ECA, with their role governed by principles set out by the OECD under the Arrangement on Officially Supported Export Credits. [4]

- **United Kingdom Export Finance (UKEF) is the UK's official ECA, which aims to help UK companies do business with overseas customers.** Its core strategic goal is 'boosting the economy, jobs and livelihoods at home and for trading partners abroad'. As summarised in UKEF's 2020-2024 business plan, UKEF supports UK exports in 3 ways: 1) provide finance for overseas buyers of UK products and services 2) provide trade finance and insurance to UK exporters to mitigate their risks and 3) refer and build awareness of products available from UKEF and the private finance sector to support UK exporters.

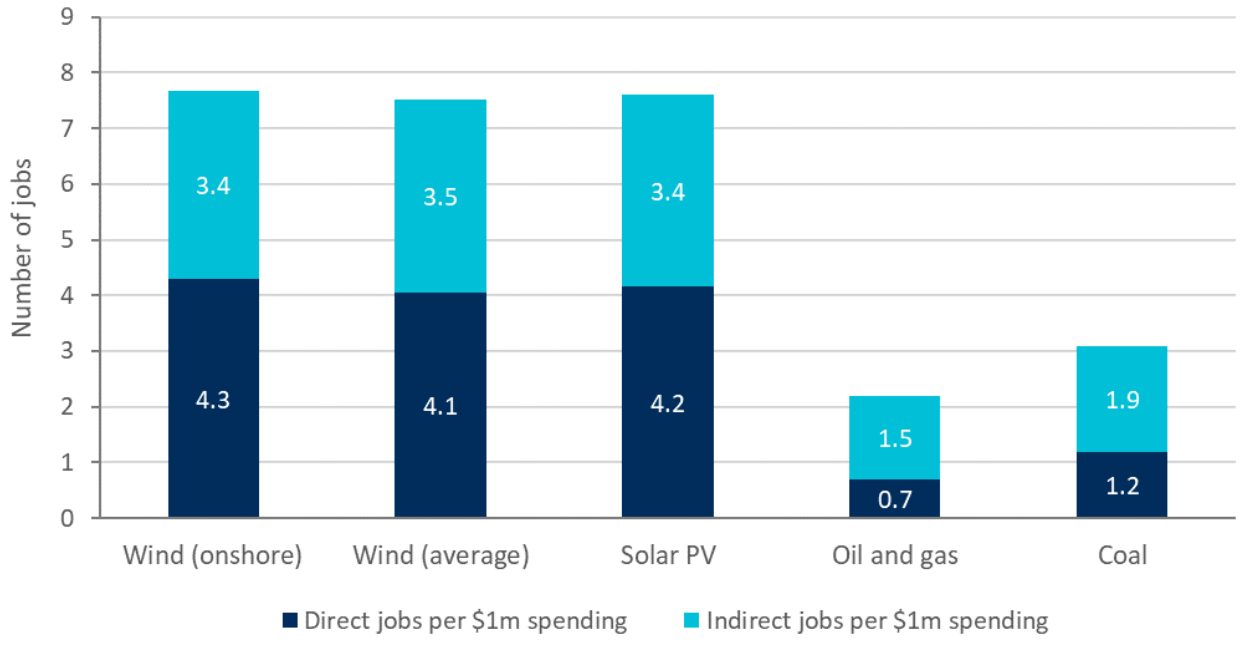
[4] See here for more information: http://www.oecd.org/trade/topics/export-credits/

1 Exports jobs supported per £ of UKEF support

Investments in renewables generally support more jobs, per £ invested, than the oil and gas industries because of higher labour requirements. The evidence that clean energy infrastructure is more labour intensive in the development and construction phase is well established, and set out in, for example, Hepburn et al. (2020). This means that a large share of investment in renewables goes towards supporting labour intensive processes such as development, manufacturing, installation, and EPCm (engineering design, procurement, and construction management). In the oil and gas industry, relatively more expenditure goes towards operation and maintenance due to variable costs in fuel or feedstock, which requires less labour. As a result, the number of jobs supported per unit investment is typically higher in renewables than in the oil and gas industry. To illustrate, a study by Garrett-Peltier (2017) suggests that every $1m in short run spending generates 7.49 full-time jobs in renewables infrastructure but only 2.65 in fossil fuels.

Therefore, UKEF support for renewables is likely to be more effective in supporting domestic employment. While UKEF does not invest directly, its support in the form of buyer credits, direct loans and trade credit insurance which can help unlock investment in renewables abroad. Assuming additional UKEF support could lead to at least as much additional investment in renewables as in oil and gas, UKEF can help support more domestic jobs by focusing on renewables. As estimates shown later in Section 3 suggest, this means that UKEF could support 150% to 200% more jobs in renewables than in oil and gas.[5]

Figure 1 Job multipliers (FTE per US$1m spending) of investments in energy projects



Source: Vivid Economics based on Garrett-Peltier (2017)

[5] While investments in renewables are more job intensive than oil and gas in general, the job intensity of UK exports will vary between export contracts. The estimates of jobs supported by exports in the UK (Section 3) are based on UK estimates of job intensity associated with different energy sectors. It is assumed that these UK estimates are representative for both the domestic and export focussed sections of the oil and gas and renewable industries.

2 Additionality of UKEF support

UKEF support is more likely to be additional, complementing private finance, when supporting renewable exports. Additionality refers to whether the exports *needed* UKEF support to materialise. In this regard, UKEF support is likely to have a larger impact in unlocking opportunities for renewables than for oil and gas for three reasons:

1. Small company sizes suggest a greater need for insurance of UK exporters: UK renewable energy companies are relatively small compared to those in the oil and gas supply chain. Their smaller balance sheets reduce the ability to absorb unexpected losses and risks such as payment delays often associated with exports. Insurance and buyer credit provided by UKEF can play a meaningful role in mitigating these risks.

2. Project capital intensity suggests a greater need for financial support for foreign buyers: Renewables projects tend to be more capital-intensive than oil and gas projects, with significant costs associated with manufacturing and installation. Buyer credit support would be important to enable UK exports.

3. Financial service, and particularly insurance, is currently more expensive for renewables projects: Insurance for renewables is often expensive and limited in coverage because the risk profiles of novel technologies are not yet well understood compared to the oil and gas industries' long track record.

Company size

UK firms in the renewable energy industries are much smaller than those in the oil and gas supply chain. On average, their annual turnover is less than a million pounds, compared to £26m for companies providing oilfield services.[6]

Even amongst companies that actively export, individual renewable energy companies generate fewer revenues and have significantly smaller balance sheets. Based on UKEF accounts between 2015/16 and 2019/20, this briefing paper identified 21 companies involved in energy projects abroad.[7] Amongst them, the weighted average turnover for businesses in the oil and gas supply chain was £552m, compared to £191m for solar and £21m for offshore wind. Furthermore, the balance sheets of renewable energy companies are smaller. The weighted average fixed assets stand at £33m for solar and £4m for offshore wind, compared to £490m for those in oil and gas supply chains.

Firm size matters for the risk that companies can take, which suggests that UKEF can play a more meaningful role supporting relatively smaller renewable firms. Smaller firms typically face higher risk premia and tighter credit constraints because they have smaller balance sheets which reduce their ability to self-insure or provide collateral. Their limited ability to self-insure and hedge risks also make them more averse to taking risks associated with export contracts. These characteristics make small firms less competitive abroad and affect their export performance disproportionately relative to larger firms.[8] Accordingly, studies have found that trade credit support has a greater impact on small and medium-sized firms. This suggests that UKEF support for renewables could be more effective in terms of unlocking business opportunities abroad and helping UK companies secure a higher market share. By contrast, support for larger companies in the oil and gas industry is less likely to be additional.

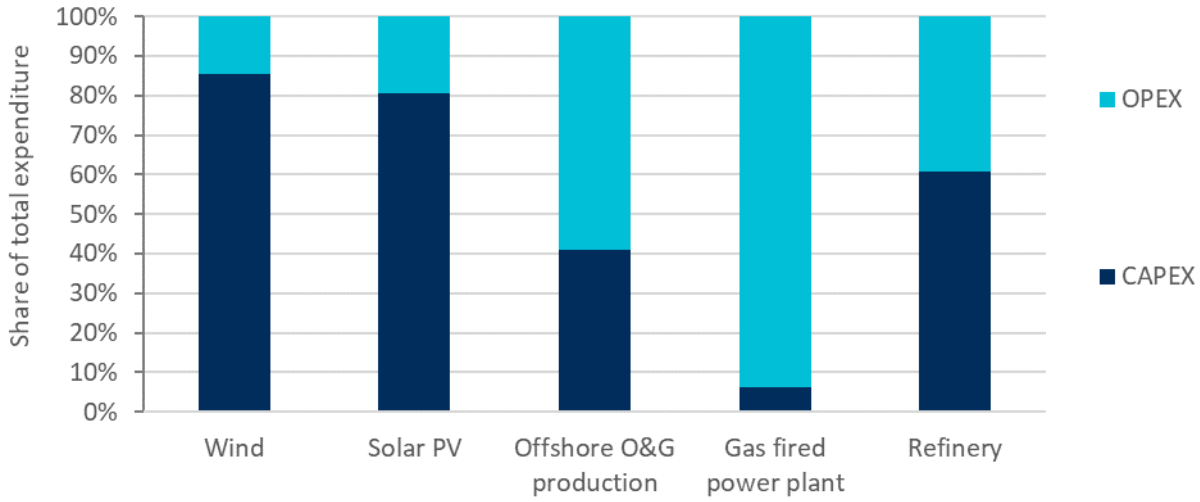
[6] Refer to Table 1 in the Appendix for the number of firms and average turnover in selected industries
[7] Refer to Table 2 in the Appendix for the list of companies and the size of their fixed assets and turnover
[8] Refer Hirsch and Adar (1974) and Eck et al. (2015) for the underlying economic theory. Empirical tests such as Calof (1994) and Wagner (1994) have often found such a correlation but the literature has no conclusive evidence on the causal impact of firm size on export performance. However, there is clear evidence that small firms are more credit constrained (e.g. Beck et al. 2005; Forbes 2007)

Capital intensity of renewables projects

Financing renewables projects are more challenging because a larger share of project costs have to be faced upfront. While upfront capital expenditures are significant for both oil and gas projects and renewables, renewables have much lower operating expenditures because there are no variable costs associated with fuel or feedstock. As a result, capital expenditure as a share of total expenditure is typically higher in renewables. As shown in Figure 2, up to 80% of the costs of solar and wind energy lie in capital expenditures, compared to just 40% for offshore oil and gas production, 5% for a gas-fired power plant, and 60% for a typical refinery. This implies that renewables developers have relatively high operating leverage. Indeed, the recent analysis by Damodaran (2020) shows that the debt-to-capital ratio of green and renewable energy companies are about 16 percentage points higher than oil and gas production companies.

The relative financing challenge of renewables projects suggests a potential role for UKEF. Renewables projects can face substantial borrowing costs, especially in developing countries.[9] Buyer credit will be important to unlock investment in foreign renewables projects and UK exports. Trade credit insurance for UK exporters of goods and services can protect them from the risks of non-payment from highly leveraged foreign buyers. The role of UKEF's in enabling UK exports and overseas investments is therefore equally or potentially more important in renewables than in oil and gas.

Figure 2 Cost breakdown of selected energy projects



Note: Financing costs are excluded from this chart. Costs vary widely for oil and gas projects depending on geography and project type. The offshore O&G data displayed above reflect costs typical in the North Sea.
Source: Vivid Economics based on Schmidt (2014), Compass International (2017), Oil and Gas Authority (2019)

Sector immaturity

The insurance coverage for risks associated with renewables is expensive and limited. This is first because revenues from renewables can be highly contingent on policy and regulatory environment, which are normally not covered by traditional insurance products. For example, private political risk insurance mainly covers risks such as expropriate breaches of investor's rights, but not legitimate changes in policy such as adjustments to FITs.[10] More importantly, due to the relative novelty of technologies, the risk profile associated with the construction and operation of renewables are not yet well understood by insurers, increasing the costs of coverage.[11] In recent years, the insurance industry has developed more innovative

[9] Ondraczek et al. (2013)
[10] Gatzert and Kosub (2015)
[11] Lloyd's of London and Vivid Economics (2019)

insurance products and alternative risk mitigation strategies tailored to renewables.[12] However, these options are not yet mature, particularly when compared to the well-established financial industry supporting the oil and gas industry.

Therefore, UKEF support is likely to be instrumental to the growth of exports in renewables and associated technologies. Boosted by decades of experience, financial resources and well-developed insurance markets, UK companies within the oil and gas industries are well equipped at coping with risks in foreign markets. UK renewable companies, as well as finance and insurance providers, have substantially less experience addressing export risks in their sector. UKEF support can play an important role in filling this gap and lower the cost of commercial insurance for renewables, especially if loan guarantees mitigate risks that insurers are currently unfamiliar with or unwilling to take. Over the longer run, this will speed up learning in the financial sector and put the UK in a stronger position to capitalise on growing export opportunities.

[12] More examples are provided by Allianz

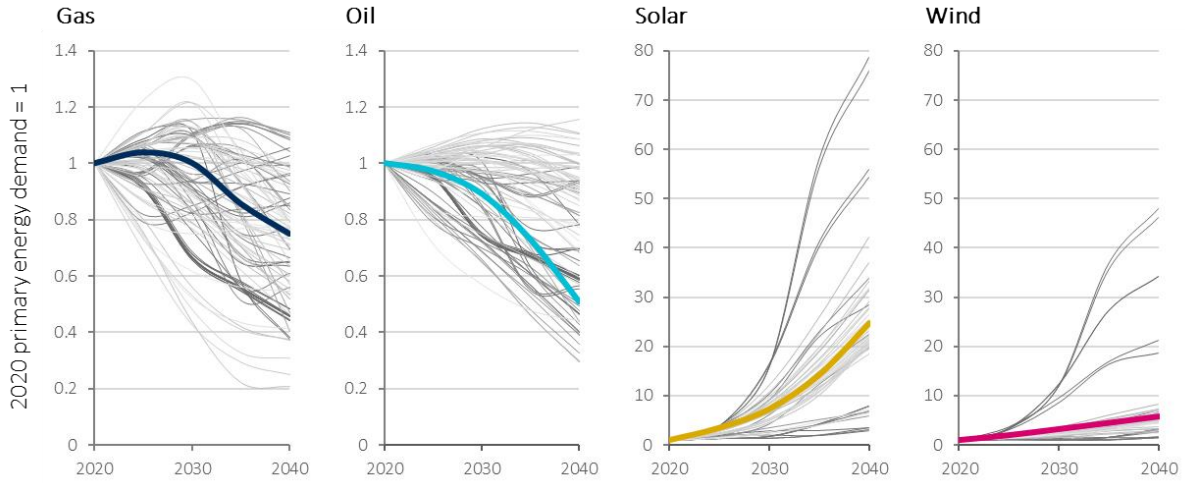
3 Market outlook and potential jobs supported through exports

The energy transition is accelerating across the globe, driving large increases in the demand for renewable energy and associated technologies. According to the International Renewable Energy Agency, the installed capacity for wind energy tripled over the past decade, while solar PV grew by nearly 25 times. Electricity generated from wind and solar grew from 1% of total electricity consumption in 2008 to over 8% in 2018.

The combination of policy and technological development will sustain strong growth in renewables over the next two decades. Over 190 countries have signed the 2015 Paris Agreement, committing to mitigate their greenhouse gas emissions. With the latest evidence from the IPCC showing that CO_2 emissions will have to fall to net zero levels around the middle of the century to achieve the Paris Agreement targets, over 20 countries have legislated or declared the intention to reach net zero emissions. Notably, China has recently announced a 2060 net zero target, highlighting the need for developing counties to decarbonise as well. The COVID-19 pandemic further hastened reduction in oil and gas demand, while green recovery packages are giving a boost to investment in renewables. Furthermore, technological advancements will continue to reduce the costs of deploying wind and solar energy. For instance, the price of solar PV modules already fell by over 90% since 2009, and wind turbine prices fell by 55-60% since 2010.[13]

This creates a substantial opportunity for businesses in the low carbon economy and calls for diversification away from fossil fuel industries. As shown in Figure 3, a majority of 1.5°C scenarios see the global demand for wind and solar energy in 2040 to be 7 and 20 times larger than today, while demand for oil and gas drops by 30% to 50%. The impact is already being felt as global investments in fossil fuel power dropped by 17% between 2014 and 2019 while upstream oil and gas capital spending dropped by 16%.[14] Oil majors are now accelerating their investments into clean energy, with companies such as BP and Shell announcing much larger investments in renewables than ever before. In 2019, global investments in renewables stood at US$311b, more than double the US$130b invested into fossil fuel power.[15]

Figure 3 1.5°C and lower 2°C scenarios of global primary energy demand

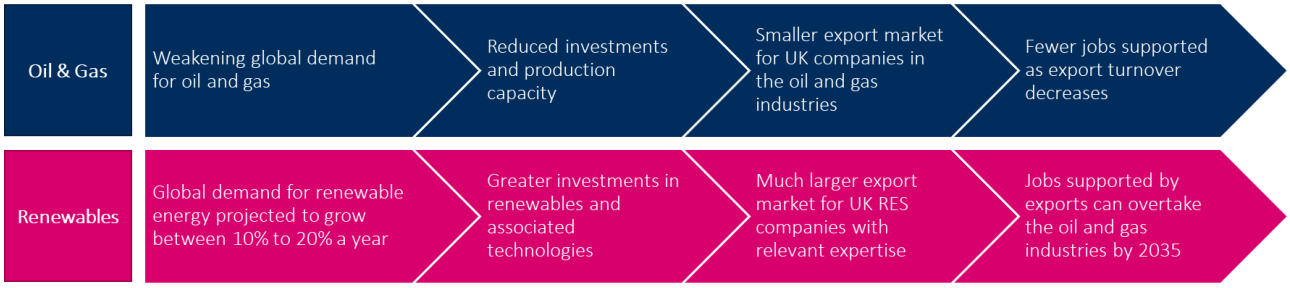


Note: Bolded lines indicate IEA (wind and solar) and BP (oil and gas) scenarios used for calculations in Section 3
Source: IIASA scenario database (1.5°C high overshoot, 1.5°C low overshoot, Lower 2°C); IEA ETP 2017 and 2020; BP Energy Outlook 2020

[13] IRENA, https://www.irena.org/costs
[14] IEA World Energy Investment 2020; upstream investments re-based at 2019 costs
[15] Ibid.

The deployment of renewables globally would create significant demand for related goods and services, which UK companies are well positioned to supply. For example, the installed capacity for offshore wind in the European Union is projected to be three times larger in 2040, while global installed capacity could be over 15 times larger. This presents a sizeable business opportunity for UK manufacturers of wind turbines and foundations as well as companies that provide installation services and help operate and maintain those offshore assets. The UK has the largest installed capacity of offshore wind in the world and can leverage its expertise to assist in offshore wind deployment in other countries. Coupled with strong policy support in the latest Offshore Wind Sector Deal, the industry has a strong platform to increase its market share abroad and support a large number of jobs through exports. Similarly, other industries such as battery manufacturers and solar project developers can benefit in this global transition to renewables, as illustrated in Figure 4.

Figure 4 How global energy demand affects UK exports



Note: UK exports jobs is contingent both on the size of global demand and the share which the UK captures.
Source: Vivid Economics

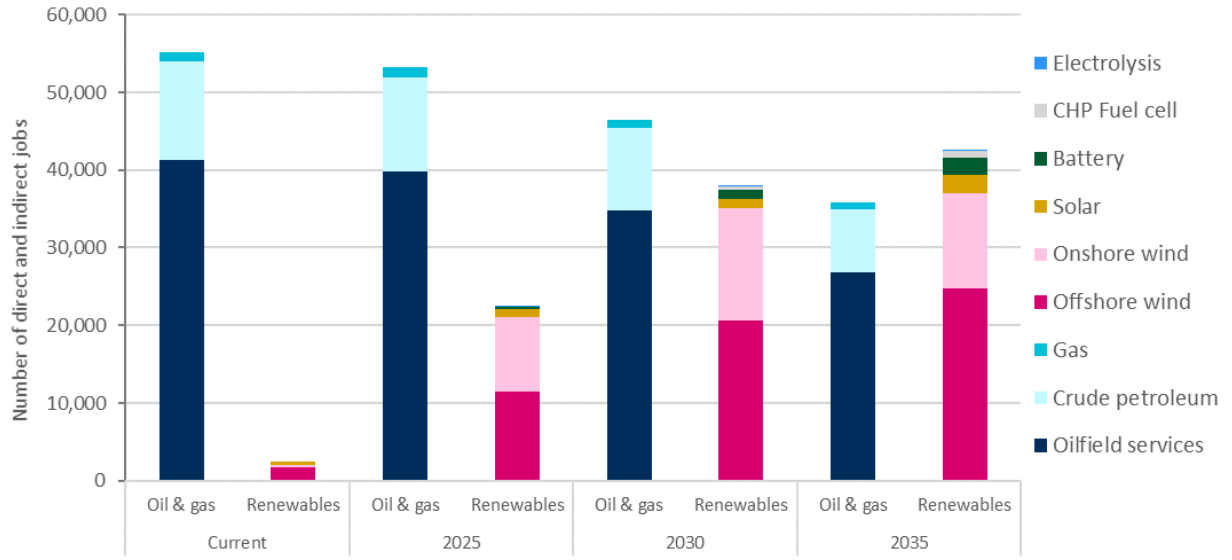
Based on scenarios consistent with 1.5°C warming and a positive outlook on UK competitiveness, annual jobs supported by exports in renewables could surpass oil and gas by 2035 (see Figure 3).[16] Currently, the UK offshore oil and gas industries support 140,000 direct and indirect jobs, of which approximately 55,000 can be attributed to exports.[17] The global decline in oil and gas investment meant this will decline to around 35,000 jobs in 2035, assuming that the UK remains equally competitive in the future (constant market share). By contrast, the renewable energy industries in the UK are currently smaller and less export-oriented. The onshore wind, offshore wind, and solar PV industries each support about 13,000 direct and indirect jobs, with less than 10% of turnover coming from exports. The jobs supported by renewable exports currently sum to around 2,500 jobs. With a positive outlook of UK competitiveness in these industries, this number could quickly rise to over 40,000 jobs by 2035, surpassing that of oil and gas.[18] This conclusion is robust even in scenarios consistent with 2°C warming, though the number of jobs supported by renewables in 2035 will be about 10% lower. Over 36,000 of the jobs supported in 2035 will be driven by offshore wind and onshore wind alone, due to the sizeable UK supply chain for the manufacturing of related equipment.[19]

Assuming UKEF provides a similar level of support to renewable exports as it does for oil and gas industries, it could help support 150% to 200% greater number of jobs by 2035 (see Figure 4). UKEF support for the oil and gas industries peaked in 2018/19 when it issued new insurance, guarantees, and loans worth up to £2.2b of maximum liability for fossil fuel projects abroad. Assuming this corresponds to the value of export

[16] The deployment scenarios are taken from a range of sources broadly compatible with a 1.5°C warming. These include the IEA Energy Technology Perspective published in 2017 and 2020 (Below 2 degrees scenario and Sustainable Development Scenario respectively) and the BP Energy Outlook 2020. See Table 3 in the Appendix for details.
[17] Based on information for OGUK Economic Report 2019 and EY 2020 report on oilfield services. Jobs attributed to exports estimated based on the share of export turnover in total turnover in sub-sectors.
[18] The market share assumptions used here are based on the Energy Innovation Needs Assessment published by BEIS, which reflect a positive but realistic outlook of UK competitiveness. In particular, the assumptions for the offshore wind supply chain is in line with the Offshore Wind Sector Deal made in 2019. However, these estimates are not designed for forecasting purposes. See Table 4 in the Appendix for details.
[19] The number of jobs associated with solar PV, energy storage and hydrogen technologies are relatively small compared to offshore wind and onshore wind. This is driven by the smaller global market (e.g. total investment in fuel cells likely much smaller than wind energy) or lower UK competitiveness (e.g. the UK is not a large manufacturer of solar PV modules, even though it has technology leadership).

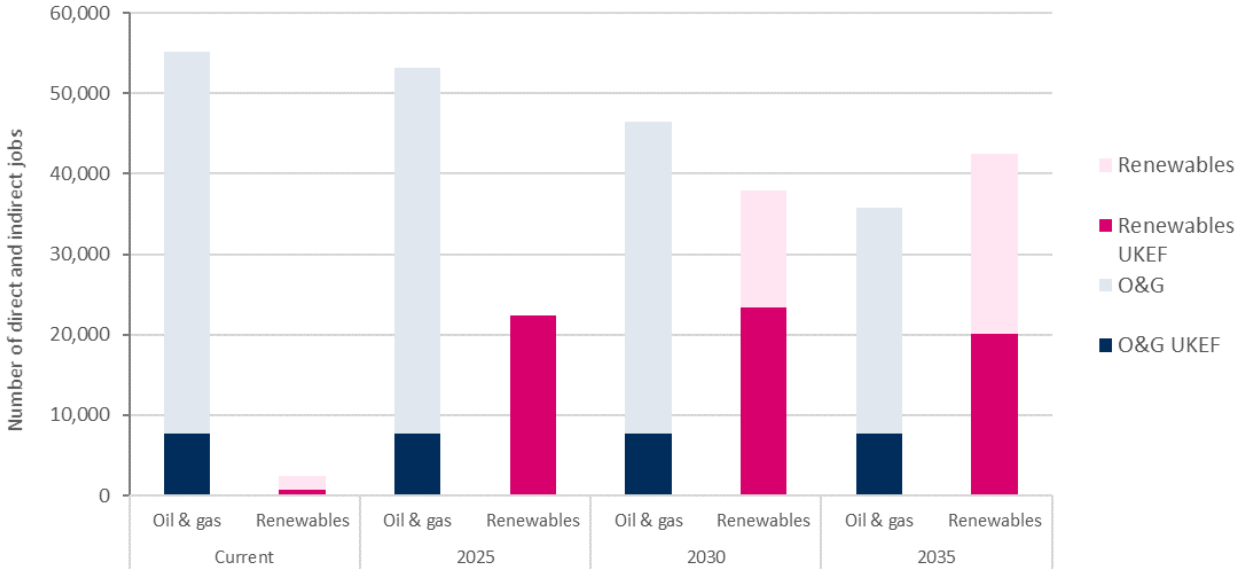
contracts, UKEF would be supporting 8,000 domestic jobs in the oil and gas supply chains.[20] If UKEF extends the same amount of support to renewables (i.e. liability of £2.2b from new businesses each year), the corresponding exports could support up to 20,000 jobs each year between 2025 and 2035 because of the relatively high job intensity of renewables, as discussed in Section **Error! Reference source not found.**.

Figure 5 Direct and indirect jobs supported by UK exports in the energy industries



Note: Methodology and assumptions are presented in the Appendix.
Source: Vivid Economics

Figure 6 Direct and indirect jobs supported by UKEF



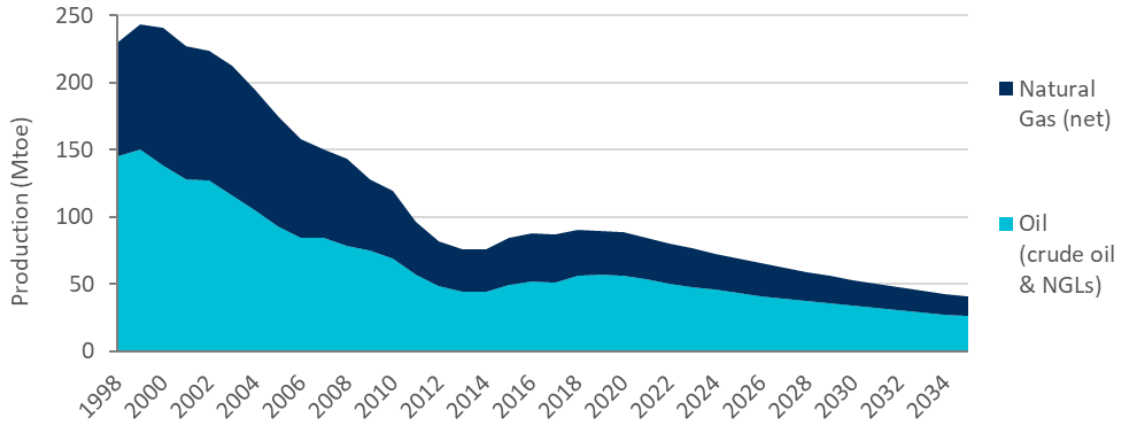
Note: Current estimates are based on UKEF accounts and job multipliers. See Appendix for methodology and assumptions behind job estimates.
Source: Vivid Economics

[20] In practice, UKEF maximum liability is slightly lower than the value of export contracts. For instance, the buyer credit facility issues loans up to 85% of contract value. The size of UKEF liability relative to export turnover may vary for each contract and there is no systematic relationship across industries. The modelling in this briefing paper makes the simplifying assumption that UKEF liability is directly proportional to the export turnover it supports in each industry.

4 UK and helping jobs transition

The production of oil and gas in the North Sea is expected to decline in the long term. UK production of oil and gas fell significantly since the early 2000s. In the long term, the latest projections from the Oil and Gas Authority indicate that oil and gas production will decline steadily out to 2035, at which point it is projected to be 55% lower than today, as shown in Figure 7.

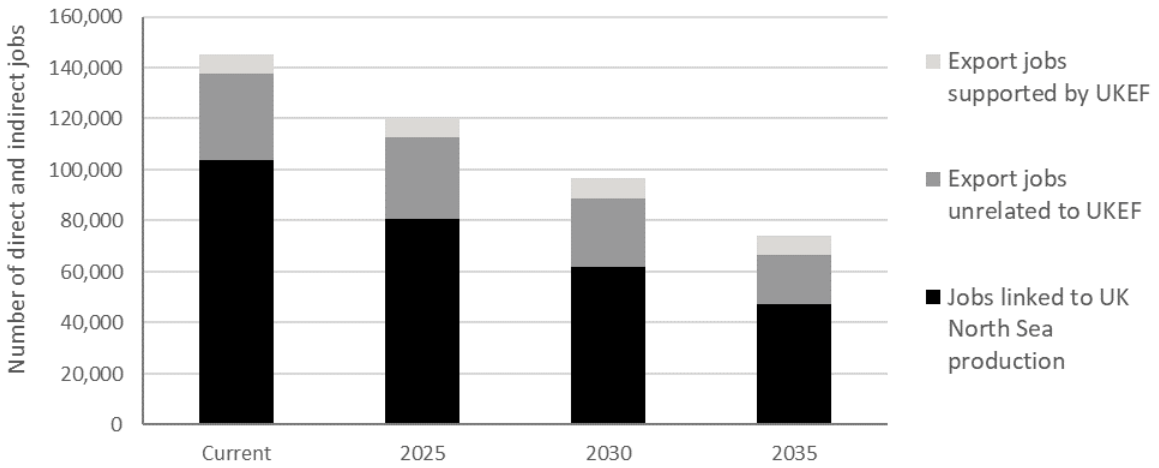
Figure 7 Actual and Projected UK Oil and Gas Production, 1998 to 2035



Source: Vivid Economics based on Oil and Gas Authority (2020)

This decline in domestic production (and associated investment) is the primary driver of jobs in the industry, and UKEF support is unlikely to play a major role in reducing the losses. The oil and gas industries currently support 150,000 direct and indirect jobs in total. Assuming declines in domestic production (Figure 7) and exports (Figure 3), by 2035, this number is projected to fall by half. Most of these job losses are driven by a decline in UK production for domestic demand. Even if UKEF continues its current level of support for oil and gas exports, the 8,000 jobs it helps sustain in the supply chain are relatively minor compared to the job losses (c. 50,000 direct and indirect jobs) due to decline in North Sea production, as shown in Figure 8.

Figure 8 Jobs (direct and indirect combined) supported by the UK oil and gas industries



Note: Jobs driven by domestic O&G demand refer to jobs involved in the physical extraction of oil and gas to meet UK demand and supply chain jobs that enable it. Exports jobs refer to those employed in the extraction of oil and gas that is exported abroad, and oilfield services exports jobs.

Source: Vivid Economics based on Oil and Gas UK (2019), EY (2020) and ONS (2019)

Fluctuations in the jobs supported by the UK oil and gas industry are relatively common and can be absorbed with good policy. Indeed, in 2009, direct and indirect jobs supported by the industry stood at approximately 150,000. This rose substantially to around 250,000 by 2014 through domestic investment, before decreasing again to around 150,000 (with a further 150,000 induced jobs) in 2019.[21] These large swings are inherent to the cyclical oil and gas industry. Key to a smooth transition of oil and gas jobs is ensuring a smooth reduction in domestic production (rather than exports) and viable alternative jobs (and training) for workers to move into.

Creating opportunities for workers to reskill and relocate to growing industries will play a much more important role than sustaining oil and gas jobs through export finance. The existing UKEF support for oil and gas projects abroad support a variety of jobs, some of which can transition to new industries more easily. For example, a substantial portion of UKEF support has been given to marine and subsea work that involves the manufacturing and installation of subsea cables and floating production units. This provides an excellent supply of labour for the rapidly expanding offshore wind industry. Meanwhile, those engaged in well services and drilling may be reskilled to help deploy the CO_2 transportation and storage infrastructure necessary for scaling up CCUS globally. Coordination between the private sector and the government will help unlock these jobs.

[21] Induced jobs refer to jobs supported by the additional spending from new household income and inter-industrial transfers generated from the direct and indirect effects. It is not the focus of this briefing paper for reasons described in the Appendix.

Appendix

Table 1 Size of UK firms in selected energy industries

Industry	2014/18 average number of firms	Average turnover per business (£)
Oilfield services	1,200	25,720,000
Offshore wind	2,100	1,450,000
Onshore wind	4,400	730,000
Solar PV	22,900	90,000
Fuel cells and energy storage	700	382,000

Source: Vivid Economics based on EY (2020) and ONS Low Carbon and Renewable Energy Economy survey (2019)

Table 2 Size of companies supported by UKEF between 2015/16 and 2019/20

Sector	Companies supported by UKEF between March 2015 and March 2020	UKEF support £ million	Fixed assets £ million	Turnover £ million
Oil and gas supply chain	General Electric Global Parts & Products	589.8	unknown	1,290
	Technip	552.7	558	790
	Baker Hughes, a GE Company	247.8	524	694
	Elecnor SA	155.8	2,184	1,852
	Enka UK Construction Ltd	87.9	13	38
	Subsea 7 Limited	72.5	793	830
	Siemens AG	26.1	1,282	756
	General Electric Global Services	18.2	unknown	30
	Alderley Systems Ltd	11.0	0	10
	JDR Cable Systems Limited	8.4	35	97
	P R Marriott Drilling Limited	2.0	28	8
	Swellfix Uk Ltd	1.6	3	18
	Wozair Limited	1.3	6	27
	Mech-Tool Engineering Ltd	0.8	2	13
	Vikoma International Ltd	0.8	1	11
	Petroleum Equipment Supply Engineering Company Limited	0.4	1	14
Offshore wind	Burntisland Fabrications Limited	16.9	0	19
	Tekmar Energy Limited	2.6	3	24
	Global Marine Systems Ltd.	0.2	297	195
	Cwind	0.2	20	33
Solar	Solar Century Holdings Limited	38.8	33	191

Note: This table omits unidentified companies in UKEF accounts and those that categorised as 'Total Exception Full' under Companies House

Source: Company filings and UKEF accounts from 2015/16 to 2019/20

Methodology and assumptions for job estimates

This note estimates the number of jobs that could be supported by UK exports of goods and services related to the global investment in oil and gas and renewables. The following types of projects or technologies are considered within the scope: extraction and production of oil and gas, oilfield services, solar PV, offshore wind, onshore wind, battery, electrolysis, and CHP fuel cell.

The general approach for estimating the number of jobs supported by exports shown in Figure 5 is based on the methodology for the BEIS Energy Innovation Needs Assessment (EINA). It can be summarised as follows:

1. For each technology, a deployment scenario broadly consistent with 1.5-2°C warming is chosen. This determines the size of installed capacity and the newly added capacity in each 5-year interval from 2020 to 2035. These scenarios are listed in Table 3.
2. The capital expenditure and operating expenditure required to build new capacity and operate installed capacity are calculated based on bottom-up technology cost estimates. Technology specific components are assessed separately, such as those listed in Table 4. Multiplying costs with the deployment scale yields an estimate for the global market demand for related goods and services.
3. A subset of this global market is considered as tradeable to the UK. For example, operation and maintenance (O&M) jobs for offshore wind deployment outside of the EU are assumed to be non-tradeable to the UK because they only hire workers domestically or regionally.
4. The UK is assumed to capture a share of the tradeable global market. Existing market shares were calculated from COMTRADE data and supplemented by third party reports and external validation from industry stakeholders during the EINA research process. These market share assumptions are displayed in Table 4.
5. Accounting for (1) to (4) results in an estimate for UK export turnover in each technology component. The direct jobs from these exports are calculated using job multipliers in proximate industries that correspond to each technology component. Summing these up returns the number of direct jobs associated with exports for each technology. Finally, the indirect jobs are calculated using Type I multipliers from ONS (2019).

Estimates for the oil and gas industry and solar PV differ from the general approach as they were not included in the BEIS EINA series. Similar to the general approach, job estimates are calculated by applying industry specific job multipliers to export turnover. The difference is that future UK export turnover is calculated using current export turnover and projected changes in global demand. This abstracts away from technology costs and market shares, implicitly assuming them as constant.

The number of direct and indirect jobs supported by UKEF each year shown in Figure 6 is estimated by attributing a fixed amount of exports, as measured by export turnover, that can be supported by UKEF. As explained in text, the modelling assumes that UKEF can take up a liability of £2.2b from new businesses each year because this was the maximum support it has given to fossil fuel projects within a financial year.

Throughout the text, we refer to three types of jobs: *direct*, *indirect,* and *induced* jobs. Direct jobs of an industry measure the labour employed by the industry to meet its final demand. Indirect jobs of an industry measure the labour employed across all industries to meet the additional demand generated from its final demand, such as in producing the steel that goes into making wind turbines for the offshore wind industry. Induced jobs measure the jobs supported by additional spending from new household income and inter-industrial transfers generated from the direct and indirect effects.

The focus of this briefing note is on the number of direct and indirect jobs because this is the level that is most relevant to comparing the oil and gas industries against renewables. For example, many indirect jobs supported by the production of oil and gas belong to jobs in oilfield services. Ruling out indirect jobs from the comparison could be misleading to the general audience. Induced jobs are not considered because they are loosely linked with the industries under consideration.

Table 3 Methodology used for projecting UK exports

Technology	Assumptions on UK exports
Oil	Current export turnover from ONS (2019) Growth rate from BP Energy Outlook 2020 Net Zero scenario
Gas	Current export turnover from ONS (2019) Growth rate from BP Energy Outlook 2020 Net Zero scenario
Oilfield services	Current export turnover from EY (2020) Growth rate is the weighted average of oil and gas deployment growth rate
Solar PV	Current export turnover from ONS (2019) Growth rate from the IEA ETP 2020 Sustainable Development Scenario
Offshore wind	IEA ETP 2020 Sustainable Development Scenario Export turnover from bottom-up calculations using cost and market share assumptions.
Onshore wind	IEA ETP 2020 Sustainable Development Scenario Export turnover from bottom-up calculations using cost and market share assumptions.
Battery	Deployment profiles used in BEIS Energy Innovation Needs Assessment (2019) Export turnover from bottom-up calculations using cost and market share assumptions.
Electrolysis	
CHP Fuel Cell	

Source: Vivid Economics

Table 4 Components and market shares considered

Technology	Component	Current market share in related goods or services		Assumed long term market share with strong learning	
		EU	RoW	EU	RoW
Offshore wind	Turbines	1.9%	1.2%	18%	5.5%
	Foundations	2.5%	0.9%	22%	0%
	Balance system	2.9%	1.0%	26%	4.0%
	Installation services	2.5%	0%	22%	0%
	O&M services	1.9%	0%	18%	0%
Onshore wind	Manufacturing and installation	0.3%	0.1%	1.6%	0.4%
Battery	Equipment	2.9%	0.6%	8.0%	2.0%
Electrolysis	Equipment	7%	1%	10%	3%
	EPCm services	NA	NA	11%	11%
CHP Fuel Cell	Equipment	0%	0%	5%	3%
	EPCm services	NA	NA	9%	9%

Note: Oil and gas and solar PV not included in this table because they are estimated directly using projections in export turnover driven by changes in global demand but not changes in UK market share. In other words, constant UK market share is assumed for oil and gas and solar PV. Current market shares are based on relevant HS codes in COMTRADE data and future market shares are validated with industry.

Source: Based on Vivid Economics (2019) and BEIS Energy Innovation Needs Assessment (2019)

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Company profile

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