Executive summary

Scottish Carbon Capture & Storage (SCCS), the largest carbon capture and storage (CCS) research group in the UK, hosted the International CCS Academic Summit in Edinburgh on 25-26 February 2016. The prestigious event allowed invited academics from 18 leading institutes from around the world to meet face-to-face, discuss international funding opportunities and develop plans for future collaborations.

Attendees also heard from the Mexican government’s energy department, SENER, about its plans for a new carbon capture, utilisation and storage centre, from the British Council on current and future international capacity building funds available via the Newton Fund programme, and from the UK Foreign and Commonwealth Office on the UK’s CCS strategy.

The summit was extremely well received by attendees, who appreciated the mix of short presentations, lab facility tours and informal networking opportunities. With limited time available, this format ensured that several existing relationships took important steps forward while many new links were forged. Several of these are expected to progress to ongoing academic co-operation.

With CCS still being a relatively immature technology, an important theme that emerged was the need for leading CCS research institutes to work together and, where possible, avoid duplication of effort. One proposal for achieving this was the creation of an international CCS Academic Network, which could take responsibility for overseeing international efforts on staff and student exchanges, postgraduate teaching and learning opportunities, including distance learning.

Despite recent policy changes by the UK Government, it has repeatedly stated that CCS has a part to play in any future energy mix and wants to make the most of the existing research base in the UK by encouraging international collaborations.

The International CCS Academic Summit was made possible by funding from the UK Foreign and Commonwealth Office (FCO), the Carbon Sequestration Leadership Forum (CSLF) and Natural Resources Canada (NRCan).
Introduction

The International CCS Academic Summit took place in Edinburgh on 25-26 February 2016. It was organised and hosted by Scottish Carbon Capture and Storage (SCCS), the largest CCS research group in the UK.

The SCCS team designed the summit’s agenda to maximise the time available to delegates for discussing collaborations face-to-face. There was also an emphasis on the administrative aspects of developing collaborations – this was not primarily a research meeting.

Each attending institute gave two short presentations, the first on current and existing international partnerships and the second on research strengths. These were interspersed with facilitated, small group “carousel” sessions to allow delegates from each institute to meet one another in an informal manner. This proved a very useful way to increase and gain the most benefit from interactions throughout the two days.

SCCS drew on existing international academic links between its partner institutes and fellow researchers in Canada, the USA, Norway, Australia, South Korea and South Africa. The invitation list was boosted by the CSLF’s country contacts, which meant representation from additional institutes in Saudi Arabia, Mexico and China. A key feature of the summit was to allow well-established CCS institutes to interact with those designated as “emerging economies” by the CSLF.

Due to the wide geographical spread of attendees, Edinburgh made sense as a meeting point. And as the birthplace of important geological concepts during the Age of Enlightenment (by James Hutton and others) as well as the spot where CO\textsubscript{2} was “discovered” (by Joseph Black), delegates may well have been inspired to overcome any jetlag and concentrate on the summit’s goals.

The core funder of the summit – the UK Foreign and Commonwealth Office – intended the event to be a forum where academics could meet in person to discuss and formalise institutional links in the form of Memoranda of Understanding (MoUs), agree joint activities, such as staff-student exchanges and joint study courses, and form partnerships to seek international funding opportunities.
Key outputs

As a good example of the types of activity promoted by the summit, the University of Edinburgh and the University of Regina were able to formally sign an MoU to allow students on Edinburgh’s CCS MSc course to undertake their dissertation projects in Canada supported by the Canadian utility, SaskPower, operators of the world’s first full-scale CCS on coal power plant.

Edinburgh also held detailed talks with the University of Calgary on developing a joint MSc, and it is envisaged that this will be finalised in the near future. Several institutes expressed interest in developing links with the University of Strathclyde on CO₂ transport issues. KACST, Calgary and Wits, in particular, valued the tour of Edinburgh’s engineering labs and would like to collaborate in future. Yonsei University and Edinburgh were able to discuss their international Horizon 2020 funding proposals.

Further collaborations initiated or developed at the summit are listed below.

- University of Alberta and Wits University – CO₂ collaborative capture membrane development and testing
- CGS/KZN and University of Calgary – student-staff exchanges and seismic data acquisition
- Universities of Oslo and Edinburgh – European research funding calls
- University of Strathclyde and CGS/KZN – CO₂ dispersion measurements from South African natural seep site
- Chinese Academy of Sciences and KACST – sharing projects through the existing KACST Centre of Excellence
- Austin and CGS/KZN/Wits University – understanding South African capacity and progress
- Universities of Regina and Calgary – field site collaborations
- Heriot-Watt University and KACST – exploration of PhD transfer/sabbatical opportunities
- Universities of Melbourne and Regina – MSc plans discussed
- Universities of Edinburgh and Texas at Austin – progress on noble gas tracer work underway, and Austin involvement in Guangdong CCUS Centre
- Universities of Oslo and Aberdeen – collaboration on 3D digital rock scans
- Universities of Aberdeen and Calgary, Alberta, Texas – CCS monitoring work
- Universities of Melbourne and Alberta – Aquistore sample access
- CGS/KZN and University of Melbourne – South African CO₂ storage future directions
- Universities of Regina and Melbourne – involvement in MSc programme
- Universities of Edinburgh and Melbourne – ongoing and collaborative projects, including the Otway facility
- Universities of Heriot-Watt and Texas at Austin – discussion on extending existing subsurface monitoring MoU, and guest lecturer programmes to include CCS activities
- China University of Petroleum and Heriot-Watt University – expansion of funded international student placements
- University of Aberdeen and the South African institutes – possible joint PhD projects discussed
- Yonsei University and Wits University – gasifier modelling design work
- China University of Petroleum made many new contacts among attendees, and explored Newton Fund opportunities with the SCCS partner institutes
- University of Edinburgh and CGS/KZN – ongoing talks on potential collaboration on Bongwana monitoring project

Mexican CCUS Centre

Several institutes formed links with UNAM in Mexico over involvement in the planned Mexican CCUS Centre, due to launch in 2016. Representatives from UNAM were also able to explore new connections on CO₂ capture, geological storage, CO₂-enhanced oil recovery and social and environmental impacts.

Nelson Mojarro Gonzalez, of the Government of Mexico’s SENER department, spoke enthusiastically about the country’s plans for CCS and CO₂-EOR, and the summit directly enabled several new institutes to develop links with key Mexican contacts.
The future for international academic collaboration

The summit concluded with all attendees participating in small group discussions of key ways to enable effective international academic collaboration in the field of CCS, leading into a full group discussion. Highlights included:

### International funding opportunities

- Launch of a new £20m Mexican CCUS Centre in 2016, with up to 30% of funding available for international partnerships
- European Horizon 2020 programmes, including specific calls to work with South Korea and Mexico, and the €42m (£32.7m) ERA Net projects (UK contribution £4m; other participants are Norway, Netherlands, Germany, Spain, Sweden, Turkey and Greece)
- UK-partner Newton Funding, available for capacity building with South Africa, Mexico and others
- The new BHP-Billiton SaskPower Carbon Capture Knowledge Centre, which will receive $20m CAD (£10.5m) over five years, including funds for research and innovation
- China National Science Research Council funding for international collaboration on CCS

### Student mobility

- There is a need to pool and co-ordinate international student and Early Career Researcher exchange funds more effectively. Student funding in some countries, e.g. the UK, is a barrier
- Establish ways to bring international students together, perhaps through programmes of short courses or annual summer school, using different locations linked to facilities or leading research centres
- A global resource for brokering joint CCS PhDs and the means of funding these could be very useful
- MSc may be the minimum level to start collaborations, PhD even better – but it would be good to expand “2+2” or “2+3” undergraduate degree programmes
- Mobilise national funding for international scholarships (e.g. Rhodes in USA, Saudi Arabia programmes)

### Teaching internationalisation

- Access to facilities (e.g. PACT, UK) and field sites (e.g. Otway, Australia) needs to be improved and facilitated internationally
- Development of online courses may well be a useful tool, but need to avoid duplication and maximise quality
- Explore the new campuses model from South Korea, which will see them hosting international centres – potentially multi-institute and multi-subject
- Scope for developing international travelling lecturers – i.e. follow the distinguished lecturers programme, Chinese Scholarship Council, MOST (Ministry of Science and Technology) in China
- Visiting staff programmes to centres of excellence can boost worldwide CCS teaching capacity
Summary and next steps

The International CCS Academic Summit was well attended and its objectives welcomed, showing a clear global interest in developing CCS as part of global efforts to decarbonise economies and meet climate targets.

Until now, it has been a challenge to capitalise on the extensive and impressive academic capacity and expertise around the globe to make CCS an everyday reality, with many researchers understandably focusing on their own national CCS activities and facilities.

To improve the situation in future, co-ordinated activity may be necessary to publicise international funding initiatives, make the best use of facilities and link international learning and teaching opportunities.

SCCS will be working to strengthen the relationships formed during the summit, and will be investigating ways of using the event and its outputs as a launchpad for a worldwide CCS academic research network – avoiding duplication of effort and making the very most of opportunities.

Suggested activities for this network include:

• Development of CCS online courses
• International PhD brokerage
• Co-ordination of annual summer schools
• International funding opportunities repository
• Advice resource for handling MoUs
• Strategy development for teaching and research
• Arranging travelling lecture programmes
• Linking up pilot sites to co-ordinate academic access
• Co-ordinated action to align National Roadmaps for mission innovation
• A “Carbon Capture Olympics” every four years to openly assess progress in CO₂ capture methods

All photos: Will Robb Photography

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