GB Battery Energy Storage System (BESS) Revenue Streams

Core Principle: BESS leverage flexibility (fast charge/discharge, energy storage) to capture value in different GB electricity markets. Optimization software is crucial for maximizing profit across streams while managing State of Charge (SoC) and degradation.

1. Wholesale Market Arbitrage

- What: Buy low, sell high in wholesale electricity markets.
- How: Charge when prices are low (e.g., night, high renewables), discharge when high (e.g., peaks).
- Markets: Day-Ahead (auction), Intraday (continuous trading closer to real-time).
- Value: Price Spread (£/MWh) - Efficiency Losses. Driven by price volatility.

2. Ancillary Services (Frequency Response)

- What: Services sold to National Grid ESO to maintain grid frequency (50Hz).
- How: Rapidly adjust charge/discharge based on frequency deviations.
- Key Services:
  - Dynamic Containment (DC): Very fast (<1s) post-fault response (DC-L: discharge for low freq, DC-H: charge for high freq). Primary BESS frequency service.
  - Dynamic Moderation (DM): Slower (<10s) response for managing smaller, pre-fault deviations.
  - Dynamic Regulation (DR): Continuous, proportional response for fine-tuning frequency.
  - (Mention FFR as older service being replaced)
- Value: Primarily Availability Payments (£/MW/h) via auctions; sometimes Utilisation Payments (£/MWh). Driven by system need for stability.

3. Balancing Mechanism (BM)

- What: ESO's real-time tool (<1hr ahead) to balance supply/demand.
- How: Submit Bids (price to charge) and Offers (price to discharge) to ESO. Accepted Bids/Offers are dispatched.
- Value: Accepted Bid/Offer Price (£/MWh), potentially higher/lower than wholesale during system imbalance. Driven by real-time system needs & strategic bidding.

4. Capacity Market (CM)

- What: Ensures long-term security of supply via availability payments.
- How: Win multi-year contracts in auctions (T-4, T-1) to guarantee availability during winter peak stress events. Subject to penalties if unavailable.
- Value: Stable, fixed Availability Payments (£/kW/year). Driven by long-term capacity needs. Affected by asset duration (derating factors).

Key Considerations:

- Revenue Stacking: Combining participation in multiple markets (where rules permit) is key to maximizing value.
- Co-optimization: Software needed to decide best action across markets considering prices, SoC, efficiency, and degradation.
- Degradation: Cycling the battery incurs a physical cost which must be factored into strategy.
- Market Evolution: Rules, services, and prices constantly change (e.g., move to dynamic services, potential new markets).

Common Acronyms:

- BESS: Battery Energy Storage System
- ESO: Electricity System Operator (National Grid)
- BM: Balancing Mechanism
- CM: Capacity Market
- DC: Dynamic Containment
- DM: Dynamic Moderation
- DR: Dynamic Regulation
- FFR: Firm Frequency Response
- SoC: State of Charge
- BSC: Balancing and Settlement Code