Ince Bio Power Limited

INCE BECCS PROJECT – PILOT PLANT – PHASE 2

Project Closure Report

PROJECT CLOSURE REPORT
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1 Introduction

1.1 Project Background

The Ince Bio Power Facility ("the Existing Facility") is a biomass power station located in Cheshire, operated by Ince Bio Power Limited (IBPL) and owned by Bioenergy Infrastructure Group (BIG). BIG and Peel NRE along with C-Capture and WSP successfully delivered Phase 1 of the Ince Bioenergy Carbon Capture & Storage (InBECCS) Project which was looking to develop a circa 10tonne/day (original concept was 20tpd but scaled down to 10tpd to meet funding constraints) CO_2 capture plant interfacing with the Existing Facility under the BEIS (NOW DESNZ) led Direct Air Capture (DAC) and Greenhouse Gas Removal (GGR) Innovation Programme ("the Programme").

Following successful completion of Phase 1, IBPL secured funding from BEIS (NOW DESNZ) for Phase 2 of the InBECCS Project which detailed the development and implement a 10tonne/day CO_2 capture Pilot Plant (minimum capacity of 1,000 tCO_2e per annum) at the Existing Facility.

C-Capture were providing the proprietary design for the carbon capture technology which would have been deployed at the Pilot Plant and WSP were providing Front End Engineering Design (FEED) and Detailed Design activities to facilitate the procurement and construction of the new Pilot Plant and its integration into the Existing Facility. The project team were to take forward the pre-FEED designs developed during Phase 1 of the Programme for the 20tpd concept and progress FEED design, Detailed Design and Procurement for the scaled down 10tpd integrated Pilot Plant. The technical detail undertaken were to be at the level to allow procurement, construction, commissioning, and operation of the fully integrated Pilot Plant.

1.2 Purpose of this Report

The purpose of this report is to provide a close out report for Phase 2 of the Ince BECCS (InBECCS) Project for the period from project initiation until the notice of Pause Date on the 21/09/2022.

The report has been structured to align with the previous issued monthly reports and has been amended to include the required closure report information detailed below:

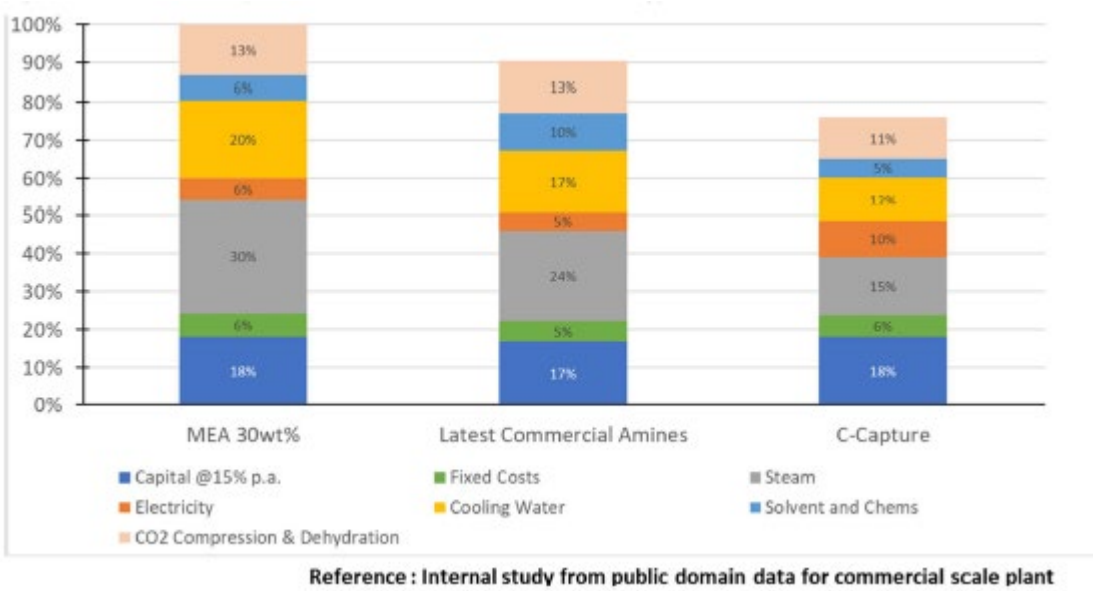
- Completed Deliverables
- Remaining Deliverables
- Reasoning on decision to close
- Lessons learned re the technology and the process of delivery

2 The C-Capture Process

2.1 Technology Summary

C-Capture has patented a unique, solvent-based technology which offers a safe, low-cost way to remove carbon dioxide from atmospheric emissions using a post-combustion capture approach and has been specifically developed as an alternative to amine-based systems, which are the main commercial offerings at present. C-Capture's solvent is amine and nitrogen free, leading to distinct commercial and environmental benefits when compared with existing technologies and particularly well-suited to low-cost carbon capture in power generation and hard-to-abate industries. C-Capture technology is sufficiently differentiated that it will provide customers with multiple benefits, including reduced CAPEX and OPEX, due to the fundamentally different nature of the technology. When combined, these represent a significant reduction in cost per tonne of CO2 abated when compared with alternative commercially available solvents. Figure 2-1 represents C-Capture's inhouse evaluation of these benefits and refers to the core ISBL technology only (i.e. additional potential OSBL benefits are not included in this comparison).

Figure 2-1 – Cost of CO2 Capture – Normalised to MEA 30wt% Technology



Reference : Internal study from public domain data for commercial scale plant

C-Capture's technology represents an attractive option due to lower energy requirements, reduced solvent degradation without potential nitrosamine formation or emissions and reduced materials of construction costs due to very low solvent corrosivity. The solvent components are not classed as hazardous and are based on inexpensive commodity chemicals which are biodegradable and potentially also available from sustainable resources.

The fundamentally different chemical processes operating in the C-Capture process means it represents a true step change in performance, requiring an energy requirement between

1.5 - 2 GJ/tonne CO2 captured, compared to >2.5 GJ/tonne CO2 for the best of the amine-based systems. (This range is general to C-Capture technology and is non project specific).

2.2 Process Overview

The C-Capture technology is a post-combustion carbon capture process tailored for use with a novel, amine and nitrogen free solvent with inherently lower energy requirements than other commercially available solvents.

Flue gas from the Existing Facility is cooled prior to entering an absorber column and then passes counter-currently with the unique solvent, where the CO2 is removed from the flue gas.

The treated flue gas exits the absorber column and enters the absorber wash column where wash water is recirculated to reduce the VOC content within the stream. The treated flue gas exits the absorber wash column and then passes through a gas-gas heat exchanger where it is heated against the incoming cooler flue gas before returning to the Existing Facility. The accumulated water/VOC from the bottom section is sent to the absorber VOC recovery package for recovery of organic compounds. The concentrated waste stream is directed to the aqueous management package where it is treated to recover a VOC rich stream which is recycled back to the solvent storage system. The effluent from the Aqueous Management Package will be sent to the Existing Facility's water recycle system. Fresh solvent is added to the system to maintain the overall balance.

The loaded 'rich' solvent exits at the bottom of the absorber column and is pumped through the lean/rich heat exchanger where it's heated against the returning unloaded 'lean' solvent. The rich solvent is further heated through the stripper steam boiler to create a multi-phase flow before entering the stripper column where CO2 readily releases from the solvent following a marginal decrease in pressure within the stripper column. The lean solvent is collected at the bottom ready for recirculation through the lean/rich heat exchanger.

The resulting CO2 stream enters the stripper wash column where the circulating wash water condenses the water vapour and recovers the VOCs from the CO2 stream. The accumulated water/VOC from the bottom section of the stripper wash column is sent to the Stripper VOC Recovery Package, which performs a similar process to the Absorber VOC Recovery Package. The resulting CO2 stream exits the top of the stripper wash column where the purification and composition are measured and then for the purpose of the Pilot Plant, is reduced in pressure and remixed with the returning treated flue gas. Alternatively, for commercial design plants, this concentrated CO2 stream could then be compressed and dehydrated ready for distribution into a pipeline system or fed directly to a utilisation process if required.

3 Project Progress

3.1 Progress Overview

The project team have progressed various engineering deliverables in line with the FEED delivery programme up until the project pause date (21/09/22). Special focus had been on developing process engineering deliverables which would underpin the process design of the Pilot Plant going forward.

Also, WSP have reviewed ground investigation reports for the Existing Facility and made recommendation to IBPL for additional geotechnical survey, below-ground services survey and topographical survey required for the Pilot Plant plot area.

WSP have developed a scope for a Construction Contractor to support the FEED phase. IBPL have used this scope to issue an Invitation to Tender (ITT) to Doosan, Ledwood Mechanical Engineering Ltd. (LMEL) and Equans.

WSP have been continually engaging with other stakeholders of the project such as Environmental Agency, IBPL's planning consultant to progress the planning and permitting activities for the Pilot Plant.

Project deliverables issued and those not completed can be seen in the sections below.

3.2 Project Deliverables Completed

With reference to the project deliverables as defined in the contract between IBPL and BEIS (NOW DESNZ), that have been issued to the Monitoring Officer (MO) for review both prior to the project pause date and as part of the project closure process.

Issued to MO for Approval - Prior to Pause

ID	Deliverable Description	Date Issued to MO	Commentary
1.1	Q2 – 2022 Project Management - (13/07/22)	14/07/2022	INBECCS – Phase 2 Kick Off Mtg MoM – 22-06-30 Ph2 Kick-off Meeting BEIS – 30.06.2022 – FINAL – Full Pack
1.1	KPIs	14/07/2022	NZIP_KPI_START_GGR_Phase 2_INBECCS_Jul2022_WIP_[TR] – v0.1
2.1	Pre-Application Meeting - Planning	14/07/2022	
3.1	Pre-Application Meeting - Permit	14/07/2022	
4.1	Project Management - Project Execution Plan	03/08/2022	

4.1	Project Management - Project Risk Register	29/07/2022 26/08/2022	Monthly Reporting
4.2	Process Engineering - Process Design Basis	24/08/2022	
4.2	Process Engineering - Process Description (C-Capture Pilot Plant)	26/08/2022	

Issued to MO for Approval – For Project Closure

ID	Deliverable Description	Date Issued to MO	Commentary
1.2	Q3-2022 Project Management - (12/10/22)	03/03/2023	Part of part complete deliverables agreement
2.2	Planning Application - Submission	03/03/2023	Part of part complete deliverables agreement
4.2	Process Engineering – Emissions Summary	03/03/2023	Part of part complete deliverables agreement
4.2	Process Engineering – Overall Heat & Mass Balance	03/03/2023	Part of part complete deliverables agreement
4.2	Process Engineering – Overall Process Flow Diagrams	03/03/2023	Part of part complete deliverables agreement
4.2	Process Engineering – Preliminary P&IDs	03/03/2023	Part of part complete deliverables agreement

3.3 Project Deliverables Not Completed

The below project deliverables are following the project pause and subsequent project closure agreement and will not be issued:

ID	Deliverable Description	Commentary
1.3	Q4-2022 Project Management - (11/01/23)	
4.1	Project Management - HSE Design Risk Management Plan	
4.2	Process Engineering (Deliverables below only)	Deliverables below only: Process Control Narrative Overall Utility Flow Diagrams

		Interface Block Flow Diagram Interface (tie-in) register Utility summary Relief Load summary Preliminary relief valve sizing (OSBL)
4.3	Process Safety	All deliverables
4.4	Mechanical & Piping Engineering	All deliverables
4.5	Electrical Engineering	All deliverables
4.6	C&I Engineering	All deliverables
5.1	Project Management	All deliverables
6.1	Tender Construction Contract	All deliverables
1.4	Q1-2023 Project Management - (12/04/23)	All deliverables
6.2	Contract Award (Construction Contractor)	All deliverables
6.3	Start on site	All deliverables
1.5	Q2-2023 Project Management - (12/07/23)	All deliverables
5.2	Process Engineering	All deliverables
5.3	Process Safety Engineering	All deliverables
5.4	Mechanical & Piping Engineering	All deliverables
7.1	Tender for Mechanical & Piping	All deliverables
7.2	Tender for Electrical	All deliverables
7.3	Tender for C&I	All deliverables
7.4	Orders placed	All deliverables
8.1	Project Management	All deliverables
1.6	Q3-2023 Project Management - (11/10/23)	All deliverables
5.5	Electrical Engineering	All deliverables
5.6	C&I Engineering	All deliverables
1.7	Q4-2023 Project Management - (10/01/24)	All deliverables
7.5	Equipment delivery to site	All deliverables
1.8	Q1-2024 Project Management - (10/04/24)	All deliverables

8.2	Mechanical Installation	All deliverables
1.9	Q2-2024 Project Management - (10/07/24)	All deliverables
8.3	Piping and Tie-in installation	All deliverables
8.4	Electrical Installation	All deliverables
8.5	C&I installation	All deliverables
9.1	Project Management	All deliverables
9.2	Pre-Commissioning	All deliverables
9.3	Commissioning	All deliverables
1.10	Q3-2024 Project Management - (16/10/24)	All deliverables
9.4	Performance Testing	All deliverables
10.1	Project Management	All deliverables
1.11	Q4-2024 Project Management - (09/01/25)	All deliverables
1.12	Q1-2025 Project Management - (31/01/25)	All deliverables

3.4 Project Closure Decision

The project relied on ~£4.9m of BEIS (NOW DESNZ) grant funding for the core technology, known as the inside battery limit scope ("ISBL") and ~£6.2m of external funding for the supporting infrastructure or outside battery limit scope ("OSBL"), initially intended to be funded by BIG, the owners of Ince Bio Power. At the time the project started BIG expected that there would be a Government supported route to market for a full-scale carbon capture plant at Ince provided through the Power BECCS business model. This supported proceeding with a part grant funded demonstrator project to de-risk C-Capture as a potential technology licensor for a commercial scale plant supported under the Power BECCS business model. The Power BECCS allocation process held during Q3-Q4 2022 did not allow small/medium scale projects like Ince Bio Power to participate. Without a route to a return for a commercial scale equivalent, there was no incentive for BIG and IBPL to carry on funding the demonstrator. No alternative source of funds could be identified, at which point after discussion with BEIS (now DESNZ) officials and project partners, it was decided to dis-continue the project.

4 Lessons Learned

4.1 Project Lessons Learned

The project was not progressed enough through the FEED and Detailed Design Phases to complete a detailed lessons learned for the technology or the process of delivery.

5 Commercial

5.1 Invoicing

Ince Bio Power Invoicing to BEIS (DESNZ)

As part of the contract between IBPL and BEIS (NOW DESNZ), a Contract Finance Table was included which detailed the deliverables to be issued to the MO and BEIS (NOW DESNZ) and the associated payment milestone associated with them. A copy of the IBPL Invoice Schedule has been provided below.

Payment Milestone Schedule

Milestone ID	Invoice Due Date	Deliverables	Cost (Excluding VAT) (Total)
1	13/07/2022	1.1, 2.1, 3.1	£48,420.61
2	12/10/2022	1.2, 3.2.4.1	£86,270.61
3	11/01/2023	1.3, 2.2 4.2, 4.3 4.4 4.5 4.6, 5.1, 6.1	£342,749.98
4	12/04/2023	1.4, 6.2, 6.3	£115,770.61
5	12/07/2023	1.5, 5.2, 5.3, 5.4, 7.1, 7.2, 7.3, 7.4, 8.1	£702,473.81
6	11/10/2023	1.6, 5.5, 5.6	£208,248.23
7	10/01/2024	1.7, 7.5	£761,971.41
8	10/04/2024	1.8, 8.2	£583,933.11
9	10/07/2024	1.9, 8.3, 8.4, 8.5, 9.1, 9.2, 9.3	£1,970,258.11
10	16/10/2024	1.10, 9.4, 10.1	£90,770.61
11	09/01/2025	1.11, 10.1	£40,770.61
12	31/01/2025	1.12	£40,770.61
			£4,992,408.30

Actual invoices issued and the project closure part completed deliverables agreed are detailed below:

Milestone ID	Invoice Issue Date	Deliverables	IBPL Invoice Ref.	Invoice Status	Cost (Excluding VAT) (Total)
1	13/07/2022	1.1, 2.1, 3.1	SIN220700290	Approved; Payment Received	£48,420.61
Project Closure – Part Deliverables Agreed	07/03/2023	1.2, 2.2, 4.1, 4.2	SIN230300097	Approved; Payment Pending	£73,125.37
					£121,545.98

End of report

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