

# RWE

## Economic effects linked to the development of the Pembroke Net Zero Centre

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# Highlights

The report examines how the economy of Wales and the local economy around the Milford Haven Waterway could benefit from activities associated with the RWE Pembroke Net Zero Centre (hereafter PNZC).

Through the development of the PNZC, RWE is seeking to decarbonise existing activity at its Pembroke Power Station while also developing new technologies including the production of hydrogen, carbon capture, battery storage and floating offshore wind.

Activities connected to the PNZC over the period to 2040 are expected to have major effects on both the local and Welsh economy, and with the development of innovative new technology having UK-wide implications.

Already in 2020/21 the Pembrokeshire energy sector and linked local activity employed close to 6,000 people. The Pembrokeshire energy and linked sectors accounted for an estimated £550m of GVA in 2020-21, or almost one quarter of Pembrokeshire total gross value added (GVA).

The RWE Pembroke Power Station employs close to 100 people, and with regular operational and capital spending of £62.5m. It is estimated that the direct activity of the power station is connected to an estimated £16.8m of GVA.

After the indirect effects of RWE Pembroke Power Station are understood, then the total Welsh economy effects of current operations are in terms of close to 280 jobs and just over £28m of GVA.

Future development around the PNZC sees a significant boost to Welsh economic activity and with much of this focused on the Pembrokeshire economy.

Under the medium activity scenarios PNZC would see support of annual Welsh construction activity of £46m - £77m pa between 2023-38. Total Welsh annual GVA connected to the medium PNZC scenario would be between £41m and £68m and with the medium scenario supporting between 900 and 1,500 jobs every year.

PNZC operational activity medium scenarios sees RWE regional employment grow by 95 in period to 2040, supporting around £16.3m of Wales GVA. Taking account of the whole economy effects of operational spending, under the medium development scenario an estimated 270 Welsh jobs would be supported and £28m of GVA pa by 2040.

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# 1. Introduction

## 1.1 Background

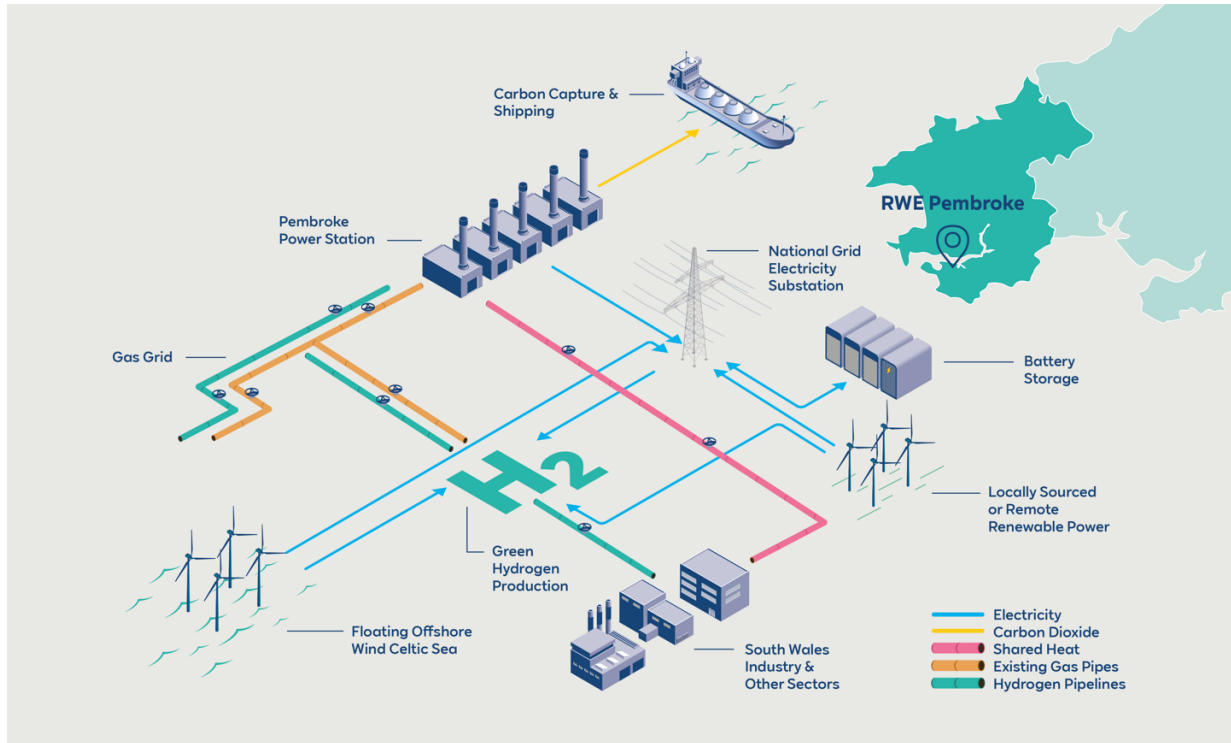
The purpose of this report is to examine how the economy of Wales and the local economy around the Milford Haven Waterway could benefit from activities associated with the RWE Pembroke Net Zero Centre (hereafter PNZC). The energy sector in Pembrokeshire currently makes a large contribution to the economy. However, all parts of the sector face challenges in adapting their operations to embrace new environmental regulations. Moreover, there are challenges to move quickly towards modes of energy production with fewer carbon emissions.

Through the development of the PNZC, RWE is seeking to decarbonise existing activity at its Pembroke Power Station while also developing new technologies. PNZC activity then embraces the following areas (see infographic overleaf):

- Decarbonisation of the Pembroke Power Station, including carbon capture and storage;
- Green hydrogen production, including feasibility studies for the development of an initial 100-300 MW electrolyser on the Pembroke site, with GW-scale opportunities in the longer term;
- Battery storage;
- Floating Offshore Wind development in the Celtic Sea.

Activities connected to the PNZC over the period to 2040 are expected to have major effects on both the local and Welsh economy, and with the development of innovative new technology having UK-wide implications.

## Pembroke Net Zero Centre - infographic



## 1.2 Report objectives

This report outlines the findings of work to examine the economic implications of expected PNZC-linked activity. Specifically the report:

- Provides a broad economic context for the PNZC development linking this to the needs and challenges facing the local economy.
- Provides a baseline for the current economic activity supported by the operation of the RWE Pembroke Power Station. This includes an assessment of its current role in the context of the Pembrokeshire economy, and conclusions on economic losses were the station to reduce or cease activity.
- Considers the local and Welsh economy consequences connected with the Pembroke Net Zero Centre including: decarbonisation of activity at the existing Pembroke Power Station; installation of a large-scale battery for the provision of ancillary services and renewable integration; capital investment to generate green hydrogen on site through an electrolyser; and RWE potential investments in large scale offshore floating wind (FLOW) in the Celtic Sea.

## 2. Pembrokeshire economy context

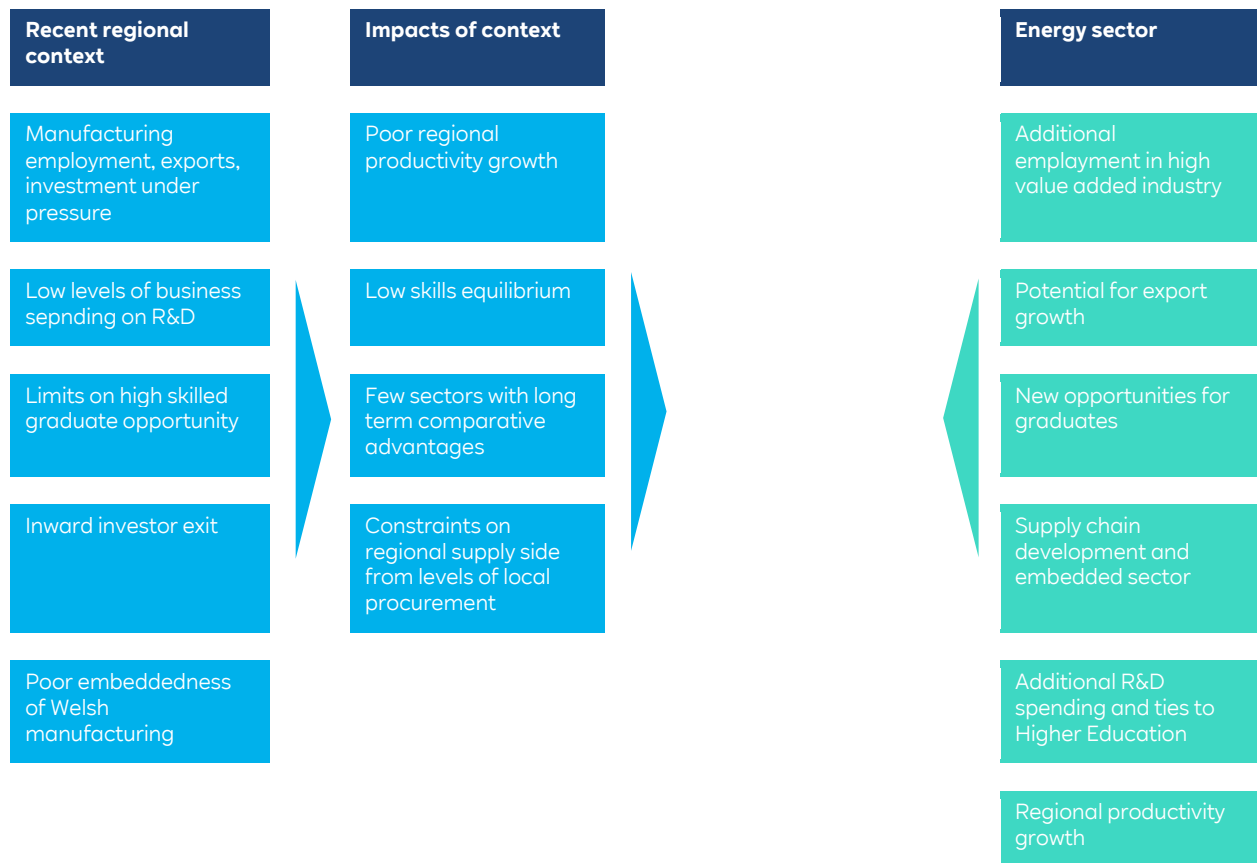
Inward investment by energy companies around the Milford Haven has been a driving force for economic growth for well over half a century. The Pembrokeshire economy faces very real economic challenges. For example, a survey of socio-economic statistics covering the local economy in 2020-2021 reveal:

- Limited local employment in sectors with high productivity characteristics;
- Relatively high numbers of jobs in non-market sectors;
- That close to 40% of employment in Pembrokeshire was part-time in 2020;
- That earnings were around 13% below the GB average;
- The presence of very few large private sector employers;
- Gross value added (GVA) per head of population 38% below the national average.

Set against this the energy sector around the Milford Haven is characterised by high value employment, industries with a record of strong productivity growth, and industries with a strong contribution to Welsh exporting. Elements of context are summarised in Figure 1 which reveals the importance of the current and future energy sector in the Milford Haven in relation to the local economy context.



**Figure 1: RWE current and future investment in context of the Pembrokeshire economy**



Further insights into the significance of the energy sector in the Haven are revealed by the following points:

- In 2020/21 the Pembrokeshire energy sector and linked local activity (i.e. in the supply chain) employed close to 6,000 people.
- The Pembrokeshire energy and linked sectors accounted for an estimated £550m of GVA in 2020-21, or almost one quarter of Pembrokeshire total GVA.



## 3. RWE Current Power Station Activity

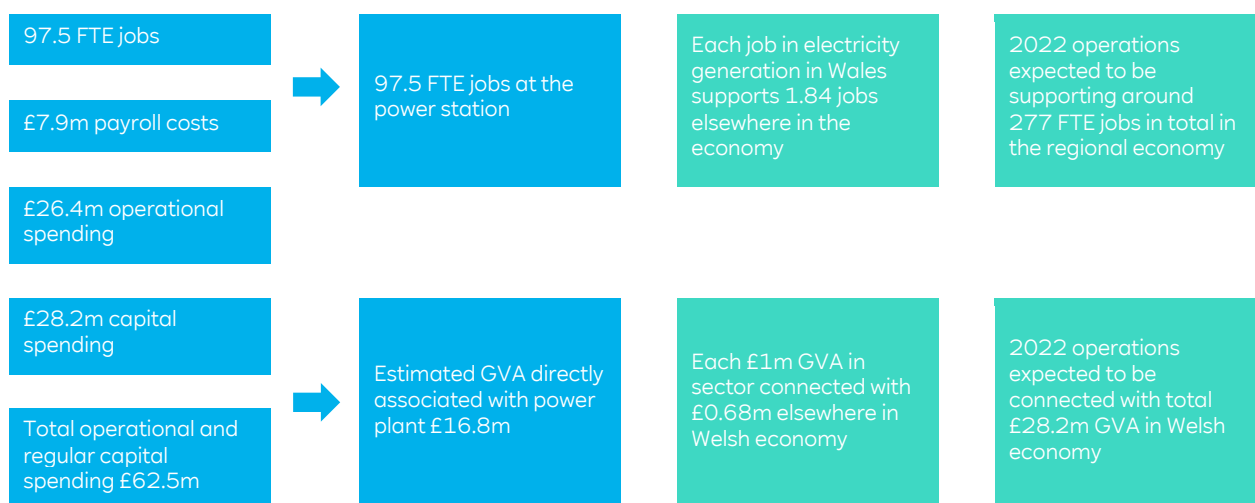
The activities of RWE through its Pembroke Power Station make-up a significant part of the local energy sector economy. Figure 2 summarises the findings of an analysis of 2021-2022 RWE Pembroke Power Station operations, and its links to the local and Welsh economy.

In analysing the economic significance of RWE operations, it is necessary to understand the direct consequences associated with the power station activity. Direct effects in Figure 2 are expressed in terms of output (or spending), value added and employment. Figure 2 reveals that the power station employs close to 100 people, and with regular operational and capital spending of £62.5m. Moreover, it is estimated that the direct activity of the power station is connected to an estimated £16.8m of GVA.

However, Figure 2 also considers the wider impacts of this direct activity. The power station through its spending and the spending of its staff supports other activity in the local and Welsh economy. In examining the relationship between the direct and indirect economic effects of power station activity we use information held within the Welsh Input-Output Tables (see Appendix 2). The Welsh Input-Output tables provide a means of estimating the indirect and induced effects on the regional economy associated with the power station operations.

This analysis summarised in Figure 2 suggests that once both the direct and indirect effects of the RWE Pembroke Power Station are understood, then the total Welsh economy effects of current operations are in terms of close to 280 jobs and just over £28m of GVA.

**Figure 2: The Economic Role of the RWE Pembroke Power Station in 2022**





Some further points can be made in terms of the reported economic impact:

- First, that local industry sectors benefit indirectly from RWE operations and this includes firms in metals, machinery and electrical equipment, construction, distribution, retail and business services.
- Second, RWE through its local purchasing supports some employment in high productivity and high wage sectors in the local economy.
- Third, any reductions in economic activity at the Pembroke Power Station would have knock-on impacts in other Welsh sectors.
- Fourth, currently in the Pembrokeshire economy there are few employment opportunities available which offer the high wages available at the Pembroke Power Station.
- Finally, here the presence of RWE creates spillover effects for other energy sector firms in the local economy, not least in terms of overall purchasing economies, and with continued operations at RWE having future ramifications for the efficient use of port facilities.

The material summarised here represents a baseline. Without new investment and innovation associated with the PNZC the current level of economic activity at Pembroke Power Station is at high risk. However, new activity as part of PNZC is expected to work to safeguard existing activity but also create new economic opportunities in Pembrokeshire and the Welsh economy.

## 4. Future economic activity supported by the Pembroke Net Zero Centre

### 4.1 Understanding future investment impacts

There are a series of difficulties in forecasting how future energy sector developments will impact on the Welsh and local economy. In part this links to uncertainty around the precise technology employed, the costs of employing that technology in some future period, and then the nature of economies that can be gained at different scales of construction.

Selected context factors in understanding the expected effects of future energy-related potential investment at PNZC are summarised in Figure 3. Key here in understanding Wales-level effects are assumptions about how far capital construction will place demands on the goods and services produced by local firms. Prior rounds of energy investment in Wales tend to highlight limited local opportunities because of the very limited Welsh supply side. Moreover, in considering the role of energy investment in local economic development it is important to recognise that many of the immediate economic consequences in terms of employment creation come through the initial construction process, and with employment in operational facilities more limited, although with this boosted during maintenance turnarounds.

A further problem is that the precise timing of capital investment is typically outside of the control of RWE and subject to a series of planning and regulatory permissions.

## Figure 3: RWE Pembrokeshire Net Zero Centre – Understanding impacts of Future Development

Capital spending levels to support decarbonisation are uncertain as is underlying technology trajectory	Floating Wind (FLOW) specific uncertainties
Uncertainty on patterns of local purchasing	Place of Milford Haven Port in FLOW value chain
Limited local supply side in terms of industries to support growth in renewables across the Haven	Future progress in consents on new FLOW locations
Energy projects employ large numbers during construction and development but smaller numbers through operations	Competitive advantage of other UK FLOW locations
Timing of new investment is uncertain and dependent on regulatory changes outside of RWE control	Supply chain development around first movers
Success in part relies on efficiency of the devolved/national planning process	Regulatory framework around electricity from FLOW and hydrogen

Figure 3 also hints at particular problems in understanding the future developmental consequences of floating offshore wind (FLOW). For example, in terms of the local economic development opportunity with FLOW, much depends on whether units are floated into position, but manufactured and assembled in locations distant from where they will generate power.

## 4.2 Approach to estimating capital spending impacts

The factors summarised in Figure 3 mean that any assessment of the future economic effects on PNZC would have to be understood at a high level.

The first step taken was to estimate the potential capital investment linked to the four main technology developments considered, and then the expected start and end times of the construction process. It was also necessary here to consider a low, medium and high capital investment scenario connected to each technology area. The full assumptions set is shown in Appendix 1 to this report, but the high level capital investment low to high assumptions are shown in Figure 4.

**Figure 4. Capital Investment Assumptions PNZC**

	Capital investment	Development time period	Operational time period
<b>Decarbonisation of existing Pembroke Power Station</b>			
Capacity 400MW-2000MW	£400m-£1,000m	From 2026	From 2030
<b>Battery storage</b>			
Capacity 200MW-500 MW	£126m-£475m	From 2024	From 2026
<b>Hydrogen electrolyser</b>			
Capacity 100MW- 1000MW	£200m-£2bn	From 2023	From 2025/26
<b>FLOW</b>			
Capacity 400MW-1400MW	£1.6bn-£4.2bn	From 2029	From 2031

Figure 4 shows an expectation of capital spending on different projects at different times from 2023 extending into the 2030s. This spending will be uneven over the period whether or not activity is at low, medium or high levels. For this analysis the projects are considered in aggregate and then with the low, medium and high scenarios understood in terms of different average annual shocks to the Welsh construction sector over a 16 year period ending in 2038.



In each case (i.e. battery, decarbonisation, electrolyser and FLOW) there is real uncertainty on local content. Prior analysis<sup>1</sup> reveals local content is restricted by the nature of the regional supply side for high value components. We assume in the analysis that high levels of regional capital spend might be considered as 25% of spending being retained in the Welsh economy and low at 15%. This assumption is irrespective of project/technology.

Assumptions are also made about the proportion of regional capital spend that is associated with gross value added. These assumptions were informed by data from the Office for National Statistics on the Construction sector.

Use was made of the Welsh Input-Output tables framework to generate estimates of how far the PNZC regional capital spend might support activity in other parts of the Pembrokeshire and Welsh economy (see Appendix 2). Gross Value Added outcomes are reported in terms of current £2022.

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<sup>1</sup> See for example Jones, C. and Munday, M. 2020. Capital ownership, innovation and regional development policy in the economic periphery: an energy industry case.. *Local Economy* 35(6), pp. 545-565. (10.1177/0269094220968048)

## 4.3 Future economic effects associated with PNZC capital programme

Figure 5 reveals the overall PNZC capital spending under the developed low, medium and high activity scenarios for the period start 2023 to end-2038. Under the MEDIUM activity scenario total investment could be as much as nearly £5bn, or around £308m per annum over this period.

**Figure 5 PNZC Expected Capital Spending Under Different Activity Scenarios**

	Overall PNZC-linked capital spending 2023-2038 £2022	Per annum 2023-38 £2022
Low	£2.33bn	£145.6m
Medium	£4.92bn	£307.5m
High	£7.18bn	£448.8m

Recall that only limited amounts of the construction spend over the period will be retained in the Welsh economy. This is picked up in Figure 6 which shows how Welsh economic impacts are affected by different regional sourcing assumptions.

For example under the higher regional spending scenario (25%) total flows to the regional construction sector over the period to 2038 are estimated at around £1.23bn or some £77m pa. This level of construction engineering activity would be associated with an estimated £35m of GVA directly. However, once the supply chain and household income effects are added this grows to around £68m i.e. as the construction sector spends money on local goods and services, and workers in the construction sector spend their incomes of local goods and services.

The final two columns consider the employment impacts. It is estimated that the annual flow of funds to the regional construction sector under the MEDIUM scenario would support around 770 jobs pa in the construction sector between 2023-38, but once supply chain effects etc are accounted this total grows to a little over 1,500 jobs per annum over the period 2023-2038

**Figure 6 The Welsh Impacts of PNZC Construction-Related Activity**

	<b>2023-2038 Total flows to regional construction £2022m</b>	<b>Annual flow of funds to regional construction sector 2023-2038 £m</b>	<b>Estimated annual Welsh GVA connected to the annual flow of capital spending £m</b>	<b>Total annual GVA connected to the annual flow of capital spending £m i.e. inc multiplier effects</b>	<b>Direct construction employment supported by the annual flow of const activity pa</b>	<b>Total Welsh employment supported by the annual flows to the construction sector pa</b>
Regional spend: High 25%						
Low	582.5	36.4	16.4	32.1	364.1	713.6
Medium	1230.0	76.9	34.6	67.8	768.7	1506.7
High	1795.0	112.2	50.5	98.9	1121.9	2198.9
Regional spend: Low 15%						
Low	349.5	21.8	9.8	19.3	218.4	428.1
Medium	738.0	46.1	20.8	40.7	461.2	904.0
High	1077.0	67.3	30.3	59.4	673.1	1319.3

To summarise:

- Under medium activity scenarios PNZC would see support for annual Welsh construction activity of £46m - £77m pa in the period to end 2038.
- Total Welsh GVA connected to the medium PNZC scenario would be between £41m and £68m and with the medium scenario supporting between 900 and 1,500 jobs per annum over the period to end 2038.

## 4.4 Approach to future operational spending and staffing

In estimating future employment activity leveraged by PNZC activities we have assumed that the baseline of current employment at the RWE Pembroke Power Station is maintained under future scenarios. Estimates were made of how PNZC developments under Low, Medium and High scenarios might add to this employment baseline (see again Appendix 1 for full assumption set). We then estimate what this additional employment and associated operational spend might mean in terms of employment and GVA supported elsewhere in Wales using once again the framework offered by the Welsh Input-Output table framework. In what follows estimates of employment are provided for three representative years 2030, 2035 and 2040.

Figure 7 shows the change in base RWE local employment in Pembrokeshire under the low, medium and high development scenarios. It is important to note here that under the HIGH scenario additional employment activity is lower in the short term because of the longer construction phases associated with constituent elements of the high scenario, which works to delay operational employment opportunities until later in the 2023-2040 period.

**Figure 7 Changes in RWE Local Employment under PNZC Scenarios**

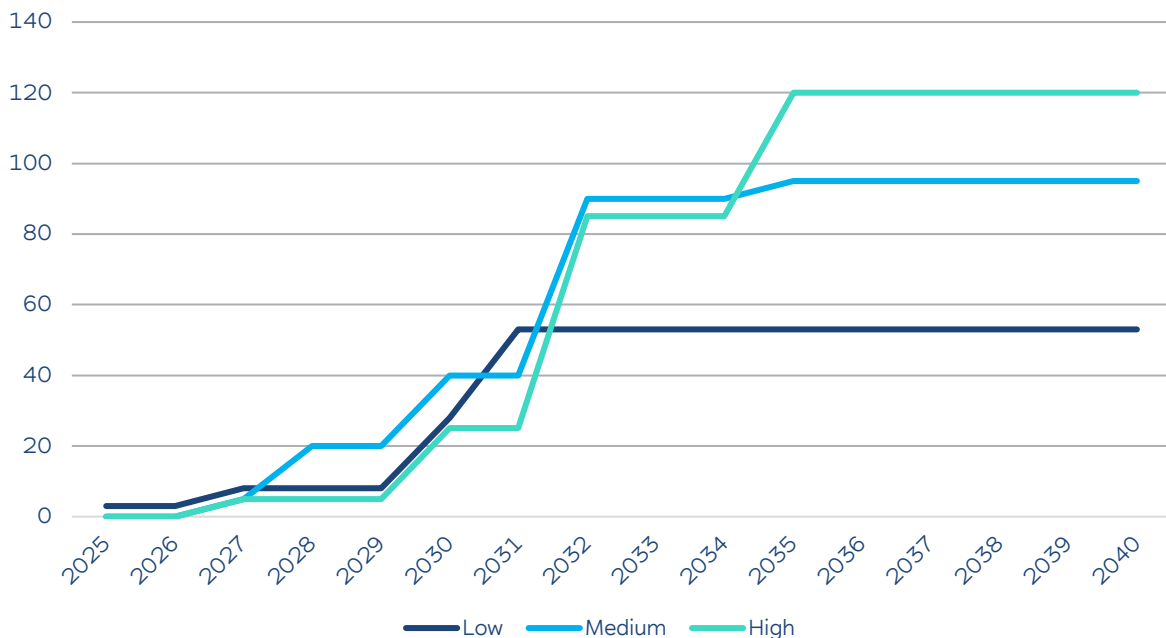




Figure 8 shows estimates of the direct operational employment expected to be connected to the PNZC scenarios, together with estimates of the indirect employment supported in other parts of the Welsh economy. Recall that as part of additional operations supported by the new investments in PNZC that new facilities will also involve additional spending in the Welsh economy and additional wage spending. For example, under the medium development scenario RWE direct employment is expected to grow by 95 people. However, the Wales-wide impacts of the medium scenario see total employment grow by just over 270 people. Similarly the operations underlying the medium scenario see GVA increase by £16.3m directly, but once all Wales effects are accounted this grows to almost £28m.

**Figure 8 Increases to RWE operational employment and GVA in Pembrokeshire 2030, 2035, 2040**

Scenario	Additional Local Operational Employment in PNZC projects (FTE)			Total employment supported in Wales by PNZC projects (FTE direct and indirect)		
	2030	2035	2040	2030	2035	2040
<b>Employment</b>						
Low	28	53	53	80	151	151
Medium	40	95	95	114	271	271
High	25	120	120	71	342	342
	Additional GVA connected to operation of PNZC projects £m			Total GVA supported in Wales by PNZC projects £m (direct and indirect)		
	2030	2035	2040	2030	2035	2040
<b>Gross value added</b>						
Low	4.8	9.1	9.1	8.1	15.4	15.4
Medium	6.9	16.3	16.3	11.6	27.6	27.6
High	4.3	20.6	20.6	7.3	34.9	34.9

## 5. Conclusions

This report reveals that the economic consequences for both Pembrokeshire and Wales resulting from PNZC activity could be significant and with these outcomes important in the context of the socio-economic needs of the Pembrokeshire economy. However, it is important to note that the numbers here are produced at a high level. While we have attempted to build in reasonable assumptions, it is likely that PNZC impacts could be significantly increased where the local content during the capital development programme were increased, or were the timings associated with capital spending changed.

Furthermore, it is necessary to consider something of the counterfactual. Without the types of investment that would be part of PNZC then it is widely expected that the Pembroke Power Station would eventually close or see much reduced level of activity. The Power Station continues to be a key part of the Milford Haven energy cluster and its presence adds to the cluster benefits experienced by all Milford Haven energy companies.

Finally, the emphasis of this report had been on employment and associated gross value added. Developments associated with the PNZC major on longer term environmental benefits from new technology. Moreover, the planned investments are also expected to lever significant returns in terms of new learning, training and education opportunities and with extensive spillover effects for local firms and institutions.

# Appendix 1

## Assumptions in Summary

### PNZC: Broad assumption set capital spending and operational employment

	Capacity	Capital Investment	Development time period	Operational time period	Operational employment (FTE)	Life of asset (years)
<b>Decarbonisation of existing Pembroke Power Station</b>	400MW-2,000MW	£400m-£1bn	From 2026	From 2030	From 20-35	25
<b>Battery storage</b>	200MW-500MW	£126m-£475m	From 2024	From 2026	From 5	25-30
<b>Hydrogen electrolyser</b>	100MW-1,000MW	£200m-£2bn	From 2023	From 2025-26	From 2-30	30
<b>FLOW</b>	400MW-1,400MW	£1.6bn-4.2bn	From 2029	From 2031	From 25-60	25

## Appendix 2

# Wales Input-Output Framework

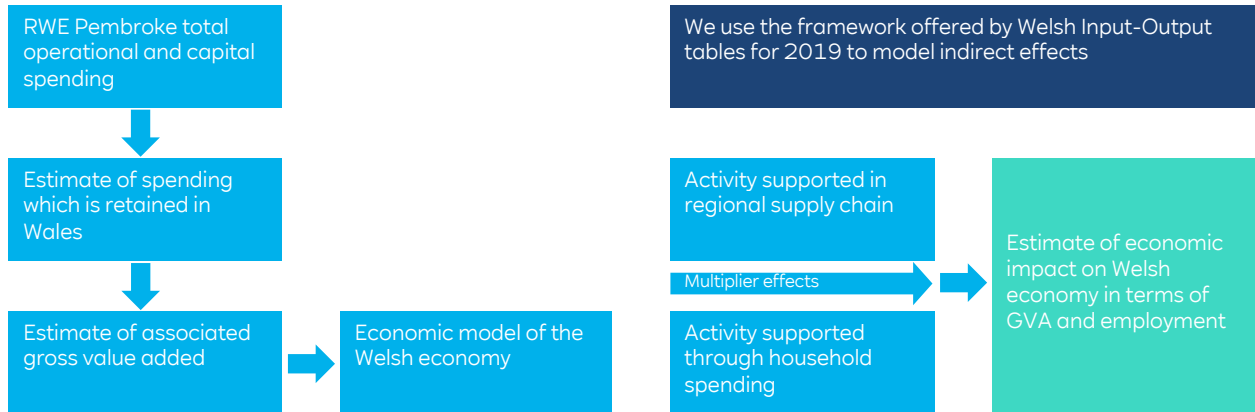
To estimate the indirect (or multiplier) consequences of current RWE Pembroke Power Station activity and then future PNZC activity it is necessary to have a picture of the local economy that specifies how the various industry sectors 'fit together' in terms of their trading relationships. This then allows the effects of activity in one sector to be traced through the entire local economy. The most comprehensive picture available of the Welsh economy is an Input-Output table.

The table presents a detailed financial map of the economy for a particular time period, typically one-year, and shows the flow of goods and services between industries, consumers and government. As well as being an important descriptive tool, the Input-Output tables can be used for economic modelling and for impact assessment. Input-Output Tables for Wales are the product of a continuing research project to develop a comprehensive picture of the Welsh economy and the way it is changing over time, undertaken by the Welsh Economy Research Unit at Cardiff Business School. Further description of the Welsh Input-Output project, its strengths and limitations, can be found at [Project\\_Report\\_Input\\_Output\\_Tables\\_Wales\\_2019.pdf \(cardiff.ac.uk\)](https://www.cardiff.ac.uk/research/welsh-economy-research-unit/project-report-input-output-tables-wales-2019.pdf).

The Figure below outlines the approach taken to estimate the total economic impact of RWE current activities on the regional economy. RWE supports a significant level of employment directly through its activity. However the company's purchasing of Welsh goods and services works to support employment in the supply chain in other parts of the Penembrokeshire and Welsh economy. Similarly those firms in the supply chain also spend money in the Welsh economy that results in further rounds of economic activity (these are 'supplier effects'). In addition economic activity results from the spending of directly employed staff at RWE, and from those employees indirectly supported by RWE operations. These are classified as 'induced income effects'. These 'induced-income' effects and must be added to the 'supplier' effects to arrive at a full understanding of the total multiplier consequences of firm spending on the Welsh economy.



## RWE 2022 Activity: Economic Consequences



The same framework of Input-Output tables was used to consider the indirect and induced effects connected to future capital investment and operational spending connected to PNZC activity.



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