Peterhead CCS Project

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Executive Summary

Her Majesty's Government (HMG) Autumn Statement and Statement to Markets on the 25th 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.

On the basis of this decision by HMG, Shell is unable to move forward with the Peterhead CCS Project, and has formalised this decision through its own Governance process.

Notwithstanding this decision, Shell is able in this Deliverable to describe the considerations which would have contributed to its final decision to invest (or not) that was planned for December 2015.

The novel nature of the Peterhead CCS Project, and the commercial and technical complexities necessarily means that decision making will be multi-faceted in nature. A fully informed decision requires an assessment of the how the Project measures in respect of;

- Achievement of the project vision.
- Ability to implement the project drivers.
- Meeting the Project essential requirements.

This document describes each in turn.

1. Introduction

1.1. Project Introduction

The Peterhead CCS Project aims to capture around one million tonnes of CO_2 per annum, over a period of 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 gas-fired power station.

As the Goldeneye gas-condensate field has ceased production, the 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 (GT13) using amine-based technology provided by Cansolv Technologies Inc. (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:

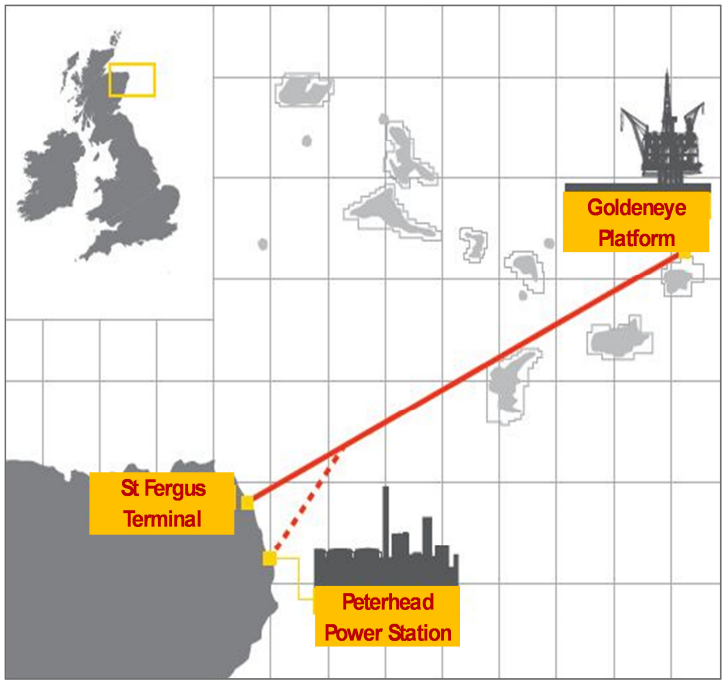

Figure 1-1: Project Location

2. Content

2.1. Achievement of the Project Vision

The ultimate objective behind Shell's participation in the CCS Commercialisation Competition is to support both HMG's own previously stated objectives for CCS and also the attainment of Shell's own vision for CCS, articulated in the Project Vision Statement.

Shell's vision is to demonstrate that clean, reliable, affordable and competitive energy can be derived from Natural Gas by the use of Carbon Capture & Storage, meeting the needs of future generations.

Shell has sought to work with HMG to build a future where Gas-based CCS can play a key role in the UK generation mix, without the need for government subsidy.

Shell's expectation of the Peterhead CCS Project was that a reliable, affordable and competitive energy source would indeed be demonstrated through a successful First of a Kind (FOAK) project, producing clean electricity in 2020, in line with the Authority's own Commercialisation Objective.

The learnings and the knowledge transferred from Peterhead would enable Phase 2 (as defined by the Authority) and other 'follow-on' projects to achieve improvements in design, execution and performance, both technically and commercially such that gas-based CCS would be able to successfully compete with other forms of clean electricity generation, through sustained reduction in the levelised cost of electricity.

At the date of this Deliverable, Shell:

i. Believes that the full realisation of the project vision is attainable had the Project been awarded a Project Contract, and
ii. remains of the view that public support is required to "kick-start" commercialisation of CCS in the UK.

2.2. Ability to Implement the Project Drivers

The next set of variables to be considered as part of a FID is the ability of the Project team to deliver the project drivers. Shell's project drivers are as follows;

- Achieve Goal Zero.
- Achieve a competitive Strike Price.
- Ensure Operability.

Achieve Goal Zero

"Goal Zero" is a core safety principle and objective for Shell, of zero harm to people and the environment. Shell's Project Execution Plan and Operational Readiness and Assurance process must provide adequate demonstration that this principle will be adhered to, with a reasonable expectation that the Goal can be achieved. Shell cannot support any Project which exhibits compromise in this area. The Project development activity during FEED placed Goal Zero at its core. Whilst certain risks and appropriate mitigating actions have been identified as part of the Project Risk Matrix (as would be expected for a Project of this nature about to enter execution stage) there is no reason to indicate that Shell's own requirements in this important area would not be met, and therefore would unlikely to have had a bearing on a Shell final investment decision (FID).

Achieve a Competitive Strike Price

Shell's objective is to prove CCS, not disprove it. Therefore attainment of a viable Strike Price competitive with offshore wind, and with an identified potential for further cost reduction is a key driver for the Project. The Strike Price (largely derived from construction cost and schedule assumptions, operational cost and performance assumptions both at the Capture Plant and Power Plant, provisions for late life costs, and commercial risks) is central to any final Bid submitted by Shell and clearly needs to be in territory where a clear "Value for Money" proposition can be demonstrated to HMG. Whilst the Strike Price was under continued review, there is no reason to indicate that Shell's Strike Price aspiration could not have been met, or that this particular driver would have attracted negative consideration in any FID.

Ensure Operability

Shell has conducted its own Operations Assurance and Readiness Review and has concluded that there are no material concerns that would have had any bearing on a FID. Shell is confident that the Peterhead Project is fully capable of being successfully and safely operated, and will also be able meet the reliability and availability thresholds necessary to deliver an economic project that meets the Authority's operational requirements.

2.3. Meeting the Project essential requirements"

Throughout the course of FEED, Shell has sought to manage and assess the general viability of the Project against 5 key areas which it considers to be essential requirements for any decision to invest in the Project. They are as follows;

- Successful Delivery of the FEED Programme.
- Delivery of a total CAPEX cost of less than £1bn (to cover all necessary construction and modification costs associated with the Capture Plant, the compression facilities, the Power Plant, the transportation, offshore storage and injection facilities).
- Delivery of a project Return which meets a minimum threshold set by Shell Leadership.
- Successful negotiation of a set of Commercial terms with respect to risk, reward and apportionment of liabilities.
- Political and regulatory certainty, while meeting the Authority's stated requirements including, the provision of clean electricity by 2020.

Successful Delivery of the FEED Programme.

The FEED Agreement which governs the Bidder's activity during the Authority's "Risk Reduction Phase" contained 145 Deliverables (including Key Knowledge Deliverables) to the Authority. The Programme of work has been delivered according to plan, with no retentions payments held by the Authority at the time of writing. Successful delivery of FEED is of course a prerequisite to any decision to invest. There have been no adverse developments in the execution of the FEED Programme of work that would have had a bearing on FID.

During the Risk Reduction Phase, Shell has, in conjunction with SSE and its main FEED Contractors Technip and WG Kenny designed a technical solution for Peterhead capable of implementation. As part of this process, Shell has sought to identify any design, engineering or construction risks to execution and to formulate appropriate mitigating actions. No technical issues of import have been identified that would have prevented an affirmative FID being made.

In the commercial sphere, a full suite of commercial and supply chain arrangements have been developed. Shell's governance requirements usually require that fully termed agreements be either

executed (with appropriate conditions precedent in place) prior to FID, or as soon as reasonably possible following FID and subsequent Board Approval. For this Project, it is Shell's understanding that the Project Contract and the CFD can only be executed once Shell as Bidder is invited to do so, following Project evaluation by the Authority and observance of due legal process, and therefore a deviation from Shell's standard process would be required. Before proceeding to FID, Shell therefore requires successful negotiation of a 'pre-execution draft' or equivalent (meaning that all commercial terms to be included in the Bid have been fully negotiated).

At the time of notice of the HMG decision on the 25th November 2015, negotiations with the Authority were very well advanced, with both parties anticipating sufficient contractual closure to allow a Shell bid and FID to be taken by year end.

The five EPC contracts, the technology licence arrangements and the suite of commercial arrangements with SSE were also in the final stages of development on the 25th November 2015 with no more than 2-3 weeks of activity remaining before execution of agreements. The other necessary supporting commercial arrangements including those with the Crown Estates Commissioners, the St Fergus Gas Terminal owners and the Goldeneye facilities owners were either complete or were capable of completion at FID. The maturity of these agreements and Shell's readiness to execute would also have been an important consideration in any FID.

All of Shell's obligations under the FEED Agreement have been completed.

Delivery of a total CAPEX cost of less than £1bn

In 2013, Shell set its own ceiling on the P50 (being defined as the mostly likely outturn cost) total CAPEX cost estimate at FID for the Project to proceed. The reasons for this were as follows;

- The Peterhead Project is in competition with other capital intensive projects within Shell for funding.
- The Project needs to represent Value for Money both in terms of capital outlay and total call upon the public purse through the CFD.

Although all EPC contracts had been fully evaluated by Shell or SSE as appropriate, none had been awarded at the time of the announcement by HMG. However, Shell is able to state that's its cost objective (subject to final signature) had been achieved, so there was no reason to believe the proposed CAPEX would have an adverse effect on FID.

The costs were verified independently from the Project team (but within Shell's global organisation) and considered to be appropriate for a FOAK application. This assessment was also substantiated through independent Benchmarking carried out by Shell.

Linked to the cost estimate is the forecast schedule for the completion of the design, construction and full chain commissioning of the necessary onshore and offshore facilities leading to the declaration of clean electricity generation. The CCS Commercialisation Competition required that this be achieved no later than 2020. On the basis of the work undertaken on the schedule planning process during FEED, Shell was on track to deliver a bid with a planned date for the declaration of clean electricity generation in the 2nd half of 2020.

Delivery of a Project Return which meets the minimum threshold set by Shell Leadership.

Throughout all stages of the competition, Shell has made its return requirements clear to the Authority, and provided wider context to the Authority on its position. This information is commercially sensitive. Any movement away from the negotiated position would have had a significant bearing on FID.

Successful negotiation of a set of Commercial terms.

As part any FID decision, it is incumbent upon the Project team to demonstrate that Shell's expectations in respect of the commercial risk-reward allocation at the time of entering into FEED has materially been preserved throughout the course of negotiations during FEED, and appropriately represented in the fully termed agreements.

The areas of principle commercial concern which will be considered in any FID decision are largely in line with the Authority's own areas of concern and are as follows;

- First and foremost, the economics of the Project need to be robust and commensurate with the risk and reward allocation of the Project.
- The contribution of the Authority to the Project through the Capital Grant, and preservation of the level submitted in previous bids.
- The level and derivation methodology of the Strike Price including the rebasing procedures. Included in any assessment would be the scope and application of the 'Rebaseable Parameters' (meaning the demonstration parameters that are permitted to cause changes to the Strike Price from its initial level), the scope of fuel gas and power price indexation, and remaining cost migration risk to the Developer through the CFD.
- The CCS risk share regime, including cost apportionment shares, and the scope of the CCS Risk definitions.
- The sharing of cost escalation during the construction phase.
- The role, function and level of any Liability Caps.
- The consequences for early termination in respect of indemnities provided and termination sums paid by the Authority to the Developer, or sums paid to the Authority in the case of where the Developer defaults under the agreements.
- In respect of decommissioning;
    a) Recovery of historic decommissioning costs in respect of the existing Goldeneye facility to the extent that in principle, the call upon the public purse is no greater than it would have been had the facility been decommissioned in the absence of a CCS Project, and,
    b) Appropriate indemnities for decommissioning costs in the event of early termination.
- The level of the maximum funding that HMG is liable to pay the Project through both the Project Contract and the CFD, and provision for cost and price outcome uncertainties.
- Appropriate upside and third party value sharing provisions and share apportionment.
- The level and nature of any Guarantees provided, not just to the Authority, but also the supply chain.
- The impact of the Authority requirements in relation to Intellectual Property and on the technology providers' proprietary rights and business.
- The degree to which the Developer carries risk in the supply chain as a result of the following;
    a) The extent to which the Developer has achieved through the negotiation of appropriate contract terms, a construct which sufficiently incentivises Key-Subcontractors to align their terms and conditions and behaviours with the wider Project objectives.

b) The extent to which there are limitations in the warranties and indemnities provided by Sub-contractors for non-performance in the supply chain resulting in the Developer defaulting to the Authority.

c) Whether there are limitations in "flowdown" of Authority requirements in the Project Contract, which are sufficiently material to compromise the Developer's economic position.

HMG's decision to remove the capital funding available to the CCS Competition under the Project Contract and therefore the removal of the Capital Grant represents a fundamental and material departure from the commercial assumptions made by Shell in respect of the risk and reward allocation at the time of entry into the Competition and subsequently at FEED. As a result of this change alone, Shell is unable to proceed with the Project; the final decision to this effect being made on the 18th December 2015. This is notwithstanding very good progress made in negotiations with the Authority in all other areas of the Project Contract and CFD, and in the supporting arrangements in the supply chain.

Political and regulatory certainty.

Political and regulatory certainty is fundamental to any significant investment of this type. In this case, alignment with HMG on the wider objective of commercialising CCS in the UK over the long term is paramount. Assessment of the regulatory environment in the UK would have had in any event a significant bearing on an FID decision.

Given that Shell had progressed the material regulatory consents including having obtained the required storage licence, agreed the terms of the Storage Permit application with HMG and lodged with the European commission for approval, and having obtained the necessary planning consents from the Local Authority, there was no reason to believe the required certainty would have an adverse effect on FID.

2.4. Other important considerations

Successful demonstration and roll-out of the CCS in the UK requires broad industry participation. Shell has considered it extremely important that other industry participants of sufficient stature invest in the Project as Shareholders to the Developer. The Authority has acknowledged this need, and has worked with Shell as Bidder to provide some flexibility in this area to enable broader industry representation at a future point in the Project. Shell considers the interests of the Bidder and Authority to be well aligned in this area.

As part of the Project FID, it was considered imperative that it be demonstrated that the Project is investible by one or more third parties, separate from any view on the Project by Shell. A view on "investibility" would therefore have been a material Bidder consideration in arriving at a positive FID.

3. Conclusion

Due to the decision by HMG on the 25th November 2015, the full spectrum of considerations described in this Deliverable were never actually brought to bear in the final investment decision made by Shell.

Whilst it is clear that it is not the intent of this Deliverable to describe the hypothetical outcome of a final investment decision had the Capital and CfD Competition funding contribution of HMG

remained in place, any decision made by Shell would have required a full assessment of the technical, economic, commercial, organisational and political factors pertinent to the Project.

4. Glossary of Terms

Term	Definition
CAPEX	Capital Expenditure
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture and Storage
CFD	Contract For Difference
CO_2	Carbon Dioxide
EPC	Engineering, Procurement and Construction
FEED	Front End Engineering Design
FID	Final Investment Decision
FOAK	First of a Kind
GT	Gas Turbine
HMG	Her Majesty's Government
MFA	Maximum Funding Amount
SSE	SSE Generation Ltd
UK	United Kingdom
WG	Wood Group