Fit4Finance

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Portfolio Bridge

Onshore Wind and Battery Energy Storage System (BESS)

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Table of Contents

Table of Contents **2**

Purpose of Portfolio Bridge **3**

What is this document for? 3

Why this document is important? 3

What this document does (and does not) 3

Using this Guidance in Practice **4**

Asset Pairing **4**

I. ANCHOR/SUPPORT ASSET 4

II. SUMMARY 4

III. FINANCIAL 7

Development Pros: 7

IV. INVESTMENT 9

V. DEVELOPMENT (Design/Planning/Grid/Build) 11

VI. CONSTRUCTION 12

VII. OPERATION 12

VIII. TRENDS 13

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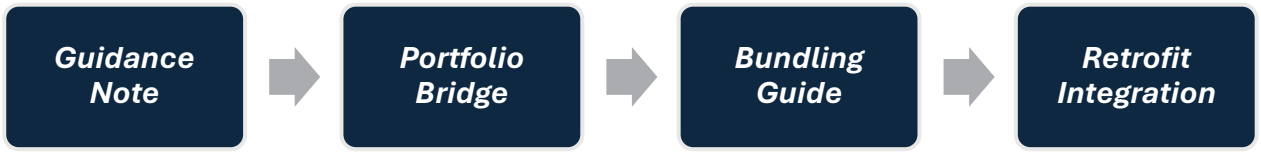
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Purpose of Portfolio Bridge

What is this document for?

The Portfolio Bridge is designed to connect single-technology project guidance with a portfolio-based approach to investment and delivery. Its purpose is to translate individual asset types into a form that allows them to be commercially and financially assessed, combined, compared, and structured as part of multi-asset bundles.

The Portfolio Bridge is designed to be used in the following sequence:



Most forms of external investment and finance are deployed at a portfolio level rather than on small standalone projects. The Portfolio Bridge addresses this gap by explaining how each technology functions within a bundle, which other assets it complements, and how its data, risks, and commercial characteristics should be interpreted at a portfolio level.

Why this document is important?

The Portfolio Bridge is important because it enables consistency and interoperability across different technologies. Without it, projects developed using separate playbooks cannot easily be aggregated, modelled together, or presented to funders in a standardised and credible way. By establishing common portfolio-facing logic, the Portfolio Bridge supports scale, reduces transaction friction, and strengthens the credibility of Local Authority portfolios in the eyes of funders and investors.

What this document does (and does not)

The Portfolio Bridge:

- defines the typical role of each asset type within a bundle (e.g. anchor, support stabilising, enabling)
- sets out which other technologies it naturally complements and why
- explains how the asset bundle contributes to asset development, construction and operation and portfolio economics and risk

The Portfolio Bridge does **not**:

- replace or duplicate the technical and commercial guidance in the single-technology playbooks
- provide specific project designs or engineering solutions
- determine which projects should or should not proceed on a standalone basis
- act as a financing manual or substitute for legal, financial, or technical advice

Instead, it provides the essential connective layer that allows single-asset guidance to be applied coherently within a portfolio and bundling context.

Using this Guidance in Practice

The Portfolio Bridge for Wind and BESS should be used as the link between early project identification and the Bundling Guide. It translates individual wind and storage opportunities into a consistent, portfolio-ready format.

At this stage, projects are often:

- defined inconsistently across sites, teams, or development stages
- subject to significant uncertainty around yield, planning, and grid access
- lacking comparable technical, financial, and commercial assumptions
- unclear in their role within a wider bundle

The Portfolio Bridge resolves this by defining each asset's role, complementary interactions, key risks (including planning and aviation), revenue pathways, and the standard project data required to assess and integrate it within a portfolio. These outputs are then used in the Bundling Guide to group, assess, and progress projects through the finance stage gates.

Asset Pairing

I. ANCHOR/SUPPORT ASSET

Co-locating wind with Battery Energy Storage Systems (BESS) is relatively rare in the UK. However, where co-location does occur, wind tends to be the anchor asset.

The sizing of the wind and storage assets is dependent on:

- Revenue: the relative value of the forecast wind and BESS revenue streams
- Capital costs: the relative value of the wind and BESS capital costs
- Regulatory and market drivers: Subsidies, wholesale electricity market prices and volatility, government intervention, grid requirements and market perception of the relative risk of the technologies will all impact the future development of each technology as an anchor or support asset
- Technical constraints: The export / import capacity on the grid

II. SUMMARY

Co-locating wind and BESS (Bundling) can have significant Financial, Investment, Development, Construction and Operational implications and should be carefully considered on an ongoing basis at each stage of a project's assessment and development.

Bundling wind and BESS is relatively untested in the UK but could provide revenue optimisation and cost reduction opportunities as well as development, construction and operational synergies, however the benefits of doing so may be project specific and will also be impacted on an ongoing basis by many factors including:

- Electricity prices and volatility
- Market developments
- Flexibility revenues

- Regulation and market contracts
- Relative capex and opex costs
- Planning and grid
- Investor confidence and market forecasts

Implications	Pros	Cons	When to bundle
Financial	**Development** Double project premiums Shared costs **Revenue** Larger revenue stack Energy arbitrage Uncorrelated revenues Reduced curtailment losses **Capex** Shared grid and infrastructure costs **Opex** Shared opex costs	**Revenue** More complex revenue stack Increased variable revenue stack (less opportunity to fix) Reduced co-located battery revenues compared to standalone batteries **Capex** Higher upfront cost	**IRR** Forecast IRR exceeds increase in required rate of return **NPV** NPV of bundled project exceeds non bundled; discount rate expected to be higher for bundled asset. Reference listed battery and wind fund discount rates. **Budgeted Expense** Bundled asset is within budgetary constraints
Investment	**Revenue** Revenue and generation optimisation Long term flexibility **Capex & Opex** Cost savings **Pipeline** Project pipeline optimisation (limited co-located wind and solar assets currently)	**Risk** Enhanced investment risk **Financing** Enhanced financing risk Many investors prefer separate technology pots	**IRR & NPVs** When bundled IRRs and NPVs exceed required hurdle rates (Reference listed battery and wind fund hurdle rates) **Risks** When revenue risk can be commercially managed (i.e. long-term contracts at appropriate prices) **Financing** Commercial finance is available and affordable

			There are sufficient investors comfortable with the technology mix **Investment** Bundled assets are acceptable asset class or expected to become acceptable asset class for target investors
Development	**Design** Potentially optimised system design **Planning** Streamlined planning process Integrated planning documentation Enhanced justification **Grid** Shared grid connection	**Design** Increased design complexity **Planning** Increased complexity	**Design** System optimisation outweighs increased complexity **Planning process** streamlined / planning dates not delayed/brought forward **Grid applications** Streamlined / grid dates not delayed/ brought forward
Construction	**Management & Works** Shared infrastructure & civils works and installation **Capex** Cost savings **Environmental** Reduced environmental impact	**Management & Works** Increased build complexity and management **Capex** Higher overall project cost	**Management & Works** Timelines reduced **Capex** Economies of scale Project cost within budgetary constraint
Operation	**Export** Export smoothing Reduced Curtailment Enhanced flexibility **Management & Operations** Single asset manager	**Export Constraint** Constrained battery export **Management & Operations** Enhanced asset management required	**Export** Co-location alleviates demand on National Grid Forecast constraints on battery operation are factored into

	Operational synergies (combined site visits/reporting for bundled assets)	Higher qualification/skill requirements	financial assessment **Management & Operations** Qualified asset managers are available
Trends	**Intermittency** Increased forecast intermittency	**Large Battery Pipeline** Increased battery pipelines make forecasting difficult	**Intermittency** Forecasts expect intermittency and battery revenues to increase / support IRRs **Pipeline** Forecasts expect pipeline to undermine standalone project revenue streams and IRRs

III. FINANCIAL

Development Pros:

Double Project Premium: The potential for double project premiums for wind and BESS co-located sites coupled with development, operational and financial benefits could lead to an increasing trend of co-located wind and BESS sites.

Shared Planning / Environmental and Technical Studies: Planning application and required assessments may apply to both assets and can be combined

- Planning (statement, design and access, EIA, screening/scoping) (one set of professional fees)
- Ecology surveys
- Landscape and visual impact assessment (LVIA)
- Flood risk assessment
- Cultural heritage and archaeology
- Transport and construction traffic assessment
- Noise assessment

Revenue Pros:

Larger revenues compared with single technology site.

Energy arbitrage low value energy generation can be stored and sold during high price periods.

Uncorrelated revenues acting as a natural "hedge". Energy price volatility and negative pricing is a benefit to BESS asset revenue streams and risk profile and a negative to wind asset revenue streams and vice versa.

Reduced curtailment losses excess wind generation can be stored instead of curtailed during congestion or negative price periods.

Revenue Cons:

Complex Revenue Stack: More difficult to forecast

Higher Variable Revenue Stack: 100% of the wind revenue can be fixed for periods of up to 30 years, often at a limited discount to merchant forecasts (particularly for shorter term fixes). For BESS fixed tolling agreements and floors exist for battery revenue streams but they are often at a significant discount to unfixed revenue stacks and for relatively short periods.1

Capex Pros:

Grid: Payments to secure grid connection, and later to install physical grid related equipment can be shared between the two technologies. These costs are based on a project's required grid capacity, not how much power travels through it. Combining two technologies to more thoroughly utilise a grid connection is therefore an efficient way of achieving economies of scale.

Shared Infrastructure: Fencing, roads, transformers, substation and SCADA (Supervisory Control and Data Acquisition) systems can be shared between projects.

Capex Cons:

Higher Upfront Capital Requirements: Wind ~£1,500k/MW2; Wind + Battery ~£2,000/MW3

Operational Cost Benefits:

General: Co-located projects will typically be able to achieve operational cost efficiencies from two technologies co-habiting the same site.

Lease Costs: Relative to separate standalone projects reduced lease costs per project

O&M Costs: Relative to separate standalone projects reduced costs per project, contractors should be able to combine site visits across technologies and monitoring should be achievable under a single contract.

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[1] **Pexapark: What is a PPA/Guide to PPAs**

[2] **Renewable Energy Generation Cost and Technical Assumptions – Onshore Wind and Solar PV: Cost of Electricity Report Update 2024**

[3] **Modo Energy Research Round Up August 2024**

IV. INVESTMENT

Co-locating wind and BESS can maximise investors' returns by increasing revenue potential, lowering costs and enhancing long-term asset value.

Overall investment risk however is perceived as higher with a co-located installation which is why listed UK wind funds either have no battery allocation or cap the battery allocation.[4] [5]

Investment Pros:

Revenue optimisation: Price arbitrage, curtailment and negative price management.

Generation optimisation: Surplus generation can be stored rather than curtailed.

Cost Savings

Shared development costs: Development savings

Shared infrastructure, grid and inverters: Capex savings

Shared operating costs: Opex Savings

Long term flexibility: As wind penetration increases long term margins may decline due to electricity price cannibalisation, conversely as renewable penetration increases BESS margins may increase as increased flexibility services are required and price volatility increases. Co-located wind and BESS projects will be better placed to mitigate the impact of price cannibalisation and adapt to evolving market rules and pricing structures than standalone projects.

Investment Cons:

Investor Preference

Many investors prefer to keep technologies unbundled to facilitate risk assessment and fund allocation. Bundling technologies together may therefore complicate funding.

Enhanced Risk

The key drivers of wind investment return are capex, yield and electricity price and all of these can be significantly derisked.

Capex and construction risk can be largely passed onto the EPC contractor.

Long term generation should be within 5% of forecast.[6]

Electricity price the electricity price can be fixed under long term Contracts for Difference (20 years in Allocation Round 7)[7] or up to 30 years in corporate power purchase agreements (although more typically at between 5-15

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[4] **Greencoat UK Wind 2024 Annual Report**

[5] **Reports & publications - TRIG**

[6] **Greencoat UK Wind 2024 Annual Report**

[7] **PV Magazine July 2025**

years). The cost of fixing the electricity price is not necessarily at a significant discount to merchant prices as the other side of the contract is also benefitting from reducing electricity price volatility.

The key drivers of battery investment return are capex, operating performance of the battery and the price for services.

The operating performance of batteries and their ability to enter different revenue stacks some of which do not yet exist is still relatively untested.

Battery revenue stacks are varied and should increase renewable energy deployment and an increase in intermittent electricity supply. However, they are also highly uncertain and will be sensitive to the level of BESS deployment.

Risk Mitigation:

Revenue Smoothing: Batteries can mitigate wind price cannibalisation by shifting power output to higher-value hours. Batteries can also reduce exposure to negative prices, which are expected to be increasingly frequent with renewable energy penetration.

Increased revenue streams (with various durations and predictability)

Uncorrelated revenues acting as a natural "hedge". Energy price volatility and negative pricing is a benefit to BESS asset revenue streams and risk profile and a negative to wind asset revenue streams and vice versa.

Reduced curtailment losses excess wind generation can be stored instead of curtailed during congestion or negative price periods.

Long Term Contracts: Both wind and BESS projects can be de-risked by introducing long term contracts to guarantee a proportion of their revenues. This can be achieved in the following ways.

PPA: can offer (10 year plus) security of income by fixing a guaranteed price per MWh of power generated by the wind project (with potential for inflation-linkage)

Contract for Difference (CfD): 20 year (Allocation Round 7) government backed contracted revenues for renewable energy projects.8 9 10

BESS optimisation floor: long-term (up to 10-year) minimum profit floor guaranteed by the optimiser trading the BESS.

Capacity market: Up to 15-year contracted revenues for the BESS element available from National Grid (subject to auction).

Tolling Agreements: BESS asset owners can receive a fixed long term fee for operational control of the batteries to an optimiser, effectively turning variable cashflows into fixed cashflows.11

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[8] **Smartest Energy: CfD AR7 results**

[9] **Catapult: (AR7) Results and Analysis**

[10] **Osborne Clarke: The Energy Transition**

[11] **Gresham House Media**

However, it should be noted that BESS contracted revenues are generally at a higher discount to the prevailing market price and for a shorter duration reflecting the perception of increased risk associated with BESS revenue streams.

V. DEVELOPMENT (Design/Planning/Grid/Build)

Design Pros:

Optimised System Design: Co-locating wind and BESS allows the design to maximise the energy capture, storage and dispatch efficiency.

Design Cons:

Increased Complexity: Co-locating wind and batteries increases complexity with regard to energy management systems, software controls and fire and safety design.

Planning Pros:

Streamlined Planning Process: Submitting a single planning application for both wind and BESS reduces duplication of effort and administrative costs.

Nationally Significant Infrastructure Project (NSIP) Removal: Projects exceeding 100 MW are deemed NSIP projects, with applications made to the Secretary of State rather than the Local Planning Authority. NSIP applications are typically slower and more expensive. From 2020, BESS and co-located storage were removed from the NSIP regime, removing this legislative impediment to co-location.

Integrated Planning Documentation: Impacts such as visual, noise and ecological effects can be assessed collectively reducing overall mitigation requirements.

Enhanced Justification: Demonstrating that storage complements the wind installation can strengthen the planning application due to:

- Alignment with UK government energy policy (supporting renewable integration and grid flexibility)
- Efficient land use
- Visual impact is incremental, not new

Planning Cons

Separate Planning Permissions: Wind and BESS components may require separate planning permissions depending on the project structure and consenting route, increasing administrative complexity, cost, and potentially programme timescales.

Fire and Safety Concerns: Battery systems have stricter fire safety requirements than wind turbines.

Consent Complexity: Environmental consents may become more complex with increased visual, heat and chemical risk considerations.

Grid Pros:

Shared Grid Connections: Wind and BESS can use the same grid connection point which may improve connection capacity utilisation.

VI. CONSTRUCTION

Build Pros:

Shared infrastructure and reduced civil work: Fencing, access roads, internal roads, civils works and security can be shared between wind and battery components.

Simplified electrical integration: AC/DC cabling, switchgear, transformers can be installed together.

Cost savings: See Financial Benefits.

Accelerated commissioning and testing: Co-location alongside sufficient onsite demand may negate the need for an export connection and avoid potential lengthy grid connection queues. Wind output can be tested immediately, allowing early detection of design or performance issues.

Reduced environmental and regulatory impact: Combined projects reduce soil disturbance, vegetation clearing and dust generation over separate builds.

Build Cons:

Increased Complexity: More complex electrical design and protection, larger substations and protection equipment required.

VII. OPERATION

Reduced Curtailment: Wind projects co-located with storage allow excess generation to be stored and released to the grid later when generation from the wind project is lower. Co-locating wind and storage may also allow a wind project to reduce exposure to negative-price periods, when the generating unit would either have to pay to generate or shut off its export. Negative pricing is expected to become increasingly significant in the UK as the electricity grid is decarbonised.

Operational Flexibility: Co-located wind and BESS projects can dynamically switch operating models, increasing commercial resilience to short- and long-term market and regulatory changes.

- Energy Markets: charge from wind (or the grid) when prices are low, discharge when prices are high and reduce exposure to negative prices.
- Ancillary Services: switch to prioritisation of ancillary services where prices dictate prioritisation.

Asset and Operation Management: Co-located wind and BESS systems can be managed by a single asset and technical manager reducing costs and increasing scale and co-ordination.

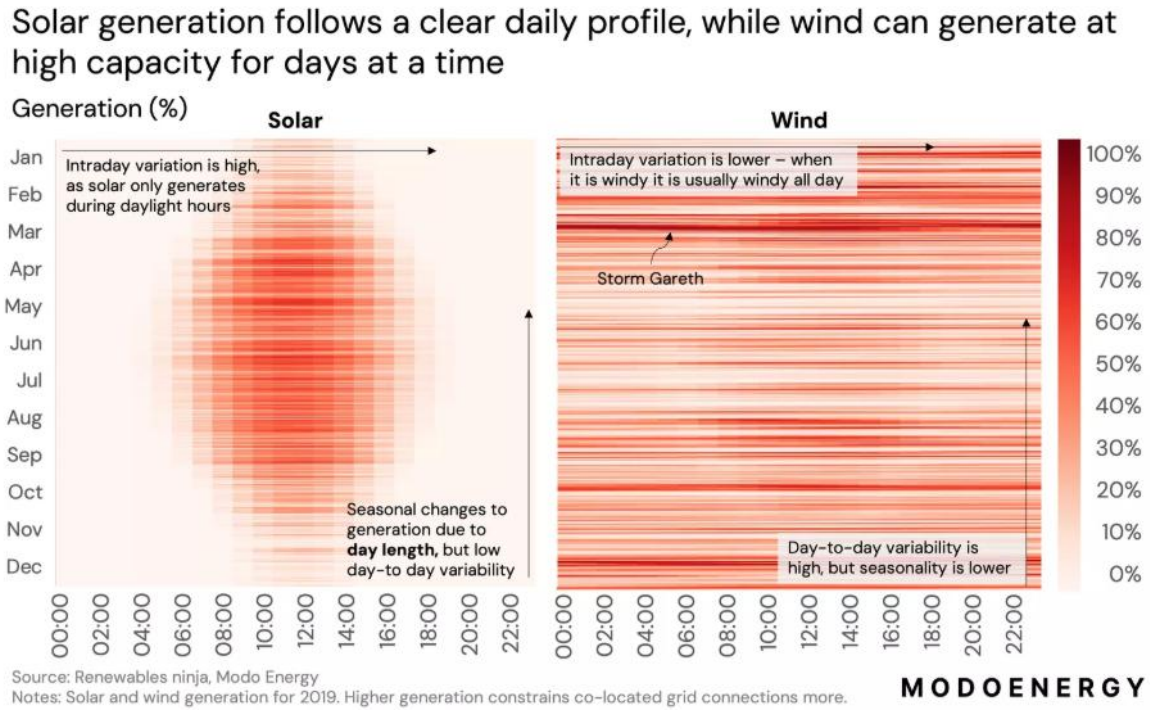
- Single site control room and monitoring
- Combined financial, technical and regulatory reporting
- Combined capacity site providing economies of scale
- Co-ordinated site and O&M management

Limits of Co-location: While co-location can smooth export, reduce curtailment and improve operational flexibility, it is not a perfect solution to the challenges of intermittent generation and a constrained grid. Depending on the sizing configuration of the wind and BESS, there will still be peaks and troughs in export, a

degree of curtailment, potential exposure to negative prices and a limit to the operational flexibility of the installation.

The limits of co-location are exacerbated with wind compared to solar generation.

Constraints on battery operations: Wind and solar have different generation profiles. Solar generation only constrains battery export during peak daylight hours when prices are typically low. However, wind generation can be high throughout the day for days at a time.



The maximum daily average generation for a solar farm in 2019 was 26%. For wind, this was 92%, with 42 days above 70%. This means that optimisers of a co-located solar battery should almost always be able to fully discharge a battery, although sometimes at a lower price. However, for a co-located wind battery, there will be days when it may not be able to profitably export enough power to complete two cycles.

VIII. TRENDS

There is currently 6.8GW of BESS in the UK, the government's Clean Power 2030 Action Plan estimates that between 23-27GW of BESS will be required by 2030 and National Grid ESO forecast that over 50GW of energy storage will be necessary to reach net zero by 2050. 12 13 14

This would indicate that, at current rates, there will be an increase in intermittency and potential battery revenue streams.

However, there is currently 60GW of consented BESS capacity and a total pipeline of 127GW indicating that the current pipeline of projects exceeds the actual BESS requirement and while there are significant hurdles in

[12] **Renewables UK: Energy Pulse: Where the UK battery market stands in 2025**

[13] **www.gov.uk: clean power 2030 action plan**

[14] **Renewablers UK: why-battery-energy-storage-systems-are-crucial-to-the-uk-s-clean-power-future/**

increasing deployment in the form of grid connection delays, insufficient manufacturing capacity, high upfront capital costs and uncertain revenue streams any oversupply of BESS projects is likely to have a significant negative impact on BESS revenues and the benefits of bundling.

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0.1	15-JAN-26	Draft	Ed Goldsworthy and Nicholas Sia Han Ming	Justin Olosunde	07-AUG-26
1.0	**30-SEP-26**	**Version 1.0**	**Nicholas Sia Han Ming**	**Dora Hargitai**	**30-SEP-26**