



EC FP7 Projects: Leading the way in CCS implementation

14-15 April 2014, London, UK

DELEGATE PACK



CO₂QUEST



AGENDA

MONDAY 14 APRIL 2014 – Roberts Building, TORRINGTON PLACE, LONDON, WC1E 7JE

Registration and lunch and breaks and dinner in Foyer

Presentations in Roberts G06 Sir Ambrose Fleming LT

1030	ARRIVALS and REGISTRATION
1100	Haroun Mahgerefteh (UCL, UK) , Welcome and Introduction to FP7 CCS and CO2QUEST
1130	George Romanos (NCSRD, Greece) - IoLiCAP - Novel ionic liquid and supported ionic liquid solvents for reversible capture of CO ₂
1200	Robert Woolley (University of Leeds, UK) - CO2PipeHaz - An Integrated, Multi-scale Modelling Approach for the Simulation of Multiphase Dispersion from Accidental CO ₂ Pipeline Releases in Realistic Terrain
1230	Sergey Martynov (UCL, UK) - CO2QUEST - The effect of impurities upon pipeline pressure-drop, and compressor requirement
1300	LUNCH
1400	Auli Niemi (Uppsala Universitet, Sweden) - MUSTANG - Quantification of deep saline formations for CO ₂ storage and modelling the effects of impurities
1430	Auli Niemi presenting on behalf of Jacob Bensebat (EWRE, Israel) - PANACEA/TRUST - Predicting and monitoring the long term behaviour of CO ₂ injected in deep geological formations
1500	Alexandre Morin (Sintef, Norway) - IMPACTS - The impact of the quality of CO ₂ on transport and storage behaviour
1530	Richard Porter (University of Leeds, UK) - CO2QUEST - Typical impurities in captured CO ₂ streams
1600	AFTERNOON BREAK
1630	Russell Cooper (National Grid, UK) - The White Rose CCS Project
1700	Alexandre Morin (Sintef, Norway) - IMPACTS - Transient fluid dynamics of CO ₂ mixtures
1730	George Romanos (NCSRD, Greece) presenting on behalf of Dimitrios Tsangaris (NCSRD, Greece) - CO2QUEST - Fluid properties and phase behaviour of CO ₂ with impurities
1800	SESSIONS END
1830	BUFFET DINNER

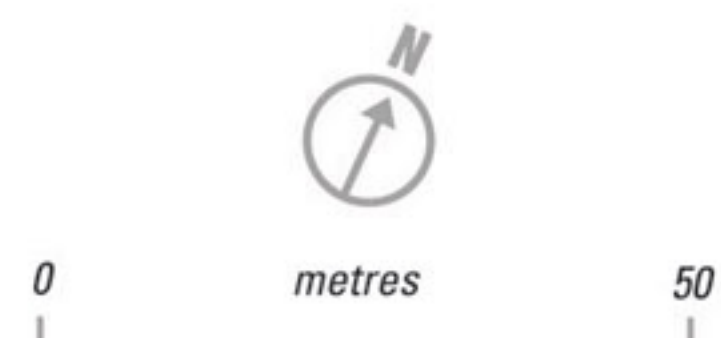
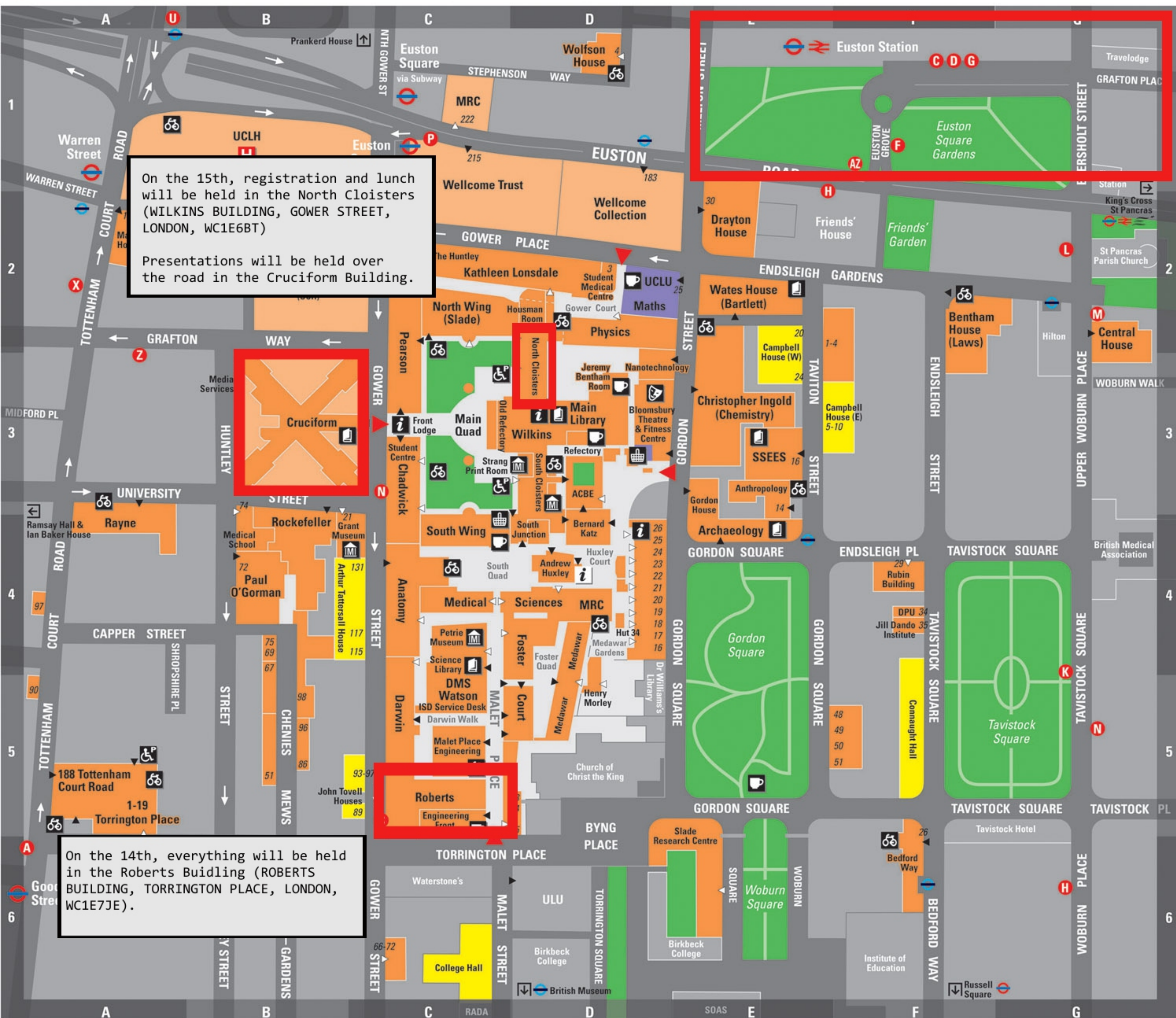
TUESDAY 15 APRIL 2014 –

Registration and lunch and breaks in North Cloisters (WILKINS BUILDING, GOWER STREET, LONDON, WC1E 6BT)

Presentations in Cruciform B304 – LT1, Cruciform Building (GOWER ST, LONDON WC1E 6AE)

0930	ARRIVALS and REGISTRATION
1000	Charles Eickhoff (Progressive Energy, UK) - IMPACTS - Techno-economic assessment of CO ₂ chains
1030	Nial Mac Dowell (Imperial College London, UK) presenting on behalf of Regis Farret (INERIS, France) – CO2QUEST - Risk assessment for the entire CCS chain and its application to CO ₂ QUEST: the specific case of impurities and real-scale experiments
1100	Solomon Brown (UCL, UK) presenting on behalf of Dennis van Hoecke (OCAS, Belgium) - CO2QUEST – Ductile and brittle fracture modelling of CO ₂ pipelines
1130	MORNING BREAK
1200	Dorothee Rebscher (BGR, Germany) - CO2QUEST - BGR and CCS
1230	Laurence Robinson (E.ON, UK) - OCTAVIUS - Optimisation of CO ₂ capture technology allowing verification and implementation at utility scale
1300	LUNCH
1400	Niall Mac Dowell (ICL, UK) - CO2QUEST - Multi-scale modelling of CO ₂ capture, transport and injection systems
1430	Hannah Chalmers (UKCCSRC, UK) - Capacity Building in the UK CCS Research Centre
1500	Haroun Mahgerefteh (UCL, UK) presenting on behalf of Yongchun Zhang (DUT, China) - CO2QUEST – Instrumentation and measurement of large-scale releases of impure CO ₂
1500	Haroun Mahgerefteh (UCL, UK) – Closing Remarks
1515	WORKSHOP END

Map 2 Bloomsbury Campus



EC FP7 PROJECTS: LEADING THE WAY IN CCS IMPLEMENTATION

14-15 April 2014, University College London

Delegate List

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Speaker Biographies

Dr Solomon Brown

Teaching Fellow, University College London, UK

FP 7 Project: CO2QUEST

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Dr. Solomon Brown is a Teaching Fellow and Research Associate in the Chemical Engineering Department, University College London. His main research interest is in the area of computational fluid dynamics applied to safety and loss prevention. Currently, his work is focused on safety aspects of CO₂ pipelines, for which he was a joint recipient of the IChemE Frank Lees Medal for his collaborative work with HSE on CO₂ pipelines safety.



Dr Hannah Chalmers

Network Director, UK CCS Research Centre, UK

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Hannah Chalmers is Network Director for the UK CCS Research Centre and is also a lecturer in power plant engineering and CO₂ capture at the University of Edinburgh. She has worked on CCS since 2003 and is internationally recognised for her research outputs on flexible operation of power plants with CO₂ capture. Her current research interests include integration of flexible CCS in electricity/energy systems and combustion of biomass in air and oxyfuel atmospheres. Additionally, she has been active in the European Energy Research Alliance CCS Joint Programme since its inception and has been elected to the Joint Programme Management Board for 2014 with specific responsibility for developing the recently established CO₂ transport sub-programme.



Russell Cooper

Design and Innovation Manager, National Grid, UK

Has been working in the gas industry since 1998 principally dealing with aspects of gas transmission through the UK high pressure network. Formerly managed the Design department for the National Transmission System before moving onto a full time role in the development of CCS. Russell worked as Technical lead delivering FEED requirements to support Scottish Powers Longannet Carbon Capture proposal in Scotland. Russell leads the Research initiative developed by National Grid to determine the parameters for safe operation of CCS transportation systems. Russell is now working on the Planning Consent application for the White Rose Cross Country pipeline from Drax to a saline aquifer in the North Sea. www.ccshumber.co.uk



Charles Eickhoff***Project Director Progressive Energy, UK*****FP7 Project: IMPACTS**charles@progressive-energy.com

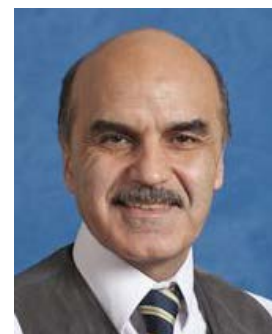
Charles Eickhoff works for Progressive Energy which is an SME low-carbon project development company. He is a chartered engineer with a degree in engineering from Cambridge University and a broadly-based technical and commercial background in the power industry. He played an active strategic and negotiation role in the privatisation of the UK electricity industry and has managed a regional energy supply business and chaired a European energy trading venture. He has experience in a broad European business background, particularly in development areas such as start-ups, special projects and joint ventures and more recently has been focussed on project development in CCS ventures. He has participated in a number of EC FP-supported projects including Dynamis, ECCO and Impacts. www.progressive-energy.com

**Dr Niall Mac Dowell*****Lecturer Imperial College London, UK*****FP7 Project: CO2QUEST**nmac-dow@imperial.ac.uk

Niall Mac Dowell is a lecturer in Energy and Environmental Technology and Policy at Imperial College London and is a Chartered Engineer with the Institution of Chemical Engineers. He has an MSc (2005) and PhD (2010) in Chemical Engineering and was awarded the Imperial College Qatar Petroleum Prize for his work on Clean Fossil Fuels in 2010. His expertise is in the development and integration of multi-scale models in the context of decarbonised Energy Systems and has published work at the molecular, unit, integrated process and network scales. Niall is a guest researcher at the MATerials and GASes Research Institute in Barcelona, Spain, and has given invited lectures on his research in the US, UK, EU and the Middle East. He conducts consultancy work for companies involved in power generation and has given advice to DECC and the ETI in a number of paid consultancy roles. Niall has travelled on behalf of the Foreign Office to travel to China and Korea to promote low carbon power generation and was part of the Imperial College Delegation to the UN FCC COP18 event in Doha, Qatar. He has been invited to provide written evidence to members of the Select Committee on Energy and Climate Change. Since 2010, he has authored over 20 papers on CCS, and his work has received more than 400 citations.

**Prof Haroun Mahgerefteh*****Professor, University College London, UK*****FP7 Project: CO2QUEST**h.mahgerefteh@ucl.ac.uk

Haroun Mahgerefteh is professor of Chemical Engineering at University College London (UCL) ranked consistently amongst the top 20 universities in the world. His main research expertise are in multi-phase CFD flow modeling of hydrocarbon transportation pipelines & safety and loss prevention in the oil & gas industries, particularly with reference to pipeline rupture safety assessment. He also has significant interest in carbon capture & sequestration where he coordinates a number of projects including the EC FP7 CO2PipeHaz and CO2QUEST projects. He is the winner of a number of awards in recognition of his research work & technology transfer, including Frank Lees Medal in Safety and Loss Prevention. Haroun Mahgerefteh is a Fellow of the Institutions of Chemical Engineers, and member of the IChemE Subject Group in Safety and Loss Prevention. Professional activities include membership of the editorial board of Journal of Process Mechanical Engineering and the External Examiner for the University of Cambridge MPhil in Advanced Chemical Engineering.



Dr Sergey Martynov

Research Associate, University College London, UK

FP7 Project: CO2QUEST

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Dr Sergey Martynov is a Research Associate and Teaching Fellow at Chemical Engineering Department, University College London. He has received MSc degree in Physics from the Moscow Power Engineering University in 1998 and PhD degree from the University of Brighton in 2005. Sergey is currently working on the CCS research projects sponsored by the EU (FP7 project CO2QUEST) and the UKCCSRC. His research interests are currently the mathematical modelling of multiphase flows emerging during failure and normal operation of high-pressure CO₂ transportation pipelines.

**Dr Alexandre Morin**

Research scientist, SINTEF Energy Research, Norway

FP7 Project: IMPACTS

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Started at SINTEF Energy Research in 2008 after a Master of Science at Ecole Nationale Supérieure des Mines de Saint-Etienne. Completed a PhD in 2012 on mathematical modelling and numerical simulation of multiphase flow in pipes. Leader of SP1 in the European FP7 project IMPACTS. <http://www.sintef.no/SINTEF-Energi-AS/>

**Professor Auli Niemi**

Professor, Uppsala Universitet, Sweden

FP 7 Project: MUSTANG

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Auli Niemi is Professor at Department of Earth Sciences, Uppsala University, Sweden. Her earlier affiliations include Research Professor at Technical Research Centre of Finland, Visiting Professor at Royal Institute of Technology, Stockholm, Sweden, visiting researcher at ETH, Zurich and research associate at LBNL, USA. She has thirty years of experience in characterization of flow and transport in geological media. Within CCS research, she is presently heading the large-scale integrating EU FP7 project MUSTANG focusing on geological storage in saline aquifers and participating to several other CCS related projects, such as EU FP7 projects TRUST, PANACEA and CO2QUEST as well as projects focusing on geological storage within the Baltic Sea region.

**Dr Richard Porter**

Research Fellow, University of Leeds, UK

FP7 Project: CO2QUEST

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Dr Richard Porter is a Research Fellow at the Energy Technology and Innovation Initiative at the University of Leeds who works on a range of CCS and biomass combustion related topics, including flue-gas chemistry, pollutant emissions and techno-economic modelling. He currently also serves as a Simulation Centre Manager for a Proctor & Gamble – University of Leeds collaborative research group. He is a chemical engineer by formal training and obtained his PhD from the University of Leeds in 2007. He also has several years' experience of developing detailed and reduced chemical kinetic mechanisms for combustion applications and their incorporation within Computational Fluid Dynamic Codes. He has published around 20 combustion and CCS research papers.



Dr Dorothee Rebscher

Senior Scientist, BGR, Germany

FP7 Project: CO2QUEST

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Dorothee obtained a Physics Diploma from University of Bonn and a PhD in Geophysics also from the University of Bonn. Professional experience at Institute of Physics, Bonn, Geological Institute, Bonn, Lawrence Berkeley National Laboratory, Berkeley and Federal Institute for Geosciences and Natural Resources, Hannover in deformation, volcanology, carbon sequestration www.bgr.bund.de

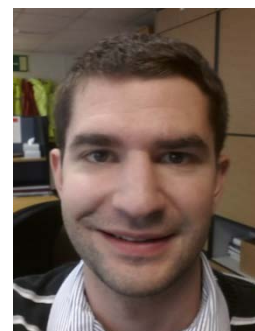
Laurence Robinson

Technical Consultant, E.ON Technologies (Ratcliffe) Ltd, UK

FP7 Project: OCTAVIUS

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Laurence Robinson is chemical engineer, focusing on the engineering challenges of CO₂ capture plant. Laurence has worked for E.ON Technologies for the last five years, supporting E.ON's R&D and demonstration activities including the 250MWe ROAD full scale CCS project and the 5MWe CO₂ pilot plant project at Wilhelmshaven power station in Germany. Laurence is active in several EU FP7 projects on CCS and is on the executive board for the OCTAVIUS and HiPerCap projects. www.eon.com

**Dr George Romanos**

Senior Researcher, NCSR 'Demokritos', Greece

FP7 Project: IoLiCAP

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George Romanos was born in Athens-Greece (1969) and studied Chemical Engineering at the National Technical University of Athens (1988-1994). In 1995 he succeeded in a fellowship allowance competition organized by the National Center for Scientific Research 'Demokritos' and joined the Institute of Physical Chemistry as a fellow postgraduate student. He received his Ph.D. in Physical Chemistry (1995-2000) from the National Technical University of Athens (School of Chemical Engineering) and he worked as a postdoctoral researcher at the Institute of Physical Chemistry until 2001. In 2006, he was elected as researcher (grade C) and from 2010 promoted to grade B. His main research activities are in the area of porous materials functionalisation /characterization and evaluation of their performance in gas adsorption, gas separation and catalytic/photocatalytic applications. <http://ipc.chem.demokritos.gr/>

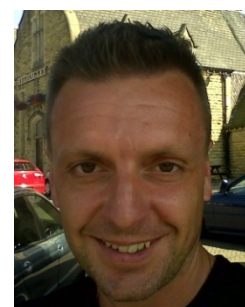
**Dr Robert M. Woolley**

Research Fellow, University of Leeds, UK

FP7 Project: CO2PipeHaz

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Dr. Robert M. Woolley is a research fellow of the Institute of Particle Science and Engineering at the University of Leeds, UK. He has extensive experience in the field of computational fluid dynamics (CFD) and has made a significant contribution to the archival literature in a number of areas including combustion, thermodynamics, kinetics, and particle science. Dr. Woolley's most recent work has been focussed upon aspects of safety relating to the transport and storage of hazardous materials and has first-hand experience of experimental measurement and the modelling of multiphase/multi-component high pressure releases of CO₂. In this field, Dr. Woolley has expertise in the thermophysical modelling of sonic multiphase flows representative of such accidental release scenarios involving both pure and impure CO₂, which also involves the prediction of phase transition with subsequent discrete-phase dispersion modelling. <https://www.engineering.leeds.ac.uk/ipse/>



FP7 Projects Represented

CO2PipeHaz (www.co2pipehaz.eu)

The CO2PipeHaz project addresses the fundamentally

important and urgent issue regarding the accurate predictions of fluid phase, discharge rate, emergency isolation and subsequent atmospheric dispersion during accidental releases from pressurised CO₂ pipelines to be employed as an integral part of large scale Carbon Capture and Storage (CCS) chain. This information is pivotal to quantifying all the hazard consequences associated with CO₂ pipeline failure, forming the basis for emergency response planning and determining minimum safe distances to populated areas.

CO₂PipeHaz

Quantitative Failure Consequence Hazard Assessment for Next Generation CO₂ Pipelines: The Missing Link

CO2QUEST (www.co2quest.eu)

As part of the challenge to reduce the impact of global warming,

pressurised pipelines are considered to be the most practical option for transporting captured CO₂ for subsequent sequestration. CO₂QUEST brings together leading international experts to address the fundamentally important issues regarding the impact of the typical impurities in the gas or dense phase CO₂ stream captured from fossil fuel power plants on its safe and economic transportation and storage. The proposed work programme focusses on the development of state-of-the-art mathematical models backed by laboratory and industrial-scale experimentation utilising unique EC funded test facilities to perform a comprehensive techno-economic, risk-based assessment of the impact of the CO₂ stream impurities on phase behaviour and chemical reactions, and on pipeline and storage site integrities.

CO₂QUEST

Impact of the Quality of CO₂ on Storage and Transport

IMPACTS (www.sintef.no/impacts)

IMPACTS is a collaborative project co-funded by the European Commission under the 7th Framework Programme. The idea of

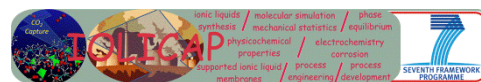
IMPACTS is to close identified knowledge gaps related to transport and storage of CO₂-rich mixtures from various CO₂ sources to enable realisation of safer and more cost-efficient solutions for CCS. IMPACTS is addressing the impact of impurities in captured CO₂, from power plants and other CO₂-intensive industries, on CO₂ transport and storage. This encompasses fluid properties, phase behavior and chemical reactions in the infrastructure complex and at the storage sites. Results from IMPACTS will help to ensure safe and reliable design, construction and operation of CO₂ pipelines and injection equipment, and safe long-term geological storage of CO₂.



IOLICAP (www.iolicap.eu)

IOLICAP project gathers expertise and skills from the domains of

chemical synthesis of Ionic Liquids (ILs), molecular simulation/statistical mechanics, phase equilibrium, electrochemistry/corrosion, physicochemical/thermophysical characterisation, nanoporous materials & membrane technology and process engineering, aiming at the development and evaluation of novel Task Specific Ionic Liquid (TSILs) solvents that (a) short-term could replace the alkanolamines in currently existing PCC installations and (b) long-term would lead to the establishment of a novel CO₂ capture process, based on hybrid absorption bed/membrane technology that will incorporate TSIL modified porous materials and membranes.



MUSTANG (www.co2mustang.eu)

MUSTANG is a four year large-scale integrating project to span from 2009 to 2013 and to be funded by the EU FP7, under the coordination of the Uppsala University. The MUSTANG consortium comprises 19 institutions. It aims at developing guidelines, methods and tools for the characterization of deep saline aquifers for long term storage of CO₂, based on a solid scientific understanding of the underlying critical processes. Field investigation technologies specifically suited to CO₂ storage will be improved and developed. These are destined to improve the determination of the relevant physical and chemical properties of the site, and enabling short response times in the detection and monitoring of CO₂ plumes in the reservoir and overburden during both the injection and containment phases. An improved understanding of the relevant processes of CO₂ spreading is aimed at by means of theoretical investigations, laboratory experiments, natural analogue studies as well as a dedicated field scale injection test, to take place at the Heletz site (Israel).



OCTAVIUS (www.octavius-co2.eu)

OCTAVIUS aims to demonstrate integrated concepts for zero emission power plants covering all the components needed for power generation as well as CO₂ capture and compression. Operability and flexibility of first generation post combustion processes are demonstrated on TNO, EnBW and ENEL pilot plants in order to prepare full scale demo projects such as the ROAD and Porto Tolle projects that will start in 2015 (see the map given hereafter).



OCTAVIUS will establish detailed guidelines with relevant data on emissions, HSE, and other operability, flexibility and costs aspects. In addition, OCTAVIUS includes the demonstration of the DMX™ process on the ENEL pilot plant in Brindisi. This second generation capture process can enable a substantial reduction of the energy penalty and operational costs. The demonstration is an essential step before the first full scale demonstration envisaged to be launched at the end of OCTAVIUS. Application to coal power stations but also NGCC will be considered.

PANACEA (panacea-co2.org)

The PANACEA project's aim is to understand the long-term fate of geologically stored CO₂. The objectives of this project are to:



- Increase the understanding of the long-term fate of stored CO₂.
- Evaluate the mechanisms of leakage through the cap-rock and the well.
- Investigate fluid-rock interactions affecting reservoir quality and cap-rock integrity
- Investigate reactivity with well cements and the effects on cement mechanical properties
- Quantify the effects of impurities in the CO₂ stream

About the co-organisier

UK CCS Research Centre (www.ukccsrc.ac.uk)

The UK Carbon Capture and Storage Research Centre (UKCCSRC) leads and coordinates a programme of underpinning research on all aspects of CCS (Carbon Capture and Storage) in support of basic science and UK government efforts on energy and climate change. The UKCCSRC brings together over 200 of the UK's world-class CCS academics to provide a national focal point for CCS research and development. The Centre is a virtual network where academics, industry, regulators and others in the sector collaborate to analyse problems devise and carry out world-leading research and share delivery, thus maximising impact. A key priority is supporting the UK economy by driving an integrated research programme and building research capacity that is focused on maximising the contribution of CCS to a low-carbon energy system for the UK.

