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ECCO

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Graduate level course using a case study from ECCO

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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Submitted (Author(s))	Paula Coussy, IFPEN	2011-10-21
Verified (WP-leader)	Karen Lyng Anthonsen, GEUS	2011-10-21
Approved (SP-leader)	Karen Lyng Anthonsen, GEUS	2011-10-21

Author(s)		
Name	Organisation	E-mail
Paula Coussy	IFPEN	Paula.COUSSY@ifpenergiesnouvelles.fr
Karen Lyng Anthonsen	GEUS	kla@geus.dk

Abstract
<p>A two day master course, titled "Assessing Carbon Capture and Storage (CCS) value chains - ECCO Project" was effectuated at University of Zagreb - Faculty of Mining, Geology and Petroleum Engineering on 6-7 May 20011.</p> <p>The course was based on research and preliminary results from the ECCO project and covered subjects as climate change issues, worldwide CO2 emissions, energy consumption and projected trends, international negotiations on GHG reductions, international treaties and directives impacting on CCS projects, the CCS value chain (capture, transport and storage), EU emission trading scheme, value chain analysis, main EOR/CCS European scenarios and analysis of a case study from ECCO.</p> <p>The course was followed and completed by 84 participants.</p>

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1 GRADUATE LEVEL COURSE USING A CASE STUDY FROM ECCO

1.1 Planning

The planning of the graduate level course was initiated at a meeting 13 April 2010. It was agreed among the present SP1 partners (IFPEN, NTNU, BELLONA, TNO, UNIZG-RGNF, GEUS, PEL, STATOIL and MOL) to have a 2 day graduate level course based on ECCO research and preliminary results. Further planning and organising of the work was done by e-mail and telephone meetings.

The ECCO Master Course was effectuated at University of Zagreb - Faculty of Mining, Geology and Petroleum Engineering on 6-7 May 20011.

Performers at the graduate level course:

Christian Bos TNO
Gøril Tjentland BELLONA
Karl Kristensen BELLONA
Benoit Cheze IFPEN
Bruno Saftic UNIZG-RGNF
Vesnica Garasic UNIZG-RGNF

All material used for the graduate level course is available at the ECCO eRoom and accessible for the project members and the European Commission. Address to eRoom is:

<http://www.sintef.no/Projectweb/ecco/Internal-pages>

1.2 Purpose of training course

The purpose of the training course is described in Annex I (Description of work) “To collect information from the project as it develops and structure a graduate level course and material on the value chain of CO₂ using a case study from ECCO as a base (not confidential data from WP3.4)”

1.3 Participants

42 graduate and undergraduate students of geological engineering, geology, mining engineering and petroleum engineering from the UNIZG-RGNF.

7 students from other faculties (5 from UNIZG - Faculty of Natural Sciences, and 2 PD students from Denmark and The Netherlands).

35 other participants (6 employees of UNIZG-RGNF, 2 from other UNIZG faculties, 7 from the national oil company INA).

A complete participant list is attached as appendix 2.

All participants were given certificate as documentation for completing the course.

2 PHOTOS



Gøril Tjentland, BELLONA



Benoit Cheze, IFPEN



Gøril Tjentland and Karl Kristensen, BELLONA in front. Bruno Saftic, UNIZG-RGNF, right of Gøril Tjentland



Christian Bos, TNO in front row and Benoit Cheze, IFPEN, is presenting.

APPENDIX 1

Master Course Program

ECCO – European Value Chain for CO₂ 1 1/2 day Master Course

Assessing Carbon Capture and Storage (CCS) value chains "ECCO Project"

Day One

	Presented by	INTERNATIONAL CONTEXT OF CLIMATE CHANGE
8:00 - 12:30	Bellona and IFPEN	<p>Climate Change introduction :</p> <ul style="list-style-type: none"> - The climate change process - IPCC - Past and actual international emissions of GHG <p>Worldwide CO₂ emission trends (historical, current):</p> <ul style="list-style-type: none"> - Main regional emitters: USA, China, Europe - Main sectoral emitters: electricity, refineries, cement ... - Other emissions indicators: CO₂/NPV, CO₂/hab,... <p>Energy consumption and projected trends</p> <ul style="list-style-type: none"> - Regional energy consumption and projected trends - Global Emissions trends: <ul style="list-style-type: none"> o IPCC scenarios o IEA scenarios <p style="text-align: center;">COFFEE - BREAK</p> <p>International negotiations on GHG reductions:</p> <ul style="list-style-type: none"> - <u>Existing agreements:</u> <ul style="list-style-type: none"> o UNFCCC level : Kyoto Protocol, o European Level : Storage Dir, EU-ETS Directive... o Others (Australian, USA, Canada...): CO₂ Voluntary market, - <u>Negotiations in progress:</u> <ul style="list-style-type: none"> o from Copenhagen to Cancun o On going international negotiations <p>International treaties & Directives impacting on CCS projects</p> <ul style="list-style-type: none"> - London Convention - Ospar Protocol

		<ul style="list-style-type: none"> - European Directives on storage - European Directive on EU-ETS including CCS - USA, Australia, Canada,..., treaties and laws <p>UNFCCC negotiations on CDM CCS</p> <ul style="list-style-type: none"> - Position of different Parties (Annex I Parties, Brazil,...)
		LUNCH TIME
	Presented by	CCS CHAIN UNITS
14:00-17:30	UoZ	<ul style="list-style-type: none"> - <u>CO₂ Capture :</u> <ul style="list-style-type: none"> o <u>technology presentation:</u> pre-combustion, post-combustion and oxy-fuel combustion: <ul style="list-style-type: none"> • technical issues • R&D progress expected - novel capture technologies - existing capture pilots o costs evaluation : capex & opex
	TNO	<ul style="list-style-type: none"> - <u>CO₂ Transport :</u> <ul style="list-style-type: none"> o <u>CO₂ transport modes :</u> pipeline and boat. <ul style="list-style-type: none"> • technical issues, challenges and constraints. o <u>CO₂ transport cost evaluation :</u> per tCO₂/km by boats and pipeline <p style="text-align: center; color: blue;">COFFEE - BREAK</p>
	TNO	<ul style="list-style-type: none"> - <u>CO₂ Storage :</u> <ul style="list-style-type: none"> o <u>Technical feasibility of CO₂-EOR :</u> <ul style="list-style-type: none"> - CO₂ injection - CO₂ leakage and production issues - Reservoir simulation o <u>Technical feasibility of CO₂-DGF:</u> <ul style="list-style-type: none"> - CO₂ injection o <u>CO₂ storage costs :</u> capex & opex o <u>CO₂ storage commercial feasibility</u>

Day Two

	Presented by	EUROPEAN CCS VALUE CHAINS
8:00 - 12:30	TNO	<p><u>1. EU Emission Trading Scheme :</u></p> <ul style="list-style-type: none"> - Mechanics of EUA pricing: Banking, CDM, JI, marginal cost curve - XL model demo - ETS scenarios using model <p><u>2. Project value chain analysis :</u></p> <ul style="list-style-type: none"> - Introduction to CAPM (Capital Asset Pricing Model) <ul style="list-style-type: none"> o WACC, discount rate o XL model demo - Decision & Risk Analysis process - Decision Gate process - Decision criteria / KPIs (NPV, IRR, etc) - Sensitivity Analysis (Montecarlo simulations using XL model demo) - Portfolio considerations - Modelling added value (taxonomy of methods) - Role of governments in “closing the chain” (tax regime etc) <p><u>3. Map of main European emitters :</u></p> <ul style="list-style-type: none"> - geographical position, - industrial sector characterisation - long term profile emissions per year <p style="text-align: center;">COFFEE - BREAK</p> <p><u>4. Map of main European CO₂ Storage reservoirs :</u></p> <ul style="list-style-type: none"> - Potential CO₂ EOR, DGF, AQF storages - Total storage capacity estimates <p><u>5. Main EOR/CCS European scenarios :</u></p> <ul style="list-style-type: none"> - presentation of 3 or 4 main scenarios identified in the ECCO project <ul style="list-style-type: none"> o quantity of CO₂ avoided and captured <p>ECCO Tool presentation</p> <ul style="list-style-type: none"> - architecture of the tool

APPENDIX 2

Participant list

ECCO MASTER COURSE REGISTRATION *UNIZG-RGNF STUDENTS*

	NAME	TITLE	INSTITUTION	ADDRESS	SIGNATURE
1	ALILOVIĆ VEDRANA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Vedrana Alilović</i>
2	BAČIĆ ALAN	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Alan Bačić</i>
3	BAKARIĆ KRISTIJAN	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Bakarić Kristijan</i>
4	BAL MARIANA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Bal</i>
5	BALUN FILIP	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Filip Bal</i>
6	BILIĆ ŠIME	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Šime</i>
7	ČUMBELIĆ IVA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Iva Čumbelić</i>
8	ĆOSIĆ ANTE	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Ćosić</i>
9	DEOTTO IVAN	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Ivan Deotto</i>
10	DOMITROVIĆ MATEA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Matea Domitrović</i>
11	FLEGO ANJA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Anja Flego</i>
12	GUDAC IVANA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Ivana Gudac</i>
13	JADREJČIĆ DINO	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Dino Jadrečić</i>
14	KEPENJEK TIHANA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Kepenjek Tihana</i>
15	KIŠ ALEN	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Alen Kiš</i>
16	KUCELJ MIŠO	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Mišo Kucelj</i>
17	KUDEC SIMONA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Simona Kudec</i>
18	KUHTA LEA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Lea Kuhta</i>
19	KULUŠIĆ ANITA	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Anita Kulušić</i>
20	LUKIĆ BRUNO	student	RGN fakultet	Pierottijeva 6, Zagreb	<i>Bruno Lukić</i>

21	MAJOR JOZSEF	student	RGN fakultet	Pierottijeva 6, Zagreb	Major Jozsef
22	MARIĆ TIBOR	student	RGN fakultet	Pierottijeva 6, Zagreb	Marić Tibor
23	MILIČEVIĆ LIDIJA	student	RGN fakultet	Pierottijeva 6, Zagreb	Milčević Lidija
24	MILJAK IVAN	student	RGN fakultet	Pierottijeva 6, Zagreb	Miljak Ivan
25	MOSTEČAK ANA	student	RGN fakultet	Pierottijeva 6, Zagreb	Mosteček Ana
26	OŽANIĆ TOMISLAV	student	RGN fakultet	Pierottijeva 6, Zagreb	Ožanić Tomislav
27	PANDŽIĆ MAGDALENA	student	RGN fakultet	Pierottijeva 6, Zagreb	Pandžić Magdalena
28	PATEKAR MATKO	student	RGN fakultet	Pierottijeva 6, Zagreb	Patekar Matko
29	PETRIČEVIĆ IVAN	student	RGN fakultet	Pierottijeva 6, Zagreb	Petričević Ivan
30	POSAVEC DANIEL	student	RGN fakultet	Pierottijeva 6, Zagreb	Posavec Daniel
31	PRŠA LUKA	student	RGN fakultet	Pierottijeva 6, Zagreb	Prša Luka
32	RUKAVINA DAVID	student	RGN fakultet	Pierottijeva 6, Zagreb	Rukavina David
33	SEČANJ MARIN	student	RGN fakultet	Pierottijeva 6, Zagreb	Sečanj Marin
34	SEKUŠAK MIRJANA	student	RGN fakultet	Pierottijeva 6, Zagreb	Sekušak Mirjana
35	SOLAR VEDRANA	student	RGN fakultet	Pierottijeva 6, Zagreb	Solar Vedrana
36	STANKOVIĆ MATIJA	student	RGN fakultet	Pierottijeva 6, Zagreb	Stanković Matija
37	TOMAŠIĆ ELIZABETA	student	RGN fakultet	Pierottijeva 6, Zagreb	Tomašić Elizabeta
38	VLAKIĆ ANTE	student	RGN fakultet	Pierottijeva 6, Zagreb	Vlačić Ante
39	VUKADIN DOMAGOJ	student	RGN fakultet	Pierottijeva 6, Zagreb	Vukadin Domagoj
40	ZALEZNIK IVAN	student	RGN fakultet	Pierottijeva 6, Zagreb	Zaleznik Ivan
41	ZVONAR PETAR	student	RGN fakultet	Pierottijeva 6, Zagreb	Zvonar Petar
42	ŽUVELA DARI	student	RGN fakultet	Pierottijeva 6, Zagreb	Žuvela Dari

ECCO MASTER COURSE REGISTRATION OTHER STUDENTS

	NAME	TITLE	INSTITUTION	ADDRESS	SIGNATURE
1	BAKOVIĆ VID	student	Prirodoslovno matematički fakultet	Roosveltov trg 6	Vid Baković
2	DELIĆ DUNJA	student	Prirodoslovno matematički fakultet	Horvatovac 102a	Dunja Delić
3	GVERIĆ ZVONKA	student	Prirodoslovno matematički fakultet	Horvatovac bb	Zvonka Gverić
4	IVA JOHOVIĆ	student	Prirodoslovno matematički fakultet	Roosveltov trg 6	
5	KARAICA BOJAN	student	Prirodoslovno matematički fakultet	Horvatovac 102a	Bojan Karaica
6	LOEVE DANIEL	PHD student	TNO	Nizozemska	Daniel Loeve
7	NCHA MBIA ERNEST	PHD student	Technical University of Denmark	Brovej 119, Room 159, 2800 Lyngby	Ernest Ncha Mbiam
8	ŽUPANIĆ DARIA	student	Prirodoslovno matematički fakultet	Horvatovac bb	Daria Županić

ECCO MASTER COURSE REGISTRATION *TEACHERS, RESEARCHERS, OTHER...*

	NAME	TITLE	INSTITUTION	ADDRESS	SIGNATURE
1	AVIROVIĆ GROZDANA	dipl. ing.	Petrokemija d.d.	Aleja Vukovar 4, 44 320 Kutina	<i>[Signature]</i>
2	BAŠIĆ HUBERT	dr.sc.	Energetski institut Hrvoje Požar	Savska cesta 163, Zagreb	<i>[Signature]</i>
3	BLAŽEVIĆ MARIO		INA d.d.	Av. V. Holjevca 10, Zagreb	<i>[Signature]</i>
4	BOBAN KRUNOSLAV		SGS Adriatica d.o.o.	Rimski put 31, 10360 Sesvete	
5	BORKO TIHOMIR	dipl. ing.	INA-industrija nafte d.d.	Lovinčićeva bb, Zagreb	<i>[Signature]</i>
6	ČAPKA DARIJA	dipl. ing.	Agronomski fakultet	Svetošimunska 25, Zagreb	<i>[Signature]</i>
7	DARIA KARASALIHVIĆ SEDLAR	doc. dr.	RGN fakultet	Pierottijeva 6, Zagreb	<i>[Signature]</i>
8	FABIJANČIĆ SUZANA	dipl. ing.	Kraš d.d.	Ravnice 48, Zagreb	<i>[Signature]</i>
9	FAJKOVIĆ HANA	dipl. ing.	Prirodoslovno matematički fakultet	Horvatovac bb	<i>[Signature]</i>
10	FRKETIĆ DAVOR	dipl. ing.	Pogon TE Rijeka		<i>[Signature]</i>
11	GOIĆ DRAGO		SGS Adriatica d.o.o.	Rimski put 31, 10360 Sesvete	
12	GROZDANIĆ IGOR	<i>mrsc.</i> dipl. ing.	INA d.d.	Šubićeva 29, Zagreb	<i>[Signature]</i>
13	HRNČEVIĆ LIDIA	doc. dr.	RGN fakultet	Pierottijeva 6, Zagreb	<i>[Signature]</i>
14	ILIJAŠ TOMISLAV		INA d.d.	Šubićeva 29, Zagreb	<i>[Signature]</i>
15	IVANOV DENIS		SGS Adriatica d.o.o.	Rimski put 31, 10360 Sesvete	
16	JANKOVIĆ BRANIMIR	dipl. ing.	RGN fakultet	Pierottijeva 6, Zagreb	<i>[Signature]</i>
17	JELAVIĆ GOJKO		Hrvatska gospodarska komora	Roosveltov trg 2, Zagreb	<i>[Signature]</i>
18	JELAVIĆ VLADIMIR	dr.sc.	EKONERG Institute for Energy and environmental protection	Koranska 5, Zagreb	
19	JURIĆ ŽELJKO	mr.sc.	Energetski institut Hrvoje Požar	Savska cesta 163, Zagreb	<i>[Signature]</i>
20	KAPOR FRANKICA	prof. dr.	RGN fakultet	Pierottijeva 6, Zagreb	<i>[Signature]</i>

21	KAPUSTIĆ IVANA	dipl. ing.	INA d.d.	Av. V. Holjevca 10, Zagreb	<i>Ivana Kapustić</i>
22	KOLAR IGOR	dipl. ing.	Hrvatski šumarski institut	Cvjetno naselje 41, Jastrebarsko	
23	KOVAČIĆ GABRIJELA		EKONERG - Institut za energetiku i zaštitu okoliša	Koranska 5, Zagreb	<i>Kovačić</i>
24	LEAKOVIĆ STJEPAN	dr.sc.	Petrokemija d.d.	Aleja Vukovar 4, 44 320 Kutina	
25	DUKAČEVIĆ HRVOJE	dipl. ing.	INA d.d.	Šubićeva 29, Zagreb	<i>HR</i>
26	MAŠIĆ LOZIKA		Hrvatska gospodarska komora	Rooseveltova trg 2, Zagreb	<i>Mario</i>
27	MATIĆ DAVOR	mr.sc.	OMV Gas Adria d.o.o.	Josipa Marohnića 1, Zagreb	<i>D. Matić</i>
28	NOVAK KAROLINA	dipl. ing.	INA d.d.	Av. V. Holjevca 10, Zagreb	<i>K.</i>
29	OČKO TANJA		Vetropak Straža d.d.		<i>Očko</i>
30	OŽANIĆ MADLENA	dipl. ing.	Ministarstvo zaštite okoliša	Ulica Republike Austrije 14, Zgb	<i>M. Ožanić</i>
31	PERKOVIĆ LUKA	dipl. ing.	Fakultet strojarstva i brodogradnje	Ivana Lučića 5, Zagreb	<i>L. Perko</i>
32	PODGORSKI VESNA	dipl. ing.	Badel 1862 d.d.	Ulica grada Gospića 7, Zagreb	
33	PUSTAJ GORDANA	dipl. ing.	RGN fakultet	Pierottijeva 6, Zagreb	<i>Pustaj</i>
34	RUKAVINA DARIO		INA d.d.	Av. V. Holjevca 10, Zagreb	<i>Dario</i>
35	RUKAVINA LANA	dipl. ing.	INA-industrija nafte	A. Kovačića 1, 44 000 Sisak	<i>Lana Rukavina</i>
36	SIMAT SANJA	mr.sc.	INA d.d.	Šubićeva 29, Zagreb	<i>Simat</i>
37	SOLDATIĆ TINA	dipl. ing.	Pogon TE Rijeka		<i>T. Soldatić</i>
38	STIPETIĆ MARIO		Ministarstvo zaštite okoliša	Ulica Republike Austrije 14, Zgb	<i>M. Stipetić</i>
39	TADESSE SHEWAYE	mr.sc.	Geotehnički studio d.o.o.	Nikole Pavića 11, Zagreb	<i>Tadesse Shewaye</i>
40	VARLEC DIJANA		Hrvatska gospodarska komora	Rooseveltova trg 2, Zagreb	
41	VULIN DOMAGOJ	dr.sc.	RGN fakultet	Pierottijeva 6, Zagreb	<i>Domagoj</i>
42	ZGORELEC ŽELJKA	dr.sc.	Agronomski fakultet	Svetošimunska 25, Zagreb	<i>Z. Zgorelec</i>