Summary of network aspects related to proposed Potterne Park Farm (PPF) Solar Park

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Major Ashley Wilson MSc, CMgr, IEng

Post Graduate Researcher for Exeter University in Renewable Energy

With contribution and peer review from John Peak

Care has been taken to evidence all assertions in the report. Any non-evidence opinion is authors own.

Executive Summary

In Wiltshire Councils' Climate Strategy Delivery Plan there is a 'High Ambition Pathway' to facilitate 590MW of solar capacity by 2030. Including recently approved solar farm developments from the Renewable Energy Planning Database, a total of 821MW should be operational in Wiltshire by 2026. As Wiltshire Council have already exceeded their most ambitious target by 39%, assuming that the Potterne Park Farm (PPF) proposal is supportive of the National Policy Statement for Energy (EN1) needs to carefully considered against the constraints this will put on other generation projects which Wiltshire council may actively want to support in the future.

To inform this decision, the wider context around the transition of the UK energy system must be understood. The UK Electricity Systems Operator (ESO) are committed to transforming the UK energy system to one that is 'Decarbonised, Decentralised, Digitalised, Democratised', also known as the 4D's. These drivers fundamentally underpin the new markets[1] which must fund future infrastructure upgrades to facilitate the British Energy Security Strategy. Energy Security Strategy.

Although the proposal represents an opportunity to decarbonise some electrical supply, the other three principles are not addressed in the project scope as there is no consideration for localised offtake (decentralised supply) or inclusion of assets which could support the local network (digitalisation). As there is to be no reinforcement of the networks within the project scope, by consuming a large part of the remaining funded generation capacity in the area, the proposal is likely to adversely impact alternative Wiltshire orientated generation options for county residents (democratisation).

Four key points should be noted:

1. Economic viability of the Potterne Park Farm (PPF) proposal hinges on a legacy low-cost connection offer which artificially inflates private investor returns for a simple system in an inefficient location. Progression of the proposal is being driven by the need to demonstrate that this isn't a 'zombie project', which Government policy must remove from the pipeline so that capacity can be released for smarter projects which support local energy resilience or National energy security needs[2].

2. Wiltshire 'High Ambition' solar targets in support Net Zero 2050 have already been substantially exceeded. Both the distribution and transmission network in Wiltshire are heavily constrained for generation capacity for the foreseeable future. Due to the legacy low-cost connection, the project isn't paying for network reinforcement. It will therefore further strain the network capacity and will contribute to the pricing out of future Wiltshire orientated generation projects. Prioritisation should now go to renewable projects which enhance existing solar capability such as storage, or improve the existing electrical

[1] ESO. 2023. ESO Innovation Strategy 2023/24
[2] DESNZ. 2023. Connections Action Plan

infrastructure, in line with transmission and distribution network strategy for the area.

3. Many of the intended ‘green energy benefits’ are inflated or misleading. Site characteristics are likely to impact the inherent generation efficiency of the proposal. The level of carbon emissions savings associated with the project are also unsubstantiated. Additionally the proposals give no detail about the environmental, social and governance aspects of the project, which are advocated by Government to ensure accurate carbon accounting, ethical supply chain management and long-term sustainability.

4. The proposed connection to the high voltage network would create a strategically valuable asset. This will make retention or expansion of the site for electrical infrastructure highly likely beyond the proposed lease term, undermining any claim to the temporary nature of the project.

The proposed system is a purely commercial venture, with no community or regional energy security interest. As such, Local Planning Authority (LPA) support should be moving away from projects which focus solely on pay-back from expiring government subsidies for cheap renewable technology, to smarter systems which integrate storage and provide network response services to balance supply and demand[3].

As the District Network Operator is obliged to honour the legacy connection agreement, it is the responsibility of the LPA to fully understand the long-term implications of siting this development in Potterne Vale and the potential impact this project would have on other Wiltshire Council priorities that support local energy security i.e. housing with integrated solar.

[3] Ofgem. 2019. Our strategic narrative for 2019 - 23

UK Energy Transition Context

Electricity Networks

To support the UKs ambition to reach Net Zero by 2050, an overhaul of the UK Electricity System is being undertaken to ensure that it can host more renewable generation[4]. To support understanding of the potential system changes, National Grid Electricity Systems Operator (ESO) have developed the Future Energy Scenarios (FES) which indicate the potential pathways the UK networks may have to cater for. These have informed the UK commitment to decarbonise the Electricity System by 2035, ensuring it represents the optimum mix of energy supply that is secure and home grown[5].

To support the transition to increased renewables, the UK Government facilitated several financial incentive schemes for developers to invest in renewable projects[6]. For solar photovoltaics (PV) projects, financial incentives often outweighed upfront connection costs, leading to a huge expansion in generation connections offers, with many being held on a speculative basis[7]. This has led to a situation where the total contracted capacity for solar PV exceeds the Electricity Systems Operator's (ESO) predicted total future generation under every scenario in 2030 and the majority in 2050[8]. However, the system appropriateness of many of the proposed projects is very questionable.

A key issue was that connections below 50MW were authorised at the local distribution level with little consideration of wider transmission network issues. Speculative applications for 49.9 MW connections were therefore optimal, as they could facilitate merchant size, commercially viable systems whilst incurring minimal Transmission Use of System (TUoS) charges. For this reason, 2016-2019 saw an unprecedented rise in applications for 49.9MW solar generation connection to DNOs, which had limited oversight at transmission level. This quickly resulted in limitations upstream. By 2021 the situation was untenable, requiring implementation of a queue management system to mitigate potential impacts on transmission infrastructure[9].

As there was some financial cost to the developer to enter the queue, there was some reduction in 49.9MW connections. However continued reductions in capital costs, improvements in panel efficiency and a growing demand for Power Purchase Agreements to purchase Renewable Energy Guarantees of Origin (REGOs) to offset emissions has continued to make solar PV the most economically viable renewable options. As the application processes continue to work on a first come, first served basis for the remaining generation capacity, developers have still continued to speculatively enter the queue.

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[4] HM Government 2023. Powering Up Britain.
[5] Gov.uk. 2021. Plans unveiled to decarbonise UK power system by 2035.
[6] Feed in Tarrifs (FiTs), Renewables Obligation, Contracts for Difference.
[7] Ofgem. 2023. Connection and Use of System Code (CUSC) CMP376: Inclusion of Queue Management process within the CUSC (CMP376)
[8] Ofgem. 2023. Open letter on future reform to the electricity connections process
[9] Electrical Network Association (ENA) 2021. Queue Management User Guide.

Additionally, as there was no penalty incurred by delaying the milestones specified on connection agreements, some companies have strategically hoarded connections, as it was still economically beneficial to queue for the connection before addressing the land planning aspects. Connection offers also had limited regulation as, until 2023, no formal landowner consents were required before connection applications were assessed or granted. This led to a small number of companies, owning a large amount of the UK generation capacity, sometimes with no viable land parcel to host the proposed system[10].

As such there remains a steady rise in generation connection applications which has created a 400GW backlog of UK projects, curtailed mainly by limited public investment in network capacity[11]. Specifically, transmission level limitations have been acknowledged as having the potential to delay national renewable targets, specifically for wind developments which are critical to the UK 10 Point Plan. There is also concern that lengthy queuing timeframes could threaten investor confidence in the UK markets for network preferred projects i.e. ones with integrated or additional stand-alone storage, as these are critical to supporting further renewable deployment.

For these reasons, in 2024 Ofgem will be focussed on clearing 'zombie projects' which fail to meet new implemented milestones on connection agreements[12]. Ofgem are also working closely with the Department for Energy Security and Net Zero (DESNZ) on facilitating the recent Connections Action Plan. This policy has increased the priority for battery energy storage systems (BESS) which are critical to deal with diurnal variation produced by large scale solar projects, as well as regulating the frequency of the networks to protect existing infrastructure. The policy has also tightened capacity application criteria, stating landowners' consent must also be obtained prior to making a new connection application which was not a pre-requisite before November 2023.

Distribution Network Operator (DNO) Strategy

The DNO for most of Wiltshire is SSEN South whose responsibilities span across the most viable solar PV areas in the UK (fig 1). To incentivise the asset types needed to best support the balance of supply and demand in their region, DNOs are expected to use the Electricity Distribution Price Control Review (RIIO-ED2) Incentive on Connections Engagement (ICE) to signal their priorities. For SSEN, this is covered in their Connections Strategy. This document commits to follow Ofgem's 4D principles and 'whole systems thinking' in supporting its customers through their connections process.

As such, SSEN's Future Business Plan focuses on incentivising all aspects of the 4D transition. In line with Ofgem's Significant Code Review, higher priority is being given to facilitation of demand technologies, small scale renewables and large scale wind

[10] Futureenergy Partners & DigiStrategy 2022. Analysis of the UK Distribution Grid Capacity and Generation Market Report 2022.
[11] Electricity Networks Commissioner. 2023. Companion Report Findings and Recommendations:4
[12] Ofgem. 2023. Ofgem announces tough new policy to clear 'zombie projects' and cut waiting time for energy grid connection

through lowering connection charges[13]. This is being done to stimulate investment in technologies the grid needs for flexibility and to alleviate the grid capacity issues which are being exacerbated by commercial scale solar developments.

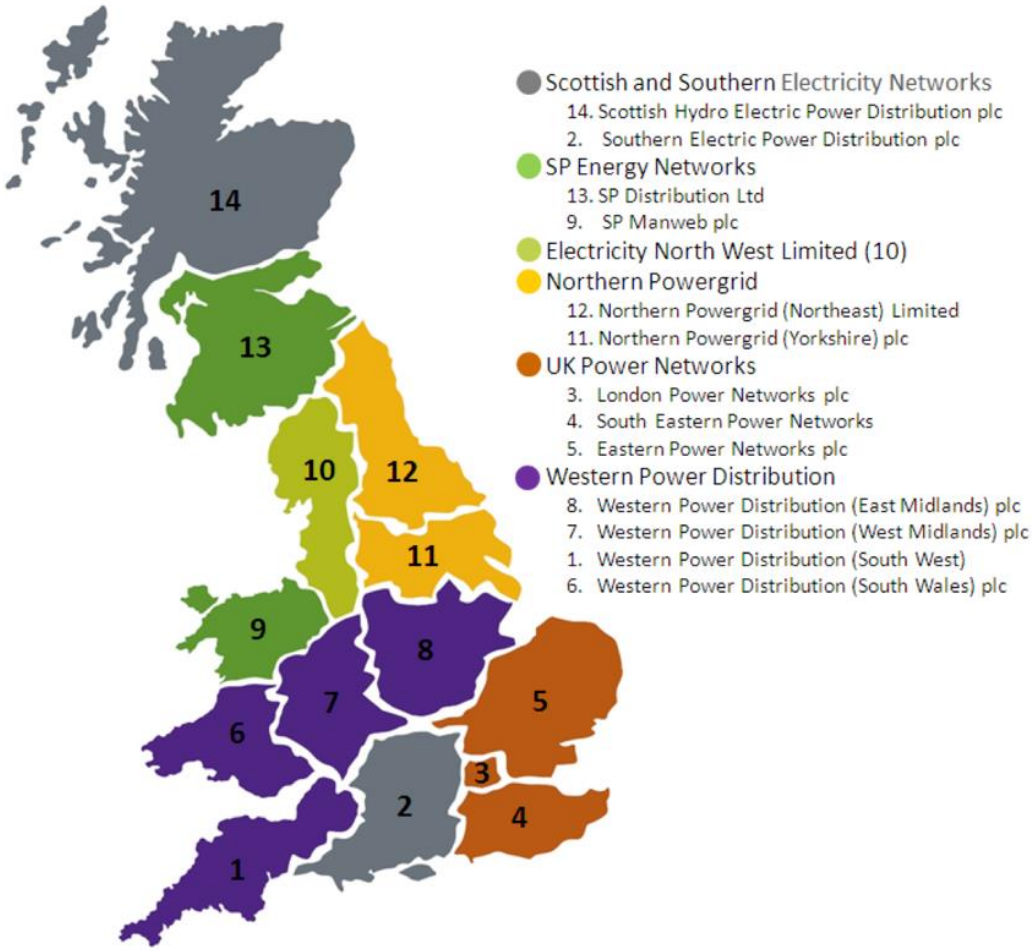

Fig 1. DNO location and ownership (Ofgem. 2017. Unlocking the capacity of the electricity networks)

Similarly, SSEN are also focussing on improving market mechanisms which help to balance regional supply and demand to ease existing network constraints. This is commonly known as 'flexibility services'. These form a critical part of the National Energy Security Strategy ensuring resilience of local supply, but also efficiency savings. Having more system flexibility is also critical to ensuring A Fair Energy Future, the purpose of which is to close the gap between those who are currently benefiting from the renewable energy transition (commercial ventures) and those who need to (those in energy poverty).

SSEN therefore have a deep commitment to maturing Flexibility Services markets, which incentivise investment in 'smarter, whole systems' assets[14]. Strong market mechanisms are being directed to stimulate capital for projects that co-locate solar PV with battery storage or hydrogen electrolysis to produce systems which can

[13] SSEN. 2022. Distribution Future Energy Scenarios
[14] SSEN. Distribution System Operator (DSO) Action Plan

provide demand/generation turn up/reduction when the networks need it. Projects with optimised storage options can benefit from revenue stacking from provision of different network services from the same assets[15]. Storage can also be used to offset potential curtailment losses arising from network constraints. These aspects mean colocation of storage with solar can increase the initial rate of return (IRR)[16].

Although Ofgem and SSEN can incentivise investment in assets which are complimentary to both Governmental targets and the wider UK energy transition, they have limited ability to specify system design changes or rescind network connection offers which have already been made. Similarly, although the Connections Action Plan represents active steps to remove legacy connection offers that are constraining visibility of actual generation capacity, there is limited ability to enforce legacy connection offers issued without milestones.

From the public consultation or evidence provided in the planning application, the current PPF proposal doesn't include any system design attributes which would complement the ESO or SSEN South Business Plans for increased flexibility. Although sections in the Design and Access Statement mention the Government Energy Security Strategy, assumptions have been kept at a very high level and fail to understand the wider context of the issues about regional energy security and resilience which the Networks are facing. Given that the project will specifically impact these, this is a misleading oversimplification.

As outlined above and below, this proposal will not support regional energy security requirements. This is mainly due to the absence of storage or flexible system operation within the system design. Arguably as the connection has already been procured, the developer doesn't need to. However, there could be better systems designs which are complimentary to the UK energy transition, which would improve energy security in the region by providing a better balance between local supply and demand. Higher energy security would result in increased options for future developments in the area, and a higher level of energy justice[17] throughout the county.

Wiltshire Energy Considerations

Existing renewable supply

For small scale solar farms (<50MW) planning in England is delegated to the local planning authority (LPA). Recently the National Planning Policy Framework (NPPF) advises that LPAs should be proactive in identifying areas which would be suitable

[15] Mohamed et al. 2022. Stacking Battery Energy Storage Revenues in Future Distribution Networks
[16] Timera Energy. 2020. Creating value via colocating batteries
[17] The underlying philosophy for energy justice is in ensuring affordability for all (McCauley et al. 2013; 'Advancing energy justice: the triumvirate of tenets'.

for renewable assets, specifically with a focus on co-locating them to local energy demand. It also advocates actively supporting community led initiatives.

In Wiltshire Councils' Climate Strategy Delivery Plan released in September 2022, there is an ambition to facilitate 590MW of solar capacity by 2030. The same document states that solar targets already total 548MW. According to the October 2023 release of the Renewable Energy Planning Database, a total of 43 solar farms are now operational in Wiltshire with an installed capacity of 442MW[18]. In addition to these, 11 further projects have planning permission which, if constructed, would add a further 379MW of capacity. This means that Wiltshire have already substantially exceeded their 'High Ambition Pathway' 2030 targets for solar development. Arguably this is why within Wiltshire's Local Plan and Planning for Devizes documents, limited prioritisation has been given to identification of additional solar PV sites. These documents highlight how grid capacity is a key limitation in the area and state that any future solar projects must be enabled with close liaison with the District Network Operator (DNO) for the area, Scottish Southern Electric Networks (SSEN).

Wiltshire Grid Capacity

SSEN manage the Bulk Supply Point (BSPs) and the Primary Substations (PSS) where the network steps down from 132kV to 32kV and from 32kV to 11kV respectively. They therefore have a responsibility to monitor the generation capacity availability for the downstream, low voltage (LV) network and the interface with the upstream, high voltage (HV) network at transmission level. The DNOs are also responsible for assessing and issuing the connection charges. Since implementation of the queue management system, they have also had to work far more closely with the ESO to understand the impact of new generation connection applications on the upstream capacity. There is therefore now a direct link between network connection pricing and network design planning.

In general, there is a principle that 'last to connect' will incur most of the additional upgrades required to facilitate the connection at the desired voltage. As such, historically solar farms would seek to locate near existing PSS, as this would lower their construction costs. However, due to grid capacity issues, this is no longer preferable, as there is often limited generation capacity at both the PSS and the upstream BSP resulting in reinforcement works at both voltage levels. As Fig 2 shows, Easterton and Devizes PSS, which both feed into the Norrington BSP is constrained. As such, unless returns are being made from local offtake, there are limited incentives for commercial ventures to connect to the local distribution network. This is the case for the proposed development, meaning that no reinforcement works will be undertaken on the downstream capacity as part of the project scope.

[18] In the spreadsheet filter by: 'Wiltshire council, 'Solar Photovoltaics' 'Ground mounted' PL/2021/10592 and PL/2021/09153 have now been granted planning permission. 19/10890/FUL planning permission has now expired.

Fig 2. Capacity for Devizes and surrounding area substations and their upstream BSP and GSP in Melksham - SSEN Generation availability heat map

Developers are therefore often targeting land parcels which connect direct to the High Voltage (HV) 132kV transmission network through development of an on-site substation. This then bypasses costly downstream reinforcement works. However, generation will still flow to the corresponding Grid Supply Point (GSP) in Melksham. Like most of the GSPs in the UK, the ability to move the generation out of area is hampered by severe limitations in wider upstream capacity (Fig 3).

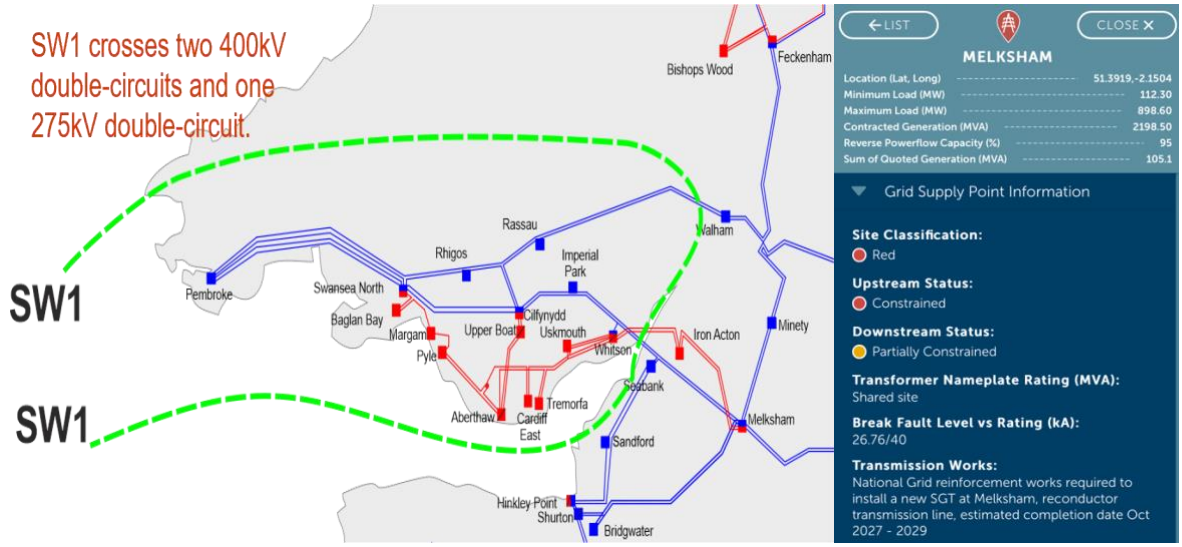

Fig 3. HV network that Melksham GSP feeds and current highly constrained upstream status (From NationalGrid ESO and SSEN Generation availability heat map)

This is because funded upgrades for the Wiltshire HV network are often considered from the perspective of the requirements for off-taking demand within the South Wales (SW1) boundary. Additional HV infrastructure has been put in place to facilitate this balance of supply and demand. However, the main limitation on further generation capacity is the thermal constraint on the Imperial Park–Melksham circuits, which is capped at 2.9GW. Upgrades to the thermal loading capacity are not due to have reinforcement until 2027-2029. Therefore, although the generation is bypassing the downstream network, it still impacts the availability of generation headroom indirectly, due to the limitations in upstream capacity. Hence, accepting the proposal will indirectly impact the downstream generation headroom. This means that future locally focussed generation capabilities could face prohibitive network connection costs due to triggering a higher proportion of upstream and downstream network upgrade costs.

Additionally, the ESO's methodology for assessing where expected future investment is required is enabled from the perspective of predicted power flows in comparison with boundary capability. To assess where prioritised investment is needed, the red line of current and future network option assessment (NOA) will fall below both the 50 & 90% confidence levels of the predicted power flows. Where the red line is above the shaded regions, it shows that there should be sufficient capability and only 'sustain' investment measures are needed. Therefore, as the existing capability of the SW1 HV network meet demand in the most likely FES – 'Customer Transformation' (fig 4), the ESO is unlikely to prioritise HV upgrades in the area within the next phase their network planning cycle (TCSNP2[19]). The TCSNP2 is based on the need for the next 10 years from 2023. It therefore indicates that the area is unlikely to be prioritised for further investment, especially as the South West (B13), London (B14), South Coast (SC1 & SC2) and South East England (LE1) boundaries all see the red line entering the predicted power flow shaded area[20].

[19] TSCNPS - Transmission Owners and other interested parties
[20] ESO. 2023. South Wales and South England boundaries

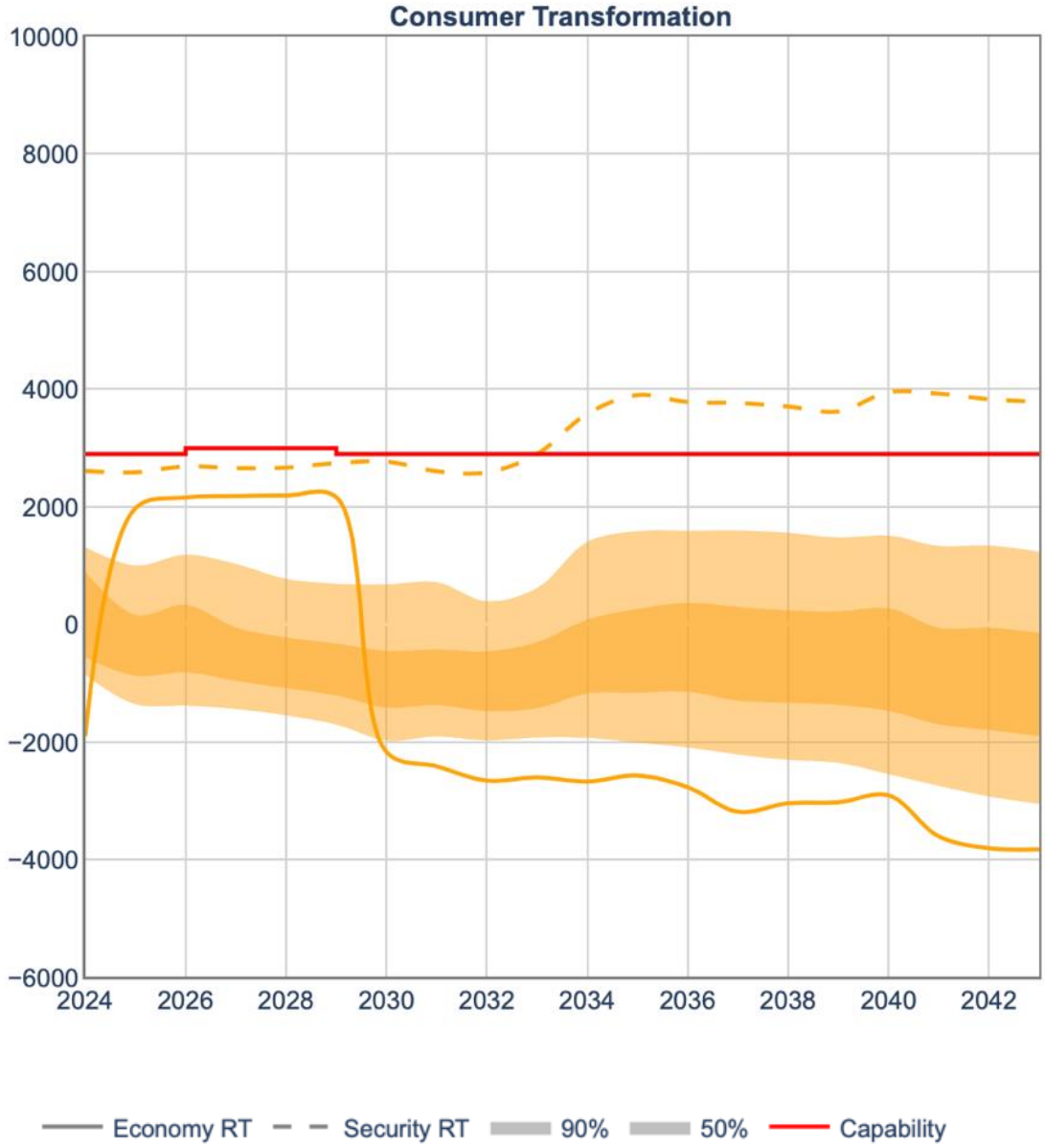

Fig 4. Boundary flows and base capability for SW1 Boundary (ESO 2023: South Wales and South England boundaries

Potterne Solar - project specifics.

As the size of the PPF project falls below 50MW, the NPPF states that planning consents should be decided by the local authority. The plans displayed at the public consultation and the planning application state 79.9 hectares are to be utilised for

solar PV. However, in some documentation, the size rises to 88 hectares. Optimum sites for solar PV are south facing, low elevation sites that have good drainage. Additionally, areas that are unlikely to incur soiling of the panels are preferred to keep maintenance costs lower. Where sites are not flat, south facing slopes are preferred although east and west facing can be feasible. North facing slopes are not preferred, as they are subject to significant shading[21]. The PPF site is on a north facing slope, close to a heavily forested area. There is therefore a high likelihood that potential generation would be impacted by shading or environmental considerations. It would therefore be important to ensure that the optimum design has been enabled, as opposed to simply making the site larger.

Shading has several impacts on the generation capability. Primarily it reduces the effectiveness of the panels as shading of even one cell can result in a much larger area of the panel being ineffective[22]. Although this can be mitigated with specialist panels or additional software, the costs of these can be prohibitive to commercial solar farms. Additionally, the type of inverter required to mitigate against the worst effects of highly shaded areas are more expensive, as many more are needed. In the 'Design and Access Statement', the basic string with single inverter configuration is shown, highlighting that microinverters are not being considered to mitigate the shading impact on efficiencies. The alternative way to mitigate against high levels of shading on efficiencies, is to increase the size of the site.

It should be noted that shading can also reduce the expected life span of the panel, as shading can result in panel hotspots that can damage the module[23]. Therefore, sites in shaded areas can result in higher operation and maintenance and potentially more asset cycles within the lease term. Mitigation for both the efficiency and longevity of the panels should therefore be requested, as they could impact the size of the site and use of the access route.

Proposed benefits

Generation benefits

The typical solar capacity factor in the UK is around 10%. However, in the PPF Design and Access Statement, the quoted 60,000MWh annual generation has assumed an overly optimistic capacity factor of 13.7%. Similarly, the proposal assumes an 18% solar panel energy conversion efficiency as opposed to the average 14% quoted by Renstart. The higher figure would require use of high-end panel technology, however, there is no detail in the application to suggest that these more expensive panels would be utilised. Additionally, none of the quoted generation figure factor in transmission and distribution system losses. Any assumptions made around these should be made clear[24]. A more realistic calculation for a 49.9MW system using this source produces a generation figure of 55,700MWh. However, benchmarking to local domestic ground and roof mounted PV systems in the area

[21] Strategic Land Group. 2023. What makes a site suitable for a solar farm?
[22] Aurora. 2023. The Ultimate Guide to PV System Losses
[23] Moussavou et al. 2018. Impact Study of Partial Shading Phenomenon on Solar PV Module Performance
[24] NationalGridESO. 2019. Transmission Losses

which typically generate <10,000 Wh/W would suggest a more accurate annual generation capacity of 50,000MWh.

Additionally, the quoted green electricity benefits for an estimated 15,000 homes supplied by the specific generation amount is a misleading statement. 60,000MWh per year supplying 15,000 homes would assume 4,000 kWh used annually per household. The current Ofgem website estimates the typical household uses 2,700 kWh of electricity but also an additional 11,500 kWh of gas in a year. As such, 'powering' 15,000 homes as advocated is not accurate, even if the figure of 60,000MWh annual generation is met. Additionally, as Fig 5. demonstrates, there is considerable seasonal variation when profiling the Ofgem average consumption with estimated generation.

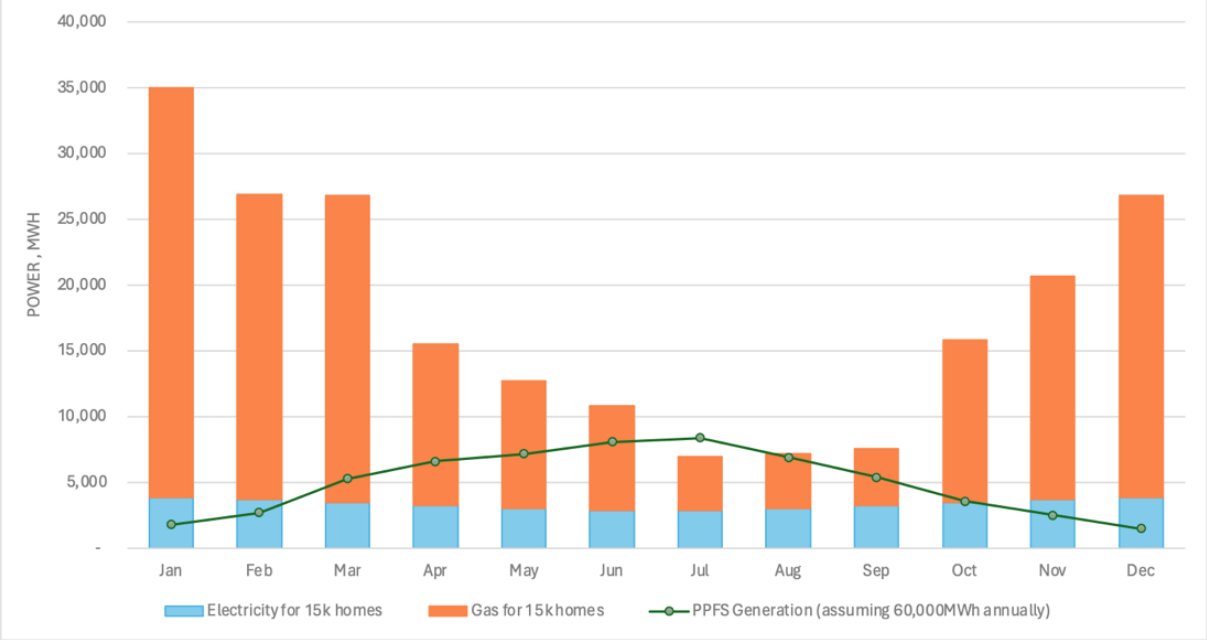

Fig 5. Profile of energy consumption from 15,000 homes profiled against PPF stated 60,000MWh of generation (generated using in2gr8tedsolutions.co.uk)

As a direct comparison, Solar Energy UK quote a 2022 average capacity of 4.34kW for rooftop solar generation. Extrapolating this out to the 14780 houses proposed within the Wiltshire Local Plan, integration of domestic level solar could produce installed capacity that exceeds the PPF proposal by around 30%. More importantly, this figure would have substantially less impact on the constrained networks due to the colocation of the demand. It would also be more efficient, due to incurring less network transmission losses.

Given these discrepancies, the methodology used to assess stated economic benefits of £1.1M over 14 months needs to be justified. This is particularly significant given the developer is assumed to have a cheap connection arrangement which could be driving the high upfront returns of the project to the investors. The LPA should therefore request to see how financially sustainable the proposal is for the full lease term, given the environmental impact will be sunk upfront. This aspect is

particularly acute during the UK energy transition, as it is highly likely Government subsidies for renewables will reduce[25] and that Ofgem regulation may change to increase connection charges retrospectively to support increased investment in the networks[26]. It is therefore common for many commercial developers to now have confidence levels against regulatory risk as part of the project financial model.

Carbon emissions savings

The PotterneSolar website also claims annual CO2 savings of 21,500 tonnes. However, using the current Greenhouse gas reporting conversion factors for scope 2 electrical emissions is 0.20707 kg CO2 saved for each kWh produced[27]. This factor is based on the carbon emissions generated by the current UK power stations per kWh generated. It includes other greenhouse gases such as methane and nitrous oxide which are converted to carbon dioxide equivalent to give a truer value of the kg CO2 eq. per kWh. Using this conversion factor against the assumed 60,000Mwh of generation produces an annual saving of 12,400 tonnes. This is 42% less than what is contained in the planning application literature.

There is also limited detail on the through life carbon costs associated with the project assumptions underpinning which should be included in any green benefits section. The carbon footprint of similar 132Kv substations proposed by the DNOs have an estimated 9,000 tonnes CO2e footprint[28].

Local benefits

The proposed 'local economic benefits' disclosed are also questionable. In the 'Design and Access Statement' 8.2.2 there seems to be a case made for local employment. However, in the same table, there are hotel and subsidence costs articulated which wouldn't be required if the workforce was local. Cost for local workers such as an Archaeological adviser also seem inflated, given the relatively small amount of archaeological significant areas within the project proposal. Although it is acknowledged that this is indicative, if the local benefits are to be assumed in, then they should be based of accurate assumptions for the project.

System design

There is very limited, or accurate information about the specific design of the solar farm in the planning application. None of the critical system design features are addressed in the 'Design and Access' documents, which seem instead to focus on the planning aspects over the suitability of the project. This is unusual but could just indicate the sub-optimal nature of this site that has been selected purely on the grounds of its location relative to HV cables and being occupied by a willing land-owner. The connection offer was most likely procured before the generation capacities in the area became constrained. As such the value of the connection

[25] Guidehouse Insights. 2023. The Impact of CfD Allocation Round 5
[26] Ofgem. 2023. Electricity network access and charging review
[27] Gov.uk. 2023 GHG Conversion Factors.
[28] SSEN. 2022. Keith 132kV Substation Works Engineering Justification Paper.

agreement for 49.9MW is now hugely elevated d. This would suggest this project is underpinned by financials resulting from an ultra-low-cost connection, as opposed to being the right system in the right place. Specifically, information about the output of the system versus the size, as well as types of panels to demonstrate optimum efficiencies needs to be justified and updated.

Most of the literature in the planning application indicates a solar only project with no battery storage. However, in the 'Design and Access Statement' there is reference to the utility of batteries. The dialogue about battery storage in Lighthouse's document although limited is accurate. The land consultants themselves therefore seem to acknowledge the requirement for optimally sized storage to ensure network resilience and project efficiency. If battery storage is to be included in the project, far more detail will be required about the safety systems put in place for them given the proximity to woodland. Additionally, understanding the size and scope of the foundation concrete work would need to be disclosed to ensure appropriate EIA.

Additionally, the planning application doesn't mention any compliance with emerging international environmental, social and governance (ESG) standards for supply chain assurance on solar panels[29]. Although reference is made to the emissions from the production of the panels, no detail if provided about the sourcing of the components or whether their production is ethical or sustainable. More detail about the how the proposed project will align with Wiltshire Council's Socially Responsible Procurement Policy should be detailed.

Land lease

The PPF proposal has requested 50-year lease term. This is longer than the market average for similar projects, which tend to be around 25-40 years[30]. Lease timeframes tend to represent efficient asset life cycles and therefore best returns on investment. The longer lease could therefore indicate more asset cycles are likely, and/or that there are some concerns over financial viability of the project which are being offset with a longer requested lease term. More asset lifecycles would have an impact on the access route use and should therefore be clearly known before planning is considered.

Although much of the planning application state that the land can be remediated to former use after completion of the lease term, this is not the case for the substation which facilitates the connection point. Assuming normal maintenance would be carried out for the project lifecycle to ensure optimum efficiencies, the presence of the substation would make the land parcel more valuable for enduring electrical infrastructure assets, and indeed attractive for expansion options beyond the initial development phase. As the installation of the connection point to the HV network is the most expensive part of the project, the land value with this asset on site would significantly outweigh the value of returning the land to agricultural use. Although it would be impossible to know the intention of the landowner at this time, the acknowledgement that the site will continue to be more lucrative in its changed

[29] Standards such as the Solar Stewardship Initiative (SSI) provide standards that provide robust ESG criteria for solar projects.

[30] Myerson Solar Farms – Benefits and Considerations for Landowners.

designation must be understood when considering environmental impact assessment (EIA), visual impact and green infrastructure responses.

Timelines

The speed at which solar farms of this size move from concept to operation can vary greatly. Historically the critical path was driven by the requirement to secure land and obtain successful planning permission. However now, obtaining grid capacity is the developer's primary concern. This is because connection works can be very expensive in areas where there is limited capacity and this would significantly impact project financial viability. With this in mind, land planning and electrical network skills available to the developer are key to reducing the timeframes. Hence, scoping optimum land and connections offers are often outsourced to third party specialists.

For new developments, associated timelines for planning and grid connection are often run in parallel and maturing each stage of both the land access and grid connection will come with associated costs. For this reason, the timeline for similar developments presented below is very indicative and must not be taken as specific to this project. However, it must be noted that the outline timeline provided by the developer on https://www.potternesolar.co.uk suggests a relatively limited time window for the planning application process. Clarification should therefore be sought from the developer on the specified milestones within the connection offer from the DNO, as these will drive the critical path for the developer. Under the new Connections Action Plan failure to meet any specified milestone could result in the DNO rescinding the connection offer.

Months before energisation date	Description
>54	Budget(s) requested to estimate optimum location to connect project to network
54	G-99 application submitted for optimum network location
54-48	Planning pre-application request submitted
51	Network operator conducts technical feasibility study of the network capacity and issues the offer detailing the associated cost.
48	Connection offer accepted (must be done within 90 days of the offer being given)
47	Land agreement confirmed
46	Initial system design
45	Public consultation
44	Formal planning application submitted
18-6	Planning permission process
6	Construction and connection

Table 1. Indicative timeline for 50MW solar farms[31].

[31] Kronos Solar Hansland Solar Farm

Key questions for the developer

1) Has local offtake been considered for the proposal? If no, why not?

2) Why is storage not being considered within the system design?

3) Is the developer planning to optimise the system design to provide flexible services?

4) Can the developer share financial considerations between connecting at the HV level as opposed to connection downstream and reinforcing the local distribution network?

5) Can any guarantee be given by the developer that generation capacity at upstream level will not be impacted by the solar farm being operational?

6) Why is the advertised timeline for the planning application process relatively short when compared to similar projects?

7) Can a copy of the connection offer be made available so that the proposed system, connection point, date of original submission to the DNO and any mandatory milestones can be confirmed?

8) Does the connection offer come with a curtailment order?

9) Can the developer demonstrate how the system design mitigates against the impact of sub-optimal orientation, elevation and proximity to environmental features which will make the system inefficient?

10) Could the site be made smaller with different types of panels or system design?

11) Does the supply chain and system components comply with Wiltshire Councils Sustainable Procurement Policy?

12) What are the modelling assumptions on the carbon emissions savings?

13) What are the through life carbon costs of the project?

14) What is the operation and maintenance schedule planned for the site?

15) What is the estimated panel asset life cycle over the 50-year lease term?

16) Are the local community likely to be offered any compensation package?

Glossary

Acronym	Title	Description
BESS	Battery Energy Storage System	Battery systems which can mitigate against network strain induced by intermittency and seasonal variation from renewables generation assets.
BSP	Bulk Supply Point	Where a distribution network steps down from 132kV (typically to 33kV or 66kV)
	Budget estimates	Process to scope cost of a potential project to the Network Operator. Costs are estimates and time limited. They can change significantly and will only be matured to a 'formal connection offer' once the network operator has done a technical feasibility study (costs associated)
	Connection charges	At distribution level, the full cost of new sole use Connection Assets are charged to the connectee. In addition, the connectee pays for a share of the Reinforcement costs under pre-determined apportionment rules.
	Connection offer	The formal connection offer has all the detailed information to inform the timelines and costs of the project from a network operators perspective. These are only valid for 90 days.
DESNZ	Department for energy Security and Net Zero	Government Department responsible for UK energy security, ensuring properly functioning energy markets, encouraging greater energy efficiency and enabling initiatives that support UK commitment to net zero.
DNO	District Network Operator	DNOs own, operate and maintain the distribution networks. They do not sell electricity to consumers, this is done by the electricity suppliers. There are 14 licensed DNOs in Britain, and each is responsible for a regional distribution services area.
ESO	Electricity System Operator	Balances the supply and demand in real time utilising existing infrastructure. In the UK this is called National Grid ESO.
	Energisation date	The date offered from the DNO for which the project is intended to connect live to the network.
G99		Standard application form and relevant associated documents which developers fill in to apply for a budget and formal grid connection
GSP	Grid Supply Point	Grid Supply Point (GSP), and where a distribution network steps down from 132kV (typically to 33kV or 66kV)
IRR	Initial rate of return	A metric used to estimate the return on an investment. The higher the IRR, the better the return of an investment.
LPA	Local Planning Authority	local government body that is empowered by law to exercise urban planning functions for a particular area.

	Network Operator	The licensed companies responsible for operating the electrical networks. In the UK these are distinguished by the voltage level. National Grid (containing both the ESO and ET) operate transmission level (275-400kV) and DNOs who operate 132kV and below.
NoA	Network Options Assessment	Provides the recommendation for which network reinforcement projects should receive investment and when.
PSS	Primary Substation	Place where voltage is dropped from 33kV to 11kV.
TUoS	Transmission Use of System	The charges associated with provision of access to and use of the transmission grid

References for glossary

National Grid – UK Energy System Group
National Grid ET - UK Energy System Electricity Transmission Owner
National Grid ESO - UK Energy System Operator
Ofgem – UK Energy System Regulator
Roadnight Taylor – Independent Speciality Grid Consultancy