



Business Information
In A Global Context

CO₂ Transportation Summit 2010

Translating the Potential into the Commercial

23-24 November 2010 • The Manhattan Hotel, Rotterdam, The Netherlands

Hear From the Top CCS Operators:

Vattenfall

E.ON

GDF Suez

Fortum

Get the latest insight from the
European Commission:

Chris Boleta

Directorate General for Energy
EUROPEAN COMMISSION

Conference Chairs:

Professor Haroun Mahgerefteh
UCL

Mike Bilio

Special Inspector, HSE

Benchmark with your European counterparts as they uncover solutions to solve the complex technical, regulatory and PR challenges of CO₂ transportation. Gain critical insights into:

- The legislative framework for CO₂ transport and geological storage in Europe
- Strategies for CO₂ pipeline infrastructure finance
- Technical, regulatory and financial challenges around implementing CO₂ EOR offshore
- Cutting-edge developments from Project ROAD with E.ON
- Transporting CO₂ by ship: what are the challenges, where are the opportunities?

Up to
14.0 CPD

Post Conference Workshop:

'How Can CCS Transport Networks Be Delivered?'

Led by:

Harsh Pershad

Senior Consultant, ELEMENT ENERGY

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Faculty at a glance

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Directorate General for Energy
EUROPEAN COMMISSION

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Consultant, VATTENFALL

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Capture Director, Maasvlakte CCS
Project ROAD, E.ON

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Business Development, FORTUM

Caroline May
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Maarten de Hoog
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Maurice Hanegraaf
Senior Consultant, ROTTERDAM
CLIMATE INITIATIVE

Professor Haroun Magrefteh
Professor, UCL

Antonin Fabbri
Research Engineer, BGRM

Weero Koster
Partner, NORTON ROSE



Despite the inarguable fact that CCS technology is being more and more widely accepted, the transportation component, vital for the overall growth of the industry, has been largely neglected - until now. Evaluating the pros and cons of pipeline and shipping methods of CO₂ transportation is becoming increasingly important as the fast paced power and energy industry embrace the Kyoto Protocol and reduce emissions. As we progress with implementing CCS, CO₂ transportation must be given the highest priority to realize the commercial opportunities within the sector, which is why C5 has developed the very first **CO₂ Transportation Summit** designed to bring together the key industry stakeholders to share the fresh experiences and exciting innovations that are driving the sector right now.

Whether you are interested in building, retrofitting or in financing a workable pipeline infrastructure network, or in transporting CO₂ by ship, this programme will identify the safest and most cost effective methods for transporting CO₂ and help you evaluate the opportunities. This program will combine regulations and policy, as well as safety and technology to give you the best overview of CO₂ transportation as we move into 2011. Gather not only an insider's view of up-to-the-minute ground-breaking CO₂ transportation strategies, but open up the opportunity for you to personally meet and network with your peers.

Leading authorities will share their knowledge and experience with specifically tailored **case studies** including:

- What funds are available and are they sufficient to move the industry forward?
- Making the business case for CO₂ shipping: do the numbers really add up?
- Investigating consequences of CO₂ composition from oxyfuel mixed with CO₂ composition from IGCC
- How implementing CO₂ EOR in offshore fields compares with current successful implementation of CO₂ EOR onshore in the USA
- Financing projects using a recovery package plus Emission Trading Scheme (ETS)

Don't miss our special session: **Creating a Successful CCS Transport System – the View from Vattenfall**

You simply cannot afford to miss the ONE conference your colleagues – and competitors – need to attend. Join us at the inaugural CO₂ Transportation Summit 2010 for an unparalleled learning and networking opportunity.

Call us on +44 (0) 20 7878 6888

Fax your registration form to +44 (0) 20 7878 6896

Register online at www.c5-online.com/Carbontransport

The CO₂ Transportation Summit 2010 is a must for leading industry players in the pipeline, shipping and construction industry including:

- Power plant operators
- Oil and gas operators
- Pipeline manufacturers
- Pipeline engineers
- Port and terminal representatives
- Gas plant engineers
- Shipbuilders and shipbrokers
- Financial and legal professionals
- Academic institutions
- Regulators

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For more information about this program or our global portfolio, please contact: **Brian Reffell** on +44 (0)20 7878 6933 or email b.reffell@C5-Online.com

08:15 Registration and Coffee**09:00 Opening Remarks from the Chair***Mike Bilio*
Special Inspector, HSE**09:10 Understanding How the Latest Developments in Pan-European CCS Initiatives Impact Your Project Strategy***Maarten de Hoog*
Director of Industry, DCMR
(Rotterdam Climate Initiative)*Weero Koster*
Partner, NORTON ROSE*Ian Phillips*
Director CO₂ Infrastructure, CO₂ DeepStore

- How do the latest developments affect business strategy for operators?
- What will the 300 million Euros from the EU Emissions Trading Scheme for CCS demonstration projects go towards?
 - how to be the project selected for funding?
- Focusing business strategy to operate CCS in Europe by 2015
 - how close are we to hitting this target?
 - what are the main barriers?
- What is the proposed CCS strategy of the new UK government?
 - developing 4 CCS projects funded by the governments CCS levy
 - what is the future for CCS funding in times of austerity?
 - will any future funding include CCS networks for transporting CO₂?
 - how is the rest of Europe affected by this proposed strategy?
- An overview of the role of infrastructure in terms of enabling future projects to be developed
 - who is doing what and where?
 - best practises from the natural gas industry? what are the lessons learned? what have been pitfalls and innovations?

10:00 The Very Latest CCS Strategy of the European Commission*Chris Bolesla*
Directorate General for Energy
EUROPEAN COMMISSION

- What is the legislative framework for CO₂ transport and geological storage
- Financing projects using a Recovery Package plus Emission Trading Scheme (ETS)
- Developing demo projects to prove technology commercially viable around 2020
- What is the current latest development in the deployment of CO₂ infrastructure
- Best practice knowledge sharing to generate synergies

10:30 Morning Refreshments**11:00 Financing a CO₂ Pipeline Infrastructure***Tom Greenwood*
CCS Analyst, BLOOMBERG ENERGY FINANCE*Jim Fitzgerald*
Director, ERNST AND YOUNG

- What funds are available and are they sufficient to move the industry forward?
- What are private investors looking for?
 - what should we expect as liquidity comes back?
 - impact of carbon price movements
- Possible areas for government intervention
 - would PPP structures help or hinder?
 - possible risk sharing models between emitters transporters and storers
- What are the latest developments from the Rotterdam Climate Initiative?

12:00 Establishing a Widespread European CO₂ Transportation Pipeline Network*Harsh Pershad*
Senior Consultant, ELEMENT ENERGY*Filip Neele*
Project Leader, TNO

- Challenges and opportunities for the development of integrated CO₂ pipeline infrastructure
- What is the timeline of the development of EU transport infrastructure?
- What are the volumes and distances?
- Where are the storage areas in Europe?
- How can we ensure efficiency in infrastructure development from the first projects onward?
- What are the CO₂ pipeline requirements for CCS?
- What are the costs involved?
 - pipeline costs
 - material costs
 - cost implications for network development?

13:00 Creating a Successful CCS Transport System: The View from Vattenfall*Jenny-Ann Nilsson*
Consultant, VATTENFALL

- What are the barriers for building a CO₂ infrastructure?
- Safety and protection distances and measures for CO₂ pipelines in Europe
- Investigating consequences of CO₂ composition from oxyfuel mixed with CO₂ composition from IGCC
- Finding ways to investigate physical behaviour and material impact of CO₂ composition in ship transport
- “Latest news” as of November 2010

13:30 Lunch**14.30 Capture, Transport and Storage of CO₂ that comes from Biomass: A Technical and Economic Assessment of the System***Antonin Fabri*
Research Engineer, BRGM

This presentation will deal with an alternative CCS system where the CO₂ to be stored comes from biomass instead of fossil fuels. The goal is to estimate the feasibility of its application on bio-refineries in the Paris Basin, France.

15:00 **Using CO₂ Shipping as a CCS Enabler**

Klass Kersemakers

Business Development Manager, ANTHONY VEDER

- Anthony Veder: a brief introduction to the company and latest developments
- Anthony Veder CO₂ shipping and CCS
 - past, present and future
- Liquid CO₂ shipping
 - an introduction to the concept
 - what advantages are there?
 - how can this concept be applied?
- Next steps needed in CCS market: what hurdles are needed to be overcome?

15:20 **Transporting CO₂ by Ship: What are the Challenges, Where are the Opportunities?**

Klass Kersemakers

Business Development Manager, ANTHONY VEDER

Joonas Raumar

Business Development, FORTUM

Ernest Groensmit

Business Development Manager, VOPAK

Maurice Hanegraaf

Senior Consultant, ROTTERDAM CLIMATE INITIATIVE

- Making the business case for CO₂ shipping: do the numbers really add up?
 - how is the role of shipping viewed by operators?
 - what is the commercial potential of CO₂ shipping?
 - is it a long or short term solution?
 - how does it compare to pipeline transportation?
 - how can CO₂ shipping benefit your business
 - striking the correct balance: how will shipping complement CO₂ pipeline transport?
 - what figures are we talking about and what is the scale of the operation?
- Exploring large scale transport of CO₂
 - outlining existing CO₂ fleet for use today? what are the specific numbers?
 - examining the technical challenges involved
 - exploring offshore discharge concepts
 - is the transport at a higher pressure than LNG
- What are the financial benefits of CO₂ shipping?
 - understanding what the business case is for CCS?
 - understanding the flexibility that CO₂ shipping offers for the operator
 - what steps have Fortum taken in realising CO₂ shipping as the primary method for transport?
 - how do we maximise ROI for stakeholders?
- Overcoming the technical challenges of dual purpose vessels?

(afternoon refreshments will be taken at a suitable point during this panel discussion)

16:45 **Chairman's Closing Remarks and Conference Adjourns**

DAY TWO – WEDNESDAY, 24TH NOVEMBER

08:15 **Registration and Coffee**

09:00 **Opening Remarks from the Chair**

Professor Haroun Mahgerefteh
UCL

09:10 **Thermodynamic Behaviour of CO₂ in Pipelines and Injection Systems**

Daan D'Hoore

Project Leader, GDF Suez

- Uncovering the phase behaviour of CO₂
- What are the effects of gravity?
- Behaviour of CO₂ during injection in empty gas reservoirs
- Pressure and temperature calculations in well tubing and well head
- Results from single phase (gas) injection: warm injection
- Results from two phase injection (cold injection)
- How do these results affect business strategy?

09:50 **CCS Project ROAD Update: The View From E.ON**

Andy Read

Capture Director Maasvlakte CCS Project, E.ON

In February 2009, E.ON announced that it had teamed up with the Rotterdam Climate Initiative to add CCS to the Maasvlakte plant. This stand out case study based presentation will delve into the latest developments from the Maasvlakte CCS project in the Netherlands, with a special focus on CO₂ transportation.

10:30 **Morning Refreshments**

11:00 **OCAP: The Solution for CO₂ Transport – The View From an Industrial Gas Supplier**

Fred Hage

Director, LINDE GAS

- Treating CO₂ as a waste or valuable product and why this is important
- CO₂ applications in general and what does the future hold?
- What are the CO₂ quality issue considerations for storage and reuse?
- CO₂ transportation: truck, ship or pipeline?
- OCAP: an existing CO₂ pipeline grid contributing to a long term CCS solution
- A proposal for CO₂ transportation and storage

11:40 **New Pipeline Safety Regulations in the UK**

Caroline May

Partner, NORTON ROSE

- What are the current regulations and how will they change?
- How do the regulations compare with Denmark, Holland, France and Germany
- What does the regulator expect for CO₂ pipeline design?
- What are the European Commission's plans on wider regulation?
- What are the legal issues?

12:20 **Lunch**

13:30 **Safety Challenges Associated with the Next Generation CO₂ Pipelines**

Professor Haroun Mahgerefteh
UCL

This presentation presents an overview of some of the unique technical and operational challenges associated with the safe and economical transportation of captured CO₂ using pressurised pipelines. The topics include:

- Impact of impurities on the CO₂ phase equilibrium behavior and equations of state
- Ductile and brittle fracture propagation
- Hydrate formation
- Corrosion
- Explosive decompression

The presentation concludes with a progress overview of the European Commission FP7 CO₂ PipeHaz designed to address some of the above issues. Led by UCL in collaboration with scientists, industrialists and legislative organizations in France, Greece, Norway and the UK the project involves the controlled rupture of an industrial scale CO₂ pipeline in China to validate the CO₂ pipeline safety assessment tools developed.

14:10 **A Policy Makers View of CO₂ Transportation**

David Rutland
Head of Enabling Activities, DECC

Georgiana Glayser
Assistant Head of Enabling Activities, DECC

- Building a policy and regulatory framework for CO₂ transportation
- Facilitating cooperation between government and operators
- What is the approach to transportation in the UK CCS Demonstration Programme?
- What will the Post-demonstration approach be? How will it affect the parties involved?

14:50 **Using CO₂ Pipelines for Enhanced Oil Recovery (EOR)**

David Hughes
Principal Reservoir Engineer, SENERGY

- Determining whether an offshore CO₂ pipeline infrastructure will kick start CO₂ EOR in North Sea fields?
- How will a CO₂ supply delivered by shuttle tankers assist the development of EOR in the more remote fields?
- How does implementing CO₂ EOR in offshore fields compare with current successful implementation of CO₂ EOR onshore (e.g. in USA)?
- What are the technical, regulatory and financial challenges around implementing CO₂ EOR offshore?
- To what extent will offshore CO₂ EOR improve the economics of carbon storage?

15:30 **Afternoon Refreshments**

16:00 **Dealing with the Impurities Challenge**

Stanley Santos
Project Leader, IAEGHG

- Current experience in CO₂ pipeline specification
- What could be a general classification for impurities for CO₂ from Power Plants with CCS?
- What are the expected impurities from:
 - post combustion capture?
 - pre-combustion capture?
 - oxyfuel combustion capture?
- Techno-economic assessment of the impact of non-condensable inert to the CO₂ pipeline

16:30 **Closing Remarks from the Chair and Conference Ends**

POST CONFERENCE MASTERCLASS: HOW CAN CCS TRANSPORT NETWORKS BE DELIVERED?

THURSDAY, 25TH NOVEMBER 2010
09:30 – 12:30 (REGISTRATION FROM 09:00)

Led by:

Harsh Pershad
Senior Consultant, ELEMENT ENERGY

Integrated pipeline networks have been identified as the most cost-effective solution for CCS in the longer term. However, these present considerable challenges in terms of organization, investor confidence, and risk management. This workshop will cover the challenges and opportunities for connecting CO₂ emitters with storage through an integrated transport network. Issues explored will include:

- What are the drivers and challenges for shared infrastructure?
- What are the cost savings and planning issues for shared infrastructure?
- Who should own the network?
- How should CO₂ transport networks be financed?
- What are the advantages and challenges for different tariff structures for a network?
- What are the roles of public and private organisations?

Harsh has a first degree in Chemistry from Imperial College, London, and a PhD on biofuel cells from Oxford University. Harsh has been working on low carbon energy technologies since 2005, and has focused on CCS technologies in particular since he joined Element Energy in Cambridge in 2006.



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Anthony Veder is one of the few tanker owners totally dedicated to the transport of liquefied gas. Established in 1937, we are involved in all aspects of gas transportation and are proud to own one of the most modern and sophisticated gas tanker fleets. Although the Carbon Capture and Storage (CCS) industry is relatively new, we have been involved from the start. We are the only gas-carrying company that has its own dedicated CO₂ vessel, which was the first to be built anywhere. Our experience with successfully shipping CO₂ for over a decade has led us to actively participate in the CCS industry.

Our CO₂ shipping concept offers the future emitters and storage providers a solution to their CO₂ transportation challenges. It allows for a standalone offshore discharge for not only storage but also Enhanced Oil Recovery (EOR) purposes. Our close involvement with several pilot projects, the Rotterdam Climate Initiative and study projects (e.g. CO₂ Europipe) has given us a fore runner role in the CO₂ seaborne transportation market. Shipping is no longer seen as a competitor to piping but as a complementary transportation modality for the CCS industry. It offers a flexible, easily deployable and cost effective logistical solution.



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ADMINISTRATIVE DETAILS

Date: 23 - 24 November 2010

Time: 08:15 - 16:30

Venue: The Manhattan Hotel

Address: Weena 686, 3012 CN Rotterdam

Telephone: +31 (0)10 430 2000

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11.0 hours (conference only) plus 3.0 hours per master class towards Continuing Professional Developments hours (Solicitors Regulation Authority). Please contact C5 for further information on claiming your CPD points.

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