Batteries Not Included (re. ExQ1.3.5)

PVDP's energy storage strategy for BWSF is stated in ES Product Description.

6.4.3	For clarity, the Project does not incorporate any battery storage. Energy generated by the Project will be stored, as required, by Battery Energy Storage Systems (BESS) that are connected to the Grid elsewhere, including the EDF 50MW BESS located at Cowley substation.

No alternative is considered in ES Alternatives Considered.

5.8.1	The Project does not incorporate any battery storage. Energy generated by the Project will be despatched to the grid but stored, as required, by Battery Energy Storage Systems (BESS) that are connected to the Grid elsewhere, including the EDF 50MW BESS located at Cowley substation.

Subsequent enquiry [RR-0709] was unproductive [REP1-020, page 11].

Can PVDP please provide its estimate of the battery capacity required to support the Botley West farm when it is operating at its design output (840 MWe)?
The Project does not include on-site BESS; instead, energy generated will be dispatched to the grid and managed by **existing off-site storage facilities**, including the EDF 50 MW BESS at Cowley substation (Section 5.8.1, **Chapter 5: Alternatives Considered [APP 42]**). This approach reflects existing National Grid infrastructure and operational flexibility.

None of this is correct. There is no existing off-site storage facility in this region. There is no NG infrastructure for this operational flexibility. APP-042 does not consider any alternatives.

EDF's 55 MWh Cowley battery provides inertial grid support for the Oxford area. It can absorb or inject energy at 50 MW for up to 30 minutes.[1]
It is neither suitable nor available as storage for solar energy.

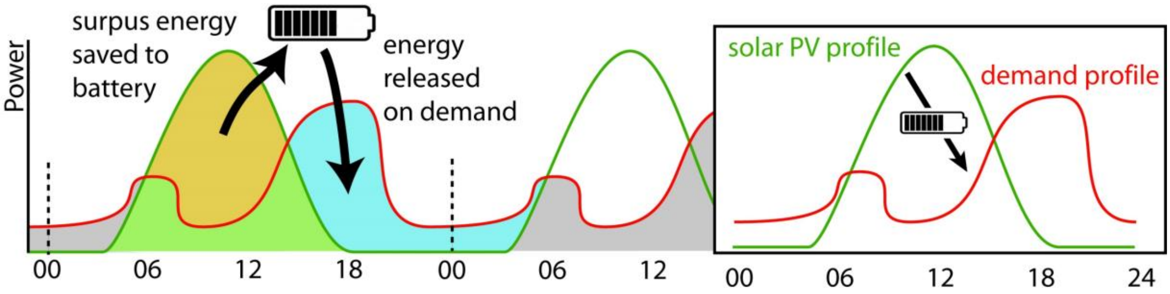
An alternative should be considered.[2]

[1] [redacted] (accessed 16/06/25)

[2] This is also a requirement in NPS EN-3 (2023) 2.10.71.

Does UK Solar PV Need a Battery?

Rooftop Solar PV is everywhere. The owners of Britain's 1.6 million rooftop installations put around 50% of their investment into the solar PV and 50% into a lithium battery.
The battery is essential: solar PV electricity is generated around midday, whereas UK domestic electricity demand is typically in the evening and early morning. The battery, in effect, converts the solar PV generating profile into the demand power profile.



Grid solar PV has the same requirement. Battery storage (BESS) transforms a solar farm's PV generation profile into the NG demand profile.

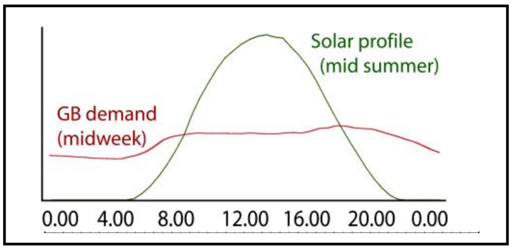
What Battery Size is Appropriate?

Of the 30 or more pending and consented solar DCOs, about half include a battery (BESS). Of these, half do not specify their battery capacity; the others propose values ranging from 90 MW to 2400 MWh. There is evident confusion within the solar DCO community.

We do not need an Electrical Engineer to tackle this question. A competent Physics student can work out the answer.

Real-time and historical profiles of daily PV generation and grid demand are readily available on the internet.

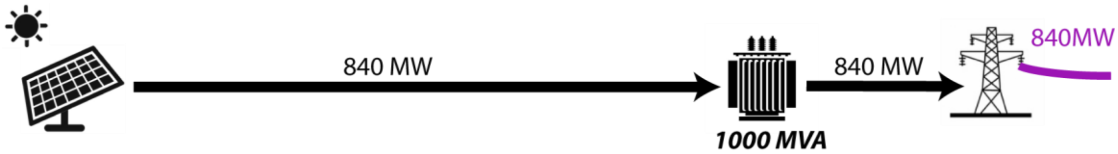
Evaluation of the required battery capacity is a straightforward exercise for an A level Physics student (see Appendix).



BWSF (840 MW) will require the support of 3100 MWh of battery storage.

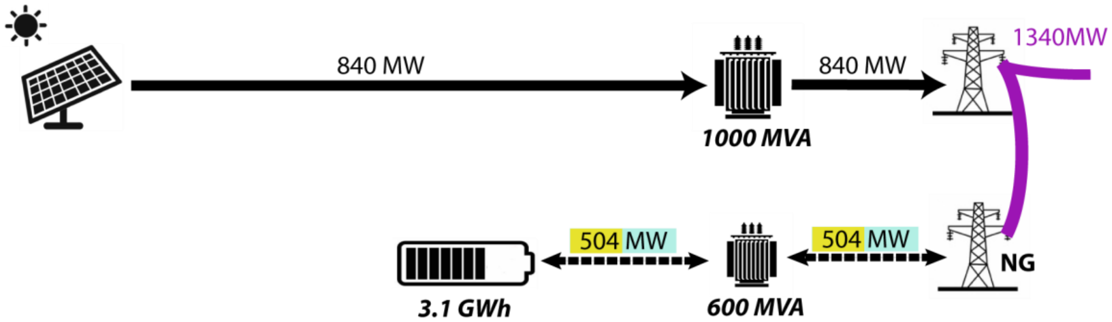
Should the Battery be sited in the Solar Farm?

The BWSF proposal has a peak output of 840 MW.



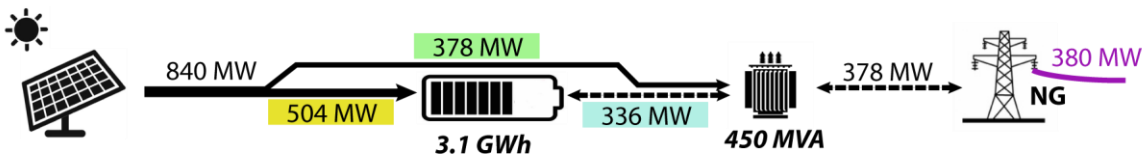
There are two options for the location of a 3.1 GWh battery: **remote** or **co-located**.

The **remote** configuration is the ‘do nothing’ option. A third-party (or multiple third parties) will construct the 3.1 GWh of BESS(s) elsewhere on the grid.



The battery’s grid connection will be at least 500 MW in order to receive BWSF’s surplus energy generation.[3]
Thus, NG’s HV capacity will have to be 1340 MW (840 + 500) to support this solar/battery configuration, on top of whatever else is on this HV circuit.

In the **co-located** configuration (‘AC coupled’), the battery is integrated into the solar farm’s circuitry.



NG’s required additional HV capacity could be 380 MW (i.e. less that the current 840 MW).

Furthermore, the substation capacity will be around 450 MVA rather than 1600 MVA (1000 + 600) for the remote option – a substantial saving in both cost and land-take for the supporting infrastructure (transformers etc.).

[3] The virtual Physics student has calculated the numbers (Appendix, part **c**). Dashed lines indicate bidirectional energy flow.

Summary

The two configurations supply the same amount of solar energy to the grid, and in both cases the battery is available for out-of-season trading in the wholesale electricity market. (Solar is a predominantly summer energy source.)

The remote option requires more than three times the additional NG capacity, and more than three times the investment in expensive transformers/switchgear. It offers no technical advantage. NG capacity expansion is the principal hindrance to the Net Zero roll-out.

It is far from certain that a 3.1 GWh third-party battery will ever exist, let alone that it will commit to purchasing BWSF's surplus energy. This has two further consequences: BWSF's surplus energy will be curtailed (discarded) in the daytime, and evening demand will be satisfied by alternative generators (e.g. natural gas CCGT).

In the days of the CEGB [REP1-157, page 1], the meeting to make a decision on battery location would have been quite brief.

Alternative Considerations

Other considerations may influence an applicant's battery decision in 2025.

1) A 3GWh battery costs several £100m and it occupies land that could otherwise be claimed for more PV. This component of the solar energy design would ideally be left to a third party (or, ultimately, the government/NESO).

2) A solar farm that produces unusable electricity might seem commercially unsound. NSIP-scale solar is in its infancy, but offshore wind is mature. In 2024, the Seagreen Field earned £104m for generating electricity and a further £262m for not generating electricity.[4] (Its production is curtailed due to grid constraints.)
On a windy June day in 2030, up to 125 GW of renewable generation will be chasing 30 GW of GB demand.[5] Unusable electricity is on course to become a lucrative additional sector in Britain's 2030 wholesale energy market.[6]

---

[4] [redacted] (accessed 16.06.25)

[5] 80 GW wind, 45 GW solar by 2030 (Clean Power 2030 Action Plan, DESNZ 2025). GB summer peak demand is around 35 GW, less 5 GW for nuclear.

[6] For industrial customers, Britain now ranks #1 in the developed world's Premier League of retail electricity prices. For domestic customers it is still #4, just behind Germany, Belgium and Ireland. [redacted] (accessed 16/06/25)

3) Government policy does not require a solar farm to have a battery. NPS EN-1 (2023) encourages electricity storage [3.3.4] but does not address co-location of solar/battery. EN-3 (2023) supports co-location for the purpose of efficient land use [2.10.10], and it allows DCO proposals to include a battery as associated development [2.10.16].

4) The argument for co-location has been put before the Inspectorate previously [East Yorkshire REP1-111, p2] and found to be not persuasive. (The lack of a battery "detracts somewhat from the Applicant's need case" [ExA report, 3.2.75].)

5) The two most recent DCOs (Mallard Pass and East Yorkshire) were consented without a battery:

> 3.2.110. … We are satisfied that the absence of BESS is a neutral factor that does not weigh against the Proposed Development in the planning balance.
>
> *MP ExA report*

> 3.2.92. I consider that the choices in terms of … the omission of battery storage … are reasonable. As such the proposal accords with NPS EN-1 paragraphs 4.3.10 to 4.3.12.
>
> *EY ExA report*

The battery strategy favoured by solar DCO applicants[7] (and endorsed by the Planning Inspectorate) has displaced the legacy of the CEGB and the experience of 1.6 million rooftop PV users.

Considered Alternative

Would PVDP please consider the co-located battery scheme (as described here) and summarise the rationale for rejecting this alternative?

[7] Sunnica (2400 MWh) was an exception. Coincidentally, Sunnica was the one solar DCO proposal that did not obtain the Inspectorate's recommendation.

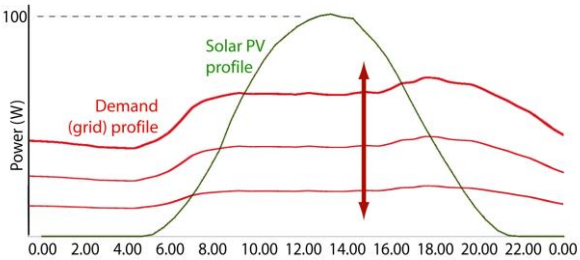
Appendix. A level Physics Question: Battery Capacity.

(a) Obtain 24-hour profiles representing GB grid demand and peak solar PV generation from the internet. Superimpose these on graph paper to estimate the battery capacity required to support 100 W (peak) of GB solar generation. (*5 marks*)

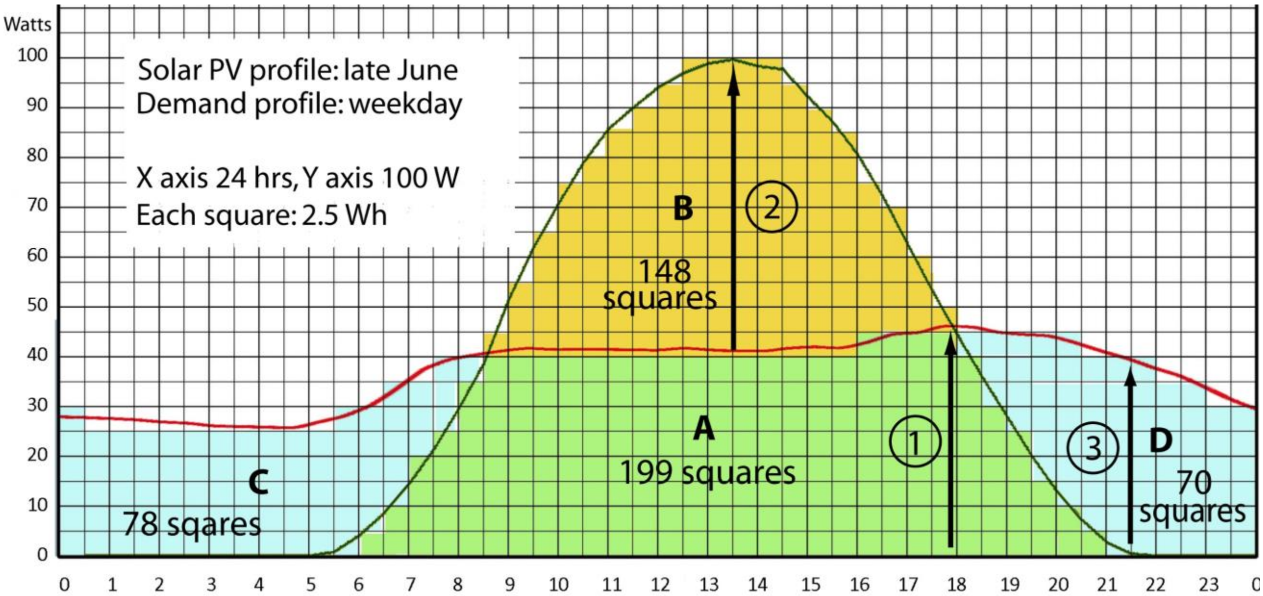
(b) What battery capacity would be required for an 840 MW solar farm? (*1 mark*)

(c) Hence or otherwise, derive the peak output power from the 840 MW PV/battery combination, as well as the maximum charge and discharge rates for the battery. (*2 marks*)

(a) Peak solar generation is in late June. A clean profile (i.e. cloud-free day) was copied from https://www.energydashboard.co.uk (accessed 10.06.25) and transferred to graph paper (green trace). The axes were labelled for 24 hours and 100 W.



A second profile (red) was obtained for typical 24-hour grid demand. This profile was superimposed and scaled (up and down) until the areas under the two curves were identical. (Area under a Power–Time curve is Energy.)



A + **B** = **A** + **C** + **D** = 347 squares.

Region **A** represent solar energy that is supplied directly to the grid.
Region **B** is the surplus energy to store in the battery. 148 squares is 148 × 2.5 = 370 Wh.

100 W (peak) of summer solar PV generation requires a battery capacity of 370 Wh.

(b) To obtain the capacity required for an 840 MW solar farm, multiply by 8.4×10^6.

An 840 MW solar farm will require a battery capacity of $370 \times 8.4 \times 10^6$ Wh = 3108 MWh.

(c) Values are obtained from the graph and scaled for 840 MW:

① The peak output power of the combined PV/battery is $45 \times 8.4 \times 10^6$ W = 378 MW.

② The peak battery charge rate is $60 \times 8.4 \times 10^6$ W = 504 MW.

③ The peak discharge rate is $40 \times 8.4 \times 10^6$ W = 336 MW.[8]

[8] The ExA is encouraged to seek verification from a current grade A Physics student or a Physics teacher.