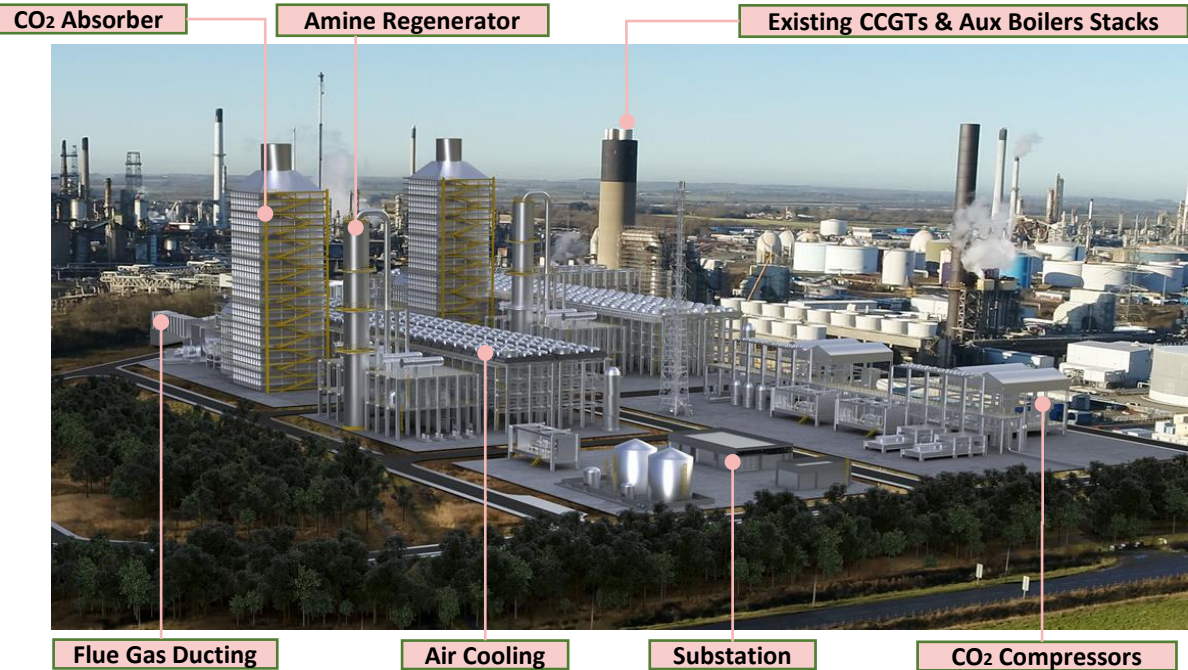


HUMBERZER 

VPI Immingham
Post Combustion Carbon Capture Project



VPI Immingham Post Combustion Carbon Capture Project

Mechanical Equipment

Fabricated Equipment

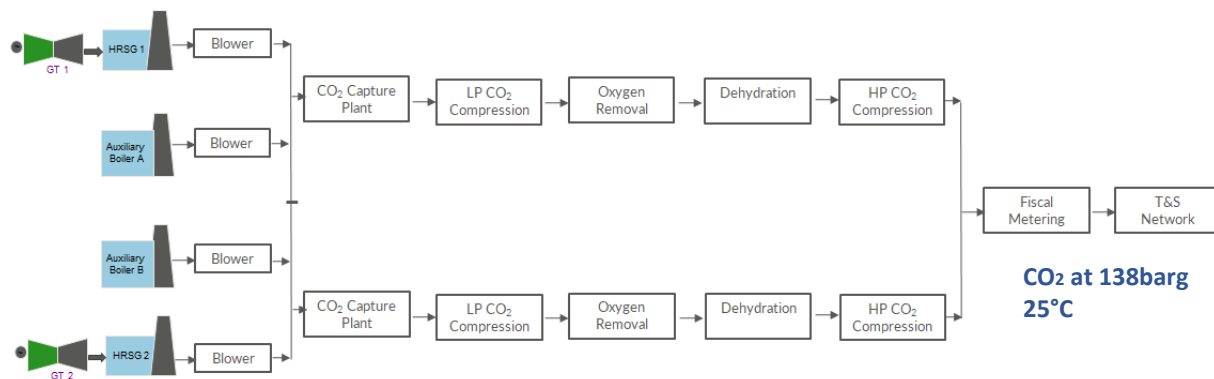
- Air Cooled Heat Exchangers - appr. 200
 - Water, solvent and CO₂ coolers
- Plate Heat Exchangers (SS) - appr. 9
- Shell and Tube Exchangers (SS) x 5
- Direct Contact Cooler and Absorber x 2
 - 18m Square slipform concrete built towers with 316SS lining, with internals and structured packing. DCC approx. 30m high & absorber approx. 60m high
- Pressure vessels and columns – x 23
 - ASME VIII
 - Up to 28m high x 8.8m Ø column; with structured packing
 - 316L SS or CS +316L clad
 - Filter Vessels
- Storage Tanks – x 3
 - CS + SS lining, up to 2000 m³

Rotating Equipment

- Compressors x 4
 - LP & HP Integrally geared centrifugal, 140 bar discharge, approx. 20MW
 - Mechanical Vapour Recovery compressor approx. 6MW
- Steam Turbine Generator (1 x 60MW)
- Pumps – x 50
 - Centrifugal ISO 5199
 - Centrifugal API 610
- Flue Gas Fans – x 4

Packaged / Misc Equipment

- Process Packages
 - Thermal reclaimers as standalone equipment or as part of package
 - O₂ Removal
 - H₂ Generation
 - CO₂ dehydration
- Utility Packages
 - Chilled Water
 - Waste Water Treatment
 - Air Compression and Dryer
- Desuperheaters x 4



Flue gas 180°C and atmospheric pressure

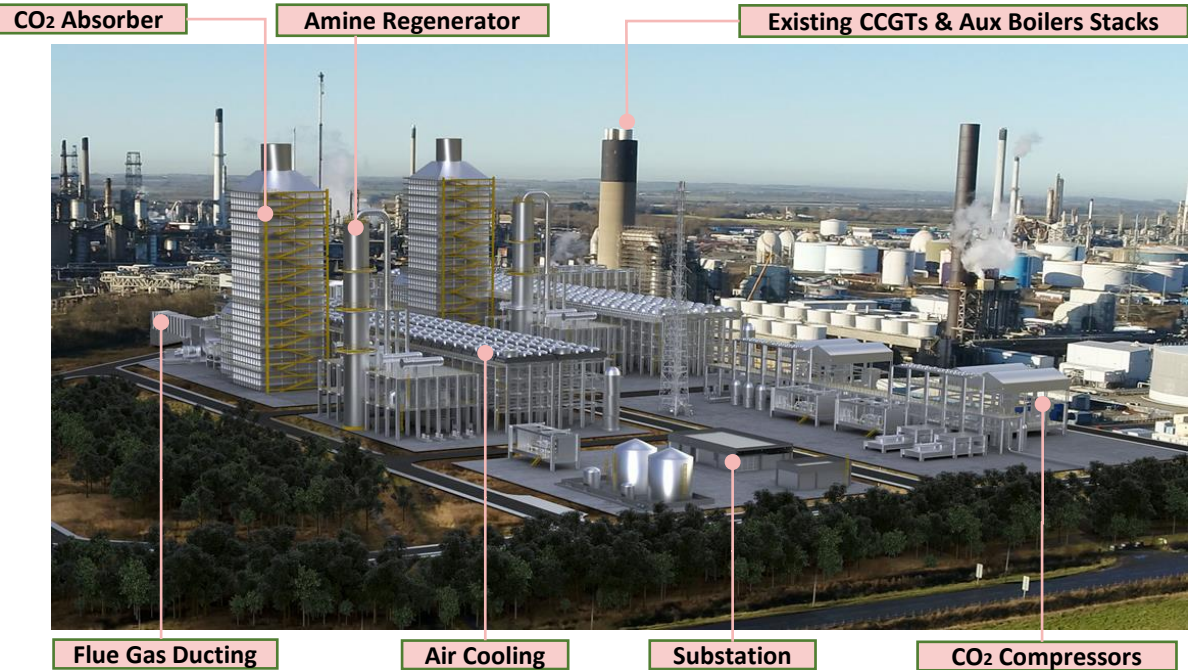
Low pressure absorption & regeneration

Compression, Deoxygenation & Dehydration

CO₂ at 138barg
25°C

HVAC

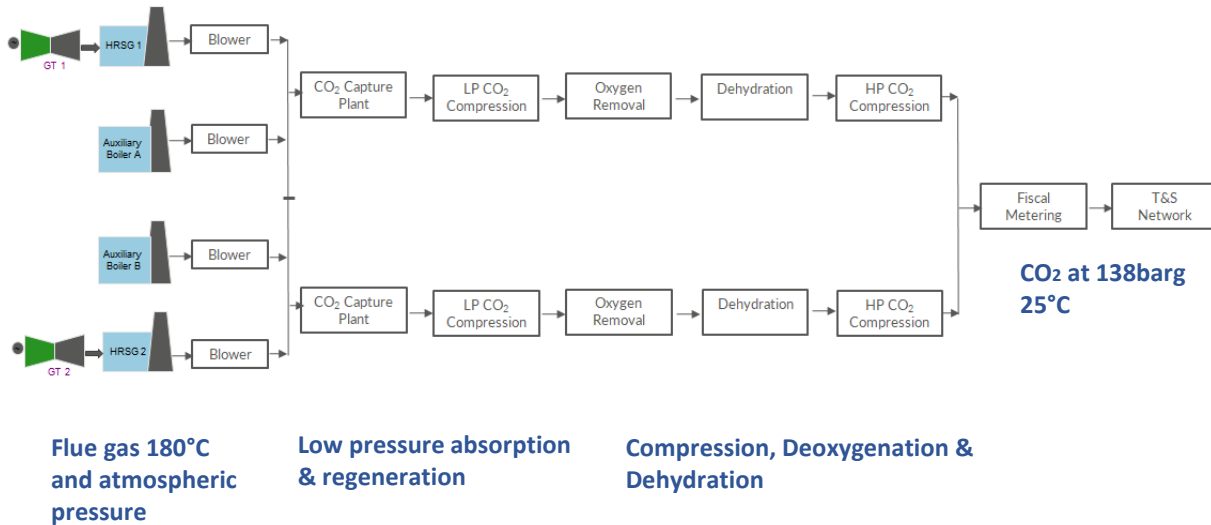
- Instrument equipment buildings
- Substation buildings
- Analyser house

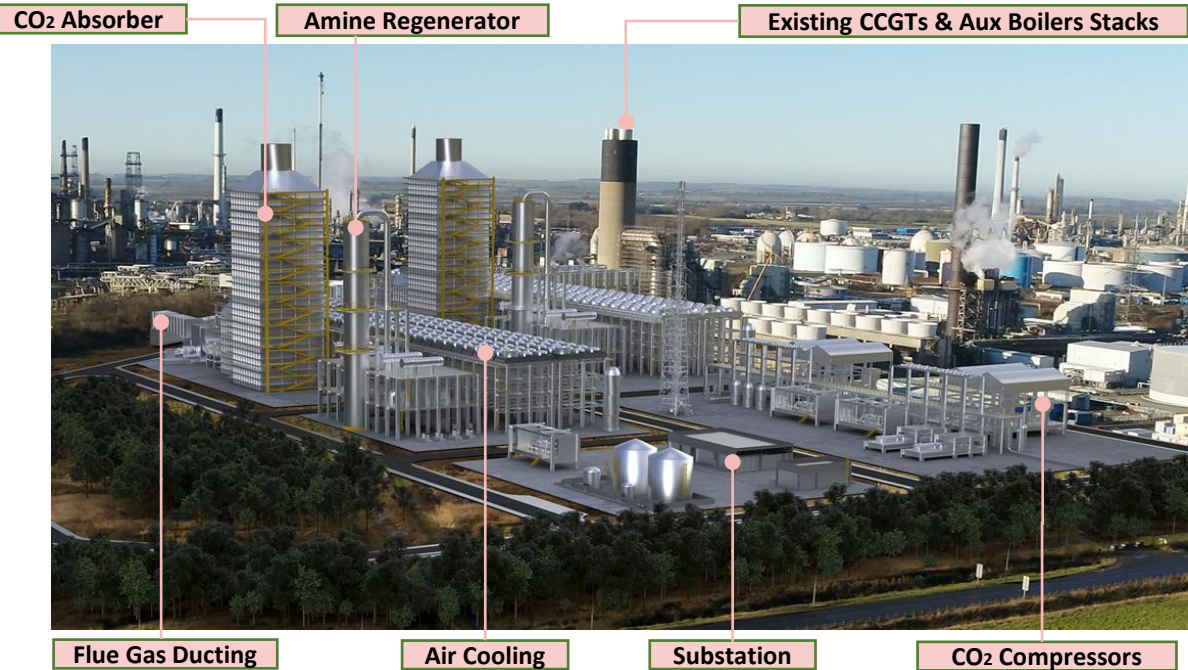


VPI Immingham Post Combustion Carbon Capture Project

Piping

- **Piping**
 - Pipe sizes from 1" to 60" NB (average 6" NB) – prelim estimate 30km
 - Materials: LTCS, 316/316L, 1.25Cr-0.5Mo, 9Cr V GrP91
 - Fittings, flanges, stud bolts, gaskets, pipe supports and support ancillaries
 - Estimated 16% LTCS, 84% Stainless Steel, 304L and 316/316L
 - U/G GRE systems
- **Valves**
 - Gate, Globe, Ball, Butterfly and Non Return Valves
 - 150LB, 300LB, 600LB, 1500LB
 - Materials: 316 SS A182 F316, 316 SS A351-CF8M, A182 Gr. F11, A182 Gr. F91, A217 Gr. C12A, A217 Gr. WC6, LTCS A350-LF2 CL.1, LTCS A352-LCC
 - Standards: API 594, API 600, API 602, API 608, API 609, API 6D, BS 1873
- **Typical Services**
 - HP, MP, LP Steam
 - Steam Condensate
 - Rich / Lean Amine (Solvent)
 - Carbon Dioxide Process (Wet / Dry)
 - Demineralised Water
 - Instrument Air / Plant Air
 - Amine Drains
 - Firewater U/G & A/G
 - Potable Water U/G & A/G
 - Lube Oil
 - Caustic 0-50%
 - Caustic Drain
 - Hydrogen
- **Digital delivery with 3D model**
- **Post Weld Heat Treatment**
- **Positive Material Identification**





VPI Immingham Post Combustion Carbon Capture Project

Civils, Structural, Architectural

Preliminary data

Developed area	82,434 m ²
"Road" surface	20,000 m ²
"Hardstanding"	35,500 m ²
Watercourse diversion	556 m
CFA Piles (approx. 25m long)	3,800 Nr.
Concrete	17,000 m ³
Pipe racks	880 m length
Duct support routes	600 m length
Steelwork	3,400 tonne

Civil Engineering Works

- Foundations – CFA type piles end bearing into weak chalk bedrock at 20 to 25m depth
- Site levels elevated from current levels
- Diversion of current watercourse
- New access roads
- New ponds, storm drainage and process drains with oil separation

Pipe, cable, duct racks

- Hot rolled steelwork frames, portalised transversely and braced longitudinally
- Potential for modularisation or partial off site construction

Structural supports

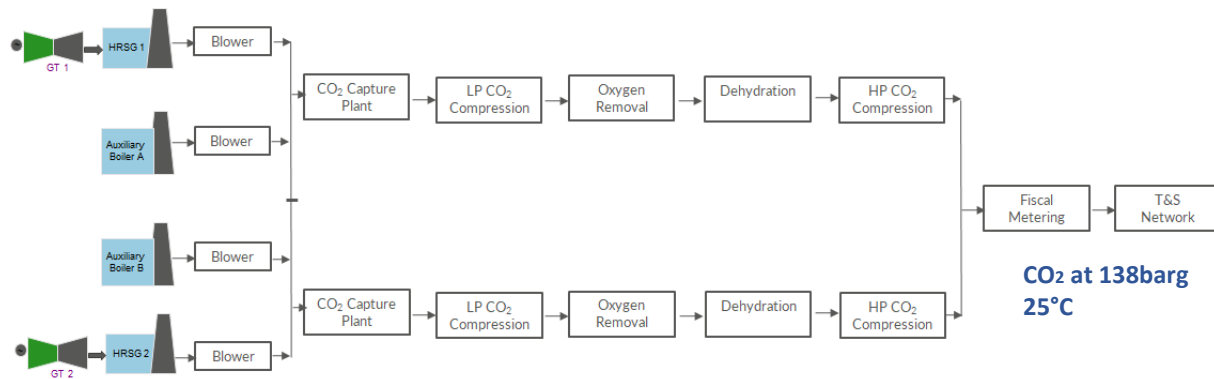
- Hot rolled steelwork frames. Braced as necessary
- Supports will be required primarily for Flue Gas Ducting and Air Coolers
- Existing structural supports may be modified and extended within the current plant

Buildings

- Modify existing buildings and new modular builds
- New CCR for the Carbon Capture Unit
- New substations, field instrument rooms, compressor shelters

Flue Gas Ducting

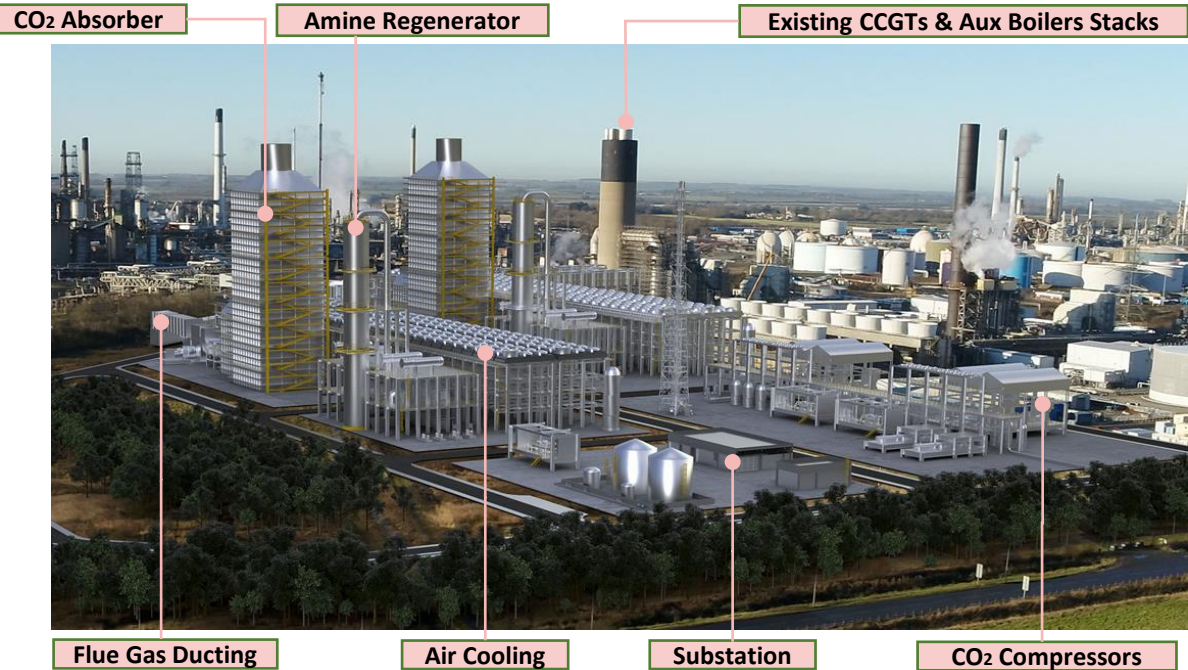
- Mild steel and both square and circular cross sections
- External insulation and weather cladding is expected to be provided
- Ducts supported at height over roads and existing facilities



Flue gas 180°C and atmospheric pressure

Low pressure absorption & regeneration

Compression, Deoxygenation & Dehydration



VPI Immingham Post Combustion Carbon Capture Project

Electrical

Outline Concept

- Tie-in points at Isolated phase bus-ducts (IPBD) between GT-0101 and Transformer 11 and between GT-0102 and Transformer 12.
- IPBDs connect tie-in points at 15.75kV and cross the road over to the boundary. At the boundary, the 15.75kV are to be stepped up to 33kV via step up transformers.
- Cables connect at the secondary side of the transformers and follow a predetermined route along the edge of the VPI Immingham plant. They get terminated at a new 33kV switchgear housed within a new Substation for the VPI Humber zero project.
- Electrical distribution network for the VPI Humber Zero project is carried out from within this Main substation.
- New Steam Turbine Generator.

Preliminary Data

15.75kV System

- 15.75kV Isolated Busducts
- 15.75 kV GCBs

Transformers

- 15.75/33kV transformers
- 33/6.6kV transformers
- 6.6/0.4kV transformers
- Oil Filled and Dry Type Transformers

HV and LV Switchgear

- 33kV switchgear
- 6.6kV switchgear
- LV switchgear
- Lighting and Small Power Distribution Boards

VSD Driven Motors (11kV, 6.6kV and 0.4kV)

- Compressor motors via unit transformers and VSDs up to 18MW
- Blowers
- Centrifugal Pumps

Large DOL Motors

- Various pumps up to 1.4 MW

Trace Heating

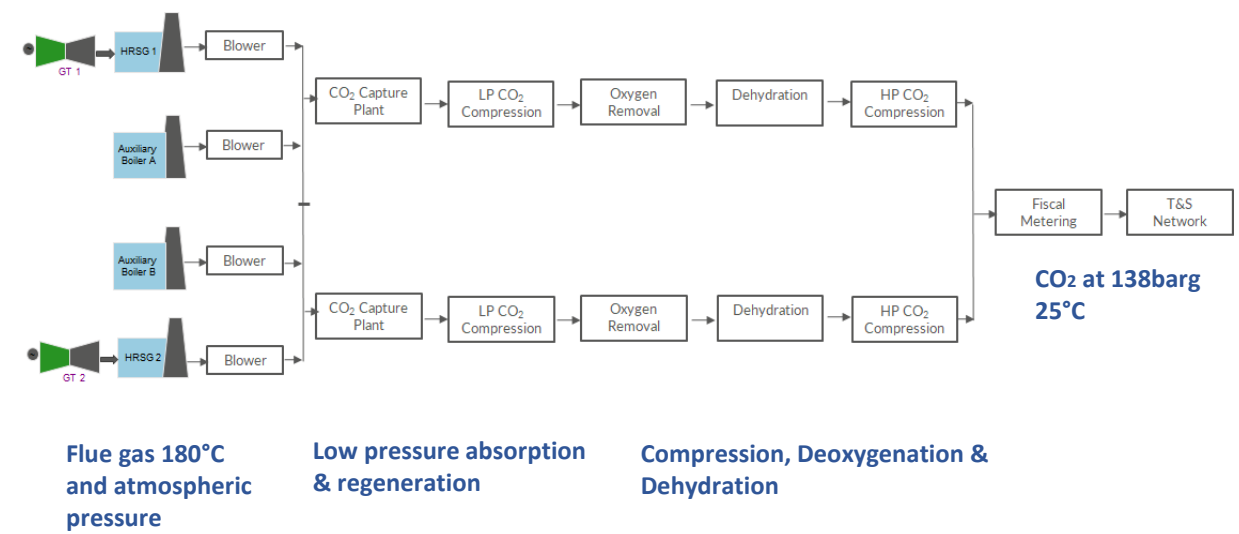
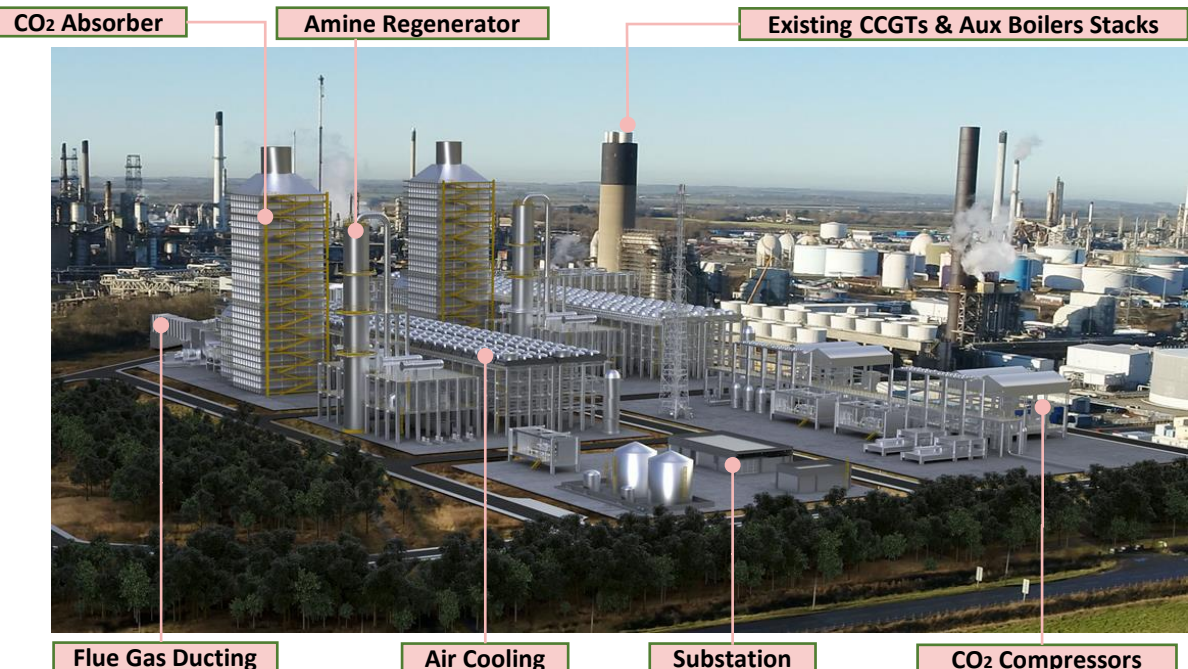
- Trace heating panels outdoor
- Trace heating cables

Emergency Diesel Generator

Other

- PMS, AC and DC UPS
- Cables (assorted), Trays
- Bulk Material – LCS, Lighting, Earthing Electrodes, LPS, Glands etc





VPI Immingham Post Combustion Carbon Capture Project

Control and Instrumentation

- **Outline Concept**
- Integrated Control and Safety System (ICSS) with approx. 5000 I/O
- Distributed Control System, Emergency Shutdown system, Fire and Gas Detection
- Machine monitoring / protection systems, operator training simulators as well as field instrumentation, analysers, fiscal metering, bulk material items (junction boxes, tubing, fittings, cable etc)
- Field Instrument Rooms (FIR) - approx. 3
- Central Control Room equipment including approx. 4 operator workstations, 1 engineering workstation, printers and 2 large wall mounted monitors

- **Preliminary Data**
- **Field Instruments**
 - Pressure Transmitters
 - Motor Operated Valves
 - Flow Transmitters
 - Flow Elements
 - Pressure Gauges / Temperature Gauges
 - Level Gauges
 - Fire & Gas Sensors
 - On/Off Valves/ESD Valves
 - Temperature Transmitters
 - Control Valves
 - Level Transmitters
 - Relief Valves

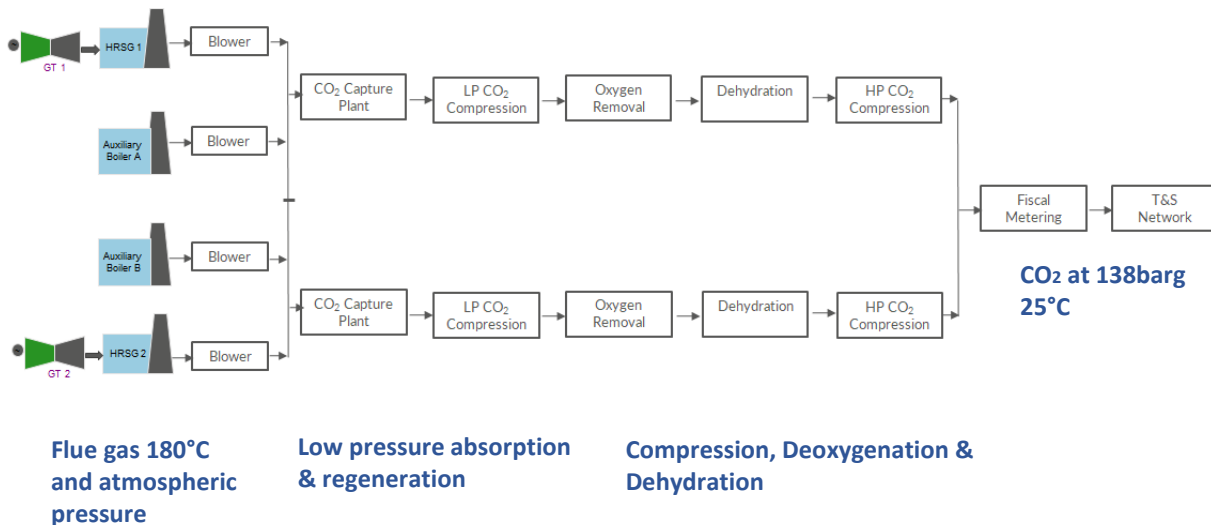
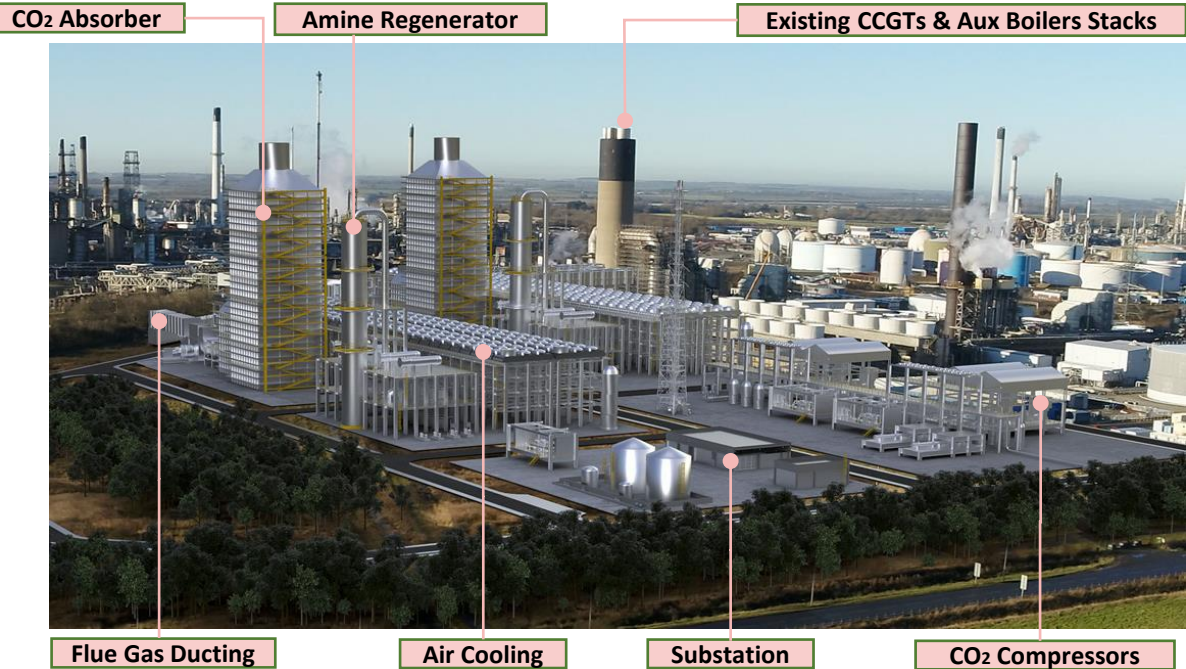
- **Analysers Inline**
 - pH
 - Others (General)
 - Moisture Content

- **Analyser Houses 2 off**
 - Gas Chromatographs, Oxygen content
 - Others (General)

- **Continuous Emissions Monitoring Systems (CEMS) Houses, 3 off**
- **CO₂ Fiscal Metering Skid complete with metering house (Gas Chromatograph, Metering computers & HVAC)**

- **Bulk Items**
 - Tubing/Fittings, Junction Boxes, cables, cable tray etc





VPI Immingham Post Combustion Carbon Capture Project

Telecommunications and Security

Outline Concept

- Existing Telecommunication and Security Systems shall be extended
- New central system equipment cabinets (approx. 4-5) shall be installed within the carbon capture plant either in FIRs / new CCR
- New system console equipment shall be provided at new and existing facilities where required i.e. CCTV workstations, PAGA Access Panels etc. in existing CCR, existing Gate House, new FIR / CCR control rooms.
- A FOC infrastructure shall be utilised for data / signal transmission and shared by Electrical, C&I and Telecom to provide connectivity between the existing facility and new carbon capture plant.

Preliminary Data

Local / Wide Area Network System

- Network Switches

IP Telephone System

- Indoor IP Telephones
- Outdoor Analogue Telephones
- Digital Voice Recorder

Structured Cabling System (SCS)

- RJ45 Data Sockets
- Data and FO Patch Panels

Digital Radio System

- Desktop/Dispatch Radio(s)
- Portable Handheld Radio(s)
- Antenna Repeater(s) (as required)

Public Address & General Alarm (PAGA) System

- Access Panels
- Indoor and Outdoor Loudspeakers
- Flashing Beacons (where noise exceeds 85dBA)

Bulk Items for all Systems

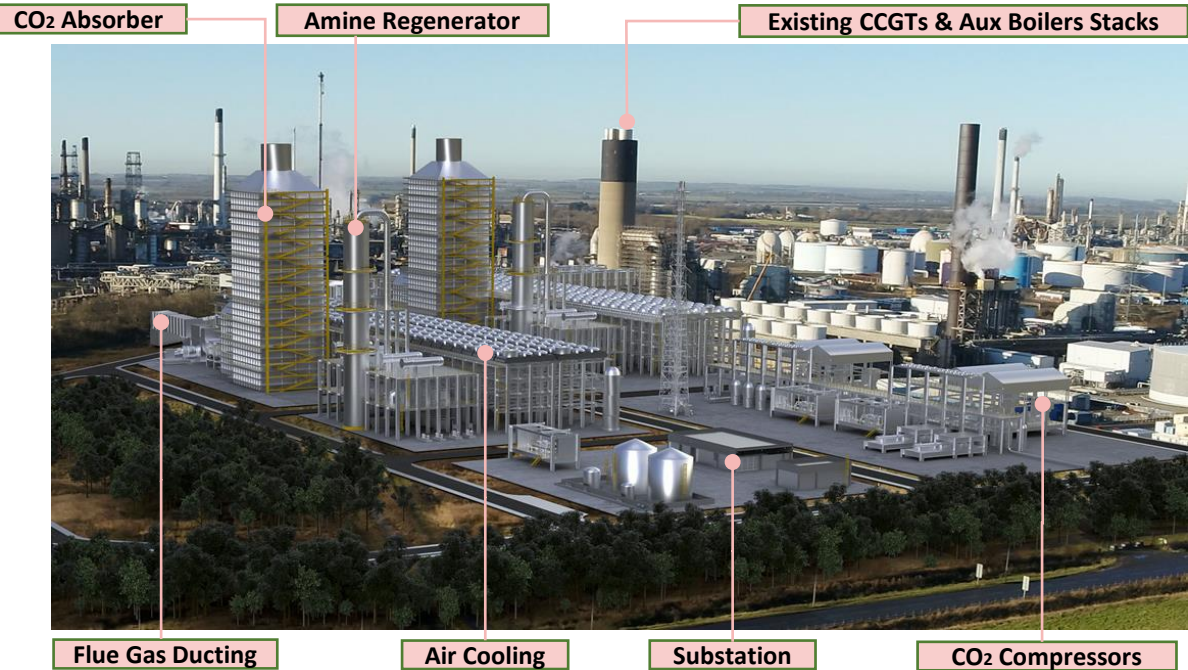
- Junction Boxes
- Cables & Glands
- Cable Tray etc

Security & Process CCTV System

- CCTV workstations incl. Large Screen Display
- Indoor & Outdoor Safe-Area CCTV Cameras
- Outdoor Safe-Area PTZ CCTV Camera
- Outdoor Hazardous Area fixed CCTV Camera

Access Control System (ACS)

- ACS Workstation incl. badge printer as required
- ACS Controllers
- Access control card readers
- Electromagnetic Door Locks & Door contacts
- Exit Pushbuttons
- Emergency exit release break glass unit



VPI Immingham Post Combustion Carbon Capture Project

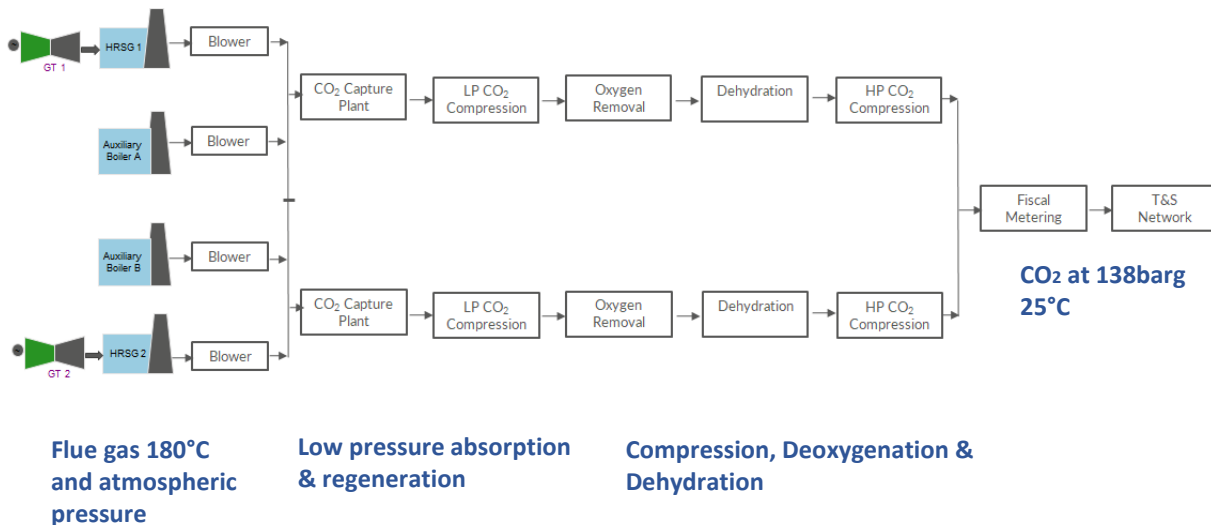
Supply Chain

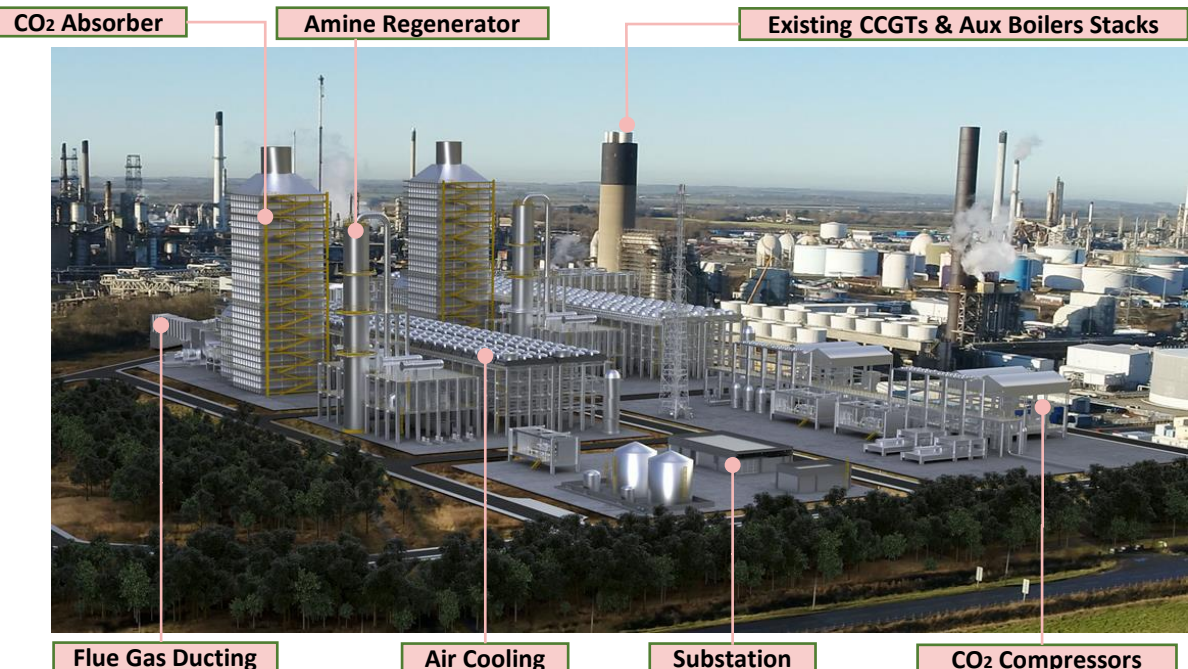
- **Objective**
 - To support the development of an Engineering, Procurement, Construction (EPC) package for the project, which will include a Class 2 cost estimate and an overall project schedule covering the period from commencement of EPC through to beneficial operation of the plant.
 - To support any other engineering, procurement, site preparations, permitting and project management activities during the FEED phase, which may be needed to achieve the overall project schedule.

- **Supplier Engagement**
 - We will be engaging with the supply base to explore and encourage participation to support the project. We will also engage with VPII's existing vendor list as well as Shell's (technology licensor) mandated vendors.
 - To support the funding model for UK Carbon Capture projects we will encourage suppliers to maximise the UK content of their materials and services, encouraging innovation whenever and wherever possible.
 - Actively promote and encourage vendors to offer cost saving options for consideration by the project wherever possible.

- **Behaviours**
 - Work to the highest standards of integrity and business ethics and eschew all forms of improper business practice
 - Respect and work in strict compliance with the project confidentiality requirements
 - Demonstrate an open and collaborative set of behaviours
 - Encourage a team working ethos with vendors

- **Timings**
 - Issue Expression of Interest – Commenced
 - Budget Enquiries to support Class 2 estimate – July to December 2022
 - Placing of purchase orders after project sanction from Q3 2023 onwards
 - ROS dates 2024-2025





VPI Immingham Post Combustion Carbon Capture Project

Construction Strategy

- HSE and quality requirements
- Advanced Work Packaging (AWP)
- Logistics & route restriction - 42m(L)x10m(W)x20m(H)
- Temporary facilities and laydown
- Maximise off site assembly with modularisation – UK fabrication yards
- Pre-Assembled Racks with Air coolers
- Promote local content and sustainability
- **Construction Contractors / Specialist (circa ~ 700 persons):**
 - Early-works, piling, Civils, Structural, Architecture (CSA),
 - Piping, Mechanical, E&I, telecoms,
 - Module Fabrication
 - Brownfield works
 - Heavy lift / transport, etc.
- **Construction Schedule 2023 to 2027:**
 - FEED Completion - Q1 2023
 - FID - Q3 2023 / Award Q3 2023
 - Early works - Q3 2023
 - Piling / foundation works - Q3 2024
 - Main construction works - Q2 2025
 - PCC works - Q2 2026
 - RFSU unit-1 - Q3 2026
 - RFSU unit-2 - Q1 2027

