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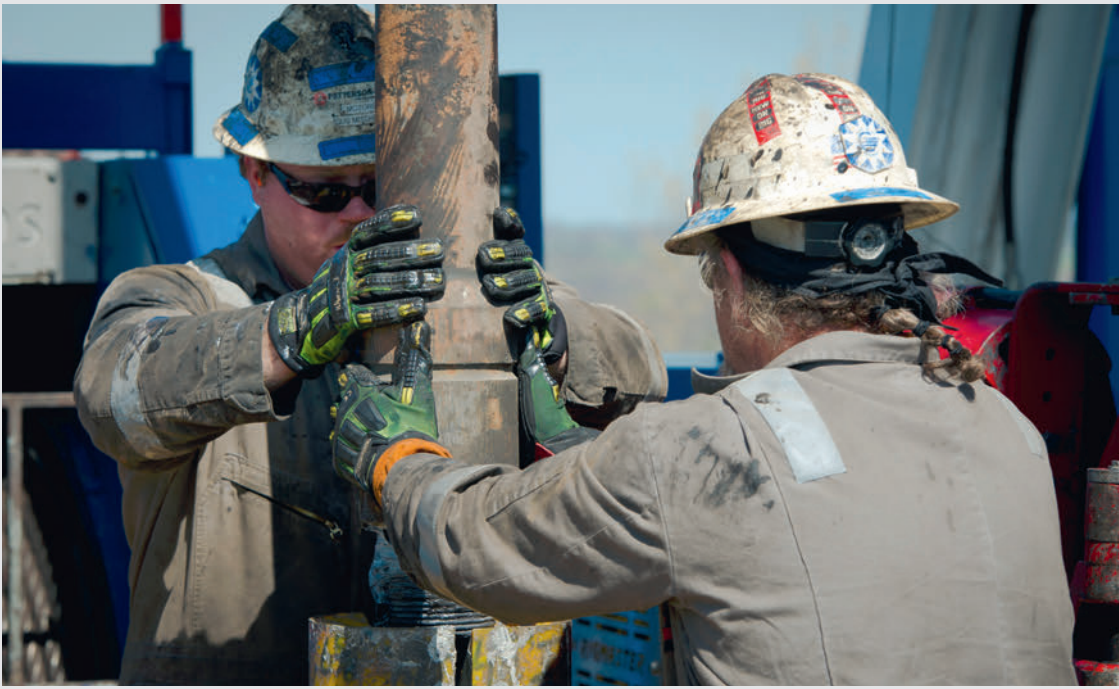
ZLG ETH Certificate of Advanced Studies (CAS) in Applied Earth Sciences

44. ZLG ETH (CAS) Short Course

Geological CO_2 Storage and Shale Gas Development



Departement Erdwissenschaften
Department of Earth Sciences

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Geological CO_2 Storage and Shale Gas Development

Resource Assessment, Operational Considerations and Risk Management

ETH Zurich
4 days of presentations and a 1-day field excursion

September 8th – 12th, 2014

Introduction
Climate change, natural resources demand and shortage as for energy and drinking water are increasingly interlinked with deep underground resource exploitation and disposal. During the past few years extraction of shale gas by hydraulic fracturing has evolved rapidly to become standard, mainly in the USA. Other countries world-wide are following. At the same time Carbon Capture and Disposal methods are developing from prototype test fields to commercial repositories. The key factors for the different technical challenges in securing energy supplies and waste disposal are essentially the same and particularly found on the inherent geological nature of the subsurface. Knowledge of the hydrogeological and physical characteristics of deep rock masses, and the processes that underpin the operations performed to increase the permeability of the rock mass is thus essential to optimize gas extraction as well as to assure proper design and sustainable operation of geological storage facilities. The announced course will aim at the technical and environmental issues associated with this expanding use of the deep underground. The complex and demanding governance care of the subsurface management will be covered in a following course (March 2015).

The continuing education course is planned as 4 days of lectures and workshops at ETH Zurich with an intermediate field excursion. The content is focussed on the fundamentals, the rock mass characterization, interaction and behaviour of the involved fluids at moderate to high pressures. Further major topics are injection techniques, hydraulic fracturing design, modelling and monitoring, environmental issues, risk assessment and the role of shale gas in energy supply. The course will furthermore present a snapshot of the current regional state of knowledge and the Swiss perspectives in the relevant specialized fields.

If shale gas is to contribute significantly to the Swiss energy mix and CO_2 and radioactive waste is to be stored in the deep geological underground, as is hoped, then there will be a need for competent specialists. Thus the announced continuing education course meets a real demand and shall contribute to their recruitment and training.

Target Audience and Expectations
The course is designed for experienced geoscientists, rock engineers and post-graduate students who wish to take the future challenges of deep subsurface harnessing and management in their profession and research. There is no need to be a petroleum geology specialist to register but remark that general geo-scientific knowledge and job related motivation is prerequisite. The participants will be introduced to leading edge extraction and disposal technology along with classical measurement and monitoring methods. Furnished with a solid background in the essential physical and chemical processes including quantitative analysis, they will be prepared to better site drillings, estimate reservoir capacities and the environmental impact of CO_2 geological storage and shale gas exploitation. Selected case studies will provide an insight to the various practical applications of the acquired knowledge.

Course Program

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8.09.2014 Monday	The opening session addresses the Swiss energy policy, the prospects of shale gas and geological CO_2 storage in the context of the manifold challenges that must be overcome to bring these to market in Switzerland. The day's main focus lies on the **basics of carbon capture and storage,** reservoir characterizations and injectivity modelling given in several lessons.
9.09.2014 Tuesday	The second day is devoted to **monitoring and risk assessment** during CO_2 injection and storage. The last two presentations are on CO_2 storage in depleted oil fields and enhanced oil recovery which leads directly over to the second main course topic: shale gas development. This day concludes with a visit to ETH laboratories where experiments on rock deformation and mineral carbonation are being conducted, followed by an ice-breaker apéro.
10.09.2014 Wednesday	A full day **field excursion** will take the participants first to Swisstopo Mont Terri underground rock laboratory situated in the Opalinus clay formation, the potential host rock for radioactive waste repository. Here is the opportunity to follow ongoing experiments on CO_2 storage and discuss with the involved researchers. Then after lunch a hike in beautiful geological setting at the hearth of the Swiss Jura Mountains a further inspection of caprocks and natural gas containing rocks is provided as well as information on the state of exploration and knowledge of the Swiss deep underground. The excursion concludes with convivial dinner in a typical local restaurant before heading back to Zurich in the evening.
11.09.2014 Thursday	The fourth day focusses on **shale gas and hydraulic fracturing.** After a disquisition on the role of shale gas in energy supply, presentations on shale gas reservoir investigation and characterization follow. A further core topic is the currently so controversial discussed exploitation method of hydraulic fracturing. Here the attention is set on the fracturing process, the extraction design and modelling and monitoring of fracture propagation. The presentations illustrate the use of monitoring and simulation tools to characterize reservoirs and to better understand processes such as fracturing, fluid flow, recharge and leakage.
12.09.2014 Friday	The last day is devoted to **risks and future outlook** of geological CO_2 storage and shale gas exploitation. The presentations cover risk management from hydraulic fracturing, leakage and flowback water and include consideration of environmental impact issues: specifically, the assessment of seismic hazard, and the footprint of storage and exploitation projects as it appears in the Environmental Impact Assessment (EIA) including the disposal of chemically contaminated fluids. Concluding case histories illustrate the methods used for completion and the lessons learned from the experiences leading to the future perspectives.

Course Instructors
The main course instructor is Dr. Srikanta Mishra from Battelle Memorial Institute, Columbus USA. He and the other involved scientists and expert practitioners offer combined in-depth knowledge on the subject matter and university-level teaching proficiency. The following persons have assured their participation:

Paul Bossart, Christian Minnig, Srikanta Mishra, Andrea Moscariello, Christophe Nussbaum, Cornelia Schmidt-Hattenberger, Gunter Siddiqi, Maria Violay, Lasse Wallquist, Mischa Werner, Stefan Wiemer, Alba Zappone

Further details and the complete program can be found at: http://www.zlg.ethz.ch

Registration Form
For 44th ZLG ETH Certificate Short Course

Geological CO_2 Storage and Shale Gas Development
September 8th – 12th, 2014

Have you previously participated in a Certificate ETH Short Course in Applied Geology?

☐ yes ☐ no

Do you intend to cover the ETH Certificate Study (consisting of 4 one week short courses including examination for awarding the certificate)?

☐ yes ☐ no

surname	first name
date of birth	nationality
address	postal code
telephone	e-mail
profession / title	university / year of graduation
company / institution	function

Motivation

Please enclose a short note describing your reasons for attending our short course.

place / date	signature

Please send this registration card to us before **20th of August 2014.**
Note that the number of participants is limited. Registrations will be accepted on a "first come first serve" basis. An invoice will be sent after registration to the persons accepted for the course. To guarantee registration, full payment (CHF 1700) must be received two weeks before the start of the course. For withdrawals later than four weeks before the start of the course, a penalty of CHF 300 will be charged. The entire course fee will be charged for withdrawals later than two weeks prior to the course.

If you do not wish to receive further announcements from us: ☐ delete from data base

Registration by internet: http://www.zlg.ethz.ch or E-Mail zlg@erdw.ethz.ch

CAS ETH in Applied Earth Sciences

September 8th – 12th, 2014

Stamp

CAS ETH in Applied Earth Sciences
(Zertifikatslehrgang, ZLG)
ETH Zentrum NO F 45
Sonneggstrasse 5
CH 8092 Zurich
Switzerland

ZLG ETH
ZERTIFIKATSLEHRGANG
IN ANGEWANDTEN
ERDWISSENSCHAFTEN

General Information

Registration
Early registration of seats is recommended as the course is limited.
Registration must be made by mail, fax or internet (http://www.zlg.ethz.ch) using the registration form. An invoice will be sent after registration to the persons accepted for the course. To guarantee a place, full payment must be received two weeks before the start of the course.

Course fee
The course fee is CHF 1700.–. This includes course documentation, opening apéro and one meal and refreshments during all coffee breaks in Zurich (4 days).

Venue
The lectures will be held in Werner Siemens Auditorium (HIT E51) at Science City ETH Zurich / Hönggerberg. Participants are responsible for their own transport and overnight accommodations. Science City is well linked either by public transportation or direct Bus connections ETH Campus Zentrum.
For details check: https://www.ethz.ch/en/campus/locations.html

Contact for Queries
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