

AIR CAPTURE: DEVELOPING TECHNOLOGIES FOR CARBON RECYCLING AND NEGATIVE EMISSIONS.

Institution of
**MECHANICAL
ENGINEERS**

Process Industries Division
Seminar

16 October 2012
London
www.imeche.org/events/S1706

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WHY YOU SHOULD BE THERE

Machines based on chemical processes that can be used to remove CO₂ directly from the atmosphere are nearing the pilot demonstration stage by entrepreneurial commercial start-up companies across North America and Europe.

Each development offers opportunities for negative emissions and commercial utilisation of captured CO₂.

Although general descriptions of these technologies are available in the public domain, detailed developments are moving fast and new potential opportunities are emerging rapidly.

Join us for a cutting-edge seminar, focusing on the latest developments and opportunities for air capture globally. This seminar is a superb opportunity to discuss prototype test results, possible routes to scale-up and manufacture, potential for commercial CO₂ utilization, current technical and funding issues, identified research gaps and competing technologies and processes.

BENEFITS OF ATTENDANCE:

- Find out about key global developments on carbon mitigation and potential opportunities for air capture
- Understand current technical issues and latest thinking on costs and deployment
- Examine the latest results and lessons learnt from prototypes and pilot plant testing
- Get updates on emerging commercial opportunities for utilisation of captured CO₂
- Appreciate the role of air capture relative to other negative emissions technologies
- Make contacts in the expanding air capture community and network for business and collaboration opportunities

WHEN 16 October 2012
WHERE One Birdcage Walk, Westminster, London, SW1H 9JJ
BOOK ONLINE www.imeche.org/events/S1706

BOOK THE CCS SEMINAR ON 17 AND 18 OCTOBER AND GET A SPECIAL PRICE (see page 6 for details)

SUPPORTING ORGANISATIONS



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GET INVOLVED

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This is an excellent way to enhance your company profile and communicate effectively to your target audience.

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- Raise awareness of your operation
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- Influence other organisations' spending plans

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SPEAKERS AND CONTRIBUTORS



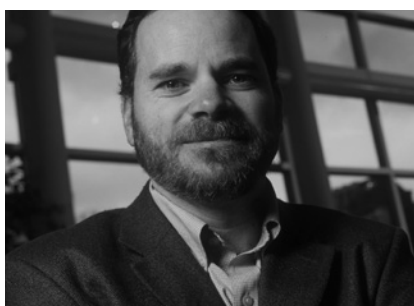
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CO-FOUNDER AND MANAGING DIRECTOR,
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GEOFFREY HOLMES
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ENGINEERING LTD



PETER HARRISON
CEO, AIR FUEL SYNTHESIS LIMITED



DAVID SHOLL
PROFESSOR OF CHEMICAL AND
BIOMOLECULAR ENGINEERING, GEORGIA
INSTITUTE OF TECHNOLOGY

PROGRAMME

**WELCOME
TUESDAY
16/10**

9:15

REGISTRATION

9:45

CHAIRMAN'S WELCOME AND INTRODUCTION

Dr Tim Fox, Head of Energy and Environment,
Institution of Mechanical Engineers

**SESSION 1
DIRECT AIR
CAPTURE
TECHNOLOGY
IN A GLOBAL
CONTEXT**

9:55

KEYNOTE PRESENTATION:

**ENERGY SECURITY, ECONOMIC DEVELOPMENT AND
GLOBAL WARMING: ADDRESSING SHORT AND LONG TERM
CHALLENGES**

Professor Graciela Chichilnisky, Co-founder and Managing Director,
Global Thermostat

Co author: P Eisenberger, Co-founder and Managing Director,
Global Thermostat LLC

- Sustainable development requires carbon-negative technology
- A \$200bn/year Green Power Fund could support this in the short and long term – and change the energy industry
- Using the Kyoto Protocol Carbon Market to set up a Green Power Fund in Latin America, Africa and Small Island States

**SESSION 2
TESTING
PROTOTYPES**

10:20

**OUTDOOR PROTOTYPE RESULTS FOR DIRECT ATMOSPHERIC
CAPTURE OF CARBON DIOXIDE**

Mr Geoffrey Holmes, Research Scientist, Carbon Engineering Ltd (CE)

Co authors: K Heidel, R&D engineer; M A Henderson, Chemist;
P Klavins, Engineering Intern; K Nold, Process Engineer; A Singh,
Chief Technology Officer; D W Keith, President, Carbon
Engineering Ltd

- Reviewing the design and operation of CE's outdoor air contactor prototype
- Prototype results: energy usage; CO₂ absorption performance; drift management of NaOH droplets; long-duration operation

10:45

**LESSONS LEARNED ON THE JOURNEY FROM CO₂ TO
AVIATION FUEL**

Mr Peter Harrison, CEO, Air Fuel Synthesis Ltd

Co author: J Jennings, Science and Technology Director, Air Fuel
Synthesis Ltd

- Overview and initial results from the Air Fuel Synthesis project
- Turning vision into reality: developing a realistic business plan
- Lessons from the marketplace

11:10

REFRESHMENTS

11:40

QUESTIONS

**SESSION 3
COST
ASPECTS**

12:00

**ANALYSIS OF EQUILIBRIUM-BASED TSA PROCESSES FOR
DIRECT CAPTURE OF CO₂ FROM AIR**

Professor David Sholl, Professor of Chemical and Biomolecular
Engineering, Georgia Institute of Technology

Co author: C Jones, Professor of Chemical and Biomolecular
Engineering, Georgia Institute of Technology

- Process modelling of temperature swing adsorption processes for CO₂ capture from air
- Discussion of scalable adsorbents for air capture

12:25

**CONSIDERATIONS IN OPTIMISING THE SIZE OF DIRECT AIR
CAPTURE DEVICES**

Professor Klaus Lackner, Ewing Worzel Professor of Geophysics;
Department Chair, Earth and Environmental Engineering; Director,
Lenfest Centre for Sustainable Energy, The Earth Institute, Columbia
University

- Optimising the scale for direct air capture units
- Economic and design factors for unit size
- The impact of unit size on cost estimation

12:50

QUESTIONS

13:10

LUNCH BREAK

14:00

CHAIR'S WELCOME

Professor Jon Gibbins, Professor of Power Plant Engineering and
Carbon Capture, Institute for Materials and Processes, School of
Engineering, University of Edinburgh

SPEAKERS AND CONTRIBUTORS



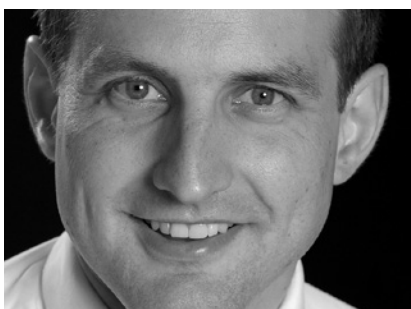
KLAUS LACKNER

EWING WORZEL PROFESSOR OF GEOPHYSICS DEPARTMENT CHAIR, EARTH AND ENVIRONMENTAL ENGINEERING DIRECTOR, LENFEST CENTER FOR SUSTAINABLE ENERGY, THE EARTH INSTITUTE, COLUMBIA UNIVERSITY



D ANTHONY GALASSO

CHIEF TECHNOLOGIST AND CARBON CAPTURE BUSINESS AREA DIRECTOR, BOEING PHANTOM WORKS, BOEING



TIM KRUGER

JAMES MARTIN FELLOW, OXFORD GEOENGINEERING PROGRAMME, OXFORD MARTIN SCHOOL, UNIVERSITY OF OXFORD



KIRSTEN FOY

SENIOR CCS ENGINEER, PARSONS BRINCKERHOFF

PROGRAMME (CONTINUED)

14:10	DEVELOPING PROFITABLE CARBON CAPTURE SYSTEMS FOR NEAR OR MID-TERM ADDRESSABLE (BUT NON-TRADITIONAL) MARKETS Mr D A Galasso, Chief Technologist and Carbon Capture Business Area Director, Boeing Phantom Works, The Boeing Company <ul style="list-style-type: none"> • Feasible geoengineering solutions exist. Direct air capture being both benign and subject to existing market demands • Applying a systems approach will create cost effective development and production • Emerging results from this process
14:35	NECESSARY ELEMENTS IN A CO₂-TO-SUSTAINABLE-FUEL SYSTEM Mr John Bøgild Hansen, Senior Advisor to Management, Haldor Topsøe A/S <ul style="list-style-type: none"> • Solid Oxide Electrolysis is an emerging highly efficient electrolysis technology • CO₂ and steam can be electrolysed to synthesis gas (CO plus H₂) • Synthesis gas can be transformed into hydrocarbon fuels for storage or transport
15:00	REFRESHMENTS
15:30	CO₂ IRRIGATION: IMPROVING THE WATER USE EFFICIENCY OF BIOMASS PRODUCTION BY USING DILUTE CO₂ Mr Tim Kruger, James Martin Fellow, Oxford Geoengineering Programme, Oxford Martin School, University of Oxford <ul style="list-style-type: none"> • Supplying CO₂ to plants significantly reduces water requirements • Potential impacts on land availability for production of biomass, water resource requirements, nutrient retention and avoidance of salinification • Provides a means to concentrate dilute CO₂ for permanent sequestration
15:55	BIOMASS-ENHANCED CCS: A SCALABLE SOLUTION TO CAPTURE CO₂ FROM THE ATMOSPHERE Dr Paul Fennell, Senior Lecturer, Imperial College Co authors: N Shah; M Workman; N Mac Dowell; N McGlashan; C Sorensen; D Pignatelli, Imperial College <ul style="list-style-type: none"> • Overview and analysis of a number of negative emissions technologies • Detailed analysis of the most promising technologies and potential limitations
16:20	A COMPUTER MODEL OF A BIOMASS PLANT WITH CARBON CAPTURE Dr Kirsten Foy, Senior CCS Engineer, Parsons Brinckerhoff <ul style="list-style-type: none"> • Performance impacts of applying amine capture to a biomass plant • Overall plant performance characteristics • Estimated electricity costs for a biomass plant with amine capture
16:45	QUESTIONS
17:05	CHAIR'S CLOSING REMARKS Professor Jon Gibbins
17:10	COMPLIMENTARY DRINKS RECEPTION SPONSORED BY VIRGIN EARTH CHALLENGE Hosted by Dr Alan Knight OBE, Non Executive Director, Virgin Earth Challenge and Dr Tim Fox, Head of Energy and Environment, Institution of Mechanical Engineers

Find out more about our speakers at www.imeche.org/events/S1706

- This programme is subject to change.
- The Institution is not responsible for the views or opinions expressed by individual speakers.

Process Industries Division

Organising committee:

Norman Harris FIMechE, Director, 20CC Ltd

Tim Fox FIMechE, Head of Energy and Environment, Institution of Mechanical Engineers

Professor Jon Gibbins, Professor of Power Plant Engineering and Carbon Capture, Institute for Materials and Processes, School of Engineering, University of Edinburgh

Michael Gibbons OBE FEI, Non-

Executive Director, 2Co Power (Yorkshire) Limited

John Armstrong FIMechE, Head of Asset Risk and Corporate Safety, E.ON UK

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OTHER EVENTS TO LOOK FOR:

27 September 2012, London

MAKING THE ENERGY CRISIS WORK FOR YOU: REDUCING FUEL COSTS IN PROCESSING.

Energy prices continue to increase dramatically. Investing in alternative energy can reduce your businesses fuels costs significantly. Industry experts will demonstrate how to implement changes, such as improving your process thermal efficiency to over 80% using trigeneration, or how 20% of the waste heat from exhaust systems may be converted into electrical energy with an investment payback period of less than 2.5 years and more.

www.imeche.org/events/S1653

If you are interested in any of these events, please contact **Taz Khatun** on on +(0)20 7973 1306 or t_khatun@imeche.org

3 October 2012, London

PROCESS SAFETY 2012: ENHANCING SAFETY PERFORMANCE TO PREVENT MAJOR ACCIDENTS.

Demonstrating ways to develop a 'safety' culture within your organisation, enabling you to manage major accident risk more effectively. With key presentations from regulators and industry, this seminar will challenge and broaden your perspectives, supporting you to enhance process safety performance within your organisation.

Keynote: **Eddie Morland**, Chief Executive, HSL

Chair: **Paul Thomas**, Rail Safety and Standards Board Chairman (RSSB)

www.imeche.org/events/S1672

17-18 October 2012, London

CARBON CAPTURE AND STORAGE: READY, STEADY, GO!

An invaluable overview of the developing CCS industry at a time when the procurement of the first full scale, full chain, CCS project for the UK is rapidly progressing with the support of £1bn of State funding plus a Feed-in-Tariff on the price of electricity generated by CCS installed plant.

Keynote: **Charles Hendry MP**, Minister of State, Department of Energy & Climate Change.

www.imeche.org/events/S1660

Book alongside Air Capture and get a discount. See registration form for details.

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Process Engineering Journal

(Proceedings of the Institution of Mechanical Engineers, Part E).

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As an Ambassador you have the chance to represent your profession and give something back to the engineering community as well as inspiring the next generation.

See www.imeche.org/volunteering for more information or go to nearyou.imeche.org to find engineering events hosted by volunteers in your area.

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AIR CAPTURE: DEVELOPING TECHNOLOGIES FOR CARBON RECYCLING AND NEGATIVE EMISSIONS.

16 OCTOBER 2012
S1706

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First Name	Job Title
Membership No	Institution
Name of Organisation (for name badge)	
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Town/City	
Postcode	
Contact Telephone	
Email	
Do you have any special requirements?	
How did you hear about this event? <input type="checkbox"/> Direct mail <input type="checkbox"/> Website <input type="checkbox"/> Colleague <input type="checkbox"/> Other	

FEES AND CHARGES Please complete the appropriate box.

Registration fees include entry to the sessions, refreshments, lunch, and a copy of the event proceedings.

DELEGATE FEES FOR AIR CAPTURE ONLY	Fee	VAT	Total	£
Member, Institution of Mechanical Engineers	£240.00	£48.00	£288.00	_____
Member, supporting organisation	£240.00	£48.00	£288.00	_____
Non-member	£270.00	£54.00	£324.00	_____
Student / Retired Member	£80.00	£16.00	£96.00	_____

SPECIAL OFFER - BOOK BOTH AIR CAPTURE (S1706) AND CCS2012 (S1660) AND SAVE

* **Note:** CCS2012 is held over two days (17 and 18 October). Please specify which day you are attending by ticking the appropriate box.

Member: S1706 and S1660	Day 1 <input type="checkbox"/> OR 2 <input type="checkbox"/> *	£470.00	£94.00	£564.00	_____
Member: S1706 and S1660	Days 1 AND 2	£610.00	£122.00	£732.00	_____
Member, supp. org.: S1706 and S1660	Day 1 <input type="checkbox"/> OR 2 <input type="checkbox"/> *	£470.00	£94.00	£564.00	_____
Member, supp. org.: S1706 and S1660	Days 1 AND 2	£610.00	£122.00	£732.00	_____
Non-member: S1706 and S1660	Day 1 <input type="checkbox"/> OR 2 <input type="checkbox"/> *	£525.00	£105.00	£630.00	_____
Non-member: S1706 and S1660	Days 1 AND 2	£705.00	£141.00	£846.00	_____
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Student / Retired Member: S1706 and S1660	Days 1 AND 2	£225.00	£45.00	£270.00	_____

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Invoice Charging (if applicable)	£10.00	£2.00	£12.00	_____
			Total	_____

TO ATTEND ONE OR BOTH OF THE RECEPTIONS S1706 S1660 (Day 1) No-fee

PAYMENT DETAILS

Payment must accompany this registration form. Registration will be confirmed only on receipt of full payment.

Please indicate method of payment: Cheque Credit Card BACS Invoice (see below)

Cheques should be made payable to IMechE and crossed. Please note international delegates may pay only by credit card, BACS or banker's draft. A copy of the draft must accompany this form. It is the delegate's responsibility to pay any bank charges.

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Billing Address of Cardholder (if different from above)				
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Amount to be Deducted	Signature			

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A copy of the draft must accompany this form.

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EVENT REGISTRATIONS

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Fax +44 (0)20 7222 9881

For registration enquiries call
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or email t_churcher@imeche.org

Please read the information listed below as each booking is subject to the Institution's standard terms and conditions.

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