



# Craig y Perthi Solar Farm

## Environmental Statement

### Chapter 03: Alternatives

Prepared for



JBM Solar Projects 25 Limited

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3312-01-ES03-001



# Document Control

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## **3.0 ALTERNATIVES**

### **3.1 Introduction**

3.1.1 Regulation 17(3)(d) and paragraph 2 of Schedule 4 of the EIA Regulations require an ES to include a description of the reasonable alternatives (for example in terms of development design, technology, location and size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option. This Chapter sets out the reasonable alternatives considered by the Applicant in the development of the project and the production of the ES.

3.1.2 It should be noted that the EIA Regulations place no specific obligation on a developer to study alternatives, but simply to describe them in the manner specified, where they have been considered.

3.1.3 In the case of the Proposed Development, and specifically the work undertaken leading up to Pre-Application Consultation, a range of alternatives have been considered. The subsequent sections provide a summary of each of the alternatives considered and design decisions taken under the following headings:

- i) Location.
- ii) Layout.
- iii) Technology.

### **3.2 Location**

#### ***Introduction***

3.2.1 Developing solar schemes has two principal criteria relating to the National Grid, which must both be satisfied:

- i) Firstly, and most importantly, any solar scheme must be located in close proximity to an existing substation that has the available capacity to import the required amount of power into the electricity grid. This can either be directly into the substation or via a point of connection into the nearby transmission network.



- ii) Secondly, solar schemes must be located close enough to the identified substation to remain viable both in terms of cable deployment for the grid connection, and to ensure that minimum transmission losses occur.
- 3.2.2 Grid connection is of key importance to solar farm as the cost of grid connection can make potentially suitable sites, given environmental issues and irradiance levels, unviable. The Applicant therefore take a principle of searching for viable sites within 10 km of potential grid connection points.
- 3.2.3 In terms of the location of grid connection points, these are prioritised based upon the solar potential available within different geographic areas of the United Kingdom. Wales, particularly West and South Wales have irradiation levels that are conducive for large scale investment in solar farms, and as such form an integral part of the Applicant's investment programme.
- 3.2.4 Upon exploring site opportunities in South Wales, discussions with National Grid identified a suitable Grid Supply Point (GSP) at the Severn Power Station, Uskmouth. This grid connection point was proposed as there is existing capacity to adequately accommodate the proposed amount of electricity to be generated onsite.
- 3.2.5 Having established the potential for a scheme to connect at this GSP, it was then necessary to determine if this was a potentially acceptable location in terms of planning policy. The national development framework for Wales, *Future Wales: The National Plan 2040*<sup>1</sup>, does not provide pre-assessed areas for solar developments, as it does for wind, and is clear that large-scale solar developments will not be permitted in National Parks or Areas of Outstanding Natural Beauty. Outside of these areas a positive policy framework exists. The national development framework states that there is strong potential in the South East of Wales for solar energy generation and Strategic and Local Development Plans should provide a framework for generation and associated infrastructure.
- 3.2.6 There is currently no Strategic Development Plan covering the South East of Wales.

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<sup>1</sup> Welsh Government (February 2021) *Future Wales: The National Plan 2040*



3.2.7 The Local Development Plan, comprising the Adopted Local Plan<sup>2</sup>, and material considerations in the form of current Supplementary Planning Guidance do not provide any spatial guidance on the location of solar farm developments. However, the supporting text of Policy GP5 General Development Principles - Natural Environment of the Local Development Plan states that '*Land identified as being of higher agricultural quality (Grades 1, 2 and 3a) will be protected from development unless there is no alternative site and the developer demonstrates that there is a proven need for the proposal.*

### ***Alternative Sites Assessment***

3.2.8 The Applicant has undertaken an Alternative Site Assessment (ASA), which is provided as an appendix to the Planning Statement included as part of this consultation. The approach to, and the findings of, this ASA is summarised below.

3.2.9 To define a search area for potential development sites the first stage was to apply the following criteria:

- i) Proximity to the electricity distribution network:
  - ii) 7.5km search area from the Uskmouth GSP at the Uskmouth Power Station.
- iii) Within this search area, an exclusion of areas subject to the following key planning and environmental constraints:
  - a) Special Protection Areas.
  - iv) Special Areas of Conservation.
  - v) Sites of Special Scientific Interest.
  - vi) National Nature Reserves.
  - vii) Scheduled monuments.
  - viii) Listed Buildings.
  - ix) Historic Landscapes.
  - x) Country Parks.
  - xi) Conservation Areas.
  - xii) Best and Most Versatile (BMV) agricultural land.

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<sup>2</sup> Newport City Council (January 2015) Newport Local Development Plan 2011-2015: Adopted Plan



- 3.2.10 The results of this search are presented on Figure 3.1, which shows that within the 7.5 km search radius from the Uskmouth GSP, there are very limited opportunities for the scale of land to viably accommodate a commercial solar farm of the scale of the proposed development without impinging on certain environmental and planning designations. Recognition was made of other consented and submitted solar schemes to the south of the South Wales Main Line railway, indicating possible areas of development.
- 3.2.11 Having undertaken this exercise, the next step was to identify sequentially suitable land from a planning policy perspective. The first two stages of this were to:
- i) Identify land which has been allocated / zoned for the type of development being proposed.
  - ii) Identify vacant Previously Development Land (PDL).
- 3.2.12 As set out above no land has been allocated/zoned for solar or general renewable energy development. In relation to PDL the only sites within the search radius of sufficient size to provide a material benefit in terms of helping to address the climate change crisis (over 200 hectares) land associated with the former Llanwern steelworks between the A4810 and the South Wales Maine Line railway, and land to the south of the A4810, opposite the operational part of the Llanwern Steelworks. These areas were not considered viable either due to existing and ongoing uses, being limited in size resulting in an unviable scheme, or being allocated within the Local Development Plan.
- 3.2.13 Having concluded that there are not any sequentially preferable, previously developed sites that could be brought forward for a commercial solar photovoltaic site within 7.5 km of the proposed GSP at Uskmouth, it was necessary to identify a greenfield site that would be acceptable in land use planning and environmental terms.
- 3.2.14 A series of environmental, operational, and land-use criteria relevant to solar development were identified, as follows:
- i) Distance from Grid Connection.
  - ii) Topography.



- iii) Deliverability/Availability.
  - iv) Remoteness from Receptors.
  - v) Glint and Glare.
  - vi) Flood Risk.
- 3.2.15 Given the coastal location of the GSP at Uskmouth, this limited the direction of search to the east of the River Usk in order to avoid a river crossing, whilst identifying several sites within the coastal flood plain. Flood risk areas categorised as Zone C were not automatically excluded as solar farms are not inherently highly vulnerable developments. Solar farms are considered less vulnerable to development<sup>3</sup> despite power stations being categorised as highly vulnerable in Technical Advice Note 15: Development and Flood Risk.<sup>4</sup>
- 3.2.16 In terms of greenfield sites, there were limited options available that met the exclusion criteria. Land to the north of Llanwern, to the west of Langstone Lane has approval for a large residential led development of around 1,100 homes as part of the Llanwern Village development. Land to the east of Langstone Road and the west of Underwood was not considered appropriate as development here would likely:
- i) Remove any separation between existing urban developments at Underwood, Llanwern, Milton and the M4 motorway. This would create a sense of urban expansion and would remove a green buffer between existing developments.
  - ii) Impact a large number of residential receptors in terms of visual amenity, glint and glare and potentially noise.
  - iii) Require the use of a number of smaller field units, which would reduce the number of solar arrays that can be deployed due to the need for field margin buffers.
  - iv) Be in close proximity to several listed buildings.
  - v) Potentially require the use of Best and Most Versatile Agricultural Land.

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<sup>3</sup> *The Planning Inspectorate Report (2018) The Developments of National Significance (Wales) Regulations 2016: Application by Gwent Farmers' Community Solar Scheme Ltd. Land on the Caldicot Levels to the south of Llanwern Steelworks Site APP/G/6935/A/16/3150137*

<sup>4</sup> *Welsh Assembly Government (2004) Technical Advice Note 15: Development and Flood Risk*





- 3.2.17 In relation to the Site, it was identified as positive against the majority of criteria prior to any mitigation being applied, with the exception of Glint and Glare impacts on a small number of residential receptors in Bishton and a small stretch of the M4 motorway, and flood risk associated with the southern portion of the Site. However, following further assessments on these matters it was apparent this could be resolved through an iterative design process to modify panel location and orientation to avoid visual amenity impacts, and the siting of any buildings to avoid flooding issues. As such the Site did not present any land use planning issues at the site identification stage.
- 3.2.18 The result of the ASA process is that the Site is considered suitable for the Proposed Development and would be, sequentially, the most acceptable within a 7.5 km radius of the GSP at Uskmouth. Consequently, it was considered unnecessary to identify any other alternative sites.

### 3.3 Layout

- 3.3.1 At the outset of the project a desk-based review was undertaken to identify the extent to which the environmental conditions on the Site or in the local area, could influence the design. This review identified the following:
- i) The Site, as originally identified was outside of any statutory environmental designation.<sup>5</sup>
  - ii) The local topography was relatively flat, with a network of existing hedgerows and trees capable of being retained and thus providing a good level of screening of development on the Site, particularly given local heritage receptors such as St Mary's Church and (former) Bishton Castle.
  - iii) The site is within an area that has a relatively low population density.
  - iv) Good access to the M4 motorway via Magor Interchange and Coldra Roundabout.

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<sup>5</sup> As a result of feedback gained through engagement with Natural Resources Wales a small area of the Gwent Levels – Redwick and Llandeenny Site of Special Scientific Interest was included within the planning boundary for the purposes of providing enhanced mitigation in the form of breeding habitat for lapwing.



- 3.3.2 Areas of flood risk were identified within the Site from the Natural Resources Wales' Flood Risk Map Viewer. Solar farms are not particularly vulnerable to the effects of flooding by virtue of the majority of the development being raised off the ground i.e., the bottom edge of the solar panels are 800 mm above ground level. Certain elements could be impacted by flooding e.g., transformer station, control room etc. However, these are capable of being designed so they are raised above flood levels on development plinths. On the basis that the facility would not be permanently staffed and can be managed remotely there is no material risk to staff from flooding events.
- 3.3.3 Surface water flooding generally occurs during intense rainfall events as a result of local topography, lack of storage in local drainage networks and/or ground conditions. As set out above flood risk does not present a significant development constraint. However, it was considered preferable to locate the main operational compound, which includes the Battery Energy Storage compound, outside areas shown to be susceptible to surface water flooding.
- 3.3.4 Solar farms are not particularly noisy. However, there is potential for noise to be generated from the Battery Energy Storage containers, the associated transformers and inverters, as well as the substation. Alternative locations for the compound were considered to minimise distance to the Castletown Sub-station and alternatively minimise distance to the road network. However, it was decided to locate the compound in a position where the distance to the nearest properties was maximised, whilst paying regard to other factors such as flood risk.
- 3.3.5 The factors set out above provided the main drivers for the layout of the scheme. Other design principles which were adopted to reduce the environmental effects of the development were:
- i) Retaining the existing field patterns and hedgerows by maintaining a minimum 5 m buffer between field boundary vegetation and the fencing around the development areas.
  - ii) Use of existing field access routes/gates between fields to reduce loss of hedgerow and existing trees.



- iii) Retaining existing topography across the Site by using ram-driven posts to mount the solar arrays, which result in minimal soil disturbance and do not require cut-and-fill construction methods, allowing the existing landform to be retained.
  - iv) Locating transformers at distances greater than 50 m from properties to reduce noise impacts.
  - v) Application of a 4.5 m buffer from the 33kV OHL, with the exception of access tracks crossing beneath.
- 3.3.6 A preliminary layout was developed, and this was subject to assessment by the following various specialists appointed on the project:
- i) Landscape.
  - ii) Heritage.
  - iii) Ecology.
  - iv) Trees.
  - v) Noise.
  - vi) Glint and Glare.
  - vii) Agricultural Soils.
  - viii) Transport.
- 3.3.7 Having reviewed the initial layout, the Glint and Glare specialists advised that there was potential for impact on residential receptors at Bishton and users of a 400m section of the M4 motorway, for a just west of Junction 23, and 800m section of the B4245 by Wilcrick. Impacts from glint and glare arise when the angle and tilt of the panels reflect sunlight towards receptors during certain times of the year and day. Mitigation was subsequently proposed to provide a suitable level of vegetation screening. With this mitigation implemented, any risk associated with glint and glare would be low. Further information on the assessment of Glint and Glare can be found in Appendix 3.1 of this ES.
- 3.3.8 Noise, which can arise from equipment such as the Battery Energy Storage containers varies depending on the specification/manufacture of the equipment. However, detailed noise modelling identified that noise emitted from operational plant required for the Proposed Development would be lower at noise sensitive receptors than existing ambient noise levels. Therefore, not considered



- necessary to amend scheme design in relation to potential noise impacts. Further details of the noise assessment are included in Appendix 3.2 of this ES.
- 3.3.9 A tree survey and assessment of the Site was undertaken, which identified numerous trees, including some potential veteran and ancient trees, which could be impacted by the proposed layout. Suitable buffer zones for these trees were identified, which required the removal of a limited number of solar arrays. Further details of the arboricultural survey are included in Appendix 3.3 of this ES.
- 3.3.10 Unlike other forms of development, solar farms generally have very minor impacts on soil quality due to their physical footprint being limited to the hollow solar panel supports, which are driven into the ground, access roads, compounds and Battery Energy Storage containers/inverter stations. Nonetheless, to reduce impact on soil quality, the access roads incorporated within the Site make use of farm access tracks where practicable to do so, and Battery Energy Storage / inverter stations have been positioned alongside these access tracks, at the edge of field units.
- 3.3.11 Onsite surveys to establish the agricultural land classification for the Site were undertaken by Amet Property in October and November 2021. These surveys confirmed that the Site did not include any land graded at 3a or above, which is considered Best and Most Versatile Agricultural Land. Further details of this survey can be found in Appendix 3.4. The Site consists of 31.1 hectares of Grade 3b land and 182 hectares of Grade 4 land. This report has been submitted to and approved by the Welsh Government Soil, Peatland & Agricultural Land Use Planning Unit, as confirmed within the Scoping Direction available in Appendix 2.2 of this ES.
- 3.3.12 Despite the lack of Best and Most Versatile Agricultural Land within the Site, the access roads and Battery Energy Storage / inverter stations were retained in locations where there would be the least amount of impact on soil quality within the individual field units.
- 3.3.13 In relation to impact on agriculture it should be noted that the vast majority of a solar farm can remain within agricultural use for grazing sheep beneath the panels. Further the reduced intensity of agricultural practices, including application of fertiliser, biocides, reduced soil disturbance and soil compaction means that over the lifetime of the solar farm the soil quality at the Site is likely to improve. When the solar farm



is decommissioned, the land can continue to be used for agriculture, potentially with greater productivity.

3.3.14 In relation to impacts on landscape character and visual amenity, the preliminary assessment concluded that the development would have a relatively limited impact on local landscape character outside the Site, largely due to extensive vegetation at field boundaries creating relatively contained field units. However, it was advised that a number of measures could be adopted to reduce and mitigate the landscape and visual effects of the development, several of which would also deliver biodiversity benefits:

- i) Removing fields from the Proposed Development that were near Bishton, near St Cadwaladr's Church, to the east in close proximity to Wilcrick Hill and to the west and north close to Llanwern Park. This resulted in the final design being more logical and compact, less 'visible' and better integrated into the immediate and wider landscape.
- ii) Proposed native species rich gap filling planting would be introduced into the existing retained vegetative structure. This would strengthen and give additional height to the existing vegetative structure, where required and reinforce the surrounding regular landscape pattern.
- iii) Incorporating substantial offsets from the settlement fringes of Bishton.
- iv) Providing wide corridors of improved access, signage and information along all PRoW that cross and border the Site.
- v) Selected managing, retaining and enhancing of boundary and internal vegetation, including the reens.
- vi) All existing retained hedgerows surrounding and within the Proposed Development would be enhanced, where appropriate and maintained at a minimum height of 3 m.

3.3.15 The resulting design was then the subject of ongoing consultation with statutory bodies and the local community, from late 2022 to early 2023.

#### ***Post Consultation Revisions***

3.3.16 Further changes were made to the Proposed Development as a result of ongoing consultation, with a revised design for assessment produced in Spring 2023. Whilst



there were numerous minor changes throughout the Proposed Development, the key changes were:

- i) Lapwing enhancement area – as a result of ongoing surveys relating to Lapwing, it was identified that the agricultural fields most used by Lapwing were to the west of where the proposed enhancement was to be located. This required a substitution in field units designated for enhancement and solar array purposes, placing more solar arrays within The Gwent Levels – Redwick Llandevenny SSSI. This also required a change to the landscape design surrounding the new enhancement area as Lapwing will not use field units with tall peripheral vegetation, thus taller trees were removed from the boundaries of the enhancement area.
- ii) Residential Offsets – in response to comments from local residents, the separation distances between the solar arrays and residential receptors were increased, particularly for those properties in Bishton.
- iii) Substation Location – the location of the operational substation was moved to the north of Bishton Road from an area just north of the South Wales Main Line railway. This relocation would ensure that the substation was away from any significant area of flood risk.

3.3.17 These design amendments are incorporated into the description of the Proposed Development included in Chapter 4.0 of this ES and are considered in the relevant technical assessments include in Chapters 5.0 to 9.0 of this ES. Therefore, no further assessment of these amendments are included in this chapter.

### **3.4 Technology**

3.4.1 With respect to the technology deployed at solar farms, the consideration of alternatives generally relates to two key operational solutions:

- i) Types of inverters.
- ii) Types of arrays.

3.4.2 The Applicant has considered these technology solutions in relation to the Proposed Development.

#### ***Type of Inverters***



- 3.4.3 Inverters receive direct current (DC) from the solar panels and convert it into alternating current (AC). This enables the electricity generated to be transferred to either the on-site Battery Energy Storage containers, or directly to the distribution network.
- 3.4.4 Inverters principally come in two different forms, which can be used on commercial solar farms. These are referred to as string inverters and centralised inverters.
- 3.4.5 String inverters are individual inverters that are placed at the end of a row, or rows, of solar panels. They are relatively small and easy to mount onto the end of arrays, and each string inverter will control a particular area, in terms of rows, of the solar farm. A key benefit of string inverters is that as the role of the inverter is decentralised, if one fails then only the panels that it controls within that string would be taken out of generation. Distributing the inverters in this way also helps to distribute any impacts associated with the noise they generate, which was a key consideration for the Proposed Development, as evidenced by the fact that operational noise of the Proposed Development is below ambient levels at noise sensitive receptors.
- 3.4.6 Centralised inverters are similar to small shipping containers, which house a large number of inverters to which the solar arrays connect. A much greater number of panels connect directly to a centralised inverter compared to a string inverter. The benefit of centralised inverters is that they are cheaper to install compared to string inverters.
- 3.4.7 The key differences between string inverters and centralised inverters are that:
- i) String inverters can be mounted directly to the solar arrays and do not require foundations or footing, unlike central inverters.
    - a) By virtue of being mounted on the solar arrays string inverters are less visually prominent than centralised inverters.
    - b) String inverters are smaller than centralised inverters and so are less visually intrusive.
    - c) String inverters are more expensive to install than centralised inverters, but generally have reduced maintenance costs due to the more straightforward technology deployed.

- d) String inverters generate lower noise levels and distribute any noise impacts across the Site – centralised inverters produce much greater noise in a single location.
- e) String inverters generally require less maintenance, and if one fails the wider solar farm can continue to generate electricity.

3.4.8 Considering the factors set out above, the Applicant has chosen to deploy string inverters with the Proposed Development.

#### ***Type of Arrays***

3.4.9 There are two principal types of solar array available for deployment within the UK:

- i) Fixed arrays.
- ii) Solar tracking arrays.

3.4.10 Fixed arrays are solar panels that are mounted on arrays which are fixed to a single height and axis, i.e., they are generally fixed to face due south.

3.4.11 Solar tracking arrays are solar panels that are mounted on arrays which are motorised and automated to track the sun across the sky. In this way they can turn to face the sun as it rises in the east, and track it through to sunset in the west, which allows them to maximise generation across the full extent of the day and deliver better yields.

3.4.12 The key differences between fixed arrays and solar tracking arrays are that:

- i) Fixed arrays are substantially cheaper to deploy and a more reliable technology.
  - f) Fixed arrays require less maintenance, and as such less traffic is likely to be generated in the operational phase.
  - g) Tracking arrays require a motor and so generate some noise, fixed arrays do not;
  - h) Fixed arrays generate less electricity per panel across the day, and as such produce a reduced yield and return for developers.
  - i) Fixed arrays can have a reduced glint and glare impact compared to solar tracking arrays.





3.4.13 Considering the factors set out above, the Applicant has chosen to deploy fixed arrays with the Proposed Development.

