

Document 1.

To note that this document has been compiled gathering reports over a number of years.

Macroeconomic Impact of Renewable Energy in Scotland

1. Summary

1. This paper brings together some of the relevant literature on the macroeconomic impact of renewable energy in Scotland. There is a particular focus on the offshore renewable sector but other technologies have also been considered.
2. Findings are presented first by key subject area, such as employment and GVA to identify themes and general conclusions across the literature.
3. This is followed by more detailed summaries of research that is considered particularly relevant or useful.
4. A complete table of the papers reviewed can be found in Annex 1.
5. This is considered a live document and should be reviewed periodically to ensure new research is included.

2. Key Subject Areas

Employment

Current

6. FAI estimate that the renewable energy sector supported 8,450 FTE jobs in 2020. Including spill-over effects (Indirect + induced jobs) into the wider economy they estimate that the renewable energy industry supports 27,000 FTE jobs in Scotland.
7. The Robert Gordon University Energy Transition Institute UK Offshore Energy Workforce Transferability Review estimates that the current UK offshore energy sector supports employment of 160,000, and by 2030 it projects this could increase to around 200,000 under its base case scenario. With the share of the low carbon offshore energy workforce increasing from 20% to 65% by 2030.
8. The economic footprint of the Scottish North Sea is significant; analysis from EY shows that the offshore O&G sector in 2019 supported an estimated 57,000 jobs. These are high value compared to the Scottish average, with an average wage of £88,000 for direct jobs, and

£51,000 in the supply chain (indirect employment), compared to a Scottish average of £29,000. Of the 25,000 direct O&G jobs, 98% were located within Aberdeen City and Aberdeenshire. They also identify that In 2019, Scotland's low carbon energy sector supported over 19,000 direct and indirect jobs (0.8% of Scotland's total employment).

9. There are several other sources that can be consulted for measures of current green jobs such as the Low Carbon Renewable Energy Employment (LCREE) Survey and Scottish Government growth statistics. The LCREE estimates that there were around 9,000 direct jobs in Low carbon electricity in 2020, broadly consistent with the above research by FAI.
10. **Across the studies there is a broad consensus that there are around 9,000 direct FTE jobs in Scotland's Renewable Energy Sector while including Indirect and Induced jobs this estimate increases to between 19,000-27,000.**

Future

11. The SOWEC Strategic Investment Report 2021 estimates that each future GW of offshore wind will require 21,000 FTE years (on average 700 full time jobs per year) to support development, construction and operation. This was estimated on the assumption of 10GW being awarded to ScotWind. They estimate that between 11,000 and 12,000 FTE years will be in Scotland.
12. STUC in their Green Jobs report estimate that there could be 30,000-95,000 jobs over 15+ years in zero carbon energy. However, they highlight that this is dependent on the right policies, noting that it could be as low as 16,000 jobs without them.
13. Estimates from Transition Economics using the same methodology used in the STUC Green Jobs report suggest that the initial 17 projects that were awarded leases through Scotwind could create between 2,300 and 14,400 jobs in Scotland. The large variance in potential job creation is down to different levels of local content. The higher the local content the more jobs will be located in Scotland.
14. Work by the Landfall strategy group shows that by the late 2030s if Scotland was to have around 26GW of Offshore wind capacity this could generate 21,000 total jobs. For onshore wind they estimate capacity of around 20.5GW by 2030, leading to 17,000 more jobs over the operational life of these projects. Combining all renewable technologies, including solar, tidal and pumped storage Landfall Strategy estimate installed capacity of 54GW by the late-2030s generating 75,000 jobs (2.7% of Scotland's employment).
15. Analysis from EY suggests that under certain of the ESC Whole Systems Scenarios (BOP and TEC) employment will exceed 60,000 jobs by 2045.
16. **Estimates on future employment are broad and are highly sensitive to the assumptions in each report. Particularly, estimates are sensitive to the assumed capacity, multipliers and assumed levels of local content. Although we cannot narrow an estimate down we can conclude that the potential job creation impacts of large scale renewable rollout are large.**

GVA/Turnover

Current

17. FAI estimated that the renewable energy industry had a turnover of £3.06 billion in 2020, broadly consistent with LCREE estimates. However, adding in the impact the sector has across the economy through spill over effects (Indirect + Induced jobs) increases the impact of the sector resulting in an estimated £5.6 billion output and over £2.5 billion GVA.
18. According to research by EY the O&G industry is responsible for a total GVA of £16bn in 2019, equivalent to 9% of total Scottish 2019 GDP (including a geographical share of UK Extra-Regio activity). Compared to the Low carbon economy which contributed £2.9bn in direct and indirect GVA in 2019 the O&G industry remains the larger and economically more important sector.

19. Current estimates of Direct and Indirect GVA are around £2.5-3bn.

Future

20. Work by the Landfall strategy group model that by the late 2030s if Scotland was to have around 26GW of Offshore wind capacity it could generate average annual GVA of £4.5bn. For onshore wind the estimated/modelled capacity of 20.5GW by 2030, leads to annual GVA of £2.8bn over the operational life of these projects. Combining all renewable technologies, including solar, tidal and pumped storage Landfall Strategy estimate installed capacity of 54GW by the late-2030s generating £10.5bn in annual GVA.
 21. ORE Catapult Project that floating wind will support 17,000 UK jobs and £33.6bn of GVA in 2050. Based on an estimate of 55GW of Offshore capacity by 2050 in the UK.
 22. According to Just Transition analysis by EY, by 2050, total Scottish O&G and low carbon GVA may be reduced to £12bn, compared to £19bn in 2019. This is primarily due to the value of the jobs in the new low carbon sectors being lower than those in the existing O&G sector. If GVA is to remain the same large amounts of investment will be required, this is detailed in the Investment section.
- 23. Estimates on future GVA/economic impacts are broad and are highly sensitive to the assumptions in each report. Particularly, estimates are sensitive to the assumed capacity, sector multipliers and assumed levels of local content. Although we cannot narrow an estimate down we can conclude that the potential economic impacts of large scale renewable rollout are large but perhaps not as large as our current O&G industry.**

Investment

24. Work by RGU in their Making the Switch report suggests that there is over £170 billion projected to be invested on capital and operating activities in the UK offshore energy sector between 2021 and 2030 (including on oil and gas, offshore wind, carbon capture utilisation and storage (CCUS) and hydrogen).

25. STUC in their green jobs report recommend Investing £2.5-£4.5bn (to 2035) in ports and manufacturing to supply large scale offshore renewables and decommissioning. This level of investment should secure the 30,000-90,000 jobs they forecast in the energy sector.
26. STUC also recommend that to gain the highest job impacts from the transition Scottish Government should set up a national Energy Company to build large scale renewables projects, expand local content requirements, invest in skills programmes to address worker shortages and to fund quick scale-up of hydrogen electrolysis and tidal stream technology.
27. Independent Just transition analysis by EY concludes that under there is likely to be more jobs but lower GVA from the transition to renewables. However, EY estimate the minimum level of investment required to 2050 in offshore wind, CCUS and hydrogen production to offset the loss of O&G jobs to be £33.3bn.
28. Work by Landfall strategy group identifies the potential that cheap energy may attract Foreign Direct investment (FDI) from energy intensive industries like data centres wishing to take advantage of cheap power. There is also the opportunity that cheap electricity will give current Scottish industry a competitive advantage.

29. Investment in the transition will have to come from both private business and government. The level of support that Scottish government should provide is dependent on current policy goals. Research also noted that there was scope for the renewable transition to incentivise FDI, potentially boosting Scotland's economy.

Barriers to reaping full economic benefit

30. Work by Landfall Strategy group identify several constraints to economic value; these include investment constraints, labour supply constraints, grid constraints, policy and technology and commercial risks.
31. Technology costs are identified as an area of concern in several reports¹. EY recommend subsidising research at critical supply chain points.
32. Across the studies Transmission infrastructure and investments in ports are identified as areas needing investment if Scotland is to be able to facilitate the renewable transition. STUC point towards this investment being able to maintain jobs in the network sector. However given that build out speeds required for Scotwind are expected to be much higher on an annual basis than current levels which may have a positive impact on Jobs.
33. Given the volume of Jobs expected to be required to support the renewable sector and the potentially even larger numbers that could be needed for supporting Hydrogen (300,000+) Scotland's tight labour markets might be stretched depending on the wind down of the O&G sector and the freeing up of O&G workers.
34. Investment Constraints are also a major concern across the Studies. There will need to be substantial investment from the private and public sectors to realise the maximum economic benefit for Scotland. The potential sums required are illustrated in the around £25bn of

¹ Independent Just transition analysis and Landfall Strategy Group for example.

CAPEX expected to be invested in Scotland announced in the first round of ScotWind, around £1bn/GW. Without access to investment it will be tricky to get projects off the ground.

35. Just Transition analysis by EY identifies that the CfD is considered the best value for money to bring large scale renewable projects such as offshore wind to market. As such there are risks around the scheme budget being substantial enough to support large scale rollout in Scotland, additionally because this scheme is managed for the UK there is potential that Scottish and UK Government opinion deviates on where best to locate generation.

36. Overall there are a substantial number of barriers that could prevent Scotland reaping full economic reward in the transition to renewable energy. Across the literature reviewed there is a general consensus that some of the main constraints Scotland could face are electricity grid and port investment, Investment Constraint and technology and commercial risks from nascent technologies (e.g. Floating offshore wind).

3. General Modelling approaches

Modelling Jobs and GVA

37. In general the approach is to take a set of assumptions (e.g. expenditures, capacities, load factors, outputs, and GVA multipliers by sector) and feed these into a model which will output estimates of economy-wide jobs, GVA and other outputs based on these assumptions and the modelling technique used.

Input-Output Modelling (IO)

38. Most macroeconomic studies of renewable deployment either use directly or are based on IO modelling. It is used in Project Ninian, FAI: The Economic Impact of Scotland's renewable energy sector 2022 update, and the STUC Green Jobs report.

39. IO models are based on a set of simultaneous equations which records the sectoral linkages of an economy in an IO table.

40. Impacts are based on multipliers that estimate the extent to which each unit of output produced in the sector requires the production of a number of supporting units of goods and services in other sectors.

41. There are two variations of IO models, Type I where the household sector is considered exogenous and the model gives "direct" (the initial change in demand) and "indirect" (those changes stimulated across the sectors in the economy) impacts. Type II which treats households as endogenous and also gives "induced" (Impacts generated by increased employee income, through both direct employment in the low carbon energy sector and indirect employment in the supply chain.) effects. Typically, as is the case across the studies referenced here both techniques will be used to get estimates of Direct, Indirect and Induced jobs.

42. Essentially Type I and II models are using different multipliers to capture different effects.

43. Scottish Government and ONS publish IO tables that contain these multipliers that can then be used to calculate direct, indirect and Induced impacts.

Other Methods

44. Some more recent studies have used use Computable General Equilibrium models (CGE), for example, FAI: The regional economic impacts of offshore wind energy developments in Scotland.
45. The Scottish Government describe CGE models as large numerical models which combine economic theory with real economic data in order to derive computationally the impacts of policies or shocks in the economy.
46. CGE models fit economic data to a set of equations which aim to capture the structure of the economy and behavioural response of agents (firms, households, government). This provides a framework to simulate policy changes and trace the impact on key economic variables, including income and expenditure flows.²
47. CGE models capture both the economy's supply and demand side and therefore allow for an adjustment in both quantities and prices following a policy shock.
48. Their main strength lies in their flexibility, as they can be adapted to simulate a wide range of policies and shocks.

4. Key Reports

Summary table of key research

49. From the wider literature search that can be found in Annex 1 around 7 reports were considered particularly important or useful. This has been based on the judgement of the author. They have been selected primarily based on age and relevance to understanding the macroeconomic impacts of renewables in Scotland.

Title	Subject Areas Covered	Region	Current/Future	Summary	Date
Robert Gordon University Energy Transition Institute UK Offshore Energy Workforce	Employment Transferability Investment	UK	Future	RGU aim to identify the impacts of the offshore transition from O&G to renewables on jobs. They also project investment in the UK offshore energy sector between 2021-2030	2021

² [Computable General Equilibrium modelling: introduction - gov.scot \(www.gov.scot\)](#)

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Transferability Review				and breaks employment down by sector (CCS, Hydrogen)	
Landfall Strategy Group - The Economic Opportunity for Scotland from Renewable Energy & Green Technology	Employment GVA Constraints Exports	Scotland	Future	Very comprehensive report included forecasts of economic value and discussions of barriers to success.	2022
FAI - The Economic Impact of Scotland's Renewable Energy Sector 2022 Update	GVA Employment	Scotland	Current	Report produced by FAI that looks at the current Economic Impact of the renewable sector in Scotland. They provide estimates of Jobs and GVA among others.	2022
STUC Green Jobs Report	Employment Policy recommendations Investment	Regional/Scotland	Future	Job estimates over several Green Economy Sectors such as Energy, Waste and Buildings.	2021
Independent Just Transition Analysis	GVA Employment Investment Transition Policy Recommendations	Scotland	Future/ Current	Builds on the work by ESC on the Whole system energy scenarios. Provides estimates and discussion of Scotland's Just transition.	2023
ORE Catapult MACROECONOMIC BENEFITS OF FLOATING OFFSHORE WIND IN THE UK	GVA Employment Investment	UK	Future	Results based on content levels and build out assumptions. These would likely need updated. Quite comprehensive cover of macroeconomic benefits Covers potential for supply chain exports.	2018

FAI: The regional economic impacts of offshore wind energy developments in Scotland	GVA Employment	Scotland	Future	Analyse the economic impact of planned increases of offshore wind in Scotland. IO results are compared CGE with focus on both construction and operation stages. First study to focus on anticipated impacts of Scottish offshore wind development. Myopic CGE framework produces the largest cumulative economic impacts. Results differ from studies which only focus on construction of renewables.	2020
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Key Reports detailed Summary

Landfall Strategy Group - The Economic Opportunity for Scotland from Renewable Energy & Green Technology - David Skilling report

Key Findings

50. Work by the Landfall strategy group model that by the late 2030s if Scotland was to have around 26GW of Offshore wind capacity could generate average annual GVA of £4.5bn and 21,000 total jobs. For onshore wind the expected capacity is around 20.5GW by 2030, leading to annual GVA of £2.8bn and 17,000 more jobs over the operational life of these projects.
51. Combining all renewable technologies, including solar, tidal and pumped storage Landfall Strategy estimate installed capacity of 54GW by the late-2030s generating £10.5bn (3.5% of Scottish GVA) in annual GVA and 75,000 jobs (2.7% of Scotland's employment).
52. Although renewables are estimated to make a significant economic and labour market contribution, this contribution will be smaller than the current size of the oil and gas sector in Scotland, which contributes ~12% of Scottish GVA. Over time, the oil and gas sector will contract, but the economic contribution of renewable energy production is not estimated to be of the same scale as oil and gas.
53. Estimates for 2050 are 80GW of capacity leading to GVA of £14.5bn and 110,000 jobs.
54. Highlights that the increase in renewables GVA will not make up for Oil and Gas (accounting for 12% of Scottish GVA)
55. Suggests the major economic value in hydrogen comes from export opportunities, being a first mover in offshore wind will create competitive, at-scale hydrogen capability. Noting that some studies suggest that Hydrogen could have greater Job and GVA impacts than the oil and gas sector. Although these are optimistic estimates.
56. Identify several wider economic benefits; Access to cheap power for Scottish business, giving competitive advantage; Increased energy resilience; Attractive for inward FDI for energy intensive firms; exporting advisory services and expertise.

57. Key constraints and risks that could limit the economic value that could be captured
- a. Labour supply constraints – the most optimistic scenario in the report suggests 300,000 jobs (10% of employment), this will require releasing oil and gas jobs and movement from other sectors and other regions of the UK and Europe.
 - b. Grid constraints
 - c. Investment Constraints
 - d. Technology and commercial risks – cost structure uncertainty (particularly for Hydrogen)
 - e. Policy and regulatory barriers

Gaps/Limitations

58. Commissioned by SNP Westminster Group. Potential for bias in reporting and assumption selection.
59. Potential for cheaper power in Scotland is dependent on the electricity system of the future. There is potential for LMP to allow lower prices, but it depends on their exact deployment method. Work is ongoing on the Review of Electricity Market Arrangements (REMA).

Robert Gordon University: Offshore Energy Transition Report

Key Findings

60. The Robert Gordon University Energy Transition Institute UK Offshore Energy Workforce Transferability Review estimates that the current UK offshore energy sector supports employment of 160,000, and by 2030 it projects this could increase to around 200,000 under its base case scenario. With the low carbon offshore energy workforce increasing from 20% to 65% by 2030.
61. Of the c. 200,000 people projected to be directly and indirectly employed in the UK offshore energy sector by 2030. c. 90,000 (c. 45%) are projected to support offshore wind, c. 70,000 (c. 35%) oil and gas, and c. 40,000 (c. 20%) other offshore related energy projects and clusters. This compares to around 160,000 people directly and indirectly employed in the UK offshore energy sector in 2021
62. This review indicates that the impact of reduced ambition, combined with lower activity level and accelerated decline in the oil and gas industry could reduce the offshore energy workforce requirements to fewer than 140,000 jobs by 2030.
63. This modelling assumes there will be a transformative increase in investment in the energy transition over the decade, with over £170 billion projected to be invested on capital and operating activities in the UK offshore energy sector between 2021 and 2030 (including on oil and gas, offshore wind, carbon capture utilisation and storage (CCUS) and hydrogen). The report recognises the uncertainties and highlights this is intended to be a flexible model which can be updated as developments materialise.

Gaps/Limitations

64. Primarily focused on the job creation aspects of the transition, missing out on the potential economic impact.
65. The focus is clearly on the oil and gas transition rather than the economic potential of renewable deployment.

FAI: The Economic Impact of Scotland's renewable energy sector 2022 update

Key Findings

66. Estimate that the renewable energy industry had a turnover of £3.06 billion and 8,450 full-time equivalent (FTE) employment in 2020.
67. However, the economic activity supported by renewables sector is far greater than its own turnover and employment. The renewable energy sector supports economic activity throughout its supply chains and this economic activity supports wage spending across Scotland.
68. Including these spill-over effects, they estimate that the renewable energy industry supports over £5.6 billion of output, over £2.5 billion of GVA and over 27,000 FTE employment across the Scottish economy.

Gaps/Limitations

69. Focus on the current Economic impact of the renewable sector. Does not suggest what the future impact could be.
70. Use Input-Output modelling based on ONS data such as the LCREE survey. There are several issues here;
 - a. First, there is no renewables category of SIC code so FAI must create their own renewables category from other SIC codes, this could mean overstating what jobs are part of the renewables sector due to SIC code overlap.
 - b. Second, due to the methodology of the LCREE survey it is not considered very accurate as a measure of renewable economic activity in Scotland.

STUC Green Jobs Report

Key Findings

71. Estimated green jobs potential across 6 sectors; Energy, Buildings, transport, Manufacturing and Industry, Waste, and Land Use.
72. Estimate that there could be 30,000-95,000 jobs over 15+ years in zero carbon energy. However, they highlight that this is dependent on the right policies, noting that it could be as low as 16,000 jobs without them.
73. Recommend Investing £2.5-£4.5bn (to 2035) in ports and manufacturing to supply large scale offshore renewables and decommissioning.
74. They also recommend; To set up a national Energy Company to build large scale renewables projects, expand local content requirements, invest in skills programmes to address worker shortages and to fund quick scale-up of hydrogen electrolysis and tidal stream technology.
75. Identify that Scotland could become a pioneer exporter in Tidal stream, Offshore wind and Hydrogen electrolysis.
76. There is some work on identifying employment hubs, but the data is limited due to a lack of granularity on the ONS data. However, Aberdeen City is estimated to have the bulk of jobs in Scotland (approx. 80%).

Gaps/Limitations

77. Methodology uses Input-Output tables, multipliers are from ONS, Homes and Communities Agency and Scottish Government. Multipliers rely on the input-Output models methodology which can overstate job estimates compared to using a bottom-up empirical approach where each multiplier's impact can be more precisely identified.
78. Missing information on the value of the jobs created. Total jobs tell us little of the quality of these jobs.
79. Include Nuclear in their green job's estimates (although this is a very small portion, we might prefer to classify this in its own low carbon generation capacity).

ORE Catapult - Macroeconomic benefits of Floating Offshore wind in the UK

Key Findings

80. Project that floating wind will support 17,000 UK jobs and £33.6bn of GVA in 2050, far outweighing the cost of providing support for the early stages of deployment of up to £2.2bn and representing a return of £15 for each £1 invested in early-stage support. (This is based on 55GW installed capacity of offshore wind by 2050 but only supporting a small portion of initial projects)
81. Highlight the huge global potential for floating offshore wind, suggest that globally there could be 4GW installed by 2030 and 55GW by 2050. With these assumptions and appropriate investment in UK business this could represent annual export values of £230m by 2031 and £550m by 2050.
82. Potential for floating offshore wind to locate in more consistently windy locations, therefore enhancing the UK's Security of Supply.

Gaps/Limitations

83. Focus on floating offshore wind does not give an indication of the impact the green transition could have more broadly.
84. Written pre-ScotWind leasing where future capacity was thought to be lower than would be assumed now.
85. Results are UK-wide, not isolating the direct impacts on Scotland.
86. Results are sensitive to local content assumptions. For the most optimistic scenario (referenced here) UK content is 65%. IN the less optimistic scenario 3 they assume only 22% UK content and 3% of global exports. This leads to a cumulative GVA of £6.8bn by 2030. Significantly less than the optimistic scenario.
87. Note investment numbers are based on support that is less than was achieved in AR4. The returns on investment may now be reduced.

FAI: The regional economic impacts of offshore wind energy developments in Scotland

Key findings

88. Academic paper that models the economic impacts of offshore wind using both Input-Output models and Computable general equilibrium models (CGE). The input –Output model gives direct, indirect and Induced impacts. The CGE model can be run with either myopic or forward-looking assumptions, In the myopic specification agents have adaptive expectations whereas in the forward-looking specification, firms and consumers have perfect foresight.

89. The author used the capacity in planning at time of publication, this was only around 2.4GW
90. The myopic simulation yields the largest overall results with a total GVA impact of £3.88 billion and increase in employment of 82,393 person years of employment. With the forward-looking simulation, the GVA impact is £2.04 billion and employment 45,181 while for the IO Type II the increases are £3.22 billion and 57,498 FTES. The myopic results are largest due to a large build-up of capital in the model during the construction phase.

Gaps/Limitations

91. Early-stage assessment of economic impacts. Misses large levels of capacity we now expect.
92. Main function of paper I to assess the effectiveness of different models in modelling economic impacts.
93. No discussion of barriers to achieving these numbers. Questions like what policies could increase the economic returns from renewables are not answered.
94. An academic paper so it is not easily picked up by those with limited background knowledge.

Independent energy system and Just transition research

Key Findings

95. The economic footprint of the Scottish North Sea is significant and our analysis shows that the offshore O&G sector supports an estimated 57,000 jobs. These are high value compared to the Scottish average, with an average wage of £88,000 for direct jobs, and £51,000 in the supply chain (indirect employment), compared to a Scottish average of £29,000. Of the 25,000 direct O&G jobs, 98% were located within Aberdeen City and Aberdeenshire.
96. The industry is responsible for a total GVA of £16bn, equivalent to 9% of total Scottish 2019 GDP (including a geographical share of UK Extra-Regio activity).
97. In 2019, Scotland's low carbon energy sector supported over 19,000 direct and indirect jobs (0.8% of Scotland's total employment) and contributed £2.9bn in direct & indirect GVA to Scotland's economy (1.6% of Scotland's total GDP).
98. Using the ESC Whole System energy scenarios as a base EY forecast jobs and GVA estimates for the energy transition. They conclude that the transition to renewable energy will lead to a net job increase but a net GVA decrease.
99. The main forecast are from the Balanced Options Pathway (BOP) which includes 30GW of wind, 9.5GW of hydrogen production capacity and 26.4 MtCO₂ of carbon capture in 2050 compared to 2019.
100. By 2050, total Scottish O&G and low carbon GVA may be reduced to £12bn, compared to £19bn in 2019. This is primarily due to the value of the jobs in the new low carbon sectors being lower than those in the existing O&G sector.
101. Maintaining high levels of Scottish content will be crucial to seeing the increase in job numbers.

102. There is potential for the gap in GVA to be plugged by new technologies. They estimate the total level of investment required to 2050 in offshore wind, CCUS and hydrogen production to offset the loss of O&G jobs to be £33.3bn, split across the three key sectors: offshore wind (£21.5bn), CCUS (£1.9bn) and hydrogen (£9.9bn).
103. The £33.3bn above does not represent the total investment required to implement the ESC BOP scenario, which includes other subsectors such as Biomass and solar.
104. EY calculate that offshore wind generation capacity would need to stand between 14 and 23 GW in 2050 in order to achieve net-nil job losses, or 33 and 46 GW to achieve net-nil GVA losses across the adjusted pathways.
105. There are several barriers and areas for concern around the key technologies identified, such as planning, uncertainty of transmission charging, nascent technologies, investment barriers and Uncertainty over the costs of CCUS to name a few.
106. EY also provide extensive policy recommendations in key areas such as offshore wind, CCUS and Hydrogen.

Gaps/Limitations

107. The analysis utilises Energy System Catapult's Scottish whole energy system scenarios. This represents one possible set of scenarios, however other net zero pathways exist, that may result in different forecasts.
108. The focus of the report is to provide baseline evidence of the O&G sector in Scotland and analysing the economic impact of the growth in the low carbon energy production sectors. It does not give a full economic impact assessment, there may be economic impacts not discussed.

ANNEX 1: Summary of Findings from wider Literature Search

Summary

1. This brief literature review aims to identify gaps where additional research would be beneficial to decision makers.
2. A general internet search was conducted followed by checking on individual sites for related literature. The below sites were checked;
 - a. Fraser of Allander Institute (FAI)
 - b. ClimateXChange
 - c. ORE Catapult
 - d. Highlands and Islands Enterprise (HIE)
 - e. BVG Associates

- f. Ricardo
 - g. Scottish Trade Union Congress (STUC)
 - h. Transition Economics
3. Within the literature surveyed there appear to be several areas where research could be undertaken to fill gaps.
- a. Value of Exporting electricity to the rest of the UK
 - b. Most economic assessment are pre-Scotwind and none have been published post Scotwind clearing round. This suggests updated impacts of the current pipeline would be beneficial
 - c. No report covers the full picture, employment, GVA, Skills, Export capabilities, supply chain opportunities, barriers to economic success and the net impact of the transition from Oil and gas to renewables.
 - d. There is also limited exploration of what excess renewable generation could be used for. Some studies focus on hydrogen potential but a study comparing excess generation uses is lacking.
4. Below is a table of research in the renewable and energy economy space relating to the question of economic impacts of large-scale renewable deployment.

Table of research

Title	Sector	Key Areas	Regional /Scotland /UK	Current / Future	Summary	Gaps/limitations	Date
SG - Energy Growth Sector Statistics	Energy Economy	GVA Trade Employment	Scotland	Current	Using SIC code mapping for an energy growth sector – attempting to capture renewable sector	Loose categorisation of energy means that the results are indicative. Missing future scenarios.	2023
ONS - LCREE	Energy Economy	Number of Businesses Turnover Trade Employment	UK and Scotland	Current	Uses survey data that is then applied across the UK. Some results are misleading.	Survey data that captures little of the future economic potential of renewables	2022

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Robert Gordon University Energy Transition Institute UK Offshore Energy Workforce Transferability Review	Oil and Gas Transition	Employment Future economy transferability	UK	Future	Estimates that the current UK offshore energy sector supports employment of 160,000, and by 2030 it projects this could increase to around 200,000 under its base case scenario. With the low carbon offshore energy workforce increasing from 20% to 65% by 2030	Pre Scotwind No economic projections Only goes to 2030 Missing regional breakdown	2021
Robert Gordon University - Making the Switch	Oil and Gas Transition	NE Scotland Investment requirements Oil and Gas transition	Regional	Future	NE Scotland - Attaining the most successful workforce scenario (Global Energy Hub) in which the offshore energy workforce reaches 54,000 from the current 45,000 requires over £17 billion in new investment between 2022 and 2030, largely focussed on offshore wind	Covers NE Scotland only	2022
PWC - Green Jobs Barometer	Green Jobs	Employment	UK, Scotland	Current	The Green Jobs Barometer measures the relative performance of UK regions and industry sectors on their progress developing green jobs* over time.	No future job estimates	2022
FAI - The Economic Impact of Scotland's Renewable Energy Sector	Energy Economy	Focus on current GVA and Employment	Scotland	Current	Scotland's renewable sector has a turnover of £2.8 billion and 6,440 FTE employment. Model is Specific to Scotland so catches more of the intricacies of the	No future estimate. Also uses the LCREE data set which is known to be more ballpark than accurate.	2021/22

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					Scottish economy than a UK wide model might.		
FAI - The Economic Impact of Scotland's Renewable Energy Sector 2022 Update	Energy Economy	Focus on current GVA and Employment	Scotland	Current	<p>We estimate that the renewable energy industry had a turnover of £3.06 billion and 8,450 full-time equivalent (FTE) employment in 2020.</p> <p>However, the economic activity supported by renewables sector is far greater than its own turnover and employment. The renewable energy sector supports economic activity throughout its supply chains and this economic activity supports wage spending across Scotland.</p> <p>Including these spill-over effects, we estimate that the renewable energy industry supports over £5.6 billion of output, over £2.5 billion of GVA and over 27,000 FTE employment across the Scottish economy.</p>	No future estimate. Also uses the LCREE data set which is known to be more ballpark than accurate.	2022
SOWEC – Strategic Investment Report 2021	Energy Economy	GVA of infrastructure investments Jobs Employment due to Scotwind (pre-clearing)	Scotland	Future	Each future GW will require 21,000 FTE job years (on average 700 full time jobs per year) to support development, construction and operation. Capturing an increasing proportion of this activity is vital for Scotland.” A 1GW wind farm deployed in Scotland after 2025 is	Small piece of Jobs analysis but this was pre Scot Wind (assumes 10GW awarded through leasing) Predominantly a policy recommendation document with focus on supply chains	2021

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		Policy recommendations			expected to generate between 11,000 and 12,000 FTE years in Scotland.		
Transition Economics - Scotwind FTE	Green Jobs	Scotwind (Pre-clearing) FTE Employment	Scotland	Future	Analysis of FTE from Scotwind projects based on committed expenditure.	Just for Scotwind Projects No forecast of the economic value of the projects Pre-clearing	2022
STUC Green Jobs Report	Green Jobs	Employment Policy Recommendations	Scotland And Regional	Future	A report on Green Jobs in Scotland from STUC suggests that there could be between 30,000 and 95,000 jobs Over 15+ years in zero carbon energy (including renewables, hydrogen and storage) - but potentially only 16,000 without the right policies.	Focus on FTE – no indication of economic impact or value of the green jobs	2021
ORE Catapult Supply Chain Survey 2022	Supply chains	Survey Supply chains	UK	Current	The aim of the survey was to gain better insight into the challenges faced by the supply chain in developing innovation to meet the needs of the offshore wind industry and to set a benchmark for the level of its confidence in future growth in the sector.	Captures only market sentiment of companies No indication of GVA, Employment or forecasts into the future	2022
ORE Catapult OFFSHORE WIND OPERATION S & MAINTENANCE A £9	Operations	Future Costs by process	UK	Future	In both UK and ROW cases, O&M rises to become the second largest offshore wind sub sector market after turbine supply by 2030. Beyond 2030, the value of the O&M market rises further, surpassing the value of the turbine sub sector market in the UK	Focus on O&M rather than the complete economic impact. No discussion of export capabilities. Is pre Scotwind leasing	2021

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BILLION PER YEAR OPPORTUNITY BY 2030 FOR THE UK TO SEIZE					before 2050 and approaching this level in the Rest of the World by then		
ORE Catapult Floating offshore wind Cost reduction pathways to subsidy free	Supply Chains	GIS Spatial modelling across the UK Cost of capital Cost reduction options	UK	Future	In this report, we aim to map the pathway to subsidy-free floating offshore wind in the UK. The potential scale of deployment is huge, with a wide geographic spread of projects in waters around Scotland, Wales, the Southwest and Northeast of England. Based on GIS mapping, we identify potential zones for floating offshore wind development and establish deployment profiles that meet, and exceed, targets for Net Zero.	Focus on specific technologies for reducing the capital cost of a wind farm.	2021
ORE Catapult Scotland's Offshore Potential	Supply chains	Site Locations Case Studies	Scotland	Current	Dated pamphlet showing offshore sites and supply chain success stories.	Very limited detail Larger report must be confidential. Dated.	2018
ORE Catapult Generating Energy and Prosperity	Energy Economy	GVA	UK	Future	Out of date based on certain offshore pathways out to 2020.	Very out of date	2014
ORE Catapult Economic Impact Study into the Development	Energy Economy	GVA Employment Production	UK	Future	Using scenarios from above ORE report it provides macroeconomic analysis of impacts.	Very out of date	2014

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of the UK Offshore Renewable Energy Industry to 2020							
ORE Catapult Skills and labour requirements of the UK offshore wind industry – Full report	Green Jobs	Employment Skills	UK Scotland	Future	Aura and Green Port Hull commissioned Energy & Utility Skills to undertake a comprehensive skills study of the UK's offshore wind industry and to provide a specific focus on that industry in the Humber region. The purpose of the study is to provide a deeper understanding of nature and extent of workforce supply and demand issues within the development, construction and operation of the UK's offshore wind energy sector through to 2032.	Dated.	2018
ORE Catapult MACROECONOMIC BENEFITS OF FLOATING OFFSHORE WIND IN THE UK	Energy Economy	Build out rates LCOE Market value of project GVA FTE Investment	UK	Future	Results based on content levels and build out assumptions. These would likely need updated. Quite comprehensive cover of macroeconomic benefits Covers potential for supply chain exports.	Slightly dated research Misses the specifics of Scotland.	2018
Aurora Energy Research	Policy Improvements	Modelling policy interventions	UK	Future	Modelled Zero subsidy CfDs and revenue stacking to see impacts on	Slightly dated Designed when there was likely a different policy landscape,	2018

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The new economics of offshore wind		and their impact.			GVA, system costs and costs to consumers	updated assumptions would be required.	
FAI Economic impact of the proposed Neart Na Gaoithe offshore windfarm	Impact Assessment	GDP FTE	Regional	Future	IA of Neart Na Gaoithe wind farm.	Dated. Specific to one wind farm	2014
IRENA Renewable Energy Benefits: Measuring the Economics	Energy economy	GDP Trade Welfare Employment	International	Future	Looks at Global GDP, Welfare, Jobs and Trade to quantify the impacts of renewables to the world. Assumptions will be dated.	Global figures that do not catch the granular detail of Scotland Old report.	2016
Strathclyde University The regional economic impacts of offshore wind energy development in Scotland	Energy economy	GVA FTE	Scotland	Future	We analyse the economic impact of planned increases of offshore wind in Scotland. IO results are compared CGE with focus on both construction and operation stages. First study to focus on anticipated impacts of Scottish offshore wind development. Myopic CGE framework produces the largest cumulative economic impacts. Results differ from studies which only focus on construction of renewables.	Will not take account of Scotwind Only has a small sample of pipeline projects that contribute to results	2020

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BVG Associates Economic Impact of an onshore wind farm	Energy Economy	GVA FTE	UK Scottish and Local Content	Future	ScottishPower Renewables (SPR) recognises the importance of the economic benefits to Scotland and the rest of the UK from investing in onshore wind generation. SPR commissioned BVG Associates (BVGA) to assess the UK, Scotland and local (south west Scotland) economic benefits created by eight onshore wind farms in south west Scotland commissioned between 2016 and 2017. The wind farms have a combined capacity of 474MW. This report shows the contribution onshore wind can make in the Government's future industrial and energy strategies.	Dated results Includes only a set of 8 wind farms in the south west of Scotland.	2017
Transition Economics Potential Clean job creation in regions with high oil and gas employment	Green Jobs	Jobs Oil and Gas Transition	Regional	Future	Total clean job potential by region by 2032 (in domestic retrofit, offshore wind and hydrogen electrolyser exports) Aberdeen & Aberdeenshire: 24,500 – 33,800 jobs Fife & Tayside: 24,100 – 34,200 jobs Teesside: 20,100 – 28,300 jobs Tyneside: 29,100 – 42,600 jobs Total clean job potential by sector by 2032 (in Aberdeen & Aberdeenshire, Fife & Tayside, Tyneside and Teesside)	No GVA estimates. Does not account for Job losses due to winding down Oil and Gas	2022

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					Domestic energy efficiency retrofit: 61,800 – 93,200 jobs Offshore Wind: 30,500 – 38,200 jobs Hydrogen electrolyser exports: 5,500 – 7,500 jobs		
Transition economics: An emergency plan on green jobs for young people	Green Jobs	Jobs	UK	Future	For Friends of the earth with a specific focus on green apprenticeships Calculates wage scarring	Focus on green apprenticeships reduced applicability across the economy.	2021
ESC Whole system energy scenarios	Energy Transition	Investment Costs in addition to baseline	Scotland	Future	This project has developed a set of Scotland-specific whole energy system scenarios, nested in and consistent with the wider UK transition. These scenarios demonstrate three qualitatively different routes for Scotland to meet its greenhouse gas (GHG) targets, allowing different choices and potential implications to be explored.	Covers costs of the transition but not FTE and GVA impacts. Focus is on capital, operating, infrastructure and resource costs.	2022
CXC Redirecting Excess Renewable Energy to Produce Hydrogen	Excess generation use	Hydrogen Use for high generation that exceeds demand	Scotland	Future	This report looks at whether curtailed energy from large-scale renewables in Scotland could be used to produce hydrogen economically. For further details, please read the report attached.	Lacks an assessment of GVA or FTE impacts from using energy to create hydrogen. Focus on hydrogen as the main use. Could be battery storage, export etc.	

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Project Ninian – Independent Just transition analysis	Energy Economy	GVA Investment Employment Policy recommendations	Scotland UK	Future and Current	Builds on the work by ESC on the Whole system energy scenarios. Analyses the transition from O&G to renewables looking at GVA, Employment, investment, and policy recommendations. They also describe the current renewable and O&G economy in Scotland.	Uses ESC Scenarios which are just one of the possible ways to achieve net zero, other pathways may change results.	2023
Landfall Strategy Group - The Economic Opportunity for Scotland from Renewable Energy & Green Technology	Energy Economy	Employment Economy GVA FTE Constraints Country Case Studies Exports Hydrogen	Scotland	Future	Very comprehensive report included forecasts of economic value and discussions of barriers to success.	Commissioned by the SNP Westminster parliamentary group which may lead to accusations of bias.	2022

Document 2.**Pre-Scoping Meeting, Killean Wind Farm**

2 September 2015, Chalmers Room, Atlantic Quay, 11:00 – 12:30

Attendees: [REDACTED: REGULATION 11(2)], Senior Development Manager, RES Ltd ([REDACTED: REGULATION 11(2)])
[REDACTED: REGULATION 11(2)], Senior Case Officer, Local Energy and Consents ([REDACTED: REGULATION 11(2)])
[REDACTED: REGULATION 11(2)], Consents Manager – Generation Projects, Local Energy and Consents ([REDACTED: REGULATION 11(2)])

11(2)) [REDACTED: REGULATION 11(2)], Case Officer, Local Energy and Consents ([REDACTED: REGULATION 11(2)])

Apologies: [REDACTED: REGULATION 11(2)], RES Ltd

1. Overview of the proposed development

[REDACTED: REGULATION 11(2)] introduced RES Ltd and her role as Development Manager for projects in Argyll and Bute. [REDACTED: REGULATION 11(2)] introduced herself as Case Officer for the project and outlined the agenda for the meeting. [REDACTED: REGULATION 11(2)] described the proposed development as a wind farm consisting of [REDACTED: REGULATION 10(5)(f)]. [REDACTED: REGULATION 10(5)(f)]. The proposed site is around halfway down the west side of the Kintyre peninsula, off the A83, the nearest settlement being Tayinloan. The site consists of commercial forestry managed by the Forestry Commission and farmed moorland grazed by cattle and sheep.

[REDACTED: REGULATION 11(2)] and [REDACTED: REGULATION 11(2)] referred [REDACTED: REGULATION 11(2)] to Argyll and Bute Local Development Plan (adopted on 26 March 2015) and the Argyll and Bute Landscape Wind Energy Capacity Study 2012 (LWECS).

2. Site constraints or likely environmental impacts from the proposed development

Site constraints were discussed for this proposed development. These were identified as follows:

- **Ornithology** - Ornithology was identified as a significant site constraint with an SPA close to the site boundary. [REDACTED: REGULATION 11(2)] explained that 2 years of bird monitoring has been carried out on site with ornithology constraint buffer areas highlighted on provided combined constraints maps. [REDACTED: REGULATION 11(2)] described the main ornithology constraints as the presence of Greenland white fronted geese and red throated diver. [REDACTED: REGULATION 11(2)] stated black grouse leks have been identified around the access area to the site and hen harriers have been identified on site with no evidence of nesting sites.
- **Forestry and presence of Peat** – [REDACTED: REGULATION 11(2)] explained that around half of the turbines are to be located in forested area, giving rise to potential compensatory planting issues. This also has an impact on the height of turbines required for this site to clear forest canopy. This will have a subsequent impact on aviation, with lighting likely to be required. There is also Peat on the site which will need to be investigated. [REDACTED: REGULATION 11(2)] explained that peat probing has been carried out on site and [REDACTED: REGULATION 11(2)] made reference to the SEPA web carbon calculator.
- **Kintyre Way through site** - [REDACTED: REGULATION 11(2)] discussed potential issues with the Kintyre Way running through the site and [REDACTED: REGULATION 11(2)] explained there is potential to carry out re-routing of the Kintyre Way which passes through the site and along the haul road. The haul road is to be used for access to the site and may require development to facilitate access to the site for

construction. [REDACTED: REGULATION 11(2)] explained that the A83 will not require any upgrades as it has been upgraded recently by Argyll and Bute Council. [REDACTED: REGULATION 11(2)] stated that topple distance has been calculated for position of turbines to the Kintyre Way. [REDACTED: REGULATION 11(2)] [REDACTED: REGULATION 10(5)(f)]. They had carried out some early consultation with John Muir Trust.

- **Landscape and visual** – Due to height of turbines and location of site, landscape and visual constraints are likely. SNH will advise on viewpoints and impact of site from various locations. This is a popular tourist area and impacts on important scenic areas will require mitigation.
- **Cumulative Impacts** - [REDACTED: REGULATION 11(2)] explained that a meeting has been held with Argyll and Bute Council Planning Department which highlighted potential for cumulative effects due to wind farms in the area. [REDACTED: REGULATION 11(2)] also discussed potential issues around the potential need for minimising views from Arran viewpoints, ferries from Gigha and views from the A83.

Further Potential Constraints

- [REDACTED: REGULATION 11(2)] discussed the Argyll and Bute Local Development Plan and the possibility of a Dark Sky Park in Kintyre and the implications with turbine lighting for aviation purposes.
- [REDACTED: REGULATION 11(2)] noted ecological surveys are incomplete at present and additional constraints may be identified on completion of these surveys. [REDACTED: REGULATION 11(2)] noted 1 otter holt has been identified on the site to date.
- [REDACTED: REGULATION 11(2)] stated that an Archaeologist has not been on site as yet but a visit is planned for next month.

[REDACTED: REGULATION 11(2)] noted that a Community Relations Manager is working on the project and will be available to respond to any queries or concerns of members of the public and local residents.

3. Issues which can be excluded from the EIA

[REDACTED: REGULATION 11(2)] [REDACTED: REGULATION 10(5)(f)]. [REDACTED: REGULATION 11(2)] advised to clearly show in scoping and subsequent ES how items have been scoped out i.e state methodology and explain how assessment has been carried out prior to exclusion from ES.

4. Site specific design constraints

As noted in section 2 above.

5. Process going forward

[REDACTED: REGULATION 11(2)] discussed pre engagement with consultees and stated that a pre scoping meeting with consultees would not be necessary due to the level of engagement already carried out.

[REDACTED: REGULATION 11(2)] said that they were due to meet aviation / defence consultees.

A preliminary timetable for the process going forward was identified. [REDACTED: REGULATION 11(2)] stated that scoping is proposed to be submitted in September 2015. [REDACTED: REGULATION 11(2)] outlined the process going forward from the submission of scoping with a post scoping meeting with consultees likely to take place in November 2015. Gate check 1 is proposed to be carried out in summer 2016 and Gate Check 2 carried out around November 2016 with an application planned to be submitted by the end of 2016. [REDACTED: REGULATION 11(2)] advised that a long gap between scoping and submission could result in advice given at scoping no longer being valid. However, this could potentially be picked up at Gatecheck One as consultees will have an opportunity to assess if anything further is required in the ES.

ACTION: [REDACTED: REGULATION 11(2)] to issue generic consultation list to [REDACTED: REGULATION 11(2)] by close on Thursday 3 September and agree updated, case specific list with [REDACTED: REGULATION 11(2)] prior to Scoping being issued.

Supplementary

[REDACTED: REGULATION 11(2)] highlighted community benefits good practice principles. [REDACTED: REGULATION 11(2)] aware of these including expected level of £5000MW pa.

Document 3.

From: <[REDACTED: REGULATION 11(2)]@gov.scot>
Sent: Thursday, April 28, 2016 11:54 AM
To: <[REDACTED: REGULATION 11(2)]@gov.scot>; [REDACTED: REGULATION 11(2)]@gov.scot>; <[REDACTED: REGULATION 11(2)]@gov.scot>; <[REDACTED: REGULATION 11(2)]@gov.scot>; <[REDACTED: REGULATION 11(2)]@gov.scot>; <[REDACTED: REGULATION 11(2)]@gov.scot>; <[REDACTED: REGULATION 11(2)]@gov.scot>; <[REDACTED: REGULATION 11(2)]@gov.scot>
Cc: <[REDACTED: REGULATION 11(2)]@gov.scot>
Subject: Meeting with RES

Hello,

Just thought I'd write up a little note from the meeting with RES. Some of this won't be relevant to all of you, but please read to the relevant bit! We met with [REDACTED: REGULATION 11(2)] and [REDACTED: REGULATION 11(2)].

[REDACTED: REGULATION 10(5)(f)]

[REDACTED: REGULATION 10(5)(f)]

[REDACTED: REGULATION 11(2)] - [REDACTED: REGULATION 10(5)(f)]

They discussed peatland and the fact that it is a group 2 site. [REDACTED: REGULATION 10(5)(f)] (hope I have worded this correctly! Sorry I'm not quite so familiar with the groups and how it works).

[REDACTED: REGULATION 11(2)] [REDACTED: REGULATION 10(5)(f)]
[REDACTED: REGULATION 11(2)]. [REDACTED: REGULATION 10(5)(f)]

[REDACTED: REGULATION 10(5)(f)]

[REDACTED: REGULATION 11(2)]< - [REDACTED: REGULATION 10(5)(f)]

Commented [MT1]: I have looked at this meeting note again and I think the majority of the note would fall under commercial sensitive (reg 10(5)(f)). I have marked up these sections but would recommend withholding the full note instead due to redactions.

[REDACTED: REGULATION 10(5)(f)]

Economic benefit

[REDACTED: REGULATION 10(5)(f)]

[REDACTED: REGULATION 10(5)(f)]

[REDACTED: REGULATION 11(2)] [REDACTED: REGULATION 10(5)(f)]

Interesting meeting, sorry for such a long note, hopefully I didn't miss anything out.

[REDACTED: REGULATION 11(2)]

[Onshore Wind and Bioenergy Policy Officer](#)
Scottish Government - Energy Division

[REDACTED: REGULATION 11(2)]

[REDACTED: REGULATION 11(2)]

E-mail: [REDACTED: REGULATION 11(2)]@gov.scot

Document 4.

From: [REDACTED: REGULATION 11(2)]

Sent: Friday, July 28, 2017 12:22 PM

To: [REDACTED: REGULATION 11(2)]< [REDACTED: REGULATION 11(2)]@gov.scot>

Subject: Glenshero - read out of meeting 28.07.17

[REDACTED: REGULATION 11(2)],

I met with SIMEC and RES yesterday to discuss their proposed application at Glenshero. This is a brief note of matters discussed for info and for the file.

Attendees

[REDACTED: REGULATION 11(2)], THC (will be principal THC contact going forward)
[REDACTED: REGULATION 11(2)], SNH (will be principal SNH contact going forward)
[REDACTED: REGULATION 11(2)], SIMEC
[REDACTED: REGULATION 11(2)], RES
[REDACTED: REGULATION 11(2)], RS (will be principal RES contact going forward)
[REDACTED: REGULATION 11(2)], RES community engagement lead
[REDACTED: REGULATION 11(2)], RES
GFG comms (name not noted)

Issues Discussed

1. [REDACTED: REGULATION 11(2)] provided an introduction to the GFG business model and SIMEC UK business plan. There will be PPA between SIMEC as operator of the wind farm with GFG as operator of the aluminium smelter at Lochaber. That will provide price stability for steel operations as part of planned GFG business expansion.
2. The plan previously circulated relates to the estate boundary – not the application site boundary. Additional plans have been provided showing the current application boundary and natural heritage designations. I have will save to the file.
3. [REDACTED: REGULATION 10(5)(f)]. Glenshero will be less than 1km from southern Stronelaig turbines and likely to be perceived as an extension in that context. No grid connection agreement in place. Likely connection point at Melgarve. Understood from discussion with SHETL and National Grid that there is sufficient capacity and no wider reinforcement works required.
4. Access. The current proposed site access shown on the site boundary plan follows the SSE haul road for Stronelaig access. [REDACTED: REGULATION 10(5)(f)]. There was some discussion around phasing and the requirement for reinstatement of existing tracks required by other consents/ permissions. It was agreed that this could be managed, but would have to be considered to ensure that reinstatement obligations were not overlooked. It was also highlighted that the point on the current application boundary map where the development site and access meets at Garva Bridge is a geological conservation review site.
5. Indicative timing. [REDACTED: REGULATION 10(5)(f)]. I confirmed that statutory minimum periods would mean scoping opinion issued [REDACTED: REGULATION 10(5)(f)], but that we would give a project specific indication of likely timing when we see the content of the report and have had an opportunity to discuss resourcing with consultees. [REDACTED: REGULATION 10(5)(f)] – particularly in relation to LVIA. RES aiming to submit an application February 2018. I encouraged them to take time at pre-application stage to use consultation to inform design. I emphasised that there will be limited opportunity to revise the project following submission of the application.
6. We discussed use of THC pre-application service. Aiming to meet on Wed 30 August. I can cover this. Emphasised the need to give consultees as much information as possible in advance to inform meaningful discussion on the day. Emphasised the role of ECU since Ministers are the consenting authority and will be responsible for producing the scoping opinion. Key consultees to attend will be THC, SEPA, SNH, CNPA (planning and LVIA since as drafted red line boundary means that both THC and CNPA are relevant planning authorities), THC transport. I would like to include JMT in early discussions. I agreed to discuss timing of engagement separately with [REDACTED: REGULATION 11(2)] since they are keen to manage their relationship with JMT, but that they should be included at scoping as a minimum.

Annex B

7. I emphasised that nothing discussed at pre-app meetings would be treated as confidential. We will not proactively publish until the scoping request is received, but all correspondence etc subject to FOI.
8. Discussed impacts on wild land, NSA, National Park. LVIA should be subject to detailed discussion and approach/ methodology to wild land assessment should be explicitly agreed through the scoping process. Access tracks should be included in LVIA. Highlighted at the outset that turbines in proposed location closely reflect those previously proposed and removed from the Stronelarig site on basis of unacceptable LVIA and wild land impacts.
9. SAC – consultees' knowledge of the site means likely to be no show stoppers, but particular consideration should be given to indirect impacts arising from deer management and hydrogeology.
10. Ornithological site survey work is underway. Access constraints mean that surveyors were transported to site by helicopter. SNH requested specific detail to allow discussion on whether helicopters may have caused disturbance having an impact on survey reliability.
11. [REDACTED: REGULATION 10(5)(f)] – run by THC and SNH. Confirmed that there is some eagle activity on site.

[REDACTED: REGULATION 11(2)]<

[REDACTED: REGULATION 11(2)]< | [Head of Energy Consents](#)

The Scottish Government | [REDACTED: REGULATION 11(2)] | [REDACTED: REGULATION 11(2)] | [REDACTED: REGULATION 11(2)]@gov.scot

To view our current casework please visit www.energyconsents.scot



Document 5.

From: [REDACTED: REGULATION 11(2)]<

Sent: Thursday, September 28, 2017 2:33 PM

To: <[REDACTED: REGULATION 11(2)]@gov.scot>

Subject: Glenshero - read out of meeting 27.09.17

[REDACTED: REGULATION 11(2)],

We met with SIMEC, RES, their environmental consultants, THC, SNH, SEPA and JMT in Inverness yesterday.

This is a note of matters discussed at the meeting in relation to the wild land assessment methodology, to act as an aide memoire when we come to prepare the scoping opinion. I will rely on THC's pre-app pack to provide a note of matters discussed in its pre-app meeting.

Your notes may be more comprehensive than mine, so please feel free to adapt as you think appropriate.

1. The objective of the meeting was stated to be to inform our scoping opinion in relation to wild land assessment methodology. Since the SNH guidance is not yet in final form, and since there is a range of styles and quality of wild land assessments (WLA), it would be beneficial to all parties to agree the methodology at the outset so that discussion at application stage can focus on the substantive merits of the proposal. We might not reach consensus on all points, but useful for us to understand where there might be conflicting views/ where more information would be required of applicant. Once agreed through scoping, we would not expect applicant to repeat assessment work to reflect any changes following publication of final guidance. Consensus that this seemed a sensible approach.
2. Consensus that WLA would be required even though site not within a wild land area.
3. Consensus that appropriate wild land areas have been identified.
4. Wild land assessment distinct from the assessment of wildness as a quality of Cairngorms National Park. Wildness may be capable of being scoped out if more information could be provided in scoping request.
5. The study area was discussed – could be whole or part of each WLA. Study should also consider cumulative effective of all three WLA. Published descriptions to be used to inform extent of study area. Greater specification required in scoping request to inform consultee responses and scoping opinion. Specific viewpoints to be identified for WLA (receptors distinct from LVIA receptors). Will need a more round consideration of the impacts as a whole, not just from the selected viewpoints.
6. Baseline. Attributes contribute to qualities – already identified by SNH in WLA descriptions. Agreed that there should be no discussion about whether WLA mapped boundaries are appropriate – boundaries will be taken at face value. Applicant to offer judgement of how the attributes of the study area contribute to the WLA as a whole. SNH expect a fairly high level statement.
7. Sensitive – the sensitivity of the qualities to change, not the WLA as a whole.
8. Significance – residual effects on the qualities, study area and WLA as a whole.

[REDACTED: REGULATION 11(2)]<

[REDACTED: REGULATION 11(2)]< **Head of Energy Consents**

The Scottish Government [[REDACTED: REGULATION 11(2)]] [REDACTED: REGULATION 11(2)] [REDACTED: REGULATION 11(2)]@gov.scot

To view our current casework please visit www.energyconsents.scot



Document 6.

MINUTES OF MEETING

Project **UK12_24542**
 Subject **Glenshero Wind Farm**
 Date **16th January 2018**
 Location **SNH, Inverness**
 Meeting no. **04**
 Taken by **[REDACTED: REGULATION 11(2)] (Ramboll)**
 Participants **[REDACTED: REGULATION 11(2)]/ [REDACTED: REGULATION 11(2)] (SNH), [REDACTED: REGULATION 11(2)]/ [REDACTED: REGULATION 11(2)] (ECU), [REDACTED: REGULATION 11(2)]/ [REDACTED: REGULATION 11(2)] (THC), [REDACTED: REGULATION 11(2)] (MacArthur Green), [REDACTED: REGULATION 11(2)]< (MacArthur Green), [REDACTED: REGULATION 11(2)]/ [REDACTED: REGULATION 11(2)] (RES), [REDACTED: REGULATION 11(2)]/ [REDACTED: REGULATION 11(2)] (Ramboll).**
 Absent **N/A**
 Copy to **[REDACTED: REGULATION 11(2)] (SNH), [REDACTED: REGULATION 11(2)] (ECU), [REDACTED: REGULATION 11(2)] (THC), [REDACTED: REGULATION 11(2)] (MacArthur Green), David MacArthur (MacArthur Green), [REDACTED: REGULATION 11(2)] (RES), [REDACTED: REGULATION 11(2)] (Ramboll).**
 Next meeting **TBC**

SCOPING PROCESS

[REDACTED: REGULATION 11(2)] raised a point of clarification on the scoping process and the consideration of additional information provided by the project team. [REDACTED: REGULATION 11(2)] requested that the team agree where to 'draw a line' and allow a consultation response to be finalised.

Following further discussion around the table, it was agreed that [REDACTED: REGULATION 11(2)] should finalise the scoping consultation response now. The project team will not submit any further information until following the receipt of the consultation response.

[REDACTED: REGULATION 11(2)] confirmed that any further clarifications to the scope can be managed through the Gate Check Report Consultation, which would be completed at the point of design freeze, nominally 12 weeks before an application for consent.

[REDACTED: REGULATION 11(2)] noted that there had been further correspondence between [REDACTED: REGULATION 11(2)] (Landscape Architect, Ramboll), SNH and CNPA on the subject of finalising the viewpoint selection. The understanding is that the viewpoint selection has been agreed by THC, SNH and CNPA; however there has been a request from MCOS for a swap. [REDACTED: REGULATION 11(2)] requested that Ramboll package up the correspondence relating to viewpoint selection and provide to [REDACTED: REGULATION 11(2)] at ECU, so that there is an auditable trail of correspondence.

ACTION:

Ramboll to provide a package of correspondence to [REDACTED: REGULATION 11(2)] to confirm final position on viewpoint selection

Ramboll Environment and Health UK Limited

PROJECT UPDATE

[REDACTED: REGULATION 11(2)] provided a brief overview of project progress, particularly in relation to programme. [REDACTED: REGULATION 11(2)] confirmed that public consultation events were completed in November 2017. The overall project programme has been delayed due to the winter weather preventing the completion of both Stage 2 peat probing work and the completion of photography for the LVIA. The revised programme is based on reaching a design freeze by the end of May 2018, with an application for consent in August 2018.

[REDACTED: REGULATION 11(2)] noted that analysis of wind data collected from the site is pointing to significant turbulence in some parts of the site, which is likely to lead to the reduction in turbines to a [REDACTED: REGULATION 10(5)(f)].

ACTION: No action/for information

REVIEW OF ORNITHOLOGY WORK

[REDACTED: REGULATION 11(2)] provided an overview of the ornithology work completed to date, which has included 2 breeding and 2 non-breeding seasons. Dialogue with the local raptor study group (RSG) has confirmed that the data collected by MacArthur Green is consistent with the RSG long term data. The data collected has confirmed that the principal issue at the site is associated with golden eagle, both in terms of flight activity through the proposed development area and in terms of overlap with established breeding golden eagle territories.

[REDACTED: REGULATION 11(2)] confirmed that PAT modelling confirms that the area is not constrained by suitable habitat availability. [REDACTED: REGULATION 11(2)] shared effort corrected flight activity maps and the initial worst case (using worst case turbine parameter inputs) collision risk model (CRM) output.

[REDACTED: REGULATION 11(2)] noted that SNH are satisfied with the scope survey work completed to date; however noted concern regarding the provisional PAT model outputs potentially underestimating the use of areas away from the core of the nest sites. [REDACTED: REGULATION 11(2)]< explained that MacArthur Green is using the PAT script from the SNH guidance note (626) and we will follow up with [REDACTED: REGULATION 11(2)] to bottom out the differences in output from SNH range models.

[REDACTED: REGULATION 11(2)] also noted the requirement to differentiate between breeding and non-breeding birds for the collision model outputs and population modelling. [REDACTED: REGULATION 11(2)] also noted that an assessment of population viability will be key to SNH's position. [REDACTED: REGULATION 11(2)] also noted concern regarding cumulative collision risk, and the potential need to look at removal of turbines from the eastern array.

[REDACTED: REGULATION 11(2)]< asked if there is any intention within SNH to review the golden eagle avoidance rate for CRM use based on research published in 2017. [REDACTED: REGULATION 11(2)] noted that she was not aware of any discussions, but that, in any case, if there was to be a change, it would be too late for this project (based on current programme). [REDACTED: REGULATION 11(2)] advised that [REDACTED: REGULATION 11(2)]< should ask

[REDACTED: REGULATION 11(2)] for clarity on this point.

[REDACTED: REGULATION 11(2)] noted that the turbines to the east of the site, where the highest densities of flights have been recorded, are likely to be most sensitive to golden eagles.

[REDACTED: REGULATION 11(2)]< explained that mitigation options being considered for eagles in habitat management away from the wind farm site and contribution to the Golden Eagle Conservation Ranger.

[REDACTED: REGULATION 11(2)] noted the need to avoid unpicking any secured mitigation committed to as part of Stronelairg WF.

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[REDACTED: REGULATION 11(2)] noted that the only other species of potential concern/interest is white tailed eagle; however, it is noted that there was not sufficient data (1 flight) upon which to base any meaningful CRM. [REDACTED: REGULATION 11(2)] noted that SNH would be interested in any further information on the age of the bird.

ACTIONS:

[REDACTED: REGULATION 11(2)]< **to ask question regarding the revision of the golden eagle avoidance rate;**

[REDACTED: REGULATION 11(2)]< **/[REDACTED: REGULATION 11(2)] to resolve issue with Script for PAT model with SNH ([REDACTED: REGULATION 11(2)])**

[REDACTED: REGULATION 11(2)]/MG to propose methodology for assessing population viability and refine collision risk modelling to support design review and finalisation of proposed development layout.

REVIEW OF OTHER ECOLOGY RECEPTORS

[REDACTED: REGULATION 11(2)]/ [REDACTED: REGULATION 11(2)]< provided an overview of other ecological receptors, noting that survey findings were limited to confirming abundant and wide spread water vole and some fields signs for otter. Consideration has also been given to FWPM.

[REDACTED: REGULATION 11(2)] noted that if works are completed in accordance with the pollution prevention guideline this will provide sufficient mitigation for FWPM only. Impacts on water voles are likely to require additional mitigation measures to be included in a species protection plan once the location of water vole activity etc has been surveyed and recorded.

[REDACTED: REGULATION 11(2)] noted that she doesn't want to agree to scoping out effects on the Monadhliath SAC, but anticipated a simple HRA process. The importance of deer management was noted.

[REDACTED: REGULATION 11(2)] noted that the EIA report should acknowledge the limitations for the survey process and take a precautionary approach e.g. include Species Protection Plans for construction even where no records have been identified for e.g. wildcat.

[REDACTED: REGULATION 11(2)] requested all raw data and survey records are presented in the TAs.
[REDACTED: REGULATION 11(2)] asked for the application to anticipate standard conditions on construction good practice and build those into the EIA report.
[REDACTED: REGULATION 11(2)]< provided a review of the peat characterisation to date. [REDACTED: REGULATION 11(2)] noted a concern regarding peat slide risk.
[REDACTED: REGULATION 11(2)] noted that the priority should be to avoid class 1 peat habitats/good quality peatland where possible and mitigate impacts as appropriate through design and habitat management. [REDACTED: REGULATION 11(2)] noted SNH objection on peat at Navidale wind farm, but that this was partly due to a lack of mitigation/compensation.
[REDACTED: REGULATION 11(2)] noted that we have looked closely at peat as part of the design process and it is not possible to 'avoid' peat, therefore attention has been given more to avoiding peat >1m in depth and higher quality areas.
HABITAT MANAGEMENT
[REDACTED: REGULATION 11(2)]< noted that the project team is considering an area of habitat enhancement as compensation for the loss of peatland habitat within the turbine array. Consideration is being given to identifying suitable areas within the wider Glenshero Estate, possibly adjacent to Creag Meagaidh SAC/SSSI.

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A preference was noted by [REDACTED: REGULATION 11(2)] and [REDACTED: REGULATION 11(2)] for a definitive red line area to be placed around the HMP area, and for assurances regarding a secure land agreement. [REDACTED: REGULATION 11(2)] noted the importance of additionality and the need to check that the areas proposed are not subject to pre-existing plans for enhancement.

ACTION:

[REDACTED: REGULATION 11(2)] to confirm with Glenshero Estate that the area proposed for enhancement is not subject to any other enhancement activities or funding.

Document 7.

Telephone note – 28 February 2019

Glenshero Wind Farm

[REDACTED: REGULATION 11(2)] called to talk about next steps following our meeting at Highland Council on 7 February 2019.

Annex B

SNH, THC and CNPA requested additional visualisations to assist with their assessments of the Special Landscape Qualities of the park.

[REDACTED: REGULATION 11(2)] intends to submit a file share with the additional visualisations to ECU, Council, SNH and CNPA for comments (as a mini gatecheck). Once the content and quality is approved, they will then prepare and submit the required Hi-RES and paper copies as Further Environmental Information.

This FEI will then be advertised and issued to all consultees as usual practice.

I consider this approach to be sensible and asked [REDACTED: REGULATION 11(2)] to send me the paper copies in the meantime.

[REDACTED: REGULATION 11(2)]
28/02/2019