14 SOCIOECONOMICS

14.1 Introduction

Background to the Study

14.1.2 RES UK & Ireland Ltd ('the applicant') commissioned Oxford Economics in the spring of 2023 to undertake a socioeconomic impact report on the proposed Mynydd Maen Wind Farm, hereafter referred to as 'the proposed wind farm', which is located in both the Caerphilly and Torfaen County Borough Councils.

14.1.3 The proposed wind farm consists of 13 three-bladed turbines, with a planned operational lifespan of 35 years. The total megawatt (MW) capacity of the proposed wind farm is expected to be 54.6 MW, with each turbine having a 4.2 MW capacity.

14.1.4 This report presents estimates relating to the direct, indirect, and induced benefits that could be generated by the construction and operation of the proposed wind farm. It also provides a discussion on the current socioeconomic environment in which the investment would take place, and the energy and environmental benefits associated with a development of this type and scale.

About the Applicant

14.1.5 The applicant is the world's largest independent renewable energy company. At the forefront of the industry for over 35 years, the applicant has delivered more than 23 GW of renewable energy projects across the globe and supports an operational asset portfolio exceeding 12 GW worldwide for a large client base. The applicant employs more than 2,500 people and is active in 14 countries working across onshore and offshore wind, solar, energy storage and transmission and distribution.

14.1.6 Since it was established in the UK in 1981, the applicant has been a pioneer in renewable energy, developing the UK's second ever wind farm in 1992. The applicant has a significant portfolio of projects covering onshore and offshore wind, solar, and energy storage. The applicant is responsible for keeping ten percent of the UK's renewable energy projects operating and it provides support services — asset management and operations & maintenance — to a sizeable portfolio for leading clients in the industry.

14.1.7 To date the applicant has developed seven onshore wind farms in Wales, and has a record of using local companies to develop, construct, and operate renewable energy projects.

Structure of the Report

14.1.8 This report is structured as follows:

- Firstly, the estimated quantifiable economic benefits of the construction and on-going phases of the proposed wind farm are presented — concentrating on employment, Gross Value Added (GVA)[1], and wages. An assessment of the potential fiscal benefits is also included;
- Secondly, an overview of the socioeconomic conditions, both at the regional and local levels, is provided as context;
- Thirdly, the energy and environmental context is considered, highlighting the contribution the proposed wind farm could make towards emissions targets at the regional and national level. Additionally, this section will also assess the potential impact

[1] Gross Value Added (GVA) measures the value of goods and services produced in an area, industry, or sector of an economy and is equal to output minus intermediate consumption.

the proposed wind farm could have on the supply of aggregates in the region and its weight against these emissions targets; and

- Finally, the overall conclusions in respect to the proposed wind farm are set out.

14.2 Quantifiable Economic Benefits

14.2.1 This section analyses the estimated quantifiable benefits of the construction and operational phases of the proposed wind farm — concentrating on employment, GVA, and wages, as well as fiscal benefits. All results relate to the benefits at the regional level (Wales), unless otherwise stated.

14.2.2 A key assumption behind Oxford Economics' analysis relates to displacement.[2] Zero displacement has been assumed during both the construction and operational phases of the proposed wind farm. This assumption is in part based on an analysis of the Welsh construction sector which is likely to have enough spare capacity to accommodate the proposed wind farm. Additionally, although the site for the proposed wind farm is currently common land used for grazing, the applicant has informed Oxford Economics that a common land application would be submitted. This would de-register the area of the common land occupied by the infrastructure necessary for the proposed wind farm, and an area of land at least equal in size to the de-registered area would be provided as replacement land so that the overall area of common land would not be reduced in size. Given the above, and the fact that the number of on-going jobs would be limited in number, the estimated benefits arising from the operational phase assume no material displacement of economic or leisure activity.

14.2.3 Although it could be argued that a development of this scale and nature could displace jobs in fossil fuel activity, the proposed wind farm would not itself displace any actual activity away from the fossil fuel power stations in operation in Wales, neither of which are located in Caerphilly or Torfaen.[3] Furthermore, there may be cumulative and long-run displacement from the fossil fuel industry because of the on-going drive for increased renewable energy. Indeed, the UK Government has set a target of net zero carbon emissions by 2050, promoting a transition away from fossil fuels towards renewable energy.[4]

Economic impact of the construction phase[5]

14.2.4 The benefits associated with the construction phase of the proposed wind farm (jobs, wages, GVA, and fiscal) are presented below. These results are based on data provided by the applicant regarding the expected value of investment to be realised in Wales as well as the number of jobs required for construction, based on previous projects. By assigning the jobs and investment data to sectors of the economy, it is possible to estimate the associated direct GVA and wage impacts (using published and/or forecast data).

14.2.5 An input-output model is then used to estimate the indirect and induced impacts that are likely to flow from a given level of investment/activity. An input-output table provides information on how sectors purchase from one another, and how households spend their income. UK input-output tables, published by the ONS, can then be used and adjusted to account for regional characteristics — please see Annex 1 at the end of this Chapter for further discussion.

[2] Displacement is the degree to which the effects which produce additional economic activity may lead to consequent reductions in activity elsewhere in the economy that would not have occurred if the intervention had not been made.
[3] According to the Department for Business, Energy & Industrial Strategy (BEIS)'s *Power stations in the United Kingdom* publication, there were two fossil fuel power stations operational at the end of May 2022 in Wales, one in Pembroke and the other in Connagh's Quay.
[4] UK Government. Web article: https://www.gov.uk/government/publications/net-zero-strategy. Accessed 17th July 2023.
[5] Please be aware that values presented throughout this section may not sum due to rounding.

14.2.6 The proposed wind farm is estimated to result in a capital spend of approximately £74.0 million (in nominal prices).[6] This figure is based on information provided by the applicant and includes the estimated cost of turbines, Balance of Plant (BoP), local and miscellaneous spend, grid connection, and professional services. Only a portion of this investment, however, would be realised in Wales.

14.2.7 The total construction spend realised within Wales is approximately £26.3 million (in nominal prices).[7] This includes the cost of grid connection, and five percent of the estimated £48.4 million turbine cost value through activities such as the use of local haulage and crane companies. The remainder of the construction spend is assumed to be imports.

14.2.8 The regional/total spend split (£26.3 million/£74.0 million) is comparable to an estimate published in a recent report by BiGGAR economics, on behalf of Bute Energy, for the Twyn Hywel Energy Park.[8] The split between construction related spend and professional services related spend in Wales is assumed to be £24.0 million and £2.2 million, respectively. For modelling purposes, all expenditure information has been converted into 2019 real prices, to keep it consistent with the model's inputs and national accounts publications.[9]

14.2.9 For the purposes of this assessment the construction phase of the proposed wind farm is estimated to commence in July 2026 and last approximately 15-months, starting operations in October 2027. The analysis therefore assumes a constant spend per month, leading to 40 percent of total spend being realised in 2026 and the remaining 60 percent in 2027. As such, Oxford Economics' baseline forecasts for GVA, productivity, and wages have been used to estimate the future economic impacts.

14.2.10 The applicant has delivered 19 onshore wind projects in the UK & Ireland over the last 10 years. They were able to provide construction related job figures for a previously delivered seven-turbine project (totalling 25.2 MW) with a construction period of 10-months. The job figures have been adjusted to account for a 13-turbine development, with a 15-month construction phase. This figure is shared across six sectors,[10] based on the expenditure split outlined in paragraphs 14.2.7-14.2.8.

[6] As the international geopolitical landscape continues to change so does the level of uncertainty around economic growth and inflation prospects in the UK. The nominal cost of the proposed wind farm, provided by RES, is an accurate estimate at the time of writing. While prices are likely to rise in the short term, we isolate the effects of inflation by calculating the economic impact in real terms.

[7] For this analysis, the total construction phase spend in Wales is defined as the cost for turbines, Balance of Plant (BoP), food, fuel, plant hire, road maintenance, grid connection, and miscellaneous. It does not include the cost of professional services.

[8] BiGGAR Economics (2022). *Twyn Hywel: Socio-Economic Impact Appraisal*.

[9] The construction phase and operational phase benefits presented within this section, which have been estimated using an Economic Impact Model, are expressed in real/constant prices with 2019 as the base year. This is consistent with the base/reference year within the ONS' National Accounts (the Blue Book 2022) and Oxford Economics' suite of forecasting models. This is not to say 2019 data has been used: the latest available data and the relevant forecast year have been taken in every case. The construction-spend figures provided by the applicant have been adjusted accordingly for consistency.

[10] The nature of employment in the majority of sectors means that the jobs directly sustained by the construction of the proposed wind farm are on-site and based in the local area in which the proposed wind farm is located. Employment in the professional services sector sustained during the construction phase could, however, be located off-site and/or be remote in nature. This is also the case for employment sustained once the proposed wind farm is operational.

14.2.11 The job figures used for modelling purposes are outlined in the table below.

Table 14.1: Job years adjusted for the proposed wind farm (13 turbines, 15-month construction phase)

	Job years
Construction	88
Professional, scientific & technical	9
Transportation & storage	5
Administrative & support services	2
Accommodation & food services	1
Wholesale & retail trade	1
Total	**106**

Source: RES / Oxford Economics

Direct construction phase impacts

14.2.12 The proposed wind farm's 15-month construction phase is estimated to create or sustain 106 direct job years of employment in Wales, 88 of which are involved with construction related activities and the remaining 18 job years are split across five additional sectors (Table 14.1)**Table 14.1**.

14.2.13 By mutliplying these jobs figures with forecasted annual earnings data for each sector, direct wage impacts as a result of the proposed wind farm can be calculated. This direct construction phase employment would be likely to create or sustain £3.16 million of additional direct wages in the Welsh economy.

14.2.14 Similarly, applying the expected investment to be realised in Wales by each sector's GVA to output ratio, based on the UK's input-output tables, provides a value for the direct GVA impact that can be assigned to each sector. The investment is estimated to directly contribute £8.93 million to regional GVA.

Table 14.2: Direct benefits from the construction phase

	Job years	Wages (£2019m)	GVA (£2019m)
Construction	88	2.61	6.90
Professional, scientific & technical	9	0.28	1.05
Transportation & storage	5	0.11	0.46
Administrative & support services	2	0.04	0.22
Accommodation & food services	1	0.03	0.18
Wholesale & retail trade	1	0.08	0.13
Total	**106**	**3.16**	**8.93**

Source: RES / Oxford Economics

Indirect and induced construction phase impacts

14.2.15 The indirect (or supply chain) effects arising from the construction related activity have been estimated using the 2019 UK input-output tables adjusted to take account of the structure and size of the Welsh economy. In doing so, the methodology uses so-called 'Flegg-adjusted Location Quotients (FLQs)', which are consistent with the latest approaches and evidence in regional input-output modelling and regional science.[11]

14.2.16 Construction activity typically has strong "backward linkages" with sectors such as building materials, architectural services, legal services and insurance. These linkages tend to result in job creation elsewhere in the local economy. This makes investment in construction particularly effective in fuelling economic growth, typically offering high output multipliers. The proposed investment could offer a regional employment multiplier of 2.2, and a regional GVA multiplier of 1.7 (once the indirect and induced effects have been accounted for). This means that for every 100 jobs and £100 of GVA directly stimulated in the construction sector in Wales, it would create or sustain 120 jobs and £70 of GVA through indirect and induced impacts.[12]

14.2.17 Indirect GVA impacts in Wales are therefore estimated to be approximately £3.10 million, creating or sustaining an estimated 61 job years of employment, with associated wages of £1.38 million (Table 14.3).

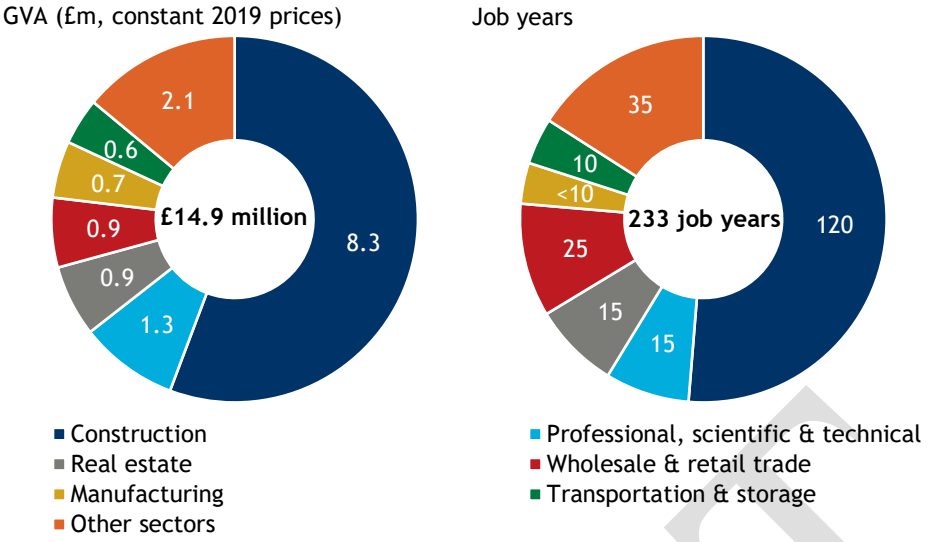
Table 14.3: Total (direct, indirect, and induced) benefits from the construction phase

	Job years	Wages (£2019m)	GVA (£2019m)
Direct	106	3.16	8.93
Indirect	61	1.38	3.10
Induced	66	1.14	2.86
Total	**233**	**5.68**	**14.89**

Source: RES / Oxford Economics

14.2.18 As both direct and indirect wages generated through the construction phase are spent on goods and services in the wider economy, a further round of benefits would spread through the region. This helps to support activity in sectors like retail and leisure outlets, companies producing consumer goods, and a range of service industries. It is estimated that this induced effect would support wider employment of approximately 66 job years alongside £1.14 million of wages. Through the numerous rounds of supply-chain and consumer spending, the benefits would be spread across multiple sectors in the Welsh economy (Diagram 14.4

[11] Flegg, A. T. and Tohmo, T. (2013) "Regional input-output tables and the FLQ formula: A case study of Finland" (Regional Studies, 47 (5). pp. 703-721).
[12] These figures relate to Oxford Economics' estimates of Type II output multipliers for the UK. Type II multipliers capture direct, indirect, and induced effects.



Source: RES, Oxford Economics. Note: may not sum due to rounding.

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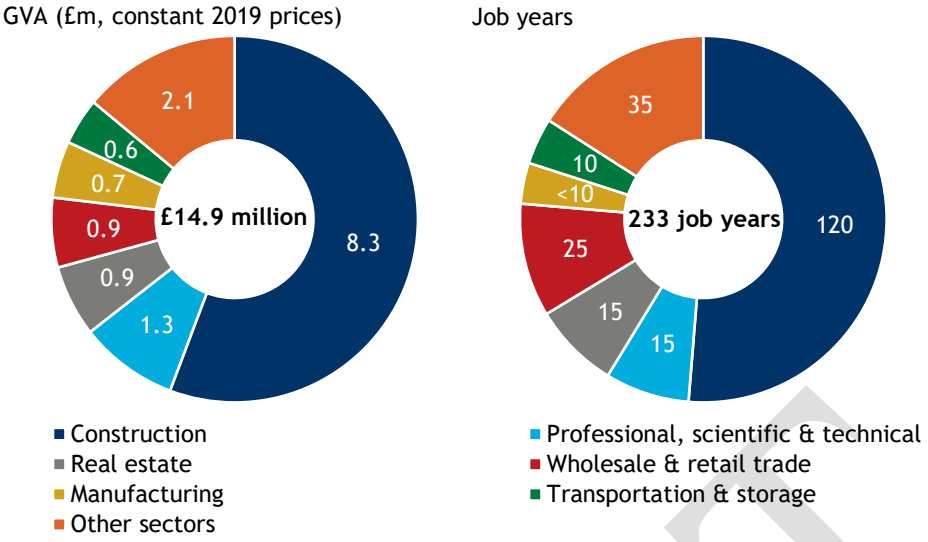
14.2.19 It is worth noting that the estimated benefits are at a regional level. An exact amount attributable to both the Caerphilly and Torfaen County Borough Councils is more difficult to identify and outside the scope of this report. Invariably it depends on the location of the companies appointed that enjoy the direct benefits and the location of the suppliers who provide them with the materials. However, the applicant has informed Oxford Economics that their previous projects have utilised local contractors wherever possible and it remains their intention to use local suppliers and labour for much of the Balance of Plant (BoP) work. It makes sense, not least in terms of the costs and distance argument, to use local firms (e.g., looking at the cost of transporting aggregates). That is, local firms can prove to be more cost efficient given the closer proximity to required capital, personnel and resources. This means that most of the direct and indirect benefits are likely to be realised within Wales, with Caerphilly and Torfaen enjoying some uplift at the local level.

14.2.20 The benefits quantified above have been tested for robustness against a recent report compiled by BiGGAR economics, on behalf of Bute Energy, for the Twyn Hywel Energy Park.[13] Accounting for the scale of both developments, the estimates of GVA and job year benefits were of similar magnitude.

Diagram 14.4: Total sectoral (direct, indirect, and induced) GVA and employment benefits from the construction phase

[13] BiGGAR Economics (2022). *Twyn Hywel: Socio-Economic Impact Appraisal*.



Source: RES, Oxford Economics. Note: may not sum due to rounding.

Economic impact of the operational phase

Direct operational impacts

14.2.21 The applicant has informed Oxford Economics that the proposed wind farm would sustain four direct full-time equivalent (FTE) jobs a year in Wales once operational in October 2027, three of which are in the professional, scientific & technical sector, and one of which is in the electricity, steam & air conditioning sector (Table 14.5). Using forecasts for productivity and annual earnings in these sectors, the associated direct GVA and wage impacts have been estimated.

14.2.22 The total direct wage impact is estimated to be £90,000 per year. After applying productivity estimates, the on-going direct employment is expected to generate £360,000 of GVA a year. Given the 35-year lifetime of the proposed wind farm, this equates to a cumulative £3.22 million of direct wages and £12.6 million of direct GVA in Wales over the entirety of the operational phase.

14.2.23 The electricity industry plays a significant role in enabling other parts of the economy. Electricity, gas, steam & air conditioning is one of the most productive sectors in Wales, with output per worker significantly above that of the region overall. As a result, the majority of the GVA impacts would be realised in this sector.

Table 14.5: Direct annual benefits from the operational phase

	Job years	Wages (£2019m)	GVA (£2019m)
Professional, scientific & technical	3	0.06	0.09
Electricity, gas, steam & air	1	0.03	0.27
Total	**4**	**0.09**	**0.36**

Source: RES / Oxford Economics

Indirect and induced operational impacts

14.2.24 Using the adjusted UK input-output tables to identify the supply-chain spending, it is estimated that the proposed wind farm is likely to create or sustain a further two indirect jobs in the Welsh economy each year, with wages of approximately £40,000 and GVA of £160,000 per year (Table 14.6). We have also estimated that as those employed directly and indirectly spend part of their wages, there would be a further two jobs sustained in the Welsh economy, with associated induced wages of approximately £30,000 and GVA of £70,000.

14.2.25 Consequently, we estimate the proposed wind farm would support eight jobs in Wales per year with associated wages of £160,000 and GVA contributions of £590,000.

Table 14.6: Total (direct, indirect, and induced) annual benefits from operational phase

	Job years	Wages (£2019m)	GVA (£2019m)
Direct	4	0.09	0.36
Indirect	2	0.04	0.16
Induced	2	0.03	0.07
Total	**8**	**0.16**	**0.59**

Source: RES / Oxford Economics

Increased tax revenues and benefit savings

14.2.26 As part of this analysis, it is assumed that approximately 33 percent of total wages would be paid to the Treasury through the channels of taxation.[14] This considers not only income tax, but also value-added tax through the purchase of goods and services by those in direct, indirect and induced employment.

14.2.27 During the construction period of the proposed wind farm, tax receipts are likely to reach £1.87 million (including direct, indirect and induced wage impacts).

14.2.28 The operational phase is estimated to generate approximately £50,000 in additional tax receipts each year of operation (Table 14.7). Over 35 years this would cumulatively equate to £1.84 million in additional tax revenues.

Table 14.7: Tax revenues arising from the proposed wind farm

	Wages (£2019m)	Tax revenue (£2019m)
Construction phase (cumulative)	5.68	1.87
Operational phase (per year)	0.16	0.05

Source: RES / Oxford Economics

14.2.29 In addition to increased tax revenues from wages, the Welsh Government would also benefit from business rates revenue as a result of the proposed wind farm. Business rate calculations in Wales rely on the Rateable Value (RV) of a property and the non-domestic multiplier ("poundage", or non-domestic rate (NDR)), minus any applicable reliefs. The RV is determined by the Valuations Office Agency (VOA), while the NDR is set by the Welsh Government each year. As of 2018–19, the NDR has been set the same across all 22 Welsh Council areas. All NDR revenues are collected by individual councils and are given to the Welsh Government, which then redistributes them to local council areas based on their proportion of the population that is aged 18 and over. This occurs regardless of the income raised by each council area, and these funds are used to finance the Local Government budgets.

[14] Based on ONS' publication: https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/datasets/theeffectsoftaxesandbenefitsonhouseholdincomefinancialyearending2014. Statistics from table 9 accessed on June 1st 2023. Direct tax as a share of gross income is 23.9 percent, and indirect taxes as a share of disposable income is 9 percent. Combined this indicates that 32.9 percent of gross income is paid to the Treasury via taxation.

14.2.30 Using an average of previous wind farm projects in Wales, the applicant has provided an estimated RV of £36,528 per megawatt per year. Given the proposed wind farm would have a total capacity of 54.6 MW, this means an estimated RV of £2.0 million. The most recent NDR multiplier for Wales is 0.535 for 2023 to 2024, or a poundage rate of 53.5p for every £1 of RV. Multiplying the estimated RV by the NDR multiplier provides an estimated figure of £1.07 million in annual business rates payable to the Welsh Government. This is equivalent to £37.3 million over the course of the project (given a 35-year operational phase).

14.2.31 Alongside increased tax revenue, the proposed wind farm would provide additional revenue savings as a result of reduced benefits payments. That is, we assume that each additional job would attract someone from the ranks of the unemployed directly or indirectly through the "job chain" effect, both during the construction and on-going operation of the site.[15]

14.2.32 Under the 'new style' Job Seekers Allowance, unemployment benefits can be up to either £67.20 or £84.80 per week, depending on age.[16] Using these two levels, it is estimated that between £810,000–£1.03 million of savings would be made during the construction phase of the proposed wind farm (Table 14.8).

Table 14.8: Annual unemployment benefit savings arising from the construction phase

	Lower estimate (£2019m)	Upper estimate (£2019m)
Direct	0.37	0.47
Indirect	0.21	0.27
Induced	0.23	0.29
Total	**0.81**	**1.03**

Source: RES / Oxford Economics / Citizens Advice

14.2.33 In addition, sustaining eight operational jobs per year could provide unemployment savings of between £980,000–£1.23 million over the project's lifetime.

14.3 Socioeconomic Context

14.3.1 The following section considers the recent and future labour market performance of the overall economy, and the construction sector more specifically, at both the regional and local level.

14.3.2 The Welsh economy has struggled to create employment opportunities over the last decade. Between 2012 and 2022, job growth in the region averaged 0.8 percent per year – 0.4 percentage points below the equivalent rate for the UK (1.2 percent). Growth within the Caerphilly and Torfaen County Borough Councils has been similarly muted over this period. Although the former grew by 1.1 percent per year on average, above the regional growth rate (0.8 percent), Torfaen had an equivalent growth rate of just 0.5 percent.

14.3.3 Within the construction sector itself, growth in employment was fairly mixed over the same time period. At the regional level, construction employment grew at an average rate of 0.3 percent per annum, adding just 240 jobs on average each year. The construction sector in Torfaen recorded a similar level of performance, growing by an average of 0.4 percent between 2012 and 2022. In contrast, Caerphilly's construction sector was the fourth fastest

[15] While the proposed wind farm may take someone from their current job, they would leave a vacancy and that would have to be filled, and so on and so forth—so eventually, a job would be filled down the line by someone from the ranks of the unemployed, though not necessarily directly. As such, the creation of a new job in the economy would lead to a reduction in unemployment by a similar amount.
[16] Figures taken from Gov.UK: https://www.gov.uk/jobseekers-allowance. If individuals are eligible for the new style JSA, they can get a weekly 'personal allowance' of up to £67.20 (18-24 year olds) or £84.80 for those aged 25 and over. Statistics accessed on June 1st 2023.

growing of Wales's 22 Borough Councils, with a 2.9 percent average annual rate of growth. As a result, by 2022, the sector was 33 percent larger than it had been a decade previously.

14.3.4 The current economic climate suggests that employment creation is set to continue to be muted in the near future, as Wales and its local areas suffer as a result of a global deterioration in economic conditions in the second half of 2022. Energy and food prices surged towards the end of 2022 in the wake of Russia's invasion of Ukraine, leading to a struggle to combat rising inflation. Citing the need to increase interest rates as a means to tackle inflation, central banks globally have hiked rates to their highest levels since the onset of the 2008 financial crisis. This has increased costs for businesses and consumers, and squeezed household disposable incomes. Interest rates are expected to remain high into 2024, and therefore it is anticipated that the risks to growth will persist.

14.3.5 It is in this context that total employment is expected to decline by 0.1 percent in 2023 at the national level, with Torfaen and Caerphilly Borough Councils expected to experience the same level of contraction. Despite this, employment in Wales and Torfaen will be 2.1 percent and 2.0 percent, respectively, above 2019 levels in 2023. In contrast, however, total employment in Caerphilly County Borough Council has yet to recover beyond where it stood pre-pandemic, and will therefore remain 2.3 percent below 2019 levels at the end of this year.

14.3.6 The construction sector is not immune from these pressures, and will similarly see contractions in employment in 2023. Across Wales, the construction sector is expected to lose more than 700 jobs this year as employment in the sector contracts by 0.8 percent. Construction in Torfaen will suffer an even stronger relative contraction of 1.3 percent in 2023 — the seventh worst performance of Wales's 22 Borough Councils. Caerphilly's construction sector, on the other hand, continues to be more robust than the national average. Despite an expected 0.6 percent decline in employment in 2023, this is less severe than the contraction forecast at the national level.

14.3.7 Employment growth prospects between 2023 and 2040 do not suggest that a significant pick up in employment is likely to occur. Total employment growth in Wales will be almost flat (0.1 percent), and below the national average (0.3 percent). Furthermore, both Borough Councils are forecast to lose jobs over the forecast period. In Caerphilly, the expected contraction is 1,400 jobs, with a loss of 400 jobs in Torfaen. Both figures are equivalent to a 0.1 percent decline in average annual growth. As a result, whereas by 2040 employment in Wales will be 3.4 percent above where it was last year, employment in Torfaen will be 1.1 percent lower. In Caerphilly Borough Council, total employment will be 2.3 percent below its 2022 level.

14.3.8 Employment in the construction sector in Wales is forecast to average 0.6 percent growth per annum, adding almost 10,000 jobs between 2023 and 2040. However, this rate of growth is 0.3 percentage points below the UK's expected growth rate.

14.3.9 At the local level, employment growth in the construction sector is forecast to be muted over this period, averaging 0.4 percent per annum in both Borough Councils. This rate of growth would see construction employment in Caerphilly and Torfaen Borough Councils growing at the fifth and sixth slowest rates, respectively, of Wales's 22 Councils. As a result, by 2040, the construction sectors in Caerphilly and Torfaen Borough Councils will be 6.2 and 5.7 percent above 2022 levels, respectively. This is a weaker performance than at both the regional (9.7 percent) and national (14.3 percent) levels.

14.3.10 The expected labour market performance is also a reflection of a weak demographic outlook, as total and working age populations are forecast to fall in both Caerphilly and Torfaen — a trend reflected across the majority of Welsh Borough Councils.

14.3.11 The above analysis has shown that the local economy faces some key socioeconomic challenges, which have been further exposed by recent developments. The weak employment outlook is likely to make it more challenging for the Councils to address economic needs and development. Therefore, investment and development opportunities in the area should be encouraged to promote opportunities and boost economic growth prospects. It would also provide private sector investment at a time when businesses and consumers are expected to reign in spending.

14.3.12 Indeed, investment into local climate change assets would help to support the jobs recovery within the Council area, but also more widely via multiplier effects. Investment into such projects would also strengthen the UK's overall energy networks, helping to achieve the Government's target of net zero emissions by 2050 and reducing the UK's reliance on energy imports — which has become increasingly important in the aftermath of Russia's invasion of Ukraine. Given this, the proposed wind farm would also help to mitigate against rising energy costs and instability in the energy market.

14.4 Energy and environmental benefits

Contribution to emissions targets

14.4.1 Although the proposed wind farm would bring positive economic benefits to the local and regional economies, its key role should be seen as its contribution towards achieving the Welsh Government's environmental targets.

14.4.2 The UK Government published its Net Zero Strategy in 2021, laying out policies and proposals for decarbonising all sectors and regions of the UK economy in order to achieve net zero carbon emissions by 2050.[17] For their part, the Welsh Senedd in March 2021 set decadal targets for reducing emissions relative to a baseline level of average emissions through 2016 to 2020. A 63 percent reduction in emissions relative to this baseline is targeted by 2030, 89 percent by 2040, and 100 percent (net zero) by 2050.[18]

14.4.3 Renewable energy will clearly have a huge role to play in meeting these goals. As such, the Welsh Government has set a target to achieve 70 percent of electricity demand being met from Welsh renewable electricity sources by 2030, as its energy system transitions to net zero. Renewable energy usage grew rapidly at the beginning of the last decade as the drive to cut emissions began to take hold, and has continued to grow steadily in recent years, with nine percent growth over the past five years for which data is available. The latest statistics for 2021 show that the government are on the way towards their target, with 55 percent of total electricity consumption in Wales being generated from renewable energy sources located in the region.[19] However, this represents a marginal decline on the 56 percent peak recorded for the previous 12 months, as a greater demand for overall energy usage led to a sharper increase in energy consumption than in renewable electricity.

14.4.4 Wind power is the most important source of renewable energy in Wales, with 70 percent of all renewable electricity generation in 2021 coming from onshore and offshore wind. 2021, however, saw the smallest increase in onshore wind capacity since 2005, with only 3.4 MW of new capacity commissioned. Due to the importance of wind energy to the renewables mix in Wales, it will be important for wind capacity to continue to grow in order for the Welsh Government to meet its targets for renewable energy usage, and net zero more broadly.

14.4.5 The proposed wind farm has a 54.6 MW capacity, consisting of 13 turbines, each with a capacity of 4.2 MW. The amount of electricity that could be produced by the proposed wind farm is estimated at 192.8 GWh per year,[20] which is equivalent to the electricity needs of approximately 55,000 homes each year,[21] or 45 percent of the current combined housing stock in Caerphilly and Torfaen County Borough Councils.

[17] UK Government. Web article: https://www.gov.uk/government/publications/net-zero-strategy. Accessed on July 23rd 2023.
[18] Welsh Government. Web article: https://www.gov.wales/climate-change-targets-and-carbon-budgets. Accessed on June 23rd 2023.
[19] Welsh Government. Web article: https://www.gov.wales/sites/default/files/publications/2022-12/energy-generation-in-wales-2021.pdf. Accessed on June 23rd 2023.
[20] This figure has been provided to Oxford Economics by the applicant. The applicant calculates the site-specific energy yield considering all known information on wind resource, topography (including terrain and forestry), choice of turbine, and losses expected for the proposed wind farm.
[21] The mean domestic electricity consumption for Great Britain is taken from figures published by the Department for Business, Energy and Industrial Strategy (BEIS): https://www.gov.uk/government/statistics/subnational-electricity-and-gas-consumption-summary-report-2021

14.4.6 In addition to providing a valuable contribution to meeting electricity demand in the region, the proposed wind farm is also estimated to reduce CO_2 emissions by 83,300 tonnes each year, equivalent to 88,200 newly registered cars. While these estimates represent a gross reduction in CO_2 emissions, it is acknowledged that the construction of wind farms would also produce emissions. Current literature shows that the carbon payback period — the time frame needed for a turbine to offset the carbon emissions generated throughout its life cycle — is relatively short for onshore wind farms. A recent study, 'Space, time, and size dependencies of greenhouse gas payback times of wind turbines in Northwestern Europe',[22] which focussed largely on onshore wind farms, finds that the payback period of wind turbines across the region averaged 5.3 months. In addition, the Director of Centre for Energy and the Environment at the University of Exeter said that the carbon payback for onshore wind farms reduces with turbine size. He states that "You can achieve this payback with a small turbine and as the turbine size increases the payback is shorter. For large three-megawatt turbines we are talking about a 75-day payback. That is very quick".[23]

14.4.7 As renewable energy usage increases, and its costs come down, the generation of electricity through wind could have financial benefits in addition to its obvious climate effects. A recent study by Renewable UK, titled 'The Onshore Wind Industry Prospectus',[24] assesses the benefits of 30 GW of onshore wind across the UK by 2030. They estimate that developing onshore wind on this scale would pay back around £16.3 billion to consumers, or £25 a year for every UK household.

Supply of aggregates in the region

14.4.8 We have been asked to consider the potential issue regarding the supply of aggregates, or mineral products, in the area, as the applicant has informed us of Pennant sandstone being located in the region where the proposed site is situated. While an exhaustive analysis of the aggregates industry and the supply of minerals in the region has not been undertaken, general conclusions can be drawn from some available data.

14.4.9 Aggregates play an important role in the economy, as they provide numerous resources critical to infrastructure throughout the UK. The construction and maintenance of houses, hospitals, and roads, amongst many other things, all rely on this industry and its products.

14.4.10 Sandstone is a type of crushed rock that was historically a source of building stones, and in recent years has primarily been used as a crushed rock aggregate. Pennant sandstone is a particular type of sandstone, which is more durable, and is used for activities such as road surfacing, where aggregates are expected to be hard wearing. Sandstone, and Pennant sandstone in particular, are therefore highly valued aggregates and considered a premium product of the quarrying industry.[25]

14.4.11 A reduction in the supply of these aggregates could, therefore, place restrictions on the ability for activities such as those listed above to be completed. Additionally, it could put upward pressure on the price of aggregates, leading to rising input costs for sectors reliant on these materials, such as construction. The availability of local mineral products, however, depends on the UK's underlying geology. Aggregates are only transported long distances when necessary, due to the substantial logistics required to move aggregates to market. As such, transport costs can be large, and adequate local supplies are an important consideration.

[22] Dammeier et al (2019). *Space, Time, and Size Dependencies of Greenhouse Gas Payback Times of Wind Turbines in Northwestern Europe*. Environmental Science Technology. Volume 53, Issue 15, p. 9289-9297.
[23] Web article: *Devon can become the heart of a 'Southwest powerhouse' fuelled by onshore wind*. Accessed on 4th July 2023.
[24] Renewable UK (2021). *The Onshore Wind Industry Prospectus*.
[25] British Geological Survey. Mineral planning factsheet: construction aggregates. https://nora.nerc.ac.uk/id/eprint/524079/1/aggregates_2019.pdf. Accessed on July 21st 2023.

14.4.12 The UK is one of the biggest suppliers of crushed rock in the world,[26] and crushed rock represented 66 percent of the UK's aggregates production in 2021.[27] Over 125 million tonnes were produced in 2021, with a total value of £1.8 billion. Of the total tonnage produced, 14.1 million was in Wales, and a considerable quantity of this was exported to other regions across Great Britain.[28] Although rates of production are high, replenishment rates for crushed rock have been close to parity in recent years across Great Britain. Therefore, although this cannot be taken for granted, it means that reserves of crushed rock are not under as significant of a threat as other aggregates, where replenishment rates are significantly lower. Indeed, at the end of 2019, total permitted reserves for crushed rock were 89 percent of total aggregate reserves.[29]

14.4.13 In 2014, the last year for which sandstone production was recorded separately, the UK produced 13.6 million tonnes of sandstone. In February 2020, there were 226 sandstone quarries in the UK, the third most of any aggregate.[30] There are significant resources of sandstone across Wales, with south-east Wales in particular having substantial concentrations of Pennant sandstone. Indeed, Wales has numerous active sandstone quarries, with 19 as of 2021.[27] The south-east of Wales is home to mutliple quarries, including one in Caerphilly, which take advantage of the high quality sandstone available in the area.[30]

14.4.14 Although Pennant sandstone deposits can be found in other locations in Great Britain, including the Forest of Dean, Gloucestershire, and Bristol, the quality of this Pennant sandstone is not as high as that found within the South Wales Coalfield. However, there are substantial deposits of Pennant sandstone across the south of Wales, stretching across multiple Borough Councils in addition to Caerphilly and Torfaen.[31]

14.4.15 The above analysis suggests that there is a significant supply of sandstone in the UK, and in particular within Wales. The proposed wind farm would also be time limited and would not sterilise any mineral resource. Therefore, it could be argued that the proposed wind farm would not threaten existing levels of supply. Pennant sandstone is, however, more limited, with the majority of high quality Pennant sandstone located within the South Wales Coalfields. Given the importance of meeting the Welsh and UK Government's climate change commitments, and the contribution the proposed wind farm could make towards these (see paragraphs **Error! Reference source not found.** to 14.4.7), it could be argued that the p roposed wind farm does not pose enough of a threat to the potential supply of aggregates for it to counterract these benefits.

14.5 Conclusions

14.5.1 The proposed wind farm would aid the Welsh Government in meeting its climate target of 70 percent of electricity demand being met by renewable energy by 2030. With an estimated annual electricity production of 192.8 GWh, the proposed wind farm could provide electricity equivalent to the needs of approximately 55,000 homes each year, or 45 percent of the current combined housing stock in Caerphilly and Torfaen County Borough Councils.

[26] British Geological Survey. World Mineral Production, 2017-2021. https://nora.nerc.ac.uk/id/eprint/534316/1/WMP_2017_2021_FINAL.pdf. Accessed July 21st 2023.
[27] British Geological Survey. United Kingdom Minerals Yearbook 2022. https://nora.nerc.ac.uk/id/eprint/534312/1/OR23001.pdf. Accessed July 21st 2023.
[28] Mineral Products Association. Profile of the UK Mineral Products Industry, 2020 Edition. https://www.mineralproducts.org/MPA/media/root/Publications/2021/Profile_of_the_UK_Mineral_Products_Industry_2020_Spread.pdf. Accessed July 21st 2023.
[29] British Geological Survey. Collation of the results of the 2019 Aggregate Minerals Survey for England and Wales. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1075214/AM2019_National_Collation-Final.pdf. Accessed July 21st 2023.
[30] British Geological Survey. Directory of Mines and Quarries 2020. https://www2.bgs.ac.uk/mineralsuk/download/dmq/Directory_of_Mines_and_Quarries_2020.pdf. Accessed July 21st 2023.
[31] British Geological Survey. The Mineral Resource Maps of Wales. https://www2.bgs.ac.uk/mineralsuk/download/wales/TheMineralResourceMapsofWales.pdf. Accessed July 21st 2023.

Additionally, the proposed wind farm could reduce CO_2 emissions by 83,300 tonnes each year, equivalent to 88,200 newly registered cars.

14.5.2 The proposed wind farm would also provide an economic boost to both Borough Council areas and the regional economy, creating jobs and stimulating economic activity during its construction and operational phases. There is a strong likelihood of local labour involvement during the construction of the proposed wind farm, which would provide an economic boost to the local areas.

14.5.3 The Borough Council areas of Caerphilly and Torfaen both face a challenging economic backdrop, with employment expected to decline over the forecast period in both Councils. As such, investment of the type and scale of the proposed wind farm can provide benefits across Wales, helping to provide and support economy-wide employment opportunities that would not otherwise have existed. It can also bring about catalytic benefits which can in turn attract further investment into Wales. For example, the knowledge, expertise and skills accumulated can act as a contributing factor to future investments in the area. Funding for such developments is usually project specific and involves considerable sunk costs. Therefore, if the proposed wind farm does not take place, the benefits, including the catalytic impact, are unlikely to be realised elsewhere in the Welsh economy.

14.5.4 The proposed wind farm is estimated to involve a capital spend of £74.0 million. Of this total, £26.3 million (nominal prices) would be realised within the Welsh economy. The projected 15-month construction phase is estimated to create or sustain 233 total (direct, indirect and induced) job years of employment, £5.68 million of wages, and £14.89 million of GVA to the Welsh economy.

14.5.5 The estimated total (direct, indirect, and induced) annual benefits realised in Wales by the operational phase of the proposed wind farm includes 8 jobs, £160,000 of wages, and £590,000 in GVA.

14.5.6 The proposed wind farm is also expected to provide a fiscal injection in terms of increased tax revenues. Estimated tax revenues over the construction phase are estimated to be £1.87 million, with an additional £50,000 expected for each year of operation. Annual business rates for the proposed wind farm are estimated at £1.07 million.

14.6 Annex 1

Glossary of definitions

Backward linkages: refers to the channels through which money, materials or information flows between a company and its suppliers, creating a network of economic interdependence. In terms of this study, it refers to the fact that the construction phase of the proposed wind farm would require the purchase and use of raw materials from sectors like building materials, steel, architectural services etc., which themselves would create supply-chain jobs in the economy.

Full-time equivalents (FTE): all the modelling completed by Oxford Economics, and all the effects associated with this modelling, assumes that employment is expressed in terms of FTE, which is important given the prevalence of part-time working especially in the construction sector. Accordingly, two part-time workers make up one full-time equivalent worker.

Gross value added (GVA): measures the value of goods and services produced in an area, industry or sector of an economy and is equal to output minus intermediate consumption.

Direct impact: defined as the economic activity and number of people employed by the wind farm (both in construction and in on-going roles).

Indirect impact: defined as economic activity that is supported because of the procurement of goods and services during construction and operations, throughout the economy. It includes not just purchases by occupiers of the proposed wind farm, but subsequent rounds of spending throughout the supply chain.

Induced impact: defined as economic activity and employment supported by those directly or indirectly employed spending their wage income on goods and services in the wider UK economy.

Jobs: any references to the employment benefits from the on-going phase once the proposed wind farm becomes operational are expressed in terms of "jobs" per annum. As noted above, these jobs are full-time equivalent in nature.

Job years: any references to the employment benefits from the construction phase of the proposed wind farm are expressed in terms of "job years". This is necessary given that construction phase activity normally spans more than a single year. A job year does not necessarily mean one job. Instead, it refers to the amount of activity that is required. For example, two people could be employed for six months—this would equate to one job year of work. Alternatively, one person could be employed for two years—this would equate to two job years of employment. The term job years is not needed when talking about the on-going phase, as these benefits are all expressed in per annum terms as discussed above.

Nominal prices: those which reflect the current situation and are not adjusted for seasonality or inflation.

Real prices (2019 prices): refers to values that have been adjusted to remove the effects of inflation and are thus measured in terms of the general price level in some base reference year. This measure of prices is more accurate. In this case, 2019 is the base year as it is consistent with the base/reference year used within UK ONS National Accounts, The Blue Book 2022.

Understanding economic impact assessments

Introduction

Economic impact modelling is a standard tool used to quantify the economic contribution of an investment or series of investments in an economy. As set out earlier in the report, the economic impact analysis outlined here estimates the contribution of the proposed wind farm through three channels (direct, indirect, and induced impacts).

These three channels form the estimates of the quantifiable economic benefits of the proposed wind farm. However, in practice there may be a range of wider economic benefits that occur as other economic agents respond 'dynamically' to the investment and operations of the proposed wind farm. While not typically quantifiable, these benefits nevertheless form an important part of the economic benefits of the proposed wind farm. These effects can include, for instance, the proposed wind farm acting as a catalyst for further clustering and agglomeration effects, providing employment opportunities for local residents, and unlocking additional growth in particular sectors.

Direct impacts

The applicant has provided Oxford Economics with the expected capital expenditure for the construction phase and provided estimates of the direct employment the proposed wind farm would create once fully operational.

The economic output produced in these sectors is translated to GVA, jobs (using local, regional, or national productivity, where appropriate), and wages. Data from published input-output tables is drawn on to estimate the direct GVA, and data is utilised from the Annual Survey of Hours and Earnings (ASHE) to estimate wages. Oxford Economics' forecasts of sectoral productivity are also used at the national, regional and/or local level.

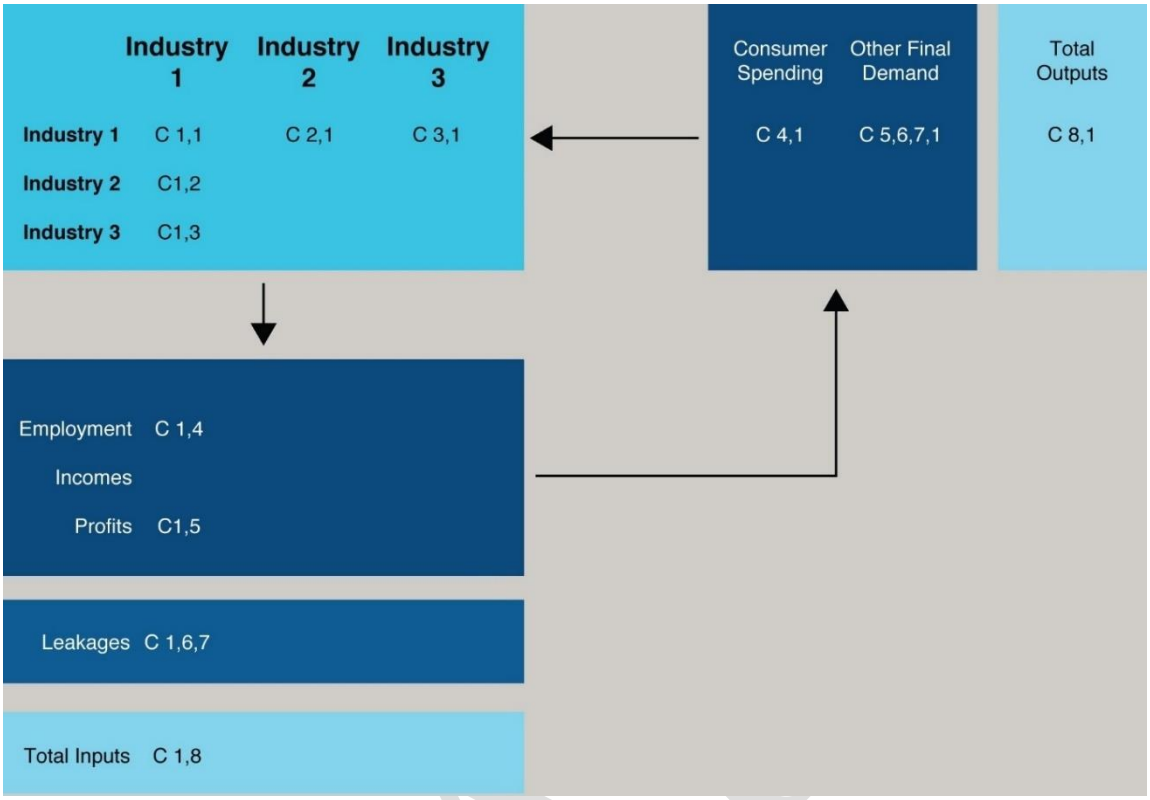
Indirect and induced impacts

Indirect and induced impacts were estimated using an input-output model. An input-output model gives a snapshot of an economy at any point in time. The model shows the major spending flows from: final demand (i.e., consumer spending, government spending, investment, and exports to the rest of the world); intermediate spending patterns (i.e., what each sector buys from every other sector—the supply chain in other words); how much of that spending stays within the economy; and the distribution of income between employment and other forms such as corporate profits. Diagram 14.9 provides an illustrative guide to a stylised input-output model.

In building the impact model, the latest UK input-output tables published by the Office for National Statistics (ONS) have been adopted.[32] To calculate regional economic impacts, the national input-output tables are adjusted to account for the characteristics of the Welsh economy—namely the overall size and degree of specialism within each sector. This reflects academic guidelines set out in papers such as Flegg & Tohmo (2013).[33]

[32] ONS, *UK input-output analytical tables—industry by industry*, 2022, accessed 2022.
[33] Flegg, A. T. and Tohmo, T. (2013), *Regional input-output tables and the FLQ formula: A case study of Finland*, Regional Studies (47 (5). pp. 703–721).

Diagram 14.9: A stylised input-output model



Source: Oxford Economics

Displacement

Displacement can be defined as the proportion of impacts generated by the proposed wind farm which are offset by reductions in economic activity elsewhere.

In order to consider the potential for displacement in the construction sector, the current level and capacity of the sector was reviewed, and its outlook for growth. This analysis indicates that the sector would have capacity to absorb the additional activity arising from the proposed wind farm, which is unlikely to result in a significant degree of displacement when placed into context of the sizeable construction sector. It is therefore assumed that no displacement occurs within the construction phase.

Similarly, the analysis of recent trends across the Welsh economy indicates that the operational phase is not likely to result in significant displacement effects. The proposed wind farm is due to stimulate activity in a sector which has traditionally employed fewer people within the local economy. Displacement is unlikely to occur when considering the scale of the proposed wind farm within the sizeable Welsh economy. The current site at the proposed wind farm is common land used for grazing, with part of the site holding telecommunications masts. The applicant have stated that no economic activity would be affected by the proposed wind farm, as a common land application would be submitted to de-register the area of the common land occupied by the necessary infrastructure (tracks and four turbines) and an area of land at least equal in size to the de-registered area would be provided as replacement land so that the overall area of common land would not be reduced in size by this proposed wind farm. It is therefore assumed that no displacement occurs within the operational phase.

Caveats

Specific information relating to the proposed wind farm was provided where possible by the applicant. The estimated benefits are based on a mix of this information, published data, and reasonable assumptions.

The cost of construction could inflate or deflate depending on movements in variables such as exchange rates, demand for wind turbines, and metal prices. As such, the information is the best current estimate at the time of writing.

This economic impact study has been developed to form part of the environmental information to be provided as part of the planning application. As such, if and when the time comes that the proposed wind farm is granted full planning permission and has been built, the economic environment may look different. The analysis assumes all facilities contained on the site are fully developed.

There is no analysis within the report focusing on how the proposed wind farm would affect income distribution and deprivation levels in the area. This is outside of the scope of this piece of work.

The quantifiable impacts calculated by Oxford Economics and outlined in this report come from an Economic Impact Model which uses an input-output framework, standard economic underpinnings, published data and a few clearly documented reasonable working assumptions. A recent publication completed by BiGGAR Economics, on behalf of Bute Energy, assesses the economic impact of Twyn Hywel Energy Park in Wales[34], and has been used to check the number of construction-phase related jobs per megawatt in Wales. The figures are found to be similar in scale to those estimated here. Another report completed by BiGGAR Economics on behalf of RenewableUK and the Department of Energy and Climate Change (DECC)[35] assessed the direct and indirect economic impacts of the commercial onshore wind sector across the UK in the decade to 2020, and RenewableUK recently published a report on the potential economic benefits of delivering 30 GW of onshore wind across the UK by 2030.[36]

The modelling presented here does not factor in industry support mechanisms.

[34] BiGGAR Economics (2022). *Twyn Hywel: Socio-Economic Impact Appraisal*.
[35] BiGGAR Economics, DECC & RenewableUK (2012). *Onshore Wind Direct & Wider Economic Impacts*.
[36] Renewable UK (2021). *The Onshore Wind Industry Prospectus*.