

USER: GEOENVIRONMENTAL RESEARCH CENTRE (GRC), SEREN MULTIPURPOSE GAS LABORATORY

*The Geoenvironmental Research Centre (GRC) is based in the Cardiff School of Engineering, Cardiff University. The school is established as a centre of excellence within Europe, with modern laboratories and state of the art computer facilities. The mission of the GRC is to undertake research and development, provide leadership, educate and engage with industry at the leading edge of the geoenvironmental arena. The GRC undertakes work on a broad front of problems ranging from fundamental studies and speculative research on local, national and international levels to projects resulting in commercial applications through knowledge and technology transfer with industry. The centre also prides itself on providing specialist education through PhD, MPhil and MSc programmes.*

### THE PROBLEM

Seren project is led by the GRC in partnership with the British Geological Survey (BGS). Seren is a European Regional Development Fund (ERDF) research project, aimed at developing innovative engineering technologies for commercial applications within the geo-energy themes including Ground Source Heat, Underground Coal Gasification, Carbon Sequestration in Coal and Soil, Geoinformatics: Low Carbon Toolkit, and Advanced Computational Modelling

The Seren Multipurpose Gas Laboratory is a world class experimental facility, designed and constructed to support commercial and research needs related to various engineering aspects of Geo-Energy applications. The Laboratory has been developed as part of the Geoenvironmental Research Centre's (GRC's) SEREN project. Industrial

collaboration is a cornerstone of the project, and will ensure that the commercial value of the research is maximised.

A fundamental objective of the Laboratory is to gain a better understanding of how various rock types will react when gases are injected or abstracted. The laboratory can provide information on gas storage, production rates and capacities, as well as any structural changes that may occur. This information will be of value in determining the operating limits for field scale plants and in general to facilitate new geo-energy applications such as geological sequestration of carbon dioxide and unconventional hydrocarbon exploitations. The data will also be used in the compilation of feasibility studies for specific sites. It is envisaged that commercial advantage will be achieved by companies that apply this new knowledge.

To help gain better understanding of how

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Fig 1. Show the Seren Multipurpose Gas Laboratory in operation.

various rock types would react with gas the GRC needed some bespoke equipment. With our proposed design we approached GDS Instruments to consult on our ideas and manufacture the equipment. After some consultations and designs meeting we agreed on a solution which we both agreed would meet our testing requirements.

## THE SOLUTION

The bespoke apparatus has been primarily designed to study gas transport and reaction properties of rocks under a wide range of pressures and temperatures.

The apparatus consists of two main analysing units:

Firstly an adsorption/desorption measurement unit. The twin cavity adsorption cell is designed to house a sample in one cavity and a known volume of gas in the second cavity. Both cavities are equalised and then the pressure decay in the sample cavity can be measured during adsorption under iso-thermal conditions.

The second piece of apparatus is a gas transport and permeability measurement unit. Based on a GDS HPETAS system, the addition of mass flow transducers has allowed accurate gaseous permeability measurements to be made along with sample abstraction options for gas composition analysis.



Fig 2. Shows CO<sub>2</sub> adsorption cell designed by GDS Instruments and Cardiff University

The Laboratory is able to replicate the conditions of a deep geological environment more accurately than can be done in standard adsorption/desorption and permeability measurements.

## RESULTS

In conjunction with an extensive programme of numerical modelling, these experimental facilities are currently being used to investigate the processes involved in carbon sequestration in coal seams in Wales.

The research will enable the Seren team to deliver world class products and knowledge to Welsh industry and assist with the creation of a “centre of expertise” in the emerging area of geo-energy.

## TESTIMONIAL

“The Seren Multipurpose Gas Laboratory has been developed at the GRC to investigate gas transport and reactions between high pressure gases and coals under in situ condition. The major parts of experimental apparatus including adsorption cell and triaxial cell have been provided GDS. In our research, the accuracy of experimental parameters such as pressure, temperature and flow are crucial. The instruments provided by GDS have shown reasonable accuracy for our purpose and have helped us to produce good quality data. Working with friendly and knowledgeable staff has been a great experience and I personally recommend GDS for its high quality service and expertise.” says Mojgan Hadi Mosleh from the Geoenvironmental Research Centre.

Cardiff University in association with:

