Methodology Note: Capture Plant CAPEX Benchmarking

Purpose and Scope

This methodology note outlines the approach used to benchmark capital expenditure (CAPEX) for carbon capture plants across a range of emitter types and project configurations. The analysis supports the generation cost modelling undertaken by DESNZ by providing comparative cost data for retrofit and new-build capture installations, adjusted to a common reference year and scale. The benchmarked data informs techno-economic assumptions for future deployment scenarios of carbon capture and storage (CCS) technologies in the UK.

Data Sources and Project Selection

The benchmarking draws on a curated set of 13 capture plant projects, spanning various emitter types including combined cycle gas turbines (CCGT), cement, energy-from-waste (EfW), and bioenergy with carbon capture and storage (BECCS). Projects were selected based on availability of detailed engineering, procurement and construction (EPC) cost data, and represent a mix of:

- New build and retrofit configurations
- FEED, FID, and post-FEED maturity levels
- UK, US, Norwegian, and Swedish locations
- Solvent technologies including Shell CANSOLV, MEA, Piperazine, and proprietary systems

Sources include Class 2 bids, FEED studies, EPC press releases, and agreed cost estimates from project developers and contractors.

Normalisation and Adjustments

To ensure comparability across projects, all CAPEX figures were normalised to Q1 2025 GBP (£) using appropriate escalation indices and exchange rates. Adjustments were applied for:

- Inflation escalation using DCCI and CPI indices
- Construction period escalation (typically 2% p.a.)
- Location factors to account for regional cost differentials
- Scaling to a common CO_2 input rate of 252 t/h and 98% design capture rate

- Flue gas CO_2 concentration effects Where necessary, scope adders and removals were applied to align project scopes with a standardised capture plant boundary, excluding CO_2 transport, liquefaction, and storage infrastructure.

Cost Metrics and Uncertainty

The primary cost metric used is EPC cost per tonne of CO_2 input capacity (GBP/t/h), supplemented by total CAPEX (P85) per tonne of CO_2 input. Uncertainty ranges were applied to reflect estimation maturity and scaling assumptions:

- ±10% for high-confidence Class 2 bids
- ±20–25% for FEED Class 4 estimates and scaled data
- Additional uncertainty flags for projects with extrapolated scope or limited public data

No adjustments were made for performance risk premiums or sustainability incentives beyond those already embedded in contractor estimates.

Key Assumptions

- All capture plants are assumed to operate continuously at design capacity
- Heat integration with host facilities is assumed where applicable (e.g. cement kilns)
- Flue gas pretreatment requirements are excluded unless explicitly costed
- Capture rate and solvent performance are assumed to meet design specifications

Use in Generation Cost Modelling

The benchmarked CAPEX data feeds into levelised cost of electricity (LCOE) and abatement cost modelling for CCS-enabled generation technologies. Capture plant costs are paired with power plant CAPEX and OPEX assumptions to derive full-chain economics. The data also supports sensitivity analysis around technology maturity, scale, and regional deployment.