

PACT

The Pilot-scale Advanced CO₂ Capture Technology (PACT) facilities are the national specialist research and development facilities for combustion and carbon capture technology research, encompassing advanced fossil-fuel energy, bioenergy and carbon capture and storage/utilisation technologies for power generation and industrial applications.

Operator:
The University of Sheffield
Location: Sheffield, UK

PACT offers the global CCUS community a unique facility to scale up multiple aspects of CCUS research.

Shared access to state-of-the-art facilities provides a cost-effective and comprehensive research capability to both industry and academia.

Developers are able to test technologies for extended periods under commercially-representative conditions with solid/liquid/gas-derived flue gas and syngas/biogas. Additionally, the PACT facilities provide high quality training opportunities for early career researchers.

Amongst the 70 companies that have already carried out projects at PACT are: Alstom (now GE), Ansys UK, BG Group (now Shell), BOC-Linde, BP, Carbon Clean Solutions, C-Capture, Costain, Doosan Power Systems, Drax Group, EON (now Uniper), EDF, Fluent Europe, Howden, National Grid, Progressive Energy, PSE, SSE, Sembcorp, and Siemens AG.

The PACT facilities bring together a comprehensive range of integrated pilot-scale and accompanying specialist research and analytical facilities, supported by leading academic expertise.

PACT facilities bridge the gap between bench-scale R&D and large-scale industrial pilot trials, enabling users to develop and demonstrate their technologies to provide the necessary commercial confidence before committing to the significant costs of large-scale trials.

Our aim is to support and catalyse industrial and academic research. By doing so, our ambition is to accelerate the development and commercialisation of novel technologies for carbon capture and clean power generation and ultimately reduce greenhouse gas emissions from both power generation and energy intensive industries.

PACT is currently involved in over 30 projects worth in excess of £41m, with grant allocation of over £4.5m.

PACT collaborates with over 120 organisations internationally, and by July 2017 the Core Facilities had hosted over 1300 visitors from 287 organisations, including 70 academics and 217 industrial organisations.

A testament to PACT's success is the international recognition received for its work in carbon capture and energy technologies reflected by its custodianship of the International CCS Test Centre Network (ITCN), membership of the European CCS Laboratory Infrastructure and the custodianship of the International Flame Research Foundation (IFRF).





Facilities

250kW Air Combustion Plant (ACP)

The **Air Combustion Plant (ACP)** is a cylindrical design, 250kWth down-fired pulverised fuel combustion system with interchangeable coal/biomass burners, fuel (coal/biomass) feeding system, a dedicated air metering skid, flue gas filter, heat exchanger, and a temperature and flow monitored water cooling system for the combustion vessel and flue ducts.

The plant is operated using a dedicated control system connected to an industry standard SCADA system in a central control room for system monitoring, operation and data acquisition.

250kW Oxyfuel Combustion Plant (OCP)

The **250kW Oxyfuel Combustion Plant (OCP)** utilises the 250kW Air Combustion Plant operated in an Oxyfuel mode whereby fuel is combusted in an atmosphere of CO₂ and O₂ rather than in air. This prevents nitrogen dilution, therefore generating flue gases with around 95% CO₂ suitable (after processing) for geological storage or CO₂ utilisation applications.

In this mode the plant is operated with a dedicated Oxyfuel Gas Mixing System (OGMS) - an automatic high precision CO₂ and O₂ mixing skid, which provides individually mixed CO₂ - O₂ gas feeds, including high concentrations.

Gas Turbine

PACT has deployed a range of modifications to the turbines to improve system efficiency and enhance capture performance. These include exhaust gas recycling (EGR), selective exhaust gas recirculation (S-EGR) and humidification of the gas turbine cycle.

Solvent-based Carbon Capture Plant (SCCP)

The **Solvent-based Carbon Capture Plant (SCCP)** enables the development, evaluation and optimisation of a variety of solvents for post-combustion capture and related technologies.

It is designed to remove up to 1 tonne/day of CO₂ (based on MEA) from an equivalent of approximately 150kW conventional coal combustion flue gas.

SCCP can be integrated with any of the combustion systems on site.

Gas mixing facility

The Gas Mixing Facility (GMF) enables the mixing of individual gas components to create synthetic flue/process gas mixtures.

It can also be used to modulate the inlet oxidisers and outlet gases from the other onsite plants.

Biomass Grate Combustion Boiler (BGB)

The 240kWth Biomass Grate Combustion Boiler (BGB) forms part of the integrated facilities at PACT and is interconnected to the PACT Post-Combustion Capture Plant with a flue gas slip stream supplying an equivalent of 150kWth biomass flue gas to the capture plant.

Supporting Facilities

- 25kW Combustion Rig
- 300kW Fluidised Bed Combustor

Analytical Facilities

- Metal emissions monitoring laboratory (ICP)
- Particle emissions analyser
- Online Monitoring and Analysis
- Analytical Labs

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