



Policy Brief

Offshore wind: a new dual export opportunity for Scotland that could maximise productive output and economy-wide benefits?

By Professor Karen Turner, Director of the Centre for Energy Policy

Summary

Scotland has been a forerunner in developing low carbon energy capacity, with the outcomes of the latest Scotwind offshore leasing rounds putting our relatively small nation on track to deliver a relatively large share of UK and European renewable wind energy. However, given the likely high absolute and relative costs of transmitting electricity generated in relatively remote Scottish North Sea offshore wind farm sites to the GB grid, **it is essential to exploit opportunities to reduce curtailment and maximise productive economic output from currently invested and planned offshore wind assets.**

While there are several valuable uses for low carbon energy produced offshore, including greener powering of oil and gas platforms, **it is crucial that Scotland look outward in maximising the economic opportunity that offshore wind presents.** Here, there are **two clear opportunities to develop new export bases for the Scottish economy: green hydrogen and renewable electricity.** Crucially, this would establish a new Scottish presence in international energy markets as the oil and gas extraction that has dominated the offshore/marine energy sector – and contributed substantially to the Scottish national and northeast regional economies since the 1970s – declines.

This policy brief reviews the **range of challenges faced in seizing the opportunity to develop new export opportunities provided by the Scottish offshore wind sector.** These are primarily in terms of ensuring the energy produced is competitively delivered to growing European demand for low carbon power and industrial feedstocks. Here, the case for policy action must be considered in the context of the potential **wider economic returns that could be generated by an offshore wind sector servicing both domestic and export markets.**

Economic ‘multiplier’ metrics reported for offshore wind by the Office for National Statistics suggest that **for every 100 direct jobs created within the Scottish offshore wind sector, another 74 may be supported across the wider UK economy.** This is an ‘employment multiplier’ of 1.74 that is close to the median (mid-range) value reported by ONS across UK production sectors and is comparable with, for example, architectural and engineering activities and the manufacture of computer and electronic equipment. However, it is lower than employment multiplier values reported for Scottish onshore wind (2.5), hydropower (3.22), nuclear (3.60), and the oil and gas extraction industry that currently dominates the Scottish offshore sector (9.85).

All of these energy sectors share the offshore wind characteristic of being highly capital-intensive/having relatively limited direct labour requirements, which generally generates relatively high employment multipliers. This suggests that the ‘missing link’ lies in domestic content. In short, **an outward-facing Scottish offshore wind sector could offer a substantially greater contribution to the Scottish and wider UK economy if the anticipated emergence of green hydrogen and/or electricity production is supported by a strong domestic supply chain.**



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1. Scotland's progress on renewable wind power

There has been considerable progress in growing renewables to decarbonise Scotland's energy supply, with the nation's renewable electricity generation having doubled in the last decade, now hosting around 26% of all renewable capacity in the UK, 2% in Europe and 0.4% across the world. As would be expected by any Scot, certainly those of us living in the windy west of Scotland, wind power dominates our renewable capacity, now at over 11 Gigawatts (GW), representing 39% of renewable wind capacity across the UK (and 5%/1% across Europe/the world). In 2022, Scotland contributed 35% of all wind generation in the UK (almost 28 terawatt hours, TWh), which equates to powering almost 10 million households (over a third of all UK households).¹

To date, the bulk of Scotland's wind capacity has been in onshore wind farms (of varying sizes, with the Whitelee Windfarm just outside of Glasgow being the largest in the UK, with 215 turbines²). However, offshore wind is growing, with Scotland's current capacity (just over 2GW) constituting 16% installed offshore wind capacity across the UK, 7% across Europe and 3% worldwide. The Scottish Government's draft Energy Strategy and Just Transition Plan (ESJTP)³ sets out plans to grow this more than five-fold (to 11GW) by 2030 (alongside a 20GW target for onshore wind), which would constitute 22% of the UK's 50GW ambition⁴).

2. Offshore wind – an opportunity to develop at least one new export base in green hydrogen?

If fully developed, the offshore wind capacity being developed in Scotland – through the Scotwind Leasing process run by Crown Estate Scotland⁵ – is on track to reach 30GW⁶. However, and certainly, in contrast to offshore wind projects south of the border, there is a very real challenge in terms of the transmission costs that would be involved in bringing all the electricity generated in the Scottish North Sea to the GB grid and whether there would be sufficient grid capacity and demand for it when it can be generated⁷.

Of course, there are opportunities to both generate and use the electricity offshore, for example, by creating 'energy islands' to help decarbonise continued oil and gas extraction⁸, which has already begun to generate income for Scotland⁹. However, and taken in the context of Scotland already engaging in extensive trade in electricity via the GB grid – thereby mitigating curtailment and intermittency issues commonly associated with wind power – there is a pressing question in terms of how developing new export bases in green energy could help maximise the energy *and* economic output of offshore assets invested.

The potential for offshore wind projects to secure the potential for green hydrogen production – which would involve using electrolyzers powered by renewable wind energy to split hydrogen from desalinated seawater – is already recognised¹⁰ and being extensively researched. Development of offshore wind energy in this regard is the focus of the UKRI-funded [Ocean REFuel](#) project that we at the University of Strathclyde's [Centre for Energy Policy](#) are currently working on. This builds on a growing research base considering the technical and cost challenges set against the need to maximise the productive use of offshore assets invested¹¹. However, our Ocean REFuel research extends to a wider economy context to focus on investigating both macroeconomic impacts and the benefits of transitioning the supply chains that have been associated with five decades of a fossil fuel extraction sector in contributing to Scottish and UK employment, GDP and associated revenue generation.¹²

A key policy and industry focus is entering the emerging European market in green hydrogen¹³, where the main export destinations for Scottish green hydrogen are likely to be Germany, the Netherlands and Belgium (i.e., Northern Europe), including extensive demand for low carbon industrial feedstocks¹⁴. Here, Scotland's (currently relatively costly) offshore wind potential is likely to face strong competition in servicing these emerging green hydrogen markets, not least from solar energy production in Southern Europe and North Africa, a challenge already recognised in [the Scottish Government's 2020 Offshore wind to green hydrogen: opportunity assessment](#).

Here, the [Net Zero Technology Centre \(NZTC\)](#) is absolutely correct in pointing to the need for policymakers to prioritise investigating green hydrogen export potential. As they note, this includes increasing the international visibility of Scotland's green hydrogen pipeline offering (though there are key opportunities for shipping of hydrogen, including around Orkney and Shetland¹⁵), as well as establishing the timing of potential hydrogen supply from Scotwind (and other) projects, and increasing engagement with European partners around offtake opportunities.



However, it is also important to consider new export opportunities for the offshore wind sector as the primary product of the electricity generated. Green hydrogen and electricity production in the offshore wind sector constitute two of three elements of the domestic- and export-facing offering of a potentially three-pronged offering of a greener North Sea marine energy sector¹⁶, with the third being transporting and storing captured carbon.¹⁷

3. An international export opportunity in electricity from offshore wind?

National Grid has already commissioned and started commercial operation in the world's longest subsea electricity interconnector, via the €1.6 billion North Sea Link (NSL) joint venture with Norwegian system operator Statnett¹⁸. This aims to enable international export and import markets for renewable energy between the UK and Norway, Belgium, France, the Netherlands and Denmark¹⁹, and has already begun operation and the delivery of carbon-saving benefits²⁰. However, the NSL connection is via the onshore GB grid²¹, which would seem to bring the same challenges in terms of transmission costs as highlighted above in the context of domestic use of offshore wind generated in relatively remote locations in the North Sea.

More generally, there has been much debate around how the wider UK offshore wind sector has been somewhat stalled not only due to the much-lauded challenges²² recently associated with setting an appropriate strike price under the Contract for Difference (CfD) mechanism²³. These challenges have arisen not least in the context of cost pressures in global supply chains but also because of constraints both in how quickly the GB grid can take new supplies and in planning to bring power to it.

However, there are further challenges for Scottish offshore wind, given the distances involved from the GB grid and the linked international interconnector. The main development for Scotland had looked to be the NorthConnect project²⁴. This would have linked Scotland and Norway, with cables landed at Peterhead, but suffered a major blow in March 2023, when the Norwegian Ministry of Petroleum and Energy denied NorthConnect's license application²⁵. Moreover, this followed Ofgem's withdrawal of the cap and floor regime previously awarded in principle to NorthConnect.²⁶

It is for all these reasons that there are increasing calls for the incoming UK Government (following the anticipated 2024 General Election) to address the types of challenges set out above if net zero targets are to be achieved and sustained wider economy gains to be maximised²⁷. Here, it is crucial that the case for policy action is set in the context of the potential contribution of the offshore wind sector to the wider economy, and how this may grow substantially with action to promote and support the development of domestic supply chain capacity and content. The importance of developing local supply chain content was an issue recognised when the Scottish Government published its [Offshore Wind Policy Statement in 2020](#), reflecting the (UK) domestic content ambitions set out in the [2020 UK Offshore Wind Sector Deal](#). In this regard, Crown Estate Scotland introduced a requirement for Supply Chain Development Statements (SCDSs) as part of the Scotwind leasing process.²⁸

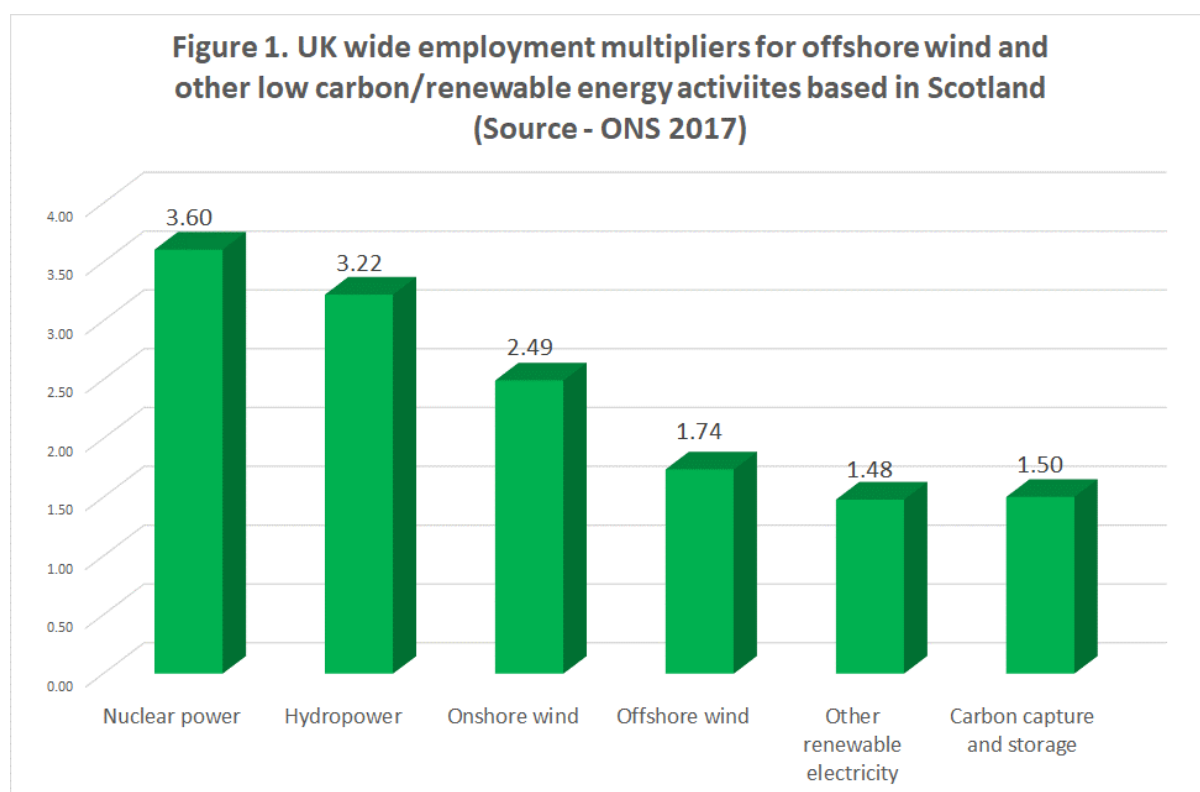
4. What kind of employment and other economic 'multiplier' impacts could result from developing domestic markets and an export base for offshore wind?

In terms of assessing what nature and extent of wider economy gains may be supported by different types of industry activity, the most common approach is to consider economic 'multiplier' data produced (using industry-by-industry input-output tables) by the Office for National Statistics²⁹ and the Scottish Government³⁰. The headline multipliers for things like output, gross value-added (GVA, or GDP), and employment are generally reported within input-output releases – allowing more expert users to trace their composition through intersectoral sales and purchases. However, ONS also produces a separate (and more user-friendly) dataset on the headline 'employment multiplier' metrics. These report total (direct plus indirect supply chain) full-time equivalent (FTE) jobs supported across the UK economy per direct industry/sector job. Due to the complexity of producing and reporting input-output data, [the most recent release on employment multipliers is for 2019](#).



While, for various disclosure reasons (given the role of relatively few commercial actors in various up and downstream activities), energy is generally highly aggregated in the sectoral reporting of input-output data (e.g., all electricity generation, transmission and distribution activities are reported in a single sector). However, ONS also produces headline employment (and turnover) multipliers for a range of low carbon/renewable energy activities abstracted from the underlying input-output data. Moreover, these data allow consideration of how the multiplier impacts may differ depending on which UK region/nation activities are located. [The most recent release on 'Low carbon and renewable energy economy multipliers' is for 2017](#), which is prior to and will not reflect any information set out in the SCDSs required by Scotwind (though these are at the planning stage in any case).

Aside from their age, caution should be exerted in using multiplier metrics, which are calculated based on what has happened in any given year to project what may happen as a sector or activity expands. This is because the presence and impact of labour and other supply constraints will limit the extent of expansion in response to a change in demand for any activity³¹. Nonetheless, multiplier metrics are a useful tool in considering what extent of wider economy benefits may ultimately be supported by different low carbon/renewable options. Figure 1 shows how the employment multiplier (total direct plus indirect FTE employment per direct own-sector FTE job) for offshore wind activity located in Scotland (the Scottish North Sea) compares with other low carbon and/or renewable energy activities, according to the 2017 data produced by ONS.³²



The employment multiplier data shown in Figure 1 indicates that Scottish offshore wind supports a total of 1.74 FTE jobs per direct industry job. Put another way, for every 100 FTE workers directly employed in the offshore wind industry another 75 jobs are supported elsewhere across the UK economy because of supply chain interactions.³³

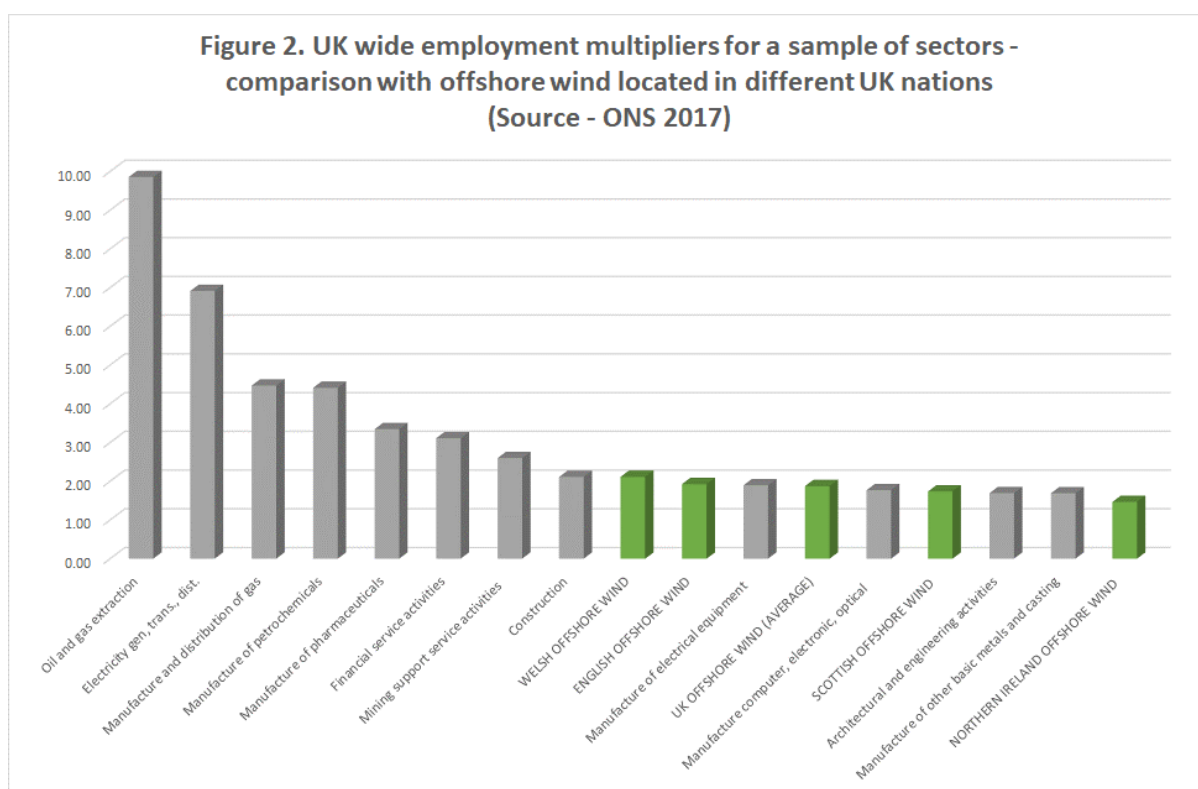
This is a smaller employment multiplier than reported for Scottish onshore wind (2.49), where for every 100 direct jobs an additional 149 are supported across the wider UK economy. Both are lower than hydropower (which has an employment multiplier of 3.22) and nuclear (3.60). However, the offshore wind multiplier is higher than the average across other renewable electricity generation sectors (1.48) – though these are relatively limited in Scotland – and for the, not yet operational, carbon capture and storage, CCS (1.50), which may be classed as another green marine energy sector.³⁴

How does the offshore wind (and, indeed, all) these employment multipliers compare with those associated with other activities across the economy? It is appropriate to make such comparisons for the same reporting year, where a separate ONS data set reports [employment multipliers for all other UK sectors in 2017](#). There, out of the 104 sectors that all UK



production activity is broken into (see Figure 2, where we report for an illustrative sample), the two highest employment multipliers reported are for energy supply sectors: oil and gas extraction (and mining of metal ores) (9.85 – or almost 9 FTE jobs supported across the UK economy for each direct industry job) and electricity generation, transmission and distribution (6.91).

In both these cases, the high employment multiplier value is due to a combination of high capital intensity, or low labour intensity of energy supply activity relative to other activities in its supply chain – a characteristic that offshore wind shares – and relatively strong domestic supply chains – a characteristic that it does not (yet) share. Thus, one challenge for offshore wind – like most of the other activities represented in Figure 1 – is whether supply chain content in the UK (and, ideally, in Scotland) can increase substantially and thereby raise both the indirect component of the employment multiplier and its overall value.



While there is certainly scope for this to happen if we start to build more (or any) parts of what are huge offshore wind turbines in Scotland, and/or locate more of the wider supporting activity at home (as required under the UK Offshore Wind Sector Deal and Scotwind process, and now potentially incentivised, with focus on locating supply chain activity in economically deprived areas, and on building UK competitiveness in international markets, through a Sustainable Industry Award element to the Contract for Difference³⁵).

Crucially, energy supply chains are not limited to technical requirements. For example, indirect employment in the finance and insurance industries tend to constitute a significant element of the oil and gas extraction multiplier. It is not clear that such requirements are yet emerging, certainly not in the ONS multiplier data for offshore wind.

Moreover, while the 2017 ONS low carbon/renewable energy multipliers need to be considered with caution, it is worth noting (see Figure 2) that the offshore multiplier reported for Scotland (1.74) is smaller than the UK average (1.87) which is pulled up by relatively high values for Wales (2.11) and England (1.93), while offshore wind located in Northern Ireland has a significantly smaller employment multiplier (1.47). No explanation is offered by ONS for this deviation across the UK nations, but it *could* suggest some anticipation of slightly stronger supply chain activity in England and Wales.

On the other hand, the Scottish offshore wind employment multiplier is by no means small when set against the full range of activities ONS reports for. In the 2017 data we refer to here, employment multipliers with a value higher than



the 1.74 figure (reported in Figure 1 for Scottish offshore wind) are only reported for 57 of the 104 sectors ONS reports (i.e., just over half). Thus, even without the emergence of stronger domestic supply chain content, offshore wind would have what may be regarded as a mid-range (almost median) employment multiplier impact on the wider UK economy. Herein, the value of 1.74 is close to that reported in Figure 2 for 'Manufacture of computer, electronic and optical products' (1.77) and slightly higher than for 'Architectural and engineering activities' (1.69) and 'Manufacture of other basic metals and casting' (also 1.69), all of which would be considered relatively 'high value' activities to the UK economy.

5. Conclusions and future directions

In writing this brief, we set out to consider whether the dual export opportunity provided by an emerging Scottish offshore wind sector – one that can produce *both* green hydrogen and electricity – could maximise the use of the capacity invested and deliver benefits to the Scottish and wider UK economies. Two crucial challenges have been highlighted in terms of (a) how green hydrogen production in the Scottish offshore sector can compete in European markets and (b) how electricity produced offshore in Scotland can be exported at all (in the absence of international interconnector infrastructure that can be accessed in a cost-effective manner).

However, ONS data (for 2017) suggest that the emergence of the Scottish offshore wind sector could trigger indirect job creation of around 74 supply chain jobs for every 100 direct industry jobs. This is comparable with existing UK sectors such as architectural and engineering services, and computer/electronic manufacturing, both of which are associated with mid-range (or median) employment multipliers of around 75-90 additional indirect jobs for every 100 direct industry jobs.

On the other hand, current employment multiplier projections for Scottish offshore wind are slightly lower than those for the comparable sectors in Wales and England, and substantially lower than for Scottish nuclear and hydropower and for the wider UK oil and gas industry. One implication that can be drawn is that much needs to be done by way of supporting the development of domestic supply chain content for offshore wind.

In short, the key takeaway message is that the Scottish offshore wind sector *could* offer a healthy wider economic and employment contribution to the wider Scottish and UK economies. However, this contribution could be substantially greater *if* the projected and potential growth in offshore wind to service both domestic and export markets for green hydrogen and/or electricity is accompanied by the development of a strong and sustainable domestic supply chain, ideally commensurate with what has been historically observed for other UK energy sectors. The challenge will be whether Scotwind projects meet the 60% of lifetime UK domestic content in the Offshore Wind Sector Deal to help boost the employment and other economic multipliers.

Acknowledgements

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End-notes and references to underlying research

1. Information drawn from a letter written by Neil Gray, Cabinet Secretary for Wellbeing Economy, Fair Work and Energy, to Pete Wishart, Convenor, Scottish Affairs Committee, published on 14th November 2023 at <https://www.gov.scot/publications/renewables-and-wind-power-update-to-scottish-affairs-committee/>.
2. See <https://www.scottishpowerrenewables.com/pages/whitelee.aspx>.
3. Download at <https://www.gov.scot/publications/draft-energy-strategy-transition-plan/>.
4. As set out in the March 2023 Offshore Wind Net Zero Investment Roadmap at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1167856/offshore-wind-investment-roadmap.pdf.



5. See <https://www.crownstatescotland.com/scotlands-property/offshore-wind/scotwind-leasing-round>.
6. See <https://www.offshorewindscotland.org.uk/the-offshore-wind-market-in-scotland/scotwind-leasing-round/#:~:text=As%20these%20%20additional%20leases,capacity%20to%20just%20over%2030GW>.
7. For example, see <https://w3.windfair.net/wind-energy/pr/39566-sowec-scotland-transmission-offshore-wind-farm-great-britain-tariff-zone-grid-connection-charge-ofgem> and the underlying report (commissioned by Scottish Offshore Wind. Energy Council, SOWEC) at <https://www.offshorewindscotland.org.uk/media/11940/strategic-investment-assessment-report-august-2021.pdf>.
8. E.g., the Green Volt project that is due to come online by the mid-2020s – see <https://www.offshorewind.biz/2023/02/09/green-volt-on-track-to-power-uk-oil-gas-platforms-by-mid-2020s/#:~:text=Located%2080%20kilometres%20east%2C%20offshore,the%20Outer%20Moray%20Firth%20area>.
9. As highlighted in a Guardian news story at the time of the Scotwind leasing round – see <https://www.theguardian.com/business/2023/mar/24/scotland-to-earn-260m-from-floating-windfarms-powering-north-sea-rigs>.
10. See the Scottish Government's 2020 'Offshore wind to green hydrogen: opportunity assessment' at <https://www.gov.scot/publications/scottish-offshore-wind-green-hydrogen-opportunity-assessment/>. Also see Crown Estate Scotland's September 2023 summary analysis of the Net Zero Technology Centre (NZTC) 'Hydrogen Backbone Link report' (<https://www.netzerotc.com/reports/hydrogen-backbone-link-report/>) at <https://www.crownstatescotland.com/news/offshore-wind-projects-could-help-secure-green-hydrogen-potential>.
11. See for example the (UK-focussed) works of [Giampieri et al. \(2024\)](#), in the International Journal of Hydrogen Energy, and [Hill et al. \(2024\)](#), in the Journal of Cleaner Production.
12. See, for example, Oil and Gas UK's 2021 Economic report at <https://oeuk.org.uk/wp-content/uploads/2021/08/OGUK-Economic-Report-2021.pdf>, HMRC's assessment of revenue contributions <https://www.gov.uk/government/statistics/government-revenues-from-uk-oil-and-gas-production--2/statistics-of-government-revenues-from-uk-oil-and-gas-production-july-2022>, and the Future Energy Skills programme's 2023 report on the transition of employment and skills at <https://futureenergyskills.co.uk/publications>.
13. See, for example, https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen_en on the European Union's hydrogen strategy and REPowerEU plan.
14. E.g., see the German government's National Hydrogen Strategy at <https://www.bmwk.de/Navigation/EN/hydrogen/national-hydrogen-strategy.html>.
15. See Question 2 at https://www.businessforscotland.com/what-does-the-700-million-off-shore-wind-auction-mean-for-scotland-ten-questions-answered/?doing_wp_cron=1709297044.5145990848541259765625.
16. This three-pronged offering of the transitioning Scottish marine energy sector is also highlighted in the February 2024 'North Sea 2' report published by Our Scottish Future, OSF, at <https://ourscottishfuture.org/wp-content/uploads/2024/02/North-Sea-2.pdf>.
17. See CEP research published in 2023 on the potential to develop an export base around the Scottish Track 2 CCUS cluster and Acorn CCS in the policy brief at <https://doi.org/10.17868/strath.00086569> and the underlying peer-reviewed journal paper published in Local Economy at <https://doi.org/10.1177/02690942211055687>.
18. See <https://www.nationalgrid.com/national-grid-powers-worlds-longest-subsea-interconnector-between-uk-and-norway>.
19. See <https://www.nationalgrid.com/national-grid-ventures/interconnectors-connecting-cleaner-future/north-sea-link>.
20. See <https://www.nationalgrid.com/national-grids-north-sea-link-strengthens-electricity-supply-and-repays-its-carbon-cost-just-six#:~:text=The%20%E2%82%AC1.6%20billion%20link,from%20London%20to%20New%20York>.
21. See <https://www.nationalgrid.com/document/146131/download>.
22. For example, see <https://windeurope.org/newsroom/news/uks-badly-designed-cfd-auction-attracts-not-a-single-investor/>.
23. Though the UK Government has recently taken action to raise the maximum strike price for renewables - <https://www.gov.uk/government/news/boost-for-offshore-wind-as-government-raises-maximum-prices-in-renewable-energy-auction> - and has been consulting on how the CfD needs to further develop – see details of the consultation at <https://assets.publishing.service.gov.uk/media/643cfd622ef3b000c66f2c2/cfd-non-price-factors-call-for-evidence.pdf> and the government response at <https://assets.publishing.service.gov.uk/media/64f9c596a78c5f00142657f9/cfd-scheme-non-price-factors-cfe-government-response.pdf>.
24. See <https://northconnect.co.uk/>.



25. See <https://www.energylivenews.com/2023/03/17/big-blow-for-norway-uk-interconnector-as-licence-application-gets-rejected/>.
26. See <https://www.ofgem.gov.uk/publications/northconnect-cap-and-floor-regime-withdrawal>.
27. E.g., see the 'North Sea 2' report published in February 2024 by Our Scottish Future, OSF, at <https://ourscottishfuture.org/wp-content/uploads/2024/02/North-Sea-2.pdf>.
28. Crown Estate Scotland report on the latest updates on the SCDSs are reported at <https://www.crownstatescotland.com/news/scotwind-leasing-supply-chain-development-statements-updated>.
29. See <https://www.ons.gov.uk/economy/nationalaccounts/supplyandusetables/datasets/ukinputoutputanalyticaltablesindustrybyindustry>.
30. See <https://www.gov.scot/publications/about-supply-use-input-output-tables/>.
31. For an example demonstrating how employment and other estimates of economy-wide impacts based on simple multiplier metrics may over estimate outcomes in the presence of supply constraints, see CEP research reported in the policy brief at <https://doi.org/10.17868/78261> and underlying peer reviewed research published in Local Economy at <https://doi.org/10.1177/02690942211055687>.
32. ONS datasets on 'Low carbon and renewable energy economy multipliers' are available for several years up to and including 2017 at <https://www.ons.gov.uk/economy/environmentalaccounts/datasets/lowcarbonandrenewableenergyeconomymultipliersdataset>.
33. Multiplier data commonly also report 'induced' effects of workers spending income in the local economy. Such multipliers are referred to as 'Type 2'. The ONS multiplier data considered here do not include induced effects and are referred to as 'Type 1', incorporating direct and indirect supply chain effects only.
34. It is important to note that ONS provide no information on the composition of the 2017 multipliers and, for example, CCS would have a higher multiplier if CEP's own standard assumption of sharing the upstream supply chain structure of oil and gas were applied.
35. See the March 2024 UK Government Response to to the Consultation on Introducing a CfD Sustainable Industry Reward at <https://assets.publishing.service.gov.uk/media/65ef95fdff117000116158e9/cfd-sustainable-industry-reward-consultation-government-response.pdf>.