Peterhead CCS Project

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Executive Summary

Her Majesty's Government (HMG) Autumn Statement and Statement to Markets on 25 November 2015 regarding the Carbon Capture and Storage Competition confirmed that the £1 billion ring-fenced capital budget for the Carbon Capture and Storage Competition was no longer available. This meant that the Competition could not proceed on the basis previously set out. In accordance with the agreements with DECC, the Peterhead FEED was completed as planned in December 2015. The Government and Shell are committed to sharing the knowledge from UK CCS projects, and this Key Knowledge Deliverable represents the evolution and achievement of learning throughout the Peterhead FEED and Shell's intentions for the detailed design, construction and operating phases of the project at the time of HMG's Statement to Markets. After the announcement the tender and CAPEX/OPEX development activities were stopped and this document represents the stage of development for each scope at the time of the announcement. The Landfall, pipeline and subsea and Goldeneye Topsides Modifications tender and CAPEX development activities were completed. A near final cost is provided for the CCCC Plant. An indicative cost for the Power Plant scope is presented that would have required further refinement if the project was progressing. With respect to OPEX, the costs related to the Power Plant scope would have needed refinement pending the discussions with the Power Plant vendors.

The purpose of this document is to provide an overview of the Front End Engineering Design (FEED) cost performance and also the costing of the Execute phase of the Project, in terms of capital expenditure (CAPEX) and operating expenditure (OPEX), for the purpose of providing CCS developers with refined cost information.

The original FEED study budget was £43,820,017 inclusive of £2 million contingency. At the end of FEED the FEED budget and estimate at completion reflect that approximately £1.5 million of the contingency has been used. As a result, the PCCS Project FEED study was completed on time and under budget. The largest use of contingency was associated with the de-risking of the pipeline landfall design, including the decision to execute a HDD trial bore hole, undertaken to confirm the technique can be employed for the rock conditions at Peterhead.

The CAPEX and OPEX estimates for the Execute phase of the PCCS project are based upon information available at the end of FEED in December 2015. The CAPEX cost estimate and estimate uncertainty takes into account information received from the Execute EPC tendering process. Both estimates are inclusive of contingency. Although final cost and schedule tender information were not available for all the engineering, procurement and construction (EPC) tenders for the Execute phase at the time of HMG's Statement, it is not expected that the final information would have deviated significantly from the figures presented in this document.

The PCCS Project Execute phase CAPEX estimate covers the anticipated costs prior to entering operations – i.e. engineering, procurement, construction and commissioning costs. The CAPEX estimate is £999.7 million MOD (Money of the Day which refers to an estimate which is inclusive of inflation and escalation to the date of expenditure).

Almost 2/3 of the Execute phase CAPEX costs are associated with the onshore scope including the required power plant modifications and new build Carbon Capture, Compression and Conditioning plant works. The offshore CAPEX components include scope associated with delivering the transportation, platform, wells and subsurface works. The relative cost split is approximately:

- Onshore: 64%
- Offshore: 22%
- Other costs: 14%

Within the Onshore CAPEX estimate, the costs are split approximately according to:

- Power Plant: 26%
- Carbon Capture, Compression and Conditioning Plant: 74%

The OPEX estimate considers costs between 2016 and 2041 and is reported in RT2015. It includes some cost incurred prior to commencing operations which includes an element for facility maintenance and operation that will increase or decrease in relation to changes in the project schedule, a 15-year injection period and a period of monitoring post injection which will not be affected by project schedule change. The OPEX estimate excludes future decommissioning or abandonment costs. The OPEX estimate is £3,668.7 million RT2015 (Real Time 2015 - Value escalated to account for Market conditions) with largest cost being from the Power Plant OPEX element (81%) and the remaining 19% from the Carbon Capture, Transport and Storage element. The fuel gas expenditure for the gas turbine supplying flue gas to the PCCS Project is the dominant cost in the OPEX estimate.

The OPEX estimate is broken down into:

- Power Plant: 79%
- Capture, Transport, Storage, Metering Monitoring and Verification: 21%

Within the Power Plant OPEX estimate, the costs are split approximately according to:

- Fuel Gas: 64%
- Other: 36%

1. Introduction

The Peterhead Carbon Capture and Storage (CCS) Project aims to capture around one million tonnes of CO_2 per annum, over a period up to 15 years, from an existing Combined Cycle Gas Turbine (CCGT) located at SSE's Peterhead Power Station in Aberdeenshire, Scotland. This would be the world's first commercial scale demonstration of CO_2 capture, transport and offshore geological storage from a (post combustion) gas-fired power station.

Post cessation of production, the Goldeneye gas-condensate production facility will be modified to allow the injection of dense phase CO_2 captured from the post-combustion gases of Peterhead Power Station into the depleted Goldeneye reservoir.

The CO_2 will be captured from the flue gas produced by one of the gas turbines at Peterhead Power Station (GT-13) using amine based technology provided by Cansolv (a wholly owned subsidiary of Shell). After capture the CO_2 will be routed to a compression facility, where it will be compressed, cooled and conditioned for water and oxygen removal to meet suitable transportation and storage specifications. The resulting dense phase CO_2 stream will be transported direct offshore to the wellhead platform via a new offshore pipeline which will tie-in subsea to the existing Goldeneye pipeline.

Once at the platform the CO_2 will be injected into the Goldeneye CO_2 Store (a depleted hydrocarbon gas reservoir), more than 2 km under the seabed of the North Sea. The project layout is depicted in Figure 1-1 below:

Figure 1-1: Project Location

2. Scope

This document provides information on the Front End Engineering Design (FEED) study cost performance and also the costing of the Execute phase of the Project in terms of capital expenditure (CAPEX) and operating expenditure (OPEX), for the purpose of providing CCS developers with refined cost information.

The FEED cost performance information includes a breakdown of the total costs incurred in conducting the FEED: showing the initial budget, current budget, and projected outturn. Emergent FEED costs, in respect of work that was not fully anticipated at the outset of the FEED phase of the Project, are also identified and described.

The CAPEX and OPEX cost estimates, as developed during FEED, for the preparation of the Project cost estimate for the Execute phase of the PCCS Project, are also presented in this cost estimate report. Estimates of cost uncertainties for CAPEX and OPEX outturns are given, together with an explanation of the issues driving those uncertainties.

3. FEED Cost Performance

3.1. Introduction

The PCCS Project FEED Study has been carried out in accordance with the FEED contract signed between DECC and Shell, which was executed in February 2014. The FEED contract is subject to UK and EU state aid rules and covers delivery of an agreed FEED Scope up to a Maximum Amount of £38 million with DECC providing up to a Total Maximum Qualifying Amount of £28.5 million (i.e. 75% of the Maximum Amount). Shell is responsible for 100% of any costs incurred during FEED which are over the Maximum Amount.

3.2. Cost Recovery

Shell's original estimate of the FEED costs included identification of costs eligible for cost recovery from DECC. At the time of signing the FEED Agreement between DECC and Shell in February 2014, Shell estimated there would be some £38m of recoverable costs incurred from February 2014 to December 2015. These costs are defined as "total reimbursable costs" in the FEED Agreement. This was used to determine the DECC TMQA of £28.5m - which is based on 75% cost recovery on eligible costs.

In the FEED Agreement, the FEED study duration was broken down into five separate payment periods. The "maximum qualifying amount" is a contractual term which defined the maximum amount that Shell was entitled to recover from DECC for each of these payment periods.

Cumulative Maximum Qualify Amounts (CMQA) were defined for the five payment periods to up to the Total Maximum Qualifying Amount (TMQA) of £28.5 million as follows:

- Payment Period 1: £6,375,000 (six million, three hundred and seventy-five thousand pounds)
- Payment Period 2: £13,875,000 (thirteen million, eight hundred and seventy-five thousand pounds)
- Payment Period 3: £20,625,000 (twenty million, six hundred and twenty-five thousand pounds)
- Payment Period 4: £25,875,000 (twenty-five million, eight hundred and seventy-five thousand pounds)
- Payment Period 5: £28,500,000 (twenty-eight million, five hundred thousand pounds)

Only recoverable costs were eligible for cost recovery from DECC. "Recoverable costs" are the costs incurred by Shell that are directly related to the execution of the FEED Agreement obligations. Costs incurred in respect of Execute Project Contract or Contract for Difference (CfD) negotiations or expenditure which DECC considered to be non-applicable or excessive for the purposes of executing the FEED Agreement were not deemed eligible for cost recovery. The recoverable costs are used to calculate Shell's claim for 75% cost recovery in each of the payment periods, up to the maximum allowed based upon the relevant CMQA/TMQA value.

A "forecast for recovery" was updated by Shell in monthly reports which were issued to DECC. Both capped and uncapped forecast amounts were provided. The capped amount reflected the TMQA/CMQA that Shell could recover from DECC in the event that £38m of recoverable costs were spent in the execution of the FEED Agreement. The uncapped amount is an arithmetical calculation of how much Shell could potentially recover from DECC if the 75% cost recovery was applied to all recoverable costs incurred by Shell, including those above the £38m total reimbursable costs estimate. However, this uncapped forecast recovery can never be applied in practice due to the existence of the capped CMQA/TMQA values in the FEED Agreement.

Actual costs incurred by Shell in the delivery of the FEED Agreement are detailed in subsequent sections of this report. The cumulative recoverable costs for the FEED contract and identification of the five payment period durations are provided in Figure 3-2 below.

3.3. Total FEED Costs Breakdown

Initial and actual FEED cost information is presented in Table 3-1

Table 3-1: Breakdown of FEED Project Costs

FEED SCOPE	Original Budget £	Latest Budget (December 2015) £	Actual Cost (December 2015) £
PROJECT MANAGEMENT	12,564,643	11,564,643	11,310,913
COMMERCIAL	3,639,335	3,664,335	3,343,659
ONSHORE	16,451,449	17,049,449	17,072,223
PIPELINES & SUBSEA	1,943,340	3,443,686	3,402,043
PLATFORM	1,741,434	1,841,434	2,092,157
WELLS & SUBSURFACE	2,659,799	2,596,799	2,754,254
OVERHEADS	2,820,017	3,194,317	3,326,564
100% TOTAL	41,820,017	43,354,663	43,301,813
CONTINGENCY	2,000,000	465,354	0
TOTAL INCL. CONTINGENCY	43,820,017	43,820,017	43,301,813

The table above shows values for the original budget, latest budget (at end December 2015) and the actual FEED costs (at end December 2015). It is broken down into the project components which were developed based upon the assigned FEED contracts and work scopes. Contingency provision is also indicated. The provision of contingency within the Project is a standard project management process to allow for the funding of uncertain scope elements in the risk reduction phase.

The FEED agreement provided detail on the planned breakdown of the project by discipline. The work breakdown structure below was used to demonstrate where the costs including manhours by discipline were booked during the FEED phase.

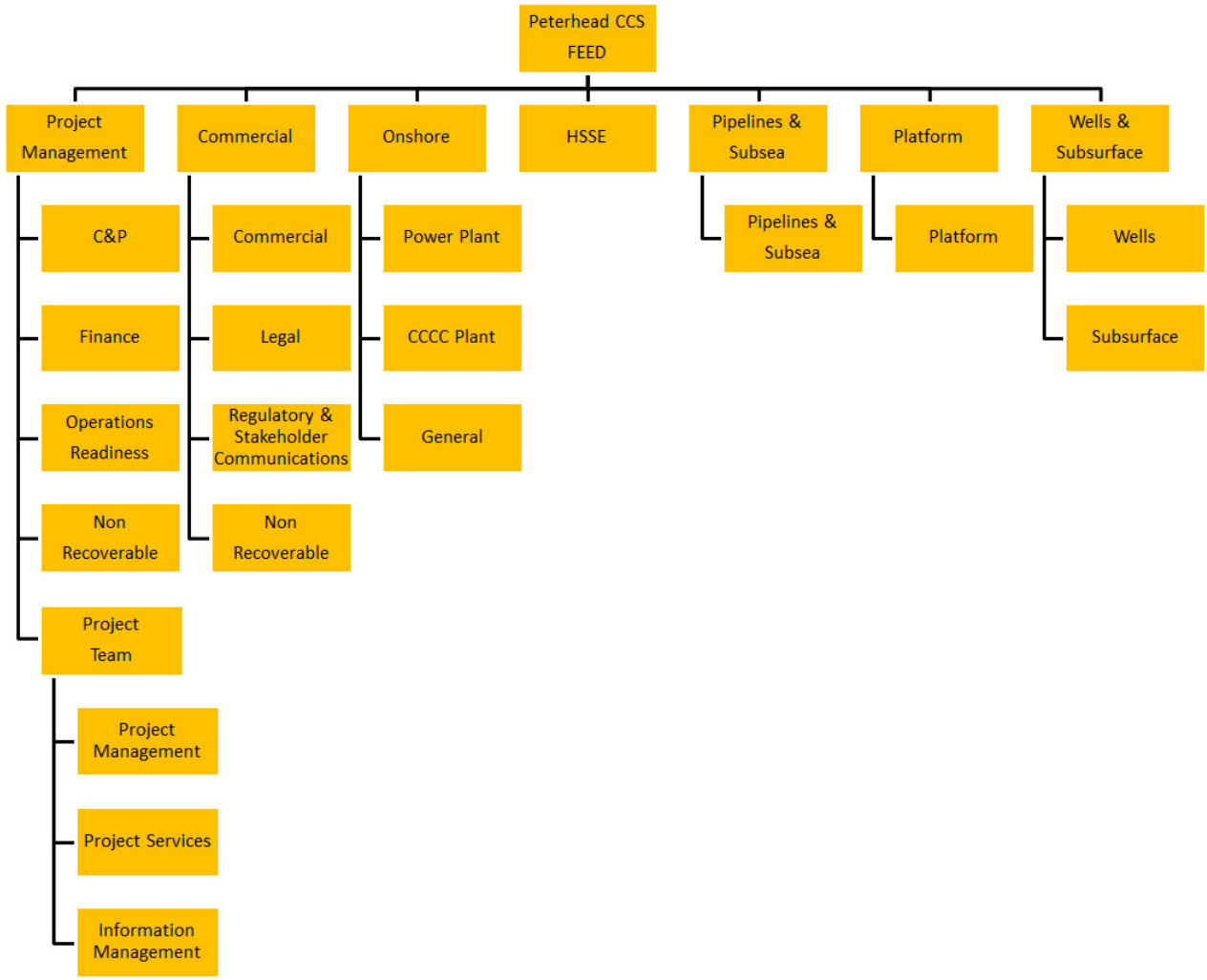


Figure 3-1: PCCS FEED Study – Work Breakdown Structure

The tabular cost report below shows a breakdown by the major sub-components of the project. The costs shown are 100% project costs, with the recoverable costs broken out in the sub-total section. Non Recoverable Costs are project costs not eligible for recovery from DECC: e.g. work on the Execute Project Contracts and CfD inputs.

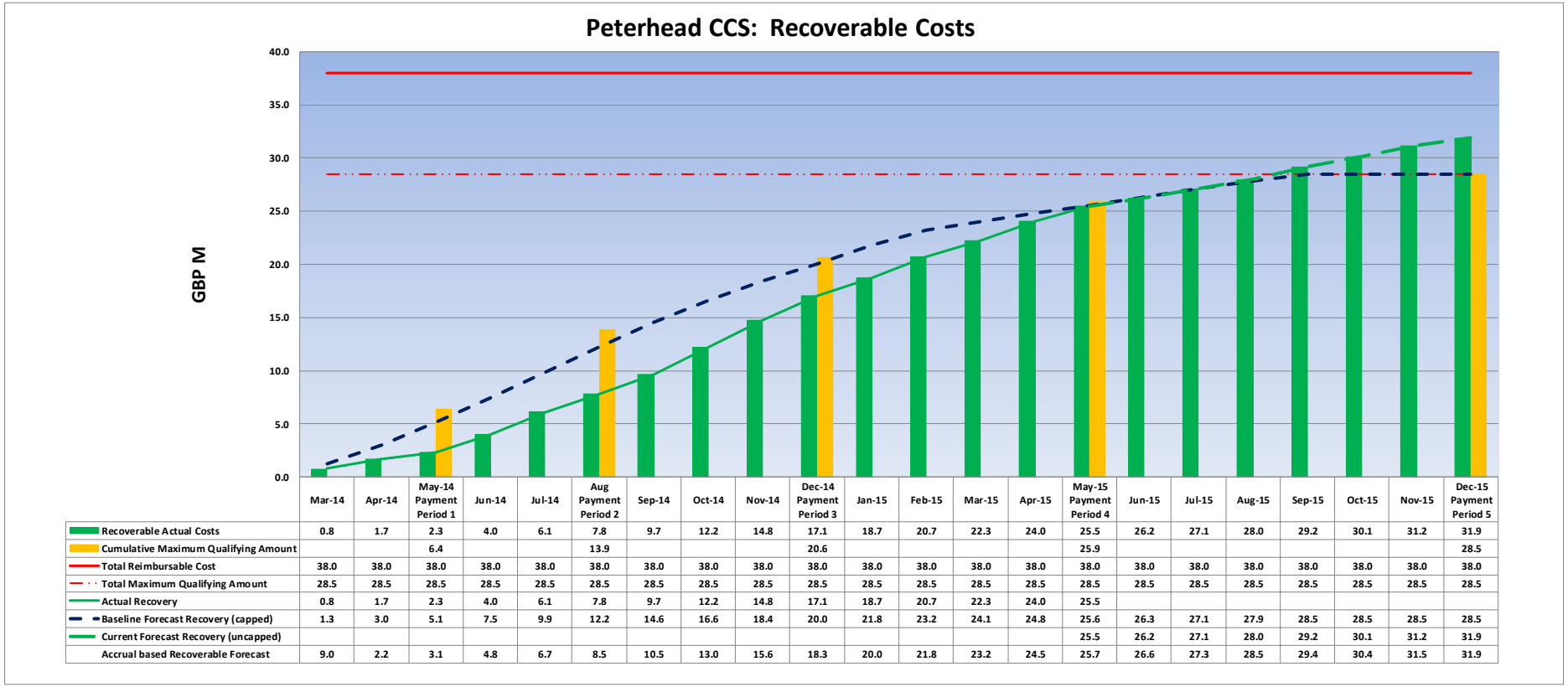
Table 3-2: Breakdown of FEED Project Costs by WBS

Work Breakdown Structure (WBS) Description	Original Budget £	Actual Cost (December 2015) £
FEED C&P Support	1,024,950	1,192,300
FEED Finance Support	407,255	545,813
FEED Ops and Maint. Support	1,008,433	1,409,464

Work Breakdown Structure (WBS) Description	Original Budget £	Actual Cost (December 2015) £
FEED Project Team	7,561,923	6,177,667
FEED Project Team - Non Recoverable	0	143,884
FEED Project Management - PMO	2,500,000	1,714,872
FEED Project Management - Third Party	62,082	126,913
PROJECT MANAGEMENT	**12,564,643**	**11,310,913**
FEED Commercial Support	907,041	797,867
FEED Legal Support	488,407	498,224
FEED Commercial Non-Recoverable	372,242	499,203
FEED Regulatory and Comms	1,621,645	1,299,362
FEED Regulatory and Comms - Third Party	250,000	249,003
COMMERICAL	**3,639,335**	**3,343,659**
FEED Onshore	2,104,950	2,577,329
FEED Onshore - SSE	3,400,000	3,432,950
FEED Onshore - Technip	9,051,499	9,135,496
FEED Onshore - PMO CCCC	0	434,423
FEED Onshore - Third Party	1,895,000	1,492,025
ONSHORE	**16,451,449**	**17,072,223**
FEED Pipelines and Subsea	1,028,340	1,327,488
FEED Pipelines and Subsea - Third Party	915,000	2,074,555
PIPELINES & SUBSEA	**1,943,340**	**3,402,043**
FEED Goldeneye Platform	1,659,321	2,067,779
FEED Goldeneye Platform - Third Party	82,113	24,378
PLATFORM	**1,741,434**	**2,092,157**
FEED Wells and Subsurface	2,142,799	2,446,011
FEED Wells and Subsurface - Third Party	517,000	308,243
WELLS & SUBSURFACE	**2,659,799**	**2,754,254**
Overheads	2,820,017	3,326,564
100% TOTAL	41,820,017	43,301,813
CONTINGENCY	2,000,000	0
TOTAL	**43,820,017**	**43,301,813**

The following chart shows the recoverable costs accrued to date and the cumulative maximum qualifying amount for each payment period. The graph also reflects the total reimbursable costs, total

maximum qualifying amount and the forecast for recovery - capped and uncapped (for information only). The accrual based recoverable forecast is also shown for information.



	Mar-14	Apr-14	May-14 Payment Period 1	Jun-14	Jul-14	Aug Payment Period 2	Sep-14	Oct-14	Nov-14	Dec-14 Payment Period 3	Jan-15	Feb-15	Mar-15	Apr-15	May-15 Payment Period 4	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15 Payment Period 5
Recoverable Actual Costs	0.8	1.7	2.3	4.0	6.1	7.8	9.7	12.2	14.8	17.1	18.7	20.7	22.3	24.0	25.5	26.2	27.1	28.0	29.2	30.1	31.2	31.9
Cumulative Maximum Qualifying Amount			6.4			13.9				20.6					25.9							28.5
Total Reimbursable Cost	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Total Maximum Qualifying Amount	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5
Actual Recovery	0.8	1.7	2.3	4.0	6.1	7.8	9.7	12.2	14.8	17.1	18.7	20.7	22.3	24.0	25.5							
Baseline Forecast Recovery (capped)	1.3	3.0	5.1	7.5	9.9	12.2	14.6	16.6	18.4	20.0	21.8	23.2	24.1	24.8	25.6	26.3	27.1	27.9	28.5	28.5	28.5	28.5
Current Forecast Recovery (uncapped)															25.5	26.2	27.1	28.0	29.2	30.1	31.2	31.9
Accrual based Recoverable Forecast	9.0	2.2	3.1	4.8	6.7	8.5	10.5	13.0	15.6	18.3	20.0	21.8	23.2	24.5	25.7	26.6	27.3	28.5	29.4	30.4	31.5	31.9

Figure 3-2: PCCS Recoverable Costs

3.4. FEED Labour

The FEED project is largely study-based. As a consequence, the cost of labour represents the overwhelming majority of costs within the FEED scope. Exceptions to this include fees for equipment hire during site investigation works, licences, application submissions, travel, and certain project overheads. For the FEED study such exceptions were considered to be small.

In general the labour costs, as contracted to Shell, are inclusive of any subcontractor overheads e.g. office, computer and communications facilities, insurance etc.

3.5. Cost of Securing Long Lead Items

During the FEED there was no cost accrued for advance payments, reservation fees, down payments or deposits for long lead items, vessel charters and rigs arising from the supply chain.

3.6. Other FEED Costs

The FEED costs reported above are inclusive of other costs that were managed by use of project contingency. Such costs in FEED included performance of technical studies and physical trials. The principal activities and costs not included in the original base budget are summarised by project area below.

3.6.1. Pipeline Landfall Options

The most significant trial work carried out during FEED was associated with the transportation pipeline landfall options. During FEED, it was decided to progress two options in parallel:

- Horizontal directional drilling (HDD); and
- Open-cut trenching.

Near the end of the FEED study, as part of the Project's risk reduction strategy, it was decided to carry out a trial bore using the HDD technique in order to confirm the rock conditions along the proposed HDD route, at the pipeline landfall. The following work was carried out to support the landfall of transportation pipeline:

- HDD pilot hole works;
- FEED for the open-cut method was performed in parallel with HDD FEED;
- Additional onshore survey work was performed to support the HDD design; and
- Expert review obtained of the report produced on the HDD landfall option.

The total value of these works was less than £1,500k.

3.6.2. Onshore (Capture Plant)

The following work was carried out to support the onshore area FEED.

- Study performed to review and assess the impact of amine degradation;
- Performance of absorber Schoepentoeter computational fluid dynamics modelling;
- Study performed near the end of FEED to de-risk uncertainties in the waste water treatment plant design.

The total value of these works was less than £500k.

3.6.3. Process Design Package

Cansolv provided a Process Design Package to the Onshore FEED contractor. The Process Design Package was incorporated into the FEED Basic Design and Engineering Package DEP by the Onshore FEED Contractor.

3.6.4. Subsurface

The following work was carried out to support the subsurface area FEED.

- Development of subsurface safety value.

The total value of this work was less than £500k.

3.6.5. Subsea

The following work was carried out to support the subsea area FEED.

- Pipe SIM modelling and subsea isolation valve bypass review;
- Pipeline flow assurance study;
- Nearshore pipeline stability study.

The total value of these works was less than £500k.

3.6.6. Application and Lease Fees

Payments for the following items were made during the FEED project.

- Goldeneye storage site lease - payment to the Crown Estate;
- Application for connection of power supply - payment to National Grid.

The total value of these items was less than £100k.

3.6.7. Relevant Work which is not part of the FEED Study Costs

In the Basic Design and Engineering Package (BDEP) Key Knowledge Deliverable – KKD 11.003 [1], reference is made to a solvent testing campaign which was carried out by Cansolv at the Test Centre Mongstad in Norway. Although the results of the testing campaign were used as an input to the FEED study work (as detailed in the BDEP KKD), this cost of this work was borne by the process licensor and was not attributed to the Peterhead CCS Project.

4. Project Cost Estimate

4.1. Introduction

An overview of Shell's standard cost estimation processes is provided along with a description of the cost estimate basis for the Peterhead CCS project. This provides context for the cost estimate information subsequently provided for both capital expenditure (CAPEX) and operating expenditure (OPEX) costs for the Execute phase of the Project which are summarised below. The CAPEX estimate covers the anticipated costs prior to entering operations – i.e. engineering, procurement, construction and commissioning costs. Costs during the operations period are presented in the OPEX estimate. The cost estimates provided do not include future decommissioning or abandonment costs.

Information on major cost components carrying cost uncertainty is also provided along with summary descriptions of the likely range of risk and reward structures which could be applicable in the CCS supply chain.

4.2. Overview of Shell's Standard Cost Estimation Process

4.2.1. Cost Estimate Accuracy

Cost estimates are prepared by Shell throughout the various phases of the Opportunity Realization Process (ORP). Estimate Types vary from Type 0 (least accurate) to Type 4 (most accurate) as the definition of each opportunity develops and matures through the process – progressing from an factored methodology to the use of detailed Material Take Off (MTO) information.

As the project moves through phases of maturation, the cost estimate should mature in line with the project: As time progresses the base estimate becomes larger as the risk mitigations are incorporated in to the design, the Contingency becomes less as the risks are understood and engineered out and the cost accuracy improves.

Table 4-1: Typical Cost Estimate Accuracies

Cost Estimate Type	Expected Accuracy
Type 1	+40% / -25%
Type 2	+25% / -15%
Type 3	+15% / -10%

4.2.2. Cost Estimate Components and Methods of Representation

The components of a cost estimate generally include:

- Base scope costs;
- Contingency;
- Market factors; and
- Inflation

Costs collected as an input to a cost model at a reference year are typically defined as a base case in terms of Estimate Date Money (EDM). The EDM Escalated cost data refers to a base case estimate which has been escalated by market effects but without inclusion of the effects of inflation. Money of the Day (MOD) applies the effects of inflation to the EDM Escalated value. Real Terms (RT) cost data consider the MOD value discounted to remove the effects of inflation considered at a specific date in time for the purpose of project comparison. The same principles are generally applied when defining CAPEX and OPEX estimates.

Market factors include allowance for market escalation – i.e. experience of a Real Terms cost increase (or decrease) because of the market volatility, over and above the impact of Inflation. Each activity within the estimate also needs to be uplifted to account for inflation and to estimate an equivalent cost at the time of Project Execution.

When preparing cost estimates, contingencies are assessed in order to arrive at a validity of the estimate with an accepted confidence level. Contingencies are assigned in order to raise the estimate to achieve a 50% confidence level, i.e. there is an equal chance that the 'as built' cost of the project will show an over or under expenditure. This figure is usually referred to as the "50/50" or "P50"

estimate and is, in statistical terms, the median of the range of possible final expenditure outcomes. The accuracy band for a cost estimate is defined by the range of costs from the P10 (10% probability that the project will come in on or under budget) to P90 (90% probability that the project will come in on or under budget).

4.2.3. Contingency and Cost Uncertainty Modelling

Contingency is added to a cost estimate to allow for further scope definition emerging in subsequent phases, and risks which have not been identified in the present project phase. It also covers minor design and field changes but does not include major scope changes, such as increased throughput/concept/layout. Contingency in the Peterhead CCS FEED study cost estimate was calculated using a probabilistic method, consistent with Shell's internal guidelines.

Shell uses proprietary simulation tools for cost risk analysis which apply an industry standard Monte Carlo simulation approach. This method generates a full range of possible outcomes and their associated probability of occurrence and is based on:

- Deterministic cost inputs and ranges;
- Probability distribution curves;
- Risks;
- Opportunities; and
- Levels of effort.

The output from the cost uncertainty modelling process provides an overall project contingency figure and also a cost uncertainty range – bounded by the P10 and P90 cost estimates. As a result of the applied cost uncertainty modelling method, cost uncertainty information is not generated for individual elements of the CAPEX and OPEX cost estimate breakdowns.

4.3. PCCS Cost Estimate Basis

The CAPEX and OPEX estimates for the Execute phase of the Peterhead CCS project were developed in accordance with normal Shell practice and appropriate market guidelines such as the Consumer Price Index (CPI) and Rate of Exchange (ROE) to take inflationary effects into account.

In accordance with Shell's normal practice, CAPEX and OPEX estimates were developed in the pre-FEED project phase based upon the concept engineering work carried out at that time. These estimates were denoted as "Type 2" estimates under Shell's cost estimation system.

The PCCS FEED study scope had a duration from March 2014 to December 2015 and consisted of two phases. Within the overall PCCS FEED study scope, an Engineering FEED study was undertaken by Shell and its engineering contractors between March 2014 and February 2015. Once the Engineering FEED study phase was completed, the project team focused on developing the EPC tendering arrangements and undertaking other activities in readiness for the execution phase (Execution Preparation Phase) until the end of November 2015.

The project CAPEX and OPEX estimates were updated mid 2015 based upon the Engineering FEED outputs – denoted as "Type 2 Updated" estimates. The CAPEX estimate was further updated in late 2015 as a result of the increased cost certainty gained through undertaking the EPC tendering process. This updated CAPEX cost estimate is denoted as a "Type 3" estimate in accordance with Shell's standard practice.

The CAPEX and OPEX estimates have been built up from a base estimate. The complete estimate has been developed from the base estimate by including an allowance for risk and contingency. This creates a P50 base estimate – i.e. the estimate has a 50% probability of over or under-running.

The Type 3 CAPEX estimate is expressed in "Money of the Day" (MOD) terms which includes inflation and escalation to the most likely date of expenditure (i.e. the known cost in 2015 has been escalated and inflated, at 2% per annum, as required in order to line up with the probabilistic execution schedule).

The Type 2 updated OPEX estimate is based on the known cost base in 2015 and is therefore already presented Real Terms (RT) 2015. Unlike the Type 3 CAPEX estimate there is no market escalation or inflation applied to the presented values.

Therefore, the P50 MOD CAPEX estimate figures developed in 2015 have inflation and escalation applied to the likely date of expenditure. Following the philosophy for development of Real Term costs, the P50 RT2015 OPEX estimate figures developed in 2015 prices have no market escalation or inflation applied to them despite the fact that in practice these costs will be incurred over the period 2016 to 2041.

The Type 3 CAPEX and Type 2 Updated OPEX estimates current at the end of the PCCS FEED study are summarised below. A more detailed CAPEX estimate breakdown is provided in APPENDIX 1. A Type 3 OPEX estimate was not also developed at the end of FEED, since the tendering process for the operations contracts will not take place until after award of the Execute contract.

4.4. Capital Expenditure (CAPEX) Estimate

CAPEX costs for the Execute phase of the PCCS project have been based upon the PCCS Project's technical scope and performance requirements detailed in the Basis of Design and Basic Design and Engineering Package Key Knowledge Deliverables – KKDs 11.001 [2] and 11.003 [1] respectively. The Execute phase CAPEX costs have been developed based upon the proposed EPC contract scopes for the provision of detailed design, construction and commissioning works as detailed in the Scope of Work for Execute Contracts, Key Knowledge Deliverable 11.058 [3]. The CAPEX cost estimate covers the entire scope of the Execute phase of the PCCS Project and is reported according to the following elements:

- Venture implementation costs;
- Onshore, covering Peterhead Power Station modification scope of work - including the new steam generator and associated balance of plant; and the Carbon Capture, Compression and Conditioning plant scope of work;
- Landfall, pipelines and subsea scope of work;
- Modifications to the Goldeneye platform and associated logistics scope of work;
- Wells and subsurface scope of work;
- Owner's costs; and
- Commissioning.

The estimate is based upon cost information available at the end of FEED in December 2015. Although final cost and schedule tender information were not available for all the engineering, procurement and construction (EPC) tenders for the Execute phase at the time of HMG's Statement, it is not expected that the final information would have deviated significantly from the figures presented in this document.

The CAPEX estimate is presented in the table below and subsequent graphics and represents the P50 MOD case. The presented figures include contingency provisions and anticipated foreign exchange (FOREX) related costs.

Table 4-2: Base Estimate CAPEX Breakdown

Cost Element	Base Estimate (£ k)
Venture (SPV) Implementation	10,620
Owner's Costs	108,990
Onshore	639,460
Landfall, Pipeline, Subsea	72,580
Goldeneye Modifications	60,690
Wells & Subsurface	88,470
Commissioning (Full CCS Chain)	18,500
FOREX	440
TOTAL	**999,750**

A more detailed breakdown of the Base CAPEX cost estimate is provided in APPENDIX 1 based upon the Execute Project phase Work Breakdown Structure (WBS). A relative breakdown for the CAPEX estimate is presented graphically in Figure 4-1.

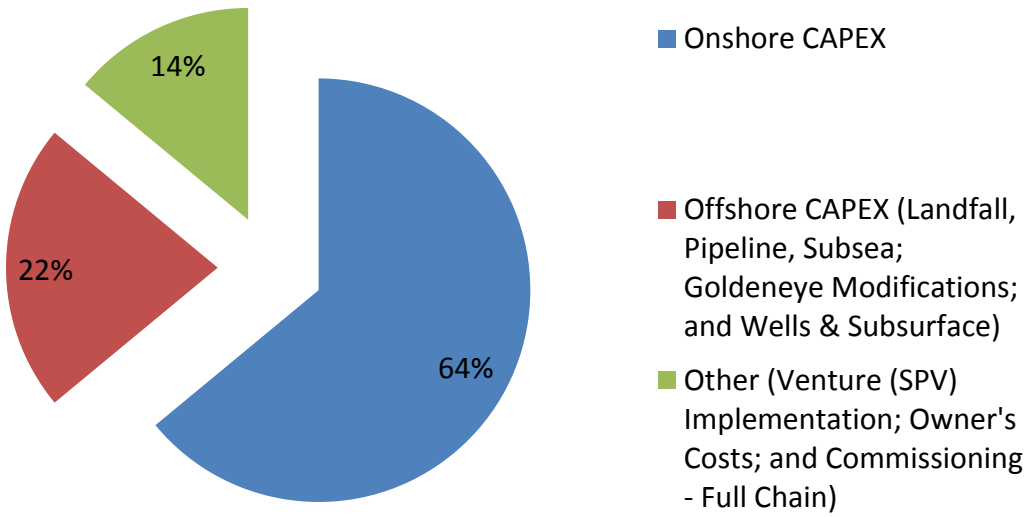


Figure 4-1: PCCS CAPEX Split

A relative breakdown for the Onshore CAPEX estimate is provided in Figure 4-2 and for the Offshore CAPEX estimate in Figure 4-3.

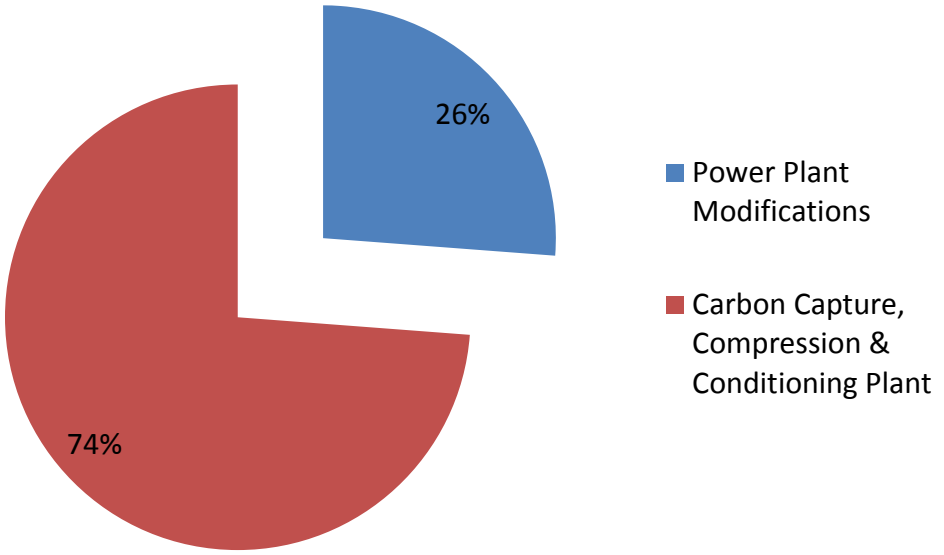


Figure 4-2: PCCS Onshore CAPEX Split

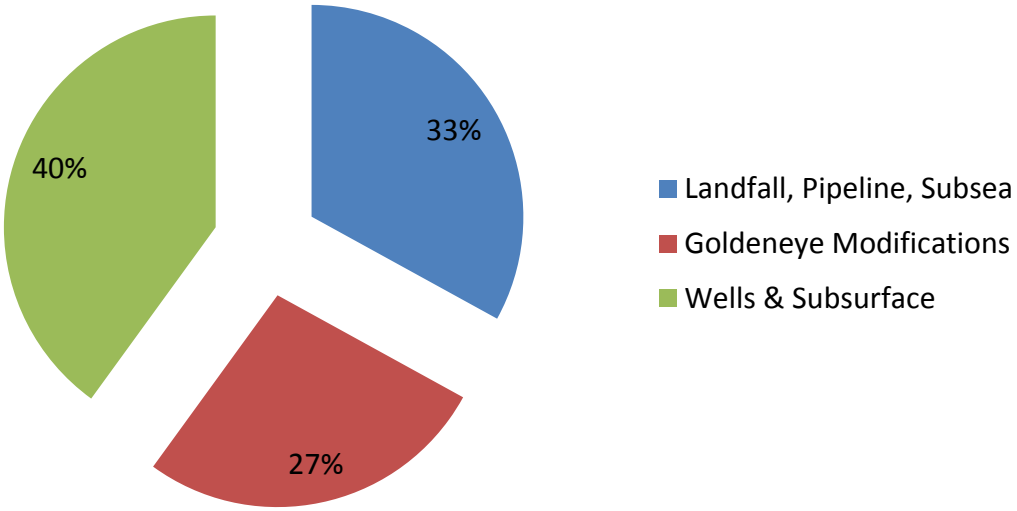


Figure 4-3: PCCS Offshore CAPEX Split

4.5. Operating Expenditure (OPEX) Estimate

The OPEX estimate presented below, is based upon information available at the end of FEED in December 2015. Although some commercial agreements had to still be finalised at the time of HMG's Statement, it is not expected that the final information would have deviated significantly from the figures presented in this document. The operational expenditure (OPEX) information should not be used for anything other than presentation of a snap shot of the most up to date estimate as of the end of December 2015.

4.5.1. OPEX Estimation Methodology

In the absence of developed standard practice in the nascent CCS industry, the OPEX estimate has generally been created in line with the Shell practice which reflects the industry standard for OPEX. The power plant estimate has been developed by SSE in accordance with standard practice for the power utility sector.

The OPEX model used as the basis of this report is built from:

- The latest project schedule;
- Bottom-up, activity-based modelling techniques;
- Data from the financial model such as:
    - Fuel gas consumption,
    - CO_2 Emissions,
    - Amine consumption,
    - Carbon Capture Conditioning and Compression Parasitic Load;
- Data from 3rd parties for operation of power plant equipment;
- Project Data for waste streams and chemical utilisation;
- Benchmarking studies for manpower.

The OPEX model provides an estimate for the period from 2016 through to 2041 which includes:

- Pre start-up costs for the Goldeneye facility; which are affected by any change in the project schedule
- Early Measurement Monitoring and Verification activities from 2016 to 2019;
- Injection phase costs for the full chain from 2020 to 2035;
- Post injection phase costs, excluding decommissioning.

4.5.2. OPEX Estimate

The OPEX estimate is presented in the table below and subsequent graphics and represents the Base Estimate, reported in RT2015 (Real Terms 2015). The Base Estimate RT2015 is £3,668.7 million between 2016 and 2041, excluding decommissioning.

Table 4-3: Base Estimate OPEX Breakdown

Cost Element	Sub Element	Cost (£ k)
Power Plant OPEX		2,900,500
	Base Plant	366,800
	Fuel Gas	2,336,800

Carbon Cost	196,900
Carbon Capture, Transport and Storage OPEX	768,200
Pre Start-Up Costs	16,700
CCCC Plant Power Import	235,100
CCCC Plant Operations	387,500
Transport	89,700
Storage	1,800
Monitoring (during and post operations)	37,400
TOTAL	3,668,700

The OPEX estimate costs are separately grouped by cost element into Power Plant related OPEX and Carbon Capture, Transport and Storage (CCS) OPEX costs. The OPEX estimate shows that the Power Plant OPEX estimate comprises approximately 80% of the total operating cost, as shown in Figure 4-4 below.

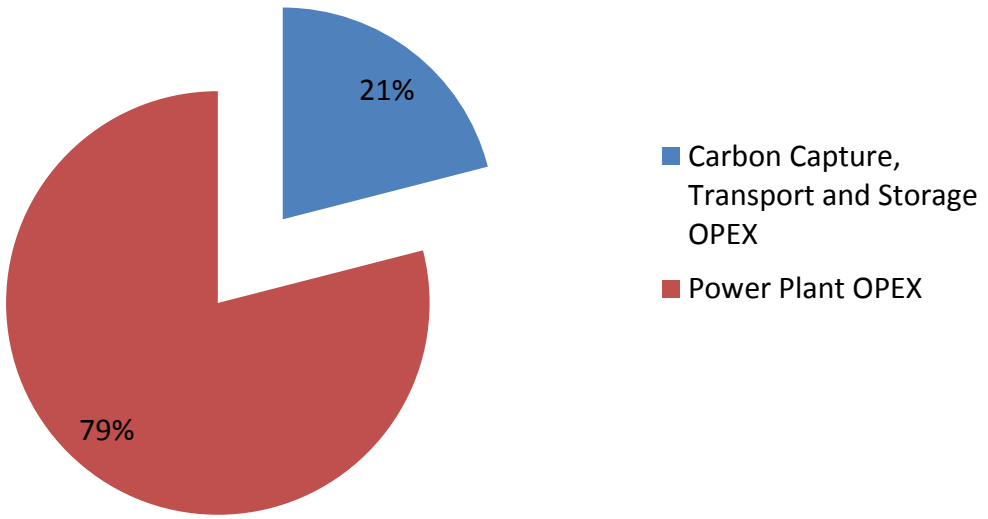


Figure 4-4: PCCS Full Life OPEX Split

The OPEX cost distribution for each year of the Project operating period is shown in Figure 4-5 below.

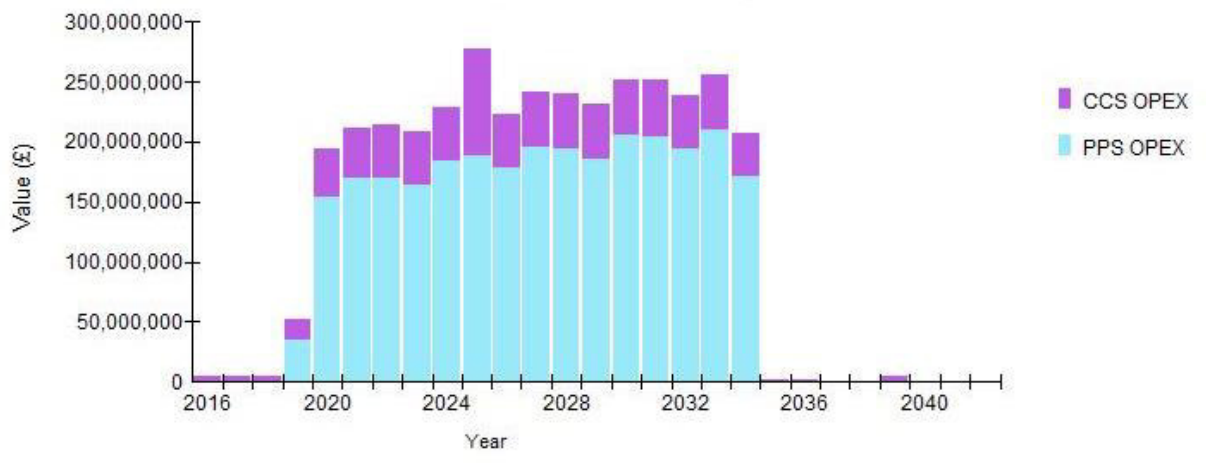


Figure 4-5: Year by Year Base OPEX Estimate

The following sections describe the primary cost drivers and assumptions of each cost element of the estimate.

4.6. Power Plant OPEX Costs

The Power Plant OPEX costs for the injection period of 2020 to 2035 account for the majority of the operating costs for the PCCS Project – some 82% of the total OPEX estimate – as shown in Figure 4-6. Within the Power Plant OPEX cost estimate, the fuel gas cost is the dominant cost element - comprising 80% of the Power Plant OPEX cost and 64% of the total PCCS OPEX cost.

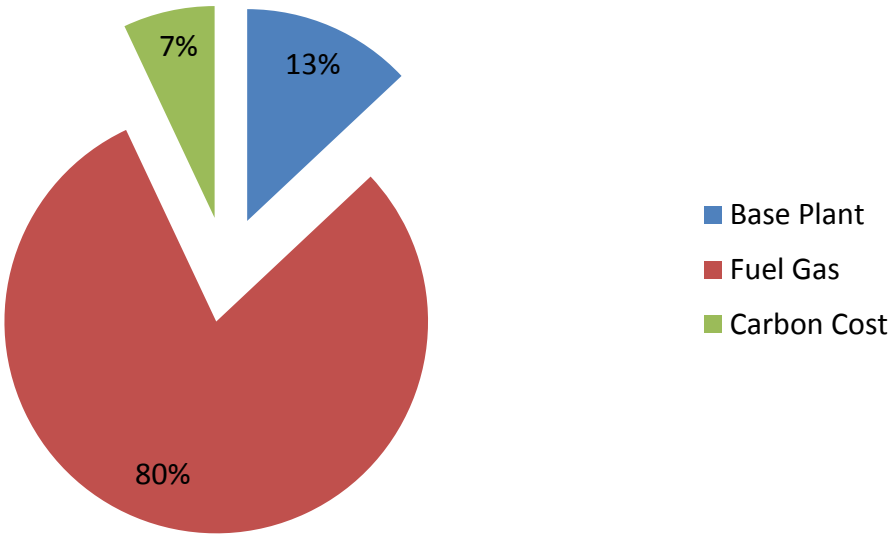


Figure 4-6: Power Plant OPEX Cost Split

The Power Plant OPEX cost distribution for each year of the Project operating period is shown in Figure 4-7.

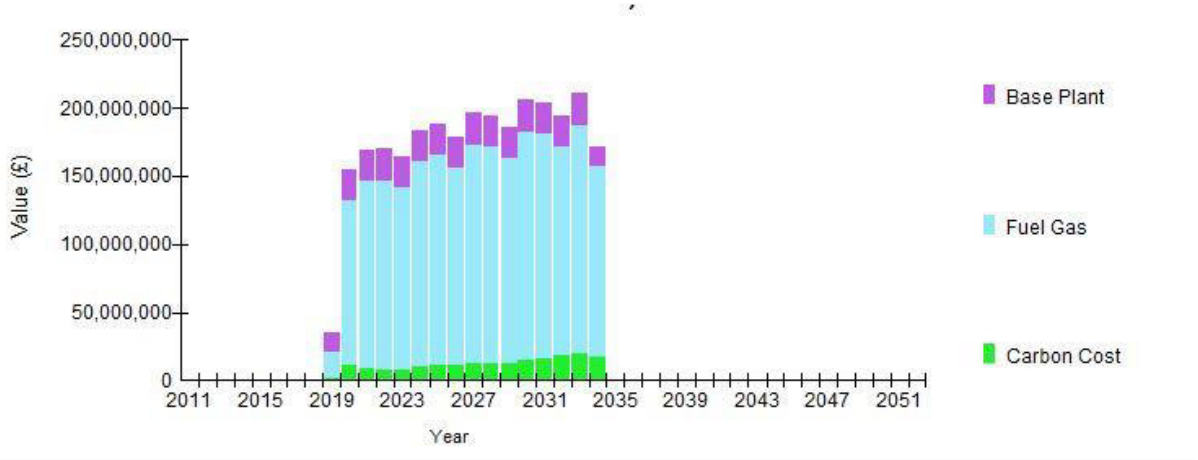


Figure 4-7: Year by Year Power Plant OPEX Estimate

The sub-elements of the Power Plant OPEX estimate are described further in the following report sections.

4.6.1. Base Plant Cost

The base plant covers the costs associated with SSE's operation of the Peterhead Power Station aspects attributable to the PCCS Project and have been provided by SSE. As of the end of December 2015, these costs have still to be finalised - particularly the gas turbine's Long Term Service Agreement (LTSA) that will affect the OPEX outturns. These OPEX costs are estimated to comprise 13% of the Power Plant OPEX estimate and 10% of the total PCCS OPEX estimate.

4.6.2. Fuel Gas

Fuel gas costs are incurred as a result of fuel gas used for operating the Power Plant's PCCS-related equipment. This OPEX cost is estimated to comprise 80% of the Power Plant OPEX estimate and 64% of the total PCCS OPEX estimate.

4.6.3. Carbon Cost

The carbon cost includes costs associated with the emission of CO_2 and is based upon costs provided by DECC for emitted CO_2. This OPEX cost is estimated to comprise 7% of the Power Plant OPEX estimate and 5% of the total PCCS OPEX estimate.

4.7. Carbon Capture and Storage (CCS) OPEX Costs

The CCS OPEX estimate for the injection period of 2020 to 2035 accounts for the remainder of the operating costs for the PCCS project – some 18% of the total OPEX estimate. As shown in Figure 4-8, within the CCS OPEX cost estimate the onshore Carbon Capture, Compression and Conditioning (CCCC) Plant costs (summating the CCCC Plant power import and CCCC Plant operating costs) presents the dominant cost element - comprising 81% of the CCS OPEX cost and 15% of the total PCCS OPEX cost.

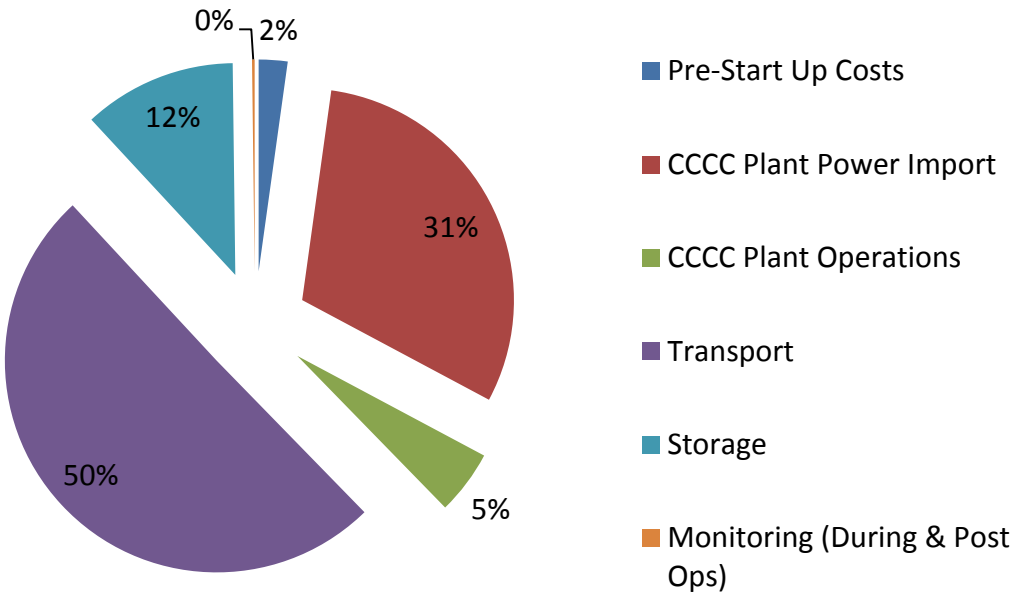


Figure 4-8: CCS OPEX Cost Split

The CCS OPEX cost distribution for each year of the Project operating period is shown in cost is shown in Figure 4-9. Note that allowance for well related activities outside of normal routine maintenance and MMV activities has created a cost spike in year 7 of CO_2 injection. Further information on the proposed injection regime including monitoring plan can be found in the Storage Development Plan, Key Knowledge Deliverable 11.128 [7].

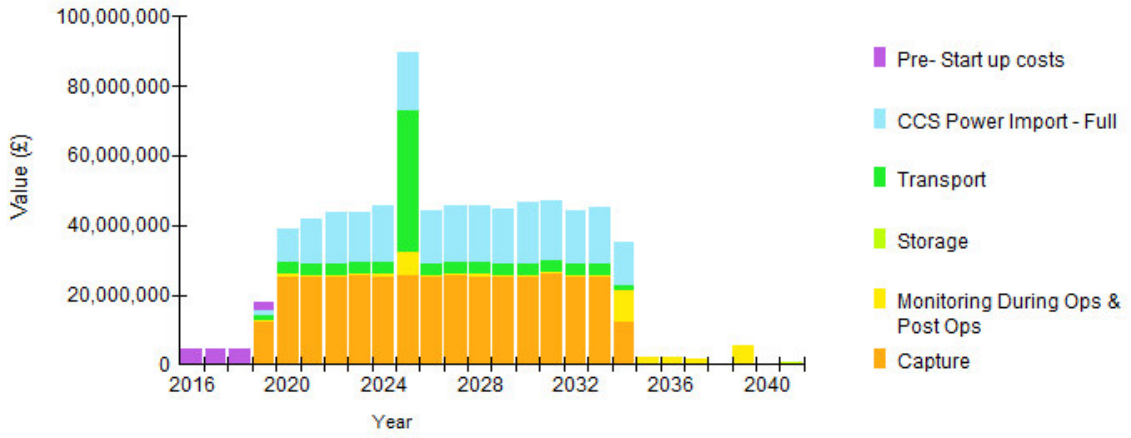


Figure 4-9: Year by Year CCS OPEX Estimate

The sub-elements of the CCS OPEX estimate are described further in the following report sections.

4.7.1. Carbon Capture, Compression & Conditioning (CCCC) Plant Operations

The CCCC Plant OPEX estimate covers costs associated with operating the onshore CCCC Plant. This OPEX cost is estimated to comprise some 50% of the CCS OPEX estimate and 9% of the total

PCCS OPEX estimate. This OPEX cost is comprised of three elements. A cost breakdown summary is provided in Figure 4-10.

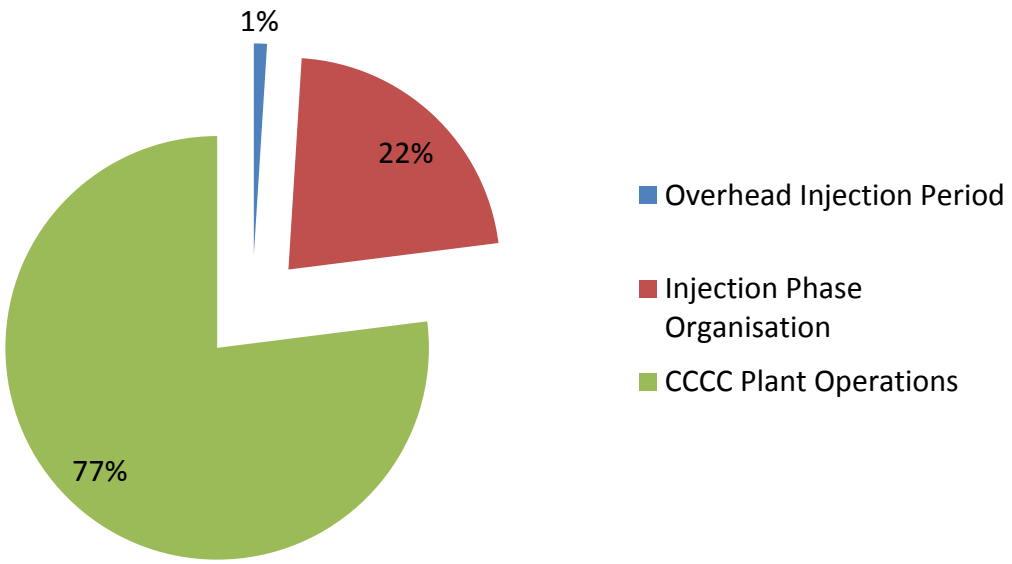


Figure 4-10: Carbon Capture, Compression & Conditioning Plant OPEX Breakdown

4.7.1.1. Overhead injection period

The overhead injection period is a small cost item attributed to the onshore operating phase insurance cost.

4.7.1.2. Injection Phase Organisation

The organisation costs include the OPEX cost for the field team required for the CCCC Plant and provision of the onshore support organisation.

4.7.1.3. Carbon Capture, Compression and Conditioning (CCCC) Plant

The relative breakdown of the Carbon Capture, Compression and Conditioning Plant cost estimate is shown in Figure 4-11 below.

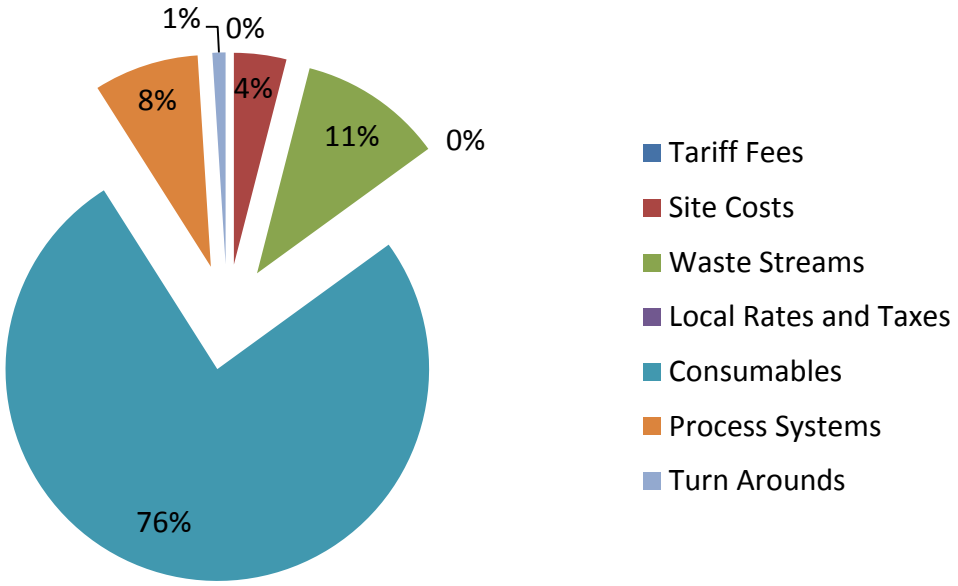


Figure 4-11: CCCC Plant OPEX Estimate

The estimate has been built using a bottom-up approach based on the equipment lists, system structure and equipment OPEX templates for the process equipment and vendor quotation and project process data for chemical usage and waste stream generation. At 76%, the use of various consumables, when combined, form the largest cost. These are associated with the chemical usage cost primarily for the replacement of amine and the handling of waste streams. These costs are constantly accrued over the full injection phase, rather than low frequency costs for specific maintenance activities.

4.7.2. CCCC Plant Power Import

The CCCC Plant Power Import costs are associated with the power supply requirement of the Carbon Capture, Compression and Conditioning (CCCC) Plant which is imported from the National Grid during the operating period 2020 to 2035. Power consumption has been based upon the defined CCCC Plant availability as detailed in the Basis of Design, Key Knowledge Deliverable 11.001 [2] in alignment with the imported electrical tariff rate defined by DECC. This OPEX cost is estimated to comprise 31% of the CCS OPEX estimate and 6% of the total PCCS OPEX estimate.

Further commentary on the anticipated availability of the CCS Chain is provided in Section 4.2 of the FEED Summary Report, Key Knowledge Deliverable 11.133 [4].

4.7.3. Transport

Transport costs are associated with the subsea pipeline between the onshore CCCC Plant and the Offshore installation, Offshore installation and associated wells and the St Fergus supplied methanol service across the period from 2016 to 2035. This OPEX cost is estimated to comprise 12% of the CCS OPEX estimate and 2% of the total PCCS OPEX estimate.

Transport costs are comprised of three main elements which are described below. Further OPEX cost breakdown information was not developed for these relatively small cost items and therefore no further breakdown of the transport OPEX costs is presented in this document.

4.7.3.1. Pipelines

OPEX costs are associated with the ongoing operation and ownership of the subsea pipeline from Goldeneye to Peterhead including pipeline lease fee and periodic maintenance and conditioning monitoring activities including pipelines, risers and subsea structural inspections supplied by the existing SUKEP asset operating the pipeline.

4.7.3.2. Offshore

OPEX costs are associated with the operation and ownership of the Goldeneye facility during the injection period including:

- Offshore insurance fee quotation supplied by the Shell insurance specialists.
- Well activities outside of normal routine maintenance and MMV activities. This creates a cost spike in year 7 of injection, to allow for one contingent tubing replacement. Costs and requirements are specified by the Well Engineering team.
- Operation of the installation.

  The operational cost is derived from the current Goldeneye operating cost budget adjusted to include an additional two trips to the facility per year (8 in total).

4.7.3.3. St Fergus Methanol supply

Methanol will be supplied to the injection wells from the St Fergus facility via a 4-inch line. The methanol and associated supply equipment up to the inlet to the 4-inch line are to be owned and operated by the existing owners, SEGAL with a tariff rate provided based on assumed fixed maintenance costs and variable methanol usage.

4.7.4. Monitoring during the Operations and the Post Operations Periods

OPEX costs are associated with the MMV activities undertaken from 2020 to 2041 and include:

- MMV activities required for the CO_2 injection period (2020 to 2035);
- MMV activities required post CO_2 injection period (2035 to 2041); and,
- Monitoring R&D funding.

This OPEX cost is estimated to comprise 5% of the CCS OPEX estimate and 1% of the total PCCS OPEX estimate.

4.7.5. Pre Start-Up Costs

Pre start-up costs cover the pre Ready For Start-Up (RFSU) period of 2016 to 2020 and include:

- Operational Costs: Costs associated with operating the Goldeneye facility including normal operating costs and planned remedial activities, which are affected by any change in the project Schedule; and
- Measurement, Monitoring and Verification (MMV) Costs: Costs associated with MMV activities required prior to CO_2 injection between 2016 to 2020.

The presented pre start-up costs are therefore entirely related to maintenance of the Goldeneye facility prior to commencing PCCS operations plus associated MMV activities. This OPEX cost is estimated to comprise 2% of the CCS OPEX estimate and 0.5% of the total PCCS OPEX estimate.

4.7.6. Storage

The OPEX costs associated with the Storage cost element include:

- Final financial mechanism payment (post transfer obligation);
- Lease Fee (a yearly cost for the lease of the reservoir from the Crown Estate);
- Storage organisation costs associated with support of the MMV activities across the full life of the project.

This OPEX cost is estimated to comprise <0.3% of the total CCS OPEX estimate.

4.8. Uncertainty of CAPEX and OPEX Estimates

The Project outturn costs will be either higher or lower than the presented estimates, depending on which risks materialise and how emerging costs mature. In order to understand the likely variability of CAPEX and OPEX outturns, Shell's standard Cost and Schedule Risk Analysis (CSRA) probabilistic method has been used. The method generates a full range of possible outcomes and their associated probability of occurrence, based on ranges (with associated probability distributions) for each parameter (input). Risk register, deterministic cost and schedule information were developed ahead of holding workshops to develop the probabilistic CAPEX and OPEX cost estimate information.

The methodology followed included the following steps:

- Consolidate Cost Estimate into major cost elements (15-60 items);
- Assign risk profile and cost uncertainty to estimate Best Case, Most Likely, and Worst Case estimate ranges;
- Incorporate Risks and Opportunities into the cost model;
- Identify and link Schedule Risk Analysis output to schedule driven elements;
- Estimate impact of Unknown / Unknowns;
- Group and correlate cost elements and risks;
- Perform analysis and generate results; and
- Challenge results, validate with team and modify / re-run if needed.

The cost estimates were broken down in alignment with the Work Breakdown Structure and the proposed structure of the EPC tenders. Risk profiles and cost uncertainties for the major cost elements varied depending upon whether the major cost element was based on (final) tendered information or was still in negotiation, was lump sum or reimbursable, and/or whether it was based on detailed and benchmarked data or was less well defined. The more certain the cost (e.g. Lump Sum agreed with preferred tenderer) the narrower the cost range, the more uncertain the cost (e.g. untendered scope of work with limited benchmark data) the wider the cost range which was applied.

Inputs were taken from the latest version of the risk and opportunities register. Risks and opportunities were screened for relevance to the CRSA: some risks were excluded as having no cost impact or were deemed included in the cost uncertainty ranges for the major cost elements. Each threat or opportunity that was incorporated in the model was given a percentage likelihood of occurrence and a minimum and maximum outturn cost if it occurred. Correlation was applied to similar major cost elements (e.g. Engineering/Procurement/Construction cost elements were correlated at around 85%), to schedule driven elements and across discrete threats and opportunities to ensure a realistic statistical prediction. The CRSA model which was developed in the proprietary Crystal Ball software tool was run 1000 times (with each run comprising 100 iterations). The results

of the performed CRSA analysis allow outturn values to be estimated for P50, P90 and P10 probability cases.

P50 represents the probabilistic result (i.e. most likely) where there is equal chance of the result being higher or lower than the value presented for the range of cost estimation scenarios studied. The P50 figures have been used to develop the CAPEX and OPEX cost estimates presented in this document. The P90 and P10 values are used as indicators of the likely range of Project outturns, and are used similar to an uncertainty value for the cost estimates.

For the CAPEX estimate, the P90 value represents a 12% over-run and the P10 value represents a -11% (under spend), when compared to the most likely (P50) outturn value.

For the OPEX estimate, the P90 value represents a 24% over-run and the P10 value represents a -16% (under spend), when compared to the most likely (P50) outturn value.

4.9. CAPEX Cost Estimate Uncertainties

As the FEED study progressed, it was possible to identify the areas of greatest cost uncertainty within the Execute phase CAPEX cost estimate. These uncertainties are generally attributable to either elements within the Execute phase EPC contracts where it was not possible to agree a fixed price approach or areas where costs could not yet be readily determined – e.g. hire of a jack-up rig. The list of major cost components which carry an uncertainty which is greater than a 5% share of the project cost uncertainty into the Execute phase of the PCCS Project are presented in Table 4-4. Further information can be found in the Major Cost Component Uncertainty report – KKD 11.144 [5].

Table 4-4: Major Costs Components

	Major Costs Component	% of Project Cost	Description of Uncertainty
1	Onshore CCCC Plant Engineering Procurement and Construction (EPC) Contract – Construction Target Cost	17%	A construction Target Price Incentive mechanism is proposed for the Construction and commissioning element of the EPC Contract where a pain/gain share mechanism will be agreed with the Contractor
2	Onshore Power Station modifications EPC Contract (Balance of Plant including Demolition)	15%	A Target Price Incentive mechanism has been agreed for the PS EPC Contract (Balance of Plant)
3	Hire of Jack-Up Rig – Costs	6%	The jack-up rig will be tendered in 2016 – day-rate costs will be confirmed then. The industry typically tenders rig requirements no more than 2 years ahead of requirements

At the time of HMG's announcement, discussions with the Engineering, Procurement and Construction (EPC) Contractors, SSE and Cansolv were still in process and therefore the final risk and reward allocation within the PCCS Execute contracts was not finalised. However, given their advanced state of development, it is considered that the likely risk and reward allocation in these contracts can be described with sufficient certainty to be instructive to other future CCS developers, notwithstanding the fact that these agreements were not executed. Further information on the proposed Execute phase contract structure can be found in the Scope of Work for Execute Contracts report – KKD 11.058 [6]

The approach to contracting in the Supply Chain is in line with Shell's business as usual contracting approach and is also in line with the industry standard approach. No characteristics unique to the PCCS project have been identified that require Shell to deviate from its usual practice when contracting with its supply chain. Currently there are no known advance payments, reservation fees, down payments or deposits for long lead items, vessel charters and rigs arising from the Supply Chain.

4.10. OPEX Cost Estimate Uncertainties

Unlike the CAPEX cost estimate, contractual arrangements have not been developed for the individual elements of the OPEX cost estimate. Sensitivity analysis has been carried out on the largest OPEX cost elements. The results obtained clearly identify that the likely operating costs are very sensitive to the fuel gas consumption cost. The items with the greatest sensitivity, with the exception of the power plant operating cost are the variable costs driven by the performance and/or availability of the PCCS Project systems which also account for most of the operating cost.

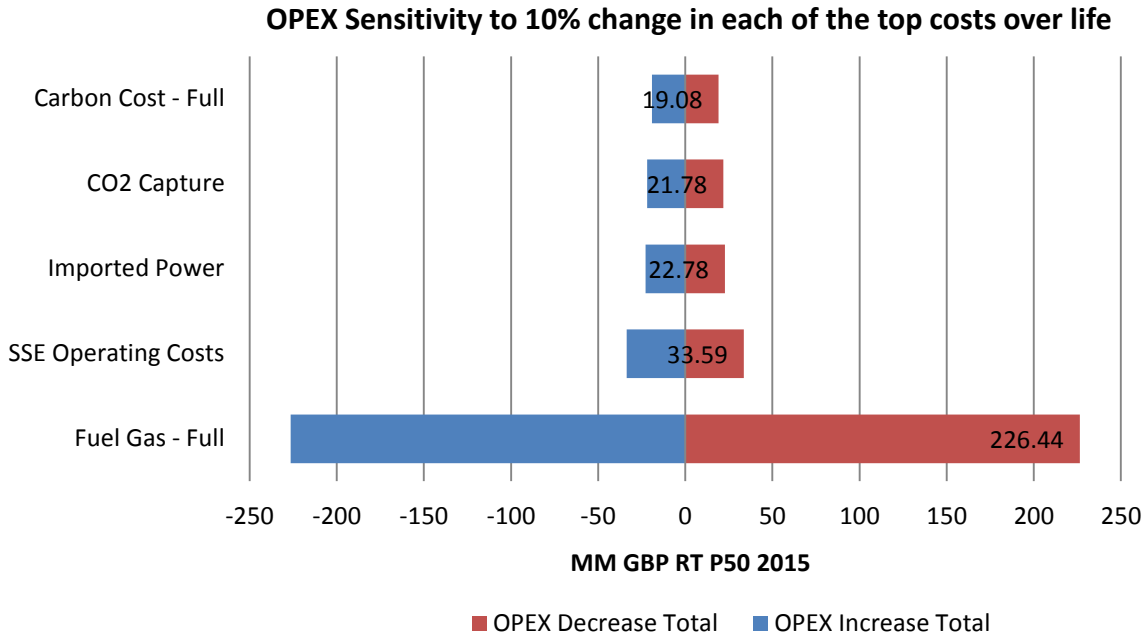


Figure 4-12: OPEX Cost Estimate Sensitivity Analysis

5. Conclusion

This document provides cost estimate information for Shell's Peterhead CCS Project. The cost estimate for the Execute phase of the Project is presented with Capital Expenditure (CAPEX) and Operating Expenditure (OPEX) cost breakdown information. Information is also presented on the Project's FEED cost performance.

The FEED original budget was £43,820,017 inclusive of £2 million contingency. The largest use of contingency was associated with the de-risking of the pipeline landfall design, including the decision to execute a HDD trial bore hole, undertaken to confirm the technique can be employed for the rock conditions at Peterhead.

The CAPEX and OPEX estimates for the Execute phase of the Project are based upon information available at the end of December 2015 and thus the data provided presents a snapshot of the most up-to-date costs at the time of writing this report.

The CAPEX estimate is £999.7 million and the OPEX estimate is £3,668.7 million. Both estimates are inclusive of cost contingencies. The CAPEX estimate is presented in MOD terms (Money of the Day which refers to an estimate which is inclusive of inflation and escalation to the date of expenditure) and the OPEX estimate is presented in RT terms.

The major CAPEX estimate components are found onshore associated with the required power plant modifications and new build Carbon Capture, Compression and Conditioning plant and comprise some 64% of the total CAPEX cost estimate. The offshore components including the transportation, platform, wells and subsurface scope of work comprises some 22% of the total CAPEX cost estimate.

The OPEX estimate considers costs between 2016 and 2041 including a 15-year injection period but excluding decommissioning. The largest cost is from the Power Plant OPEX element (79%) with the remaining 21% associated with the carbon capture, transport and storage activities. The fuel gas expenditure is the dominant cost in the OPEX estimate.

6. References – Bibliography

1. PCCS-00-PTD-AA-7704-00002, Basic Design and Engineering Package – KKD 11.003
2. PCCS-00-PT-AA-7704-00001, Basis of Design for the CCS Chain – KKD 11.001
3. PCCS-00-PTD-VA-5793-00002, Scope of Work for Execute Contracts – KKD 11.058
4. PCCS-00-MM-AA-7180-00001, FEED Summary Report for Full CCS Chain – KKD 11.133
5. PCCS-00-PTD-VA-7180-00001, Major Cost Component Uncertainty report – KKD 11.144
6. PCCS-00-PTD-VA-5793-00002, Scope of Work for Execute Contracts – KKD 11.058
7. PCCS-00-PT-AA-5726-00001, Storage Development Plan – KKD 11.128

7. Glossary of Terms

Term	Definition
CAPEX	Capital Expenditure
CCCC	Carbon Capture, Compression and Conditioning
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture and Storage
CO_2	Carbon Dioxide
CTA	Construction and Tie-in Agreement
DECC	Department of Energy and Climate Change
EAC	Estimate at Completion
EPC	Engineering, Procurement and Construction
FEED	Front End Engineering Design
FGS	Flue Gas Supply
GBP	Great British Pounds
GT	Gas Turbine
HDD	Horizontal Directional Drilling
KKD	Key Knowledge Deliverable
LP	Low Pressure
LTSA	Long Term Service Agreement
MCC	Market Compensation Charge
MMV	Measurement, Monitoring and Verification
MOD	Money Of the Day
NOAK	Nth of a Kind
O&M	Operations and Maintenance
OPEX	Operating Expenditure
PCCS	Peterhead Carbon Capture and Storage
PPA	Power Purchase Agreement
PS	Power Station
R&D	Research and Development
RFSU	Ready For Start Up
RT	Real Terms (Value escalated to account for Market conditions)
SCR	Selective Catalytic Reduction
SEGAL	Shell-Esso Gas and Liquids
SPV	Special Purpose Vehicle
SUKEP	Shell UK Exploration & Production

APPENDIX 1. Execute CAPEX Estimate (Based on WBS)

WBS Level 1	WBS Level 2	WBS Level 3	WBS Level 4	WBS Level 5	TOTAL CAPEX ESTIMATE (MOD GBP)
Peterhead CCS					
	1.1 Venture Implementation				
		1.1.1 Venture Implementation			
			1.1.1.1 Commercial / VI		
				00- VENTURE MANAGEMENT TEAM	**2,768,077**
				00A -COMMUNICATIONS	**1,973,280**
				01- SHELL GOVERNANCE TEAM	**593,615**
				Project Specific VI Costs	**5,281,361**
	1.2 Owners Costs				
		1.2.1 Owners Costs			
			1.2.1.1 SHELL OPERATOR TEAM		
				PM / PE / Business Support	**36,101,090**
				Onshore	**6,604,057**
				Subsea	**3,835,590**
				Goldeneye	**3,541,063**
				Wells & Subsurface	**5,076,413**
				Commissioning	**18,290,818**
			1.2.1.3 SHELL THIRD PARTY COST		
				Project Management	**177,385**
				Onshore	
				Subsea	**1,692,496**
				Goldeneye	
				Wells & Subsurface	
				Commissioning	**1,323,120**
			1.2.1.4 INSURANCE, FINANCE & TAX		
				Insurance	**12,205,879**
				Finance	
				Tax	
			1.2.1.5 MISCELLANEOUS		
				Logistics	
				HSSE	**2,111,888**
				Other (Incl. License Fees)	**9,428,816**
				Consumables	
				First Fills	
				Spares	**2,664,123**
				Project Specifics Miscellaneous Costs	**2,715,718**
				OWNERS COST - ACTIVITY ALLOWANCE	**3,220,487**
	1.3 Onshore				
		1.3.1 Power Plant			
			1.3.1.1 SSE Breakdown		
				SSE	**11,000,000**
				Lot 2	**80,000,000**
				Lot 3	**48,000,000**
				Insurance	**1,440,000**
				Risk / Contingency	**21,600,000**
			1.3.1.2 EPC General		
				Detailed Design	
				Procurement & fabrication	
				Construction	
			1.3.1.3 Power Station Modifications		
				Detailed Design	
				Procurement & fabrication	
				Construction	
			1.3.1.4 SCR		
				Detailed Design	**750,000**
				Procurement & fabrication	**2,250,000**
				Construction	**2,000,000**
			1.3.1.5 Pre-commissioning & Handover		
				Detailed Design	
				Procurement & fabrication	
				Construction	

WBS Level 1	WBS Level 2	WBS Level 3	WBS Level 4	WBS Level 5	TOTAL CAPEX ESTIMATE (MOD GBP)
Peterhead CCS					
		1.3.2 CCCC			
			1.3.2.1 Capture Plant		
				Detailed Design & Engineering	**8,063,453**
				Procure Major Equipment & Fabrication	**83,297,661**
				Procure Bulk Materials	**76,261,715**
				Project Management	**17,813,670**
				Construction	**89,148,993**
				Site Services / Indirect Field Cost	**55,611,910**
				Commissioning & Start Up	
			1.3.2.2 Compression & Conditioning Plant		
				Detailed Design & Engineering	**5,993,746**
				Procure Major Equipment & Fabrication	**19,459,946**
				Procure Bulk Materials	**18,239,442**
				Project Management	
				Construction	**18,751,800**
				Site Services / Indirect Field Cost	
				Commissioning & Start Up (TCE)	
			1.3.2.3 Waste Water Treatment Plant		
				Detailed Design & Engineering	**1,223,826**
				Procure Major Equipment & Fabrication	**11,875,429**
				Procure Bulk Materials	**1,897,446**
				Project Management	
				Construction	**8,002,734**
				Site Services / Indirect Field Cost	
				Commissioning & Start Up	
			1.3.2.4 132 kV Connection		
				Detailed Design & Engineering	**578,725**
				Procure Major Equipment & Fabrication	
				Procure Bulk Materials	**807,098**
				Project Management	
				Construction	**258,567**
				Site Services / Indirect Field Cost	
				Commissioning & Start Up	
			1.3.2.5 Onshore Pipe & Pig Trap		
				Detailed Design & Engineering	**783,857**
				Procure Major Equipment & Fabrication	**298,451**
				Procure Bulk Materials	**163,269**
				Project Management	
				Construction	**541,877**
				Site Services / Indirect Field Cost	
				Commissioning & Start Up	
			1.3.2.6 EPC General / Other		
				Detailed Design & Engineering	**405,860**
				Procure Major Equipment & Fabrication	
				Procure Bulk Materials	**277,846**
				Project Management	
				Construction	**3,393,847**
				Site Services / Indirect Field Cost	
				Commissioning & Start Up	
				Overhead	**11,858,200**
				Profit	**5,959,241**
		1.3.3 Non-EPC Base Scope			
			1.3.3.1 Non-EPC Base Scope		
				Visitor Centre & Social Development	**2,420,649**
			1.3.3.2 EPC Activity Allowance		
				CCCC Activity Allowance	**29,027,267**

WBS Level 1	WBS Level 2	WBS Level 3	WBS Level 4	WBS Level 5	TOTAL CAPEX ESTIMATE (MOD GBP)
Peterhead CCS					
	1.4 Subsea				
		1.4.1 Subsea EPC			
			1.4.1.1 Landfall, Pipeline Installation (KP 0.39 to KP 1.2)		
				Project Management / Preliminaries	**452,681**
				Detailed Design and Engineering	**1,017,892**
				HSEQ	**152,419**
				Procurement	**261,423**
				Horizontal Directional Drilling Operations (HDD)	**4,943,413**
				Pipeline Fabrication	**2,253,560**
				Pipeline Installation	**1,380,310**
				Pre-commissioning Activities	
				Data Manuals and As-Built Documentation Package	**57,957**
			1.4.1.2 Offshore Pipeline Installation (KP 1.093 to KP 22.175)		
				Project Management / Preliminaries	**551,574**
				Detailed Design and Engineering	**1,061,198**
				HSEQ	**152,419**
				Procurement	**4,024,861**
				Pipeline Installation	**15,084,063**
				Precommissioning Activities	
				Data Manuals and As-Built Documentation Package	**57,948**
			1.4.1.3 Onshore Fabrication		
				Project Management / Preliminaries	**254,896**
				Detailed Design and Engineering	**610,736**
				HSEQ	**152,419**
				Procurement	**866,898**
				Fabrication and Construction of SSIV	**702,978**
				Fabrication and Construction of Subsea Spool Pieces	**287,131**
				Precommissioning Activities	
				Data Manuals and As-Built Documentation Package	**57,957**
			1.4.1.4 Subsea Construction / Tie-in Activities		
				Project Management / Preliminaries	**254,896**
				Detailed Design and Engineering	**834,002**
				HSEQ	**152,419**
				Procurement	**717,791**
				Fabrication and Construction of SSIV	**1,832,592**
				Fabrication and Construction of Subsea Spool Pieces	**12,559,374**
				Precommissioning Activities	
				Data Manuals and As-Built Documentation Package	**57,957**
			1.4.1.5 Pre-Commissioning Activities		
				Project Management / Preliminaries	**546,113**
				Detailed Design and Engineering	**610,736**
				HSEQ	**152,419**
				Procurement	**302,729**
				Pre-commissioning Activities	**827,920**
				Data Manuals and As-Built Documentation Package	**57,957**
		1.4.2 Non-EPC Base Scope			
			1.4.2.1 EPC Activity Allowance		
				Subsea Activity Allowance	**7,673,825**
			1.4.2.2 Shell Materials		
				Free Issue Materials	**9,958,062**
		1.4.3 St Fergus			
			1.4.3.1 St Fergus		
				ISC - Plant Upgrades	**1,652,447**

WBS Level 1	WBS Level 2	WBS Level 3	WBS Level 4	WBS Level 5	TOTAL CAPEX ESTIMATE (MOD GBP)
Peterhead CCS					
	1.5 Goldeneye Modifications				
		1.5.1 Goldeneye Modifications EPC			
			1.5.1.1 General		
				Logistics	**6,683,920**
			1.5.1.2 Goldeneye Modifications (EPC Contract)		
				Project Management	**4,510,654**
				Detailed Design/Engineering	**3,923,972**
				Procurement & Fab	**9,032,014**
				Construction	**7,596,705**
			1.5.1.3 Shell Services		
				Mob / Demob	**3,476,860**
				W2W Vessel & Gangway	**22,188,872**
		1.5.2 Non-EPC Base Scope			
			1.5.2.1 EPC Activity Allowance		
				Goldeneye Activity Allowance	**3,276,374**
	1.6 Wells & Subsurface				
		1.6.1 Wells & Subsurface			
			1.6.1.1 Mob / Demob		
				Mob	**4,103,402**
				Demob	**4,103,402**
			1.6.1.3 Workover (x4)		
				Well GYA01	**15,680,404**
				Well GYA02	**15,680,404**
				Well GYA03	**15,680,404**
				Well GYA04	**15,680,404**
		1.6.2 Subsurface			
			1.6.2.1 Third Party Costs		
				Subsurface (2017)	**13,313,134**
				Subsurface (2018, 2019 & 2020)	**3,386,449**
		1.6.3 Non-EPC Base Scope			
			1.6.3.1 EPC Activity Allowance		
				Wells Activity Allowance	
				Subsurface Activity Allowance	**837,933**
	1.7 Commissioning				
		1.7.1 Commissioning			
			1.7.1.1 Commissioning		
				CSU Team	**11,840,679**
				EPC - CSU Support	**5,114,200**
				Integrated Commissioning	**1,548,129**

P50 MOD Excluding FOREX	**999,296,089**
FOREX	436,416
P50 MOD	**999,732,505**