STC'23

STUDENT TECHNICAL CONFERENCE

Program

8 – 10 November 2023 | Clausthal-Zellerfeld

STC' 23

STC 2023 Plan

	WED 8th Nov			THU 9th Nov	FRI 10th Nov
8 a.m.				Registration & welcome snacks	Welcome snacks Team's Distribution
9 a.m.				Opening Ceremony SPE President (Keynote 1)	Joanna Jedrys (Keynote 2)
10 a.m.				SPE President (Keynote 1) Posters (with coffee)	Masoud's Presentation William's Presentation
11 a.m.	Group 1 Registration	Group 2	Group 3	Hammo's Presentation Indira's Presentation	Drillbotics' Presentation Drillbotics show
12 p.m.	Registration			Lunch	Lunch
1 p.m.	Institute Tour	Registration		Jakub's Presentation Jituboh's Presentation	Job fair (with coffee)
2 p.m.	Lunch	Lunch	Registration	Shayak's Presentation Subhashish's Presentations	Clausthal - Bowl
3 p.m.	Workshop	Team - building	Lunch	Job fair (with coffee)	Award ceremony + official congress end
4 p.m.	Team - building	Institute Tour	Team - building	YP panel	Clausthal/Goslar walk (optional)
5 p.m.		Workshop	Institute Tour	Technical game Group picture	Clausthal/Goslar walk (optional)
6 p.m.	SPE Chapters exchange			Rest	Rest
7 p.m.	BBQ			Group dinner	Party
8 p.m.	BBQ			Group dinner	Party
9 p.m.				Group dinner	Party

University of Clausthal
SPE Student Chapter

German Section

Scan the QR code to register!

Welcome back…

Welcome to the Student Technical Conference 2023, finally back as an in-person format.

We are glad you are here and wish you success, new learnings, and fun during the two days of the conference and during the pre-program.

This conference is primarily made for students related to the energy industry, faculty, and for engineers and scientists. We offer plenty of interesting new technical topics from academia, general networking, and opportunities for students and potential employers to get to know each other.

The STC has been a constant in the offerings of the German Section of SPE for many years now. After 2 virtual formats and one year without the STC, we again expect some many participants from Germany, Europe, and further abroad.

As you can imagine, organizing such an event is a lot of work and requires a lot resources. Planning started at the beginning of the year, with meetings every two weeks and later on a weekly basis. We appreciate having found many new student volunteers taking on the various tasks. Keep that in mind and let us know how we can improve or if you have questions – the team is there to help you.

We are also very thankful for our sponsors to support us. Thanks to them, we can offer financial support to presenters and participants and let them focus on their technical work. Moreover we would like to thank the YP committee of the GSSPE, organizing the YP Panel and mentoring students.

We hope that you not only enjoy the conference but take out something tangible as well, may it be a new and important technical idea, a valuable insight how to grow personally, a possible internship, or something else entirely. Make the most out of your STC!

On behalf of the organizing committee,

Jasna Merkelbach

STC 2023 Chair

The Organizing Committee for the Student Technical Conference 2023

GSSPE:

- Jasna Merkelbach, Chair
- Ingo Forstner, Advisor

Student Chapter Aachen:

- Radwa AlMoqaddam

Student Chapter Clausthal:

- Abdulla Al-Izzi
- Ali Alkhawaja
- Alireza Farsimadan
- Guzel Kazakbaeva
- Lennard Müller
- Mohamed Eita
- Orwa Mohaidy
- Waithera Gakio

Student Chapter Freiberg:

- Leonel Sebastião Machava

And Our Event Volunteers!

We thank the many other contributors who have put a lot of time, thought, and energy to make this happen!

Contents

How to participate in surveys

We will do some real-time surveys at a few times throughout the conference, using the Kahoot App.

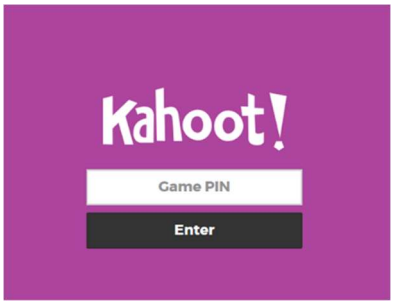
In order to participate, you will need to use your smartphone and require an internet connection.

There are two alternative ways to participate

1. Open the Kahoot.it website in your browser, or
2. Install the Kahoot! App

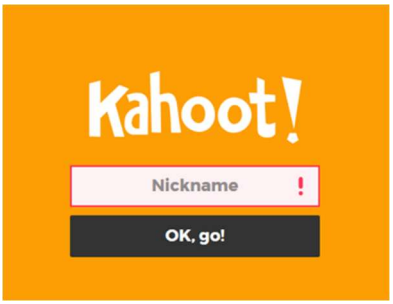
When we start the survey on the big screen, please open either the website or the app on your smartphone.

It will look similar to this:

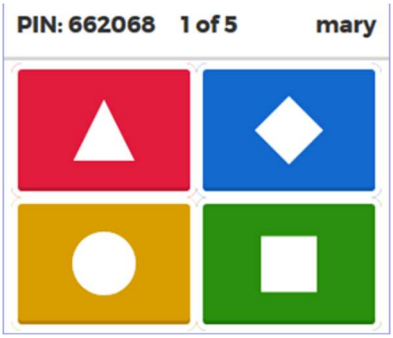


It asks for a six-digit game PIN that you will see on the big screen. Enter that number and click Enter.

Alternatively, you can just scan the QR-code that will be shown on the big screen and join the game.



You are asked for a nickname. Please enter one. It can be a fantasy name. Once entered, your nickname will show on the big screen until the survey starts.



There are different types of questions (Quiz, Puzzle, True or False, Type Answer). Please click on your respective choice for each question within typically 20-40 seconds.

The conference was made possible thanks to the following sponsors:

Presentations and posters by students from:

How do I get to Clausthal from Goslar? And how do I get back?

You always can get to Clausthal with bus 830, which you will find at Bus station directly next to the Railway station.

TWO ROUTES from Goslar ZOB to Clausthal-Zellerfeld Kronenplatz and back

1. Direct route:

Duration 29 min., travels every hour (xx:23) – to *Clausthal*

Duration 31 min., travels every hour (xx:19) – to *Goslar*

2. Indirect route – through Hahnenklee

Duration 48 min., travels every hour (xx:58) – to *Clausthal*

Duration 49 min., travels every hour (xx:41) – to *Goslar*

If you stay at the Ferienpark am Waldsee, we recommend to leave the bus at Ostbahnhof

The way from Hanover to Goslar

The route from Hanover airport to Hanover Main Station (Hbf):

S-Bahn (S5) travels every 30 min (xx:06 and xx:36) from the airport directly to Hanover main station (Hbf) – duration 17 min.

The route from Hanover main station (Hbf) to Goslar:

A train called ERX travels every hour (xx:48) from Hanover to Goslar – duration 65 min.

The way from Hamburg to Hanover

The route from Hamburg airport to Hamburg Main Station (Hbf):

S-Bahn (S1) travels every 10 min from the airport directly to Hamburg Main Station (Hbf) – duration 24 min.

The route from Hamburg Main Station (Hbf) to Hanover Main Station, there are two options:

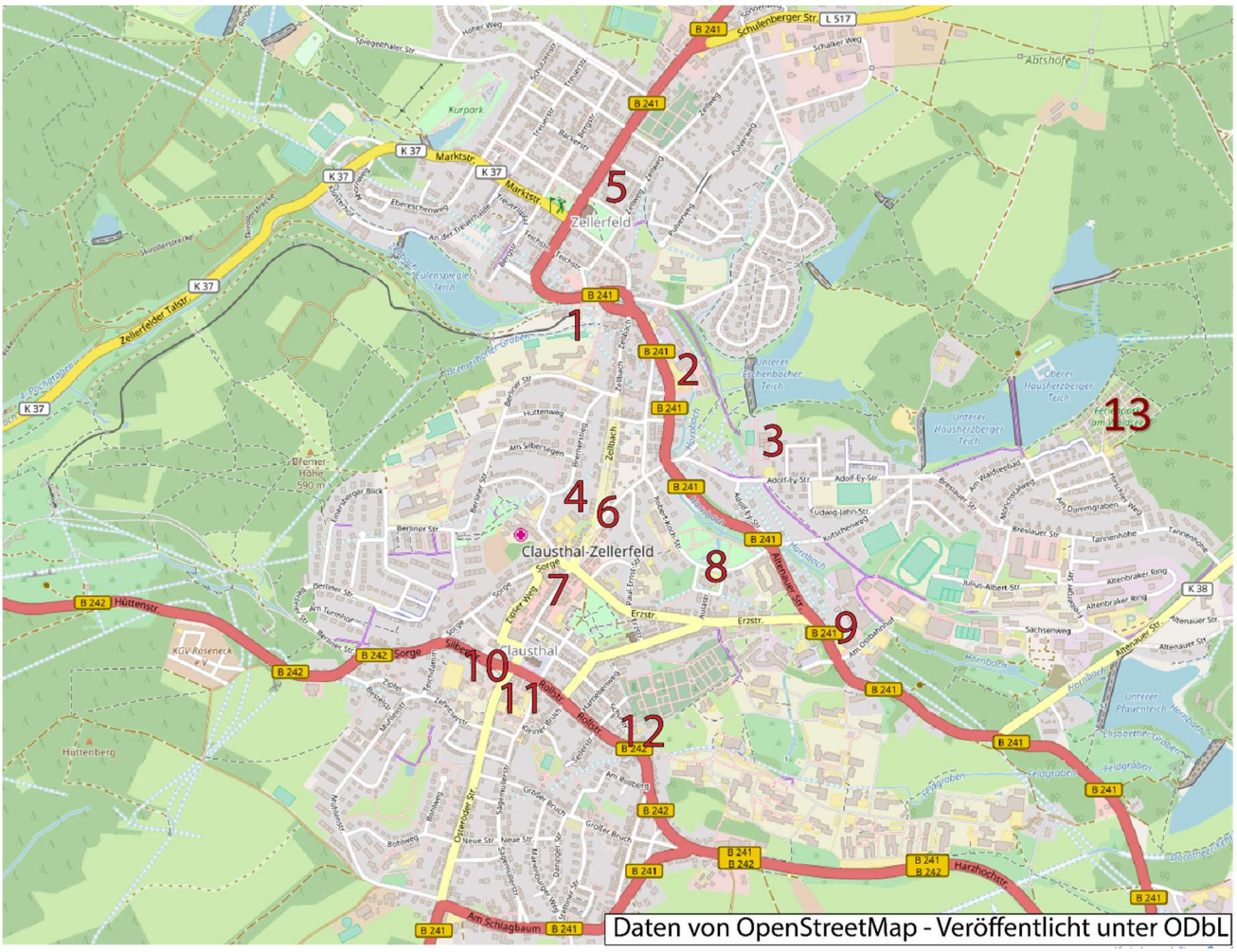
Regional Train: cheaper, slower and train changes are required (Metronom via Uelzen or Buchholz "Nordheide")

ICE or IC: expensive, faster, and direct connection to Hanover Main Station (Hbf)

The way from other cities

The way from other airports and cities you can find on: https://www.bahn.com/en/view/index.shtml

Clausthal – Overview map



1. Central Bus Station (Clausthal-Zellerfeld ZOB)

(Please do not exit the bus at *Clausthal-Zellerfeld ZOB* when arriving; but at the bus stop *Kronenplatz*)

2. Supermarket "Lidl", *Bauhofstraße 21-25*

3. Hostel, *Adolf-Ey-Straße 9*

4. Hotel "Goldene Krone", *Kronenplatz 3*

5. „Harzhotel zum Prinzen", *Goslarsche Str. 20*

6. Kronenplatz Bus Stop, *Kronenplatz*

7. "Main Street" with several restaurants, banks (ATMs) and cafés, *Adolph-Roemer-Straße*

8. Aula Academica (Conference Venue), *Aulastraße 8*

9. Supermarket "Netto", *Altenauer Str. 33*

10. Kellerklub, *Silberstraße 1*

11. Supermarket "Penny", *Osteröder Str. 1*

12. Kebab Restaurant "Uni Döner", *Rollplatz 3*

13. Ferienpark am Waldsee, Mönchstalweg 30

Conference Venue

Aula Academica der TU Clausthal, Aulastraße 8, 38678 Clausthal-Zellerfeld

Accommodation

Students:

For students, the hotel Ferienpark am Waldsee is booked (rooms will be shared). The organizing committee takes care of organizing the rooms for those who indicated "Need Accommodation" during registration.

From the hotel, you will take a 21 min. walk to Aula Academica (2.1 km).

Ferienpark am Waldsee: Mönchstalweg 30, 38678 Clausthal-Zellerfeld | +495323 81661

For industry/faculty:

Hotels rooms are pre-booked here (code word STC Clausthal 2023) possibly still some rooms available. Rooms will need to be booked directly:

Hotel Goldene Krone: Kronenplatz 3, 38678 Clausthal-Zellerfeld | +49 53 23 93 00 | info@goldenekrone-harz.de

Prices: 97€ incl. breakfast for the pre-booked rooms.
Take a short walk (500m) via Erzstraße and you'll reach Aula Academica.

Harzhotel zum Prinzen: Goslarsche Str. 20, 38678 Clausthal-Zellerfeld | +49532396610 | hotel@zum-prinzen.de

Prices from 69€ - 74.50€ incl. breakfast for the pre-booked rooms.
20min. walk (1.5km) to Aula Academica

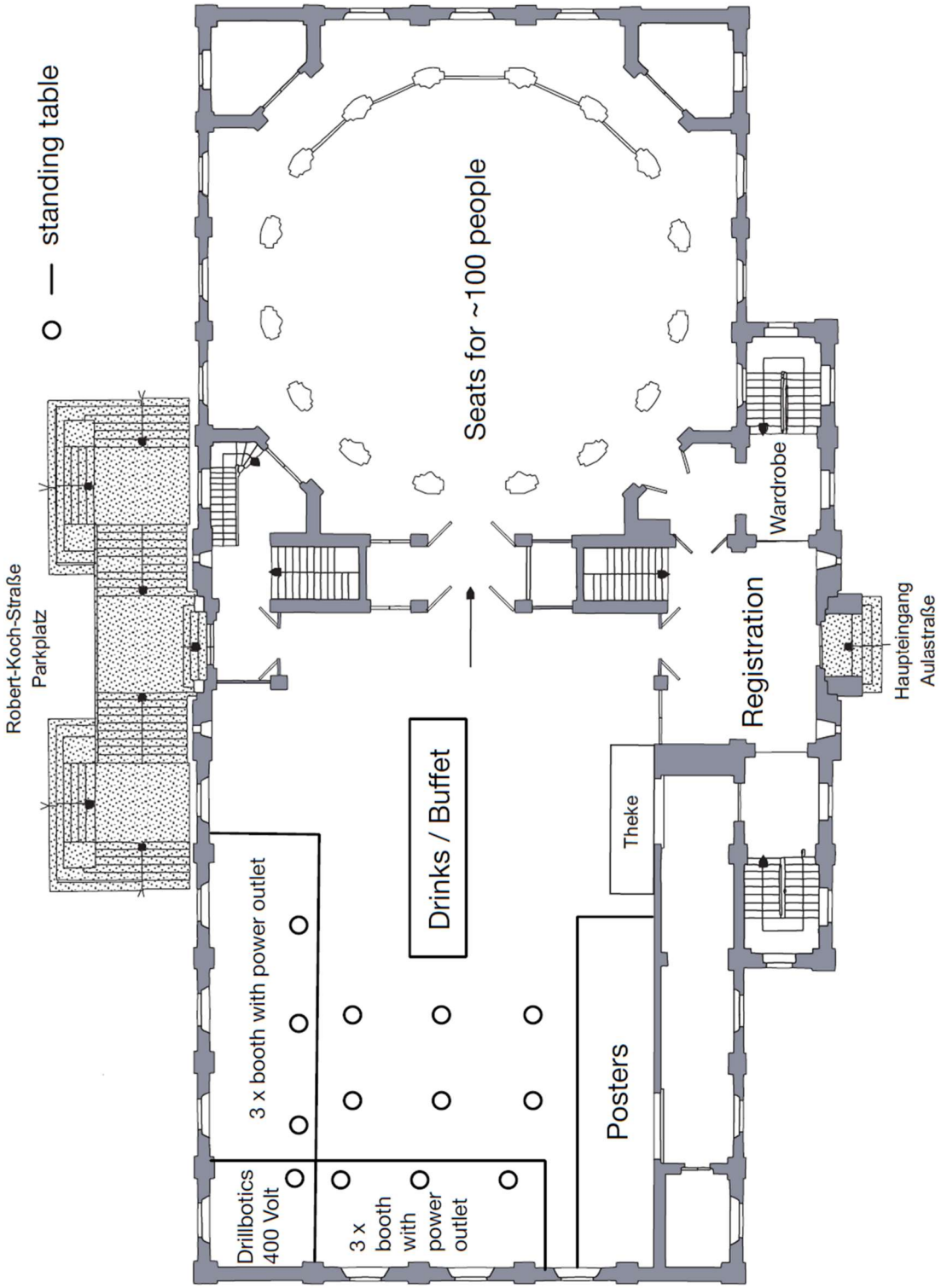
Travel Expenses

Please **coordinate travel** with your student chapter and **car-pool.**

Reimbursement requests (see above table) can be made by e-mail to the GSSPE treasurer Edna Michelle Bisso Bi Mba. You must provide receipts.

For reimbursement questions, Edna Michelle Bisso Bi Mba will be available at the GSSPE booth.

Sitemap


o — standing table
Seats for ~100 people
Robert-Koch-Straße
Parkplatz
Wardrobe
Registration
Haupteingang
Aulastraße
Drinks / Buffet
Theke
Posters
3 x booth with power outlet
Drillbotics 400 Volt
3 x booth with power outlet

Pre Program

Institute tour

One-hour tour starting from Aula to the Institute of Subsurface Energy Systems where you will have the chance to visit our faculty, labs, lecture halls, and the drilling workshop that serves oil and gas companies to perform tests on their pipes.

Workshop

An academic small assignment along an assigned team that is going to improve your soft skills but also your knowledge.

Team-building activities

Few games for the sake of entertainment to enhance the teamwork spirit and increase communication with others.

SPE Chapters Exchange

Location: Institute of Subsurface Systems, Agricolastraße 10, 38678, Clausthal-Zellerfeld

Time: from 18:00 – 19:00

Student Chapter representatives will share best practices and discuss the challenges encountered during the chapter activities

Barbeque „Meat and Greet“

Informal grill event to welcome the STC participants and to get to know each other

Location: Institute of Subsurface Systems, Agricolastraße 10, 38678, Clausthal-Zellerfeld

Time: from 19:00

Beer, Softdrinks, Grilled meat, cheese, vegetarian skewers, potato salad

SPE bar opened with billiard and music

Keynote Speaker

Medhat M. Kamal

2023 SPE President

Thursday – 9:30 - 10:00

Medhat (Med) Kamal, 2023 SPE President, is a Chevron Fellow Emeritus with primary responsibilities including competency development within the company, identification and development of emerging and white-space technology opportunities, and provision of technological advice and counsel to senior management. He formerly was a fellow and leader at the dynamic reservoir characterization group for Chevron Energy Technology Company. Before Chevron he worked for ARCO, Flopetrol Schlumberger, and Amoco. He holds master's and doctorate degrees in petroleum engineering from Stanford University, and a bachelor's degree in petroleum engineering and a master's in engineering from Cairo University.

He says "We need to make sure that everybody recognizes the fact that we are going to be doing what we are doing now and we are going to add to it our efforts in:

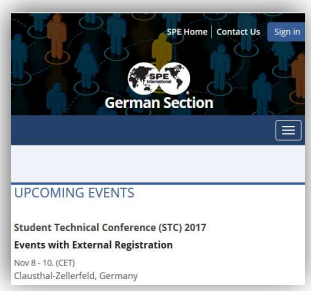
1. Area of climate change mitigations and,
2. In the formation of New Energies

I call that**: Petroleum ++**"

We feel honored to have Med Kamal as a Keynote Speaker and look forward to his attendance of STC!

Get updated on GSSPE!

connect.spe.org/Germany



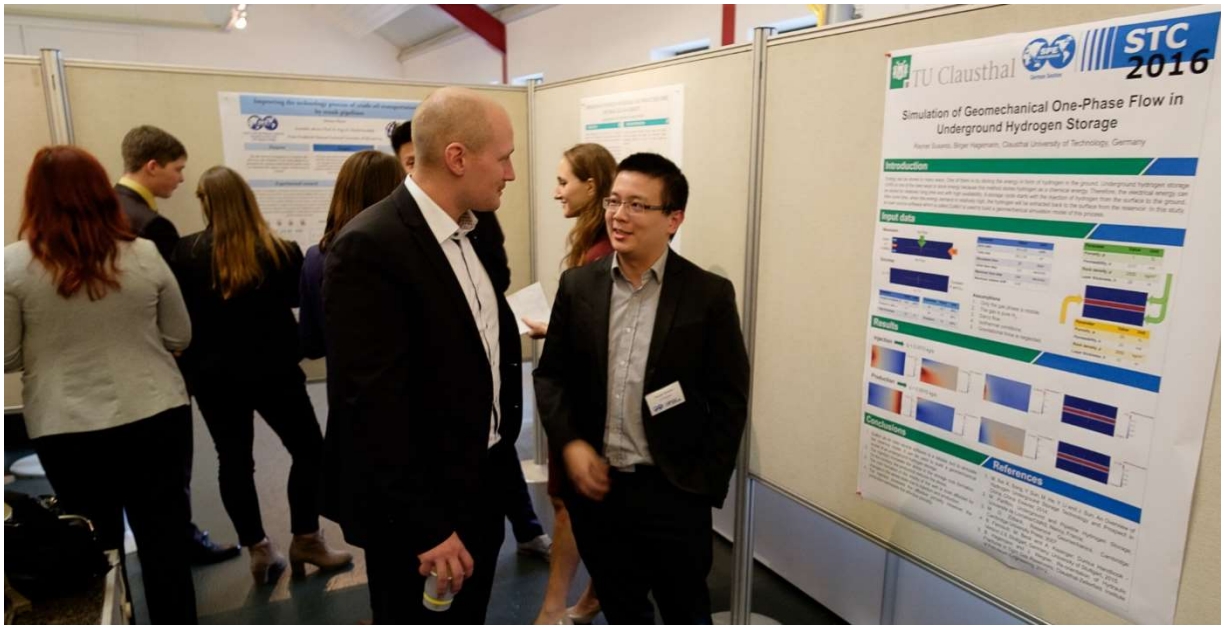
linkedin.com/company/SPEgermany

SPE International
German Section

Technical Poster Session

Thursday, 10:00

and throughout the whole event



Technical Poster Session

Name: Marrune, Cruz R.
Co-Author: Machava, Leonel Sebastião

University: TU Bergakademie Freiberg
Studying: Petroleum Engineering
Field of interest: Reservoir/Production Engineering, Drilling Engineering, Environmental Sustainability

Economic evaluation of the combined hydrogen and waste heat generation from electrolysis

The diversification of energy sources is one of the most important strategies for achieving the German government's goals of reducing greenhouse gas emissions by 2030 and achieving climate neutrality by 2050. This can be achieved through the Power to X (Pt-X) process. The process uses electrolysis to convert electrical energy into hydrogen (H2) and oxygen (O2). In addition, energy is generated in the form of waste heat during hydrogen production.

This study presents an economic evaluation of the combined production of hydrogen and waste heat by alkaline electrolysis. Firstly, the basics of alkaline electrolysis were analyzed and evaluated, as well as the possibility of recovering the waste heat from the electrolysis by means of a heat pump or a heat exchanger. The aim of this study is to assess the economic viability and profitability of the integrated hydrogen and waste heat production system using the Net Present Value (NPV) method. The NPV allows a systematic analysis of the costs, benefits and investment decisions involved.

Critical factors such as electrolysis efficiency, electricity costs, thermal energy output and capital investment were considered. These factors play a key role in determining the overall viability of the integrated system. In addition, this study aims to provide valuable insights into the economic competitiveness of combined hydrogen and waste heat production compared to stand-alone hydrogen production or conventional heat generation methods. The results of this study will provide a clear overview of the economic viability and production costs, all of which are critical to decision makers for stakeholders, including policy makers, industry leaders and investors. It also provides an overview of the implementation of alkaline electrolysis systems, furthering the quest for sustainable energy production and use

Technical Poster Session

Name: Alkuhali, Akram Khaled
University: TU Clausthal
Studying: Petroleum Engineering

Overview of CCUS Application worldwide

The presentation provides an overview of global carbon capture and storage (CCS) projects and their progress in mitigating CO2 emissions. Highlighting the significant growth in the number of CCS facilities and the capture capacity, showcasing the global commitment to reducing CO2 emissions and combating climate change. The projects are categorized based on their respective continents, emphasizing the efforts made by various regions to implement CCUS technologies. It also provides the different techniques employed for CO2 capture, including industrial capture, power capture, direct air capture (DAC), and CO2 utilization. Additionally, presenting examples of projects focused on CO2 storage and utilization, highlighting their impact on reducing overall CO2 emissions. The presentation presents a comprehensive review, assessment, and analysis of numerous global projects undertaken to capture CO2. The findings demonstrate the global momentum behind CCS projects and the challenges faced in their implementation.

Technical Poster Session

Name: Gakio, Waithera

University: TU Clausthal
Studying: Petroleum Engineering

Literature Review of the Available Relative Permeability and Capillary Pressure Measurement Techniques of Gas-Liquid Systems

The world's current focus on climate change led to notable progress in the fields of geological storage of carbon dioxide (CO2) and even hydrogen (H2) in depleted gas fields, aquifers and salt caverns. Fluid distribution within a reservoir is a critical factor that impacts the effectiveness of resource extraction and storage. Two primary properties, capillary pressure and relative permeability, play key roles in governing fluid behavior within the reservoir. Capillary pressure aids in assessing the sealing capacity of caprock, while relative permeability affects the distribution of gas flow during injection. This study provides a comprehensive overview of relative permeability and capillary pressure measurement techniques for gas-liquid systems, namely CO2-brine, H2-brine, N2-brine, and CH4-brine. Relative permeability employed both steady-state and unsteady-state approaches. Additionally, capillary pressure is investigated using the step-by-step (standard) approach, continuous injection approach, residual capillary pressure approach, and dynamic capillary threshold pressure approach. A comparison of these techniques is then presented, highlighting their individual strengths and limitations. Case studies of Li et al. (2005) and Rezaei et al. (2022) are provided as examples to further understand the effects of pressure, brine salinity, interfacial tension, and type of rock on the above-mentioned gas-liquid while determining breakthrough pressure and relative capillary curves. Notably, similarities between H2 and N2 led to the conclusion that N2 may be used as a substitute for H2 when determining relative permeability considering the safety regulations associated with H2 gas.

Technical Poster Session

Name: Zamaninia, Mahmoodzia

University: TU Clausthal

Studying: Petroleum Engineering

Bulk densities of Liquid-Liquid-Vapor systems [n-butanol+H2O+CO2] and [n-dodecane+H2O+CO2]

Enhanced oil recovery (EOR) is a process employed to extract additional oil from a reservoir once primary and secondary recovery methods have been exhausted. One common EOR method involves injecting a fluid into the reservoir to modify properties relevant to the transport of reservoir fluids, including viscosity, density, and interfacial tension (IFT), among others, with the aim of increasing its efficiency. The addition of a surface-active agent can decrease IFT, leading to an increased mobility ratio and improved fluid flow through porous media within the reservoir. One potential model fluid for EOR is a mixture of n-butanol, water, and carbon dioxide (CO2), with n-butanol serving as the surfactant given its amphiphilic nature. Additionally, to simulate fluid behavior in depleted reservoirs, n-dodecane (n-C12) is selected as a representative example of oil present in the reservoir. It is assumed that CO2 and water are also present in the depleted reservoir fluid as part of the mixture. Further research is essential to gain a deeper understanding of the properties of these mixtures, particularly their bulk density essential for IFT determination. Therefore, saturated bulk density determination under reservoir conditions, i.e., enhanced pressures and relatively moderate temperatures, becomes fundamental. This study presents experimental measurements of the saturated bulk density of ternary systems, specifically [n-butanol + H2O + CO2] and [n-C12 + H2O + CO2]. In particular, the saturated liquid organic phase, the aqueous phase, and the vapor phase were measured between 313.15 K to 333.15 K and up to the organic phase miscibility pressure. The densities of the two liquid phases and the vapor phase formed by these systems were measured using a densimeter based on the oscillating tube method. For comparison, the saturated bulk liquid phase density of [H2O + CO2] from literature data and experimental density result of [n-Butanol + CO2] and [n-C12 + CO2] at the same pressure and temperatures were used. The results show that pressure and temperature have a significant impact on the bulk density of the system. The density results of the aqueous phase in the ternary system agree with the saturated bulk liquid phase density of [H2O + CO2], while the organic saturated phase density of the ternary systems differs from the liquid phase in [n-butanol + CO2] and [n-C12 + CO2] due to the variations in solubility.

Presenters on Thursday

Thursday, 11:00

Name: Eita, Yasser Mohamed Sabri Farag

University: TU Clausthal

Paper refers to:

Studying: Petroleum Engineering

Well integrity monitor by detecting anomalies using machine learning and rule-based models for hydrocarbon assets

The challenge of ensuring the integrity of oil and gas wells is currently one of the most critical issues in the industry. With the emergence of Artificial Intelligence (AI) and Machine Learning (ML), many companies are exploring novel technologies to enhance well integrity and prevent dramatic incidents. This project introduces an AI-driven system and Rule-Based (RB) model designed to monitor well integrity in natural flow, gas lift and water injector wells. Prototypes of ML and RB models were developed to identify instances of annulus leakage by analyzing time series sensor data for abnormal patterns.

Historical anomalies of annulus leakage in wells were categorized according to the type of well, and the anomalies relevant to these incidents were classified as either short-term or long-term. The primary aim is to create ML and RB models that can recognize both past and future events in previously unseen wells. The success criteria for this project were determined in collaboration with Subject Matter Experts (SMEs). Two statistical metrics, the Detected Event Rate (DER) and the False Alarm Rate (FAR), were defined to quantitatively assess the model's performance and determine its suitability for the next phase of development. To feed the models, high-frequency sensor data were extracted from the production historian. The selection of sensors crucial for the project was made in consultation with the SMEs, and only a limited number of sensors were used as input variables. To enhance model performance and computational efficiency, the raw data underwent preprocessing and resampling. After developing the models, deployment is done for the model's connection to the live data that is needed to achieve the aim of the project by notifying SMEs upon detecting any abnormal behavior by the models.

Remark: This is an actual project which is currently taking place at Wintershall Dea.

Thursday, 11:30

Name: Yessenaliyeva, Indira
University: TU Clausthal
Studying: Petroleum Engineering

Effect of microscale events on the interpretation of Darcy scale multiphase fluid flow

A hydrocarbon reservoir is a complex system of pores and channels with different fluid phases at unique composition. Fluid flow on a pore-scale is governed by capillary forces, induced by pressure gradients on Darcy's scale. Pore phenomenon, currently, is integrated into Darcy's equation by a phenomenological coefficient, the relative permeability. Fast dynamics in pores and pore channels is spontaneous and turbulent, making Darcy's equation irrelevant due to its assumptions. What information is this phenomenological coefficient capable to transmit from a pore-scale to a macroscopic scale? Duration of an individual pore event is milliseconds to seconds, whereas Darcy's time scale is days, leading to insensitivity of Darcy's scale. Geometry of pores, fluid topology, interfacial tension, external pressure gradient and other factors influence fast dynamic events and define efficiency of oil displacement as well as ultimate oil recovery. This paper aims to study complex phenomenon of Haines jumps, Snap-off and Choke-off in a pore and to understand their effect on the interpretation of multiphase fluid flow on a Darcy's scale. First case study explains impact of pore events on a residual oil saturation through a capillary number in wide and narrow pore size distributions. Second case study formulates non-equilibrium theory for derivation of phenomenological coefficient, the relative permeability, and explains dissipation of energy due to fluctuations of capillary pressure during oil displacement. It is known, reservoir simulation forecasts greatly depend on the relative permeability. It is, therefore, of high importance to understand behavior of multiphase flow in porous medium, quantify nature of fast dynamics and directly link pore events to Darcy's scale for reliable reservoir performance forecasts, recommendations for efficient EOR techniques with a final goal to recover unrecoverable.

Thursday, 13:00

Name: Drochomirecki, Jakub Mateusz

University: DTU Technical University of Denmark

Paper refers to:

Studying: Petroleum Engineering

Feasibility Study of Low-Enthalpy Geothermal Doublet Systems for Heat Extraction in Stenlille Area, Denmark

This paper investigates the feasibility of utilizing low-enthalpy geothermal doublet systems to generate 28 MW of energy from a geothermal; hot water source, located in the Stenlille area of Denmark. The objective is to partially cover the heating demand of the Storkøbenhavn district. A comprehensive geological study of the prosperous Gassum formation was conducted using log and well data. Multiple scenarios, tailored to the specific geology, were incorporated into a multi-flow model. A finite element model was adjusted and applied to simulate four different scenarios of the doublet systems under varying boundary conditions and well configurations. The study found that implementing a checkboard pattern with two production and two injection wells enabled the satisfaction of the heat demand for 32,704 households over a 20-year period. The economic analysis revealed a net present value (NPV) of 7,477 k€ and an internal rate of return (IRR) of 11.4% for this configuration. Conversely, configurations with fewer than four wells resulted in unacceptably high injection pressures. As a result, these scenarios were investigated under a thermal power requirement of 14 MW. Despite yielding lower NPVs compared to the 28 MW scenario, all configurations at this reduced thermal power level still indicated profitability. Furthermore, a sensitivity analysis demonstrated the significant influence of reservoir porosity on the project outcomes. Reducing the porosity by 2% resulted in a negative NPV, suggesting that the project would not be economically viable. Consequently, the paper recommends conducting more extensive subsurface measurements to enhance the reliability of the results and inform decision-making regarding the potential implementation of the geothermal doublet system in the Stenlille area.

Keywords: Geothermal energy, energy transition, district heating, renewables, doublet systems

Thursday 13:30

Name: Jituboh, Emmanuel

University: TU Clausthal

Studying: Drilling and Production Engineering

Viability of Converting Depleted Oil Wells in Nigeria to Geothermal Wells for Electricity Generation

There is a shift in trend from fossil fuels to energy with little or no impact on the environment in Africa. Geothermal energy is the heat extracted from the sub-surface which can be used for various applications like heating and electrical power generation with the aid of power cycles. For the heat to be extracted from the subsurface, several systems such as geothermal probes can be utilized by using a working fluid such as water to transport the heat to the surface for the intended application.

According to the Nigeria National petroleum Corporation, about 31% of the oil fields are currently producing. Over 90% of the oil fields are in the Niger-Delta region of the southern part of Nigeria. Even though a large amount of the oil fields are non-operational, huge amounts of money are still spent on maintenance of the wells to limit or control the emission of methane. These depleted oil wells in these regions could be retrofitted to geothermal wells using downhole heat probes which can help to mitigate the cost of maintenance.

A mathematical model was developed with the aim of estimating the amount of electricity that can be generated from the geothermal energy extracted using a coaxial downhole heat probes in the depleted oil wells of the Niger-delta region (South, Northeast and South-east). The model also described parameters that could affect the geothermal energy extraction process and the operating conditions of the Organic Rankine cycle.

The downhole coaxial heat probes are commonly designed by installing two pipes in a concentric design in a way the large diameter pipe serves as the injection string and the smaller diameter pipe which is properly insulated to limit heat loss serves as the production string. Water is selected as the preferred working fluid due to its relatively high boiling point and low viscosity. Water evaporation is dependent on the geothermal gradient and hydrostatic pressure, it is important to pressurize the entire system to prevent the evaporation of water. The working fluid is injected through the injection string, as it flows downwards, it is heated up by heat transfer from the formation. In the heat probe, the working fluid attains its highest temperature at the bottom. The heated working fluid flows upward through the production string which should be properly insulated to the wellhead where the outlet of the heat probe is located. From the outlet it is fed to the heat exchanger of the ORC to generate electrical power.

Based on the geothermal gradient, the region with the highest potential for electricity production is the North-East region of the Niger-delta. This work shows that retrofitting depleted oil wells to geothermal wells is a technically viable option.

Thursday, 14:00

Name: Majumder, Shayak

University: TU Bergakademie Freiberg
Paper refers to:
Studying: Groundwater Management

Potential Effects of (Aquifer Thermal Energy Storage)-ATES at Reiche Zeche, Freiberg

Aquifer Thermal Energy Storage or ATES system is an open-loop geothermal technology which relies on seasonal storage of cold and/or warm groundwater in the aquifer. ATES offers a way to store energy for later use. Below is a typical schematic of how an ATES system is set up, with two wells: a warm well and a cold well.

During summertime, the water is extracted from the aquifer by the cold well (Duijff et. al, 2023) and used for cooling purposes. With the help of this set-up, the water is heated up and thereby injected back in the warm well, storing the energy until the onset of the wintertime. Furthermore, during winter times, the flow is reve rsed, whereby warm water is extracted from the warm well and used for heating purposes. The heating is provisioned with the help of a heat pump to achieve the required temperature. Subsequently, the water is cooled in this resultant process and re-injected into the aquifer through the cold well, thereby completing a time cycle period of 1 year. In summary, ATES technology involves the seasonal storage of thermal energy in underground aquifers, which are natural geological formations that can store large amounts of water. The base fundamental logic is to use the loss of thermal energy in the aquifer when warm water (or cold water) in the ATES energy zones overlap each other. In summary, we can also say that ATES systems are like "Underground Heat Accumulators & Rechargable Storage Batteries".

Thursday, 14:30

Name: Dey, Subhashish

University: Karlsruhe Institute of Technology

Studying: Applied Geosciences

Unraveling the Enigma: Molecular Tracer Sorption in High-Temperature Geothermal Environments

Understanding the sorption behavior of molecular tracers in high-temperature geothermal environments is vital for optimizing geothermal reservoir characterization. In this research, we embark on a journey to unravel this enigma, shedding light on the interactions between tracers and geological formations under simulated geothermal conditions.

Our research plan includes batch experiments conducted in an autoclave at elevated temperatures (70°C and 200°C) and high pressures along with the preparation of artificial brines with varying salinities. Different sorption media, such as quartz sand, sandstone, sands, and cuttings, will replicate the conditions found in geothermal reservoirs. Additionally, we will identify common geothermal tracers through a short literature review and prepare tracer solutions, including uranine, various naphthalene sulfonates, and potentially other compounds. The sorption process will be continuously monitored over time, primarily by tracking changes in fluorescence in the water, enabling the construction of sorption isotherms under these challenging geothermal conditions. Our research builds upon the extensive use of uranine and eosin as tracers in groundwater and geothermal systems. To advance geothermal reservoir characterization, there is a growing need for reliable tracers with specific characteristics, such as low detection limits, ease of analysis, high resistance to biodegradation, low adsorption coefficients, long-term stability, and low toxicity.

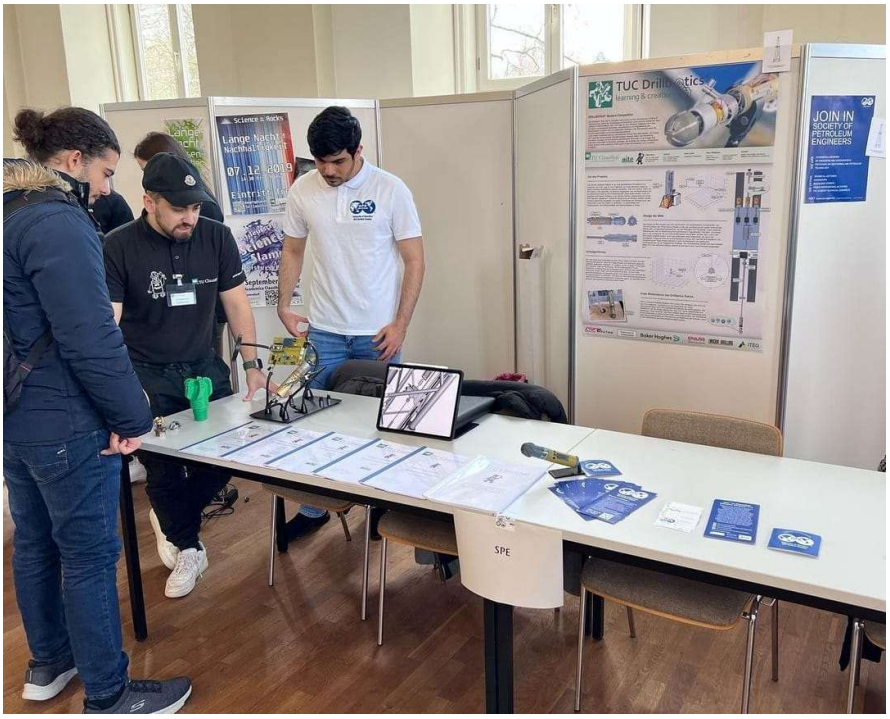
While fluorescent tracer sorption behavior has been studied extensively, data for saline and high-temperature environments remain limited. Our study seeks to address this knowledge gap by conducting two time series experiments to analyze tracer behavior under simulated geothermal conditions.Tracers help assess the interaction between geological formations and potential energy reservoirs, ensuring the efficiency and sustainability of geothermal energy production. By providing a comprehensive understanding of tracer behavior under geothermal reservoir conditions, our research aims to enhance the predictability and efficiency of tracer testing in geothermal systems, ultimately contributing to the advancement of sustainable geothermal energy production.

Keywords: Sorption properties, molecular tracers, geothermal environments, batch experiments, fluorescence monitoring, sorption isotherms, reservoir charact

Job Fair

Thursday – 15:00-16:00

Our job fair will feature booths where sponsoring companies will have the opportunity to engage with students and discuss their available positions. This is a great chance for students to learn about different industries and gain valuable insights from professionals.
In addition to networking and career opportunities, our event will also serve as a marketing platform for sponsoring companies, where they can showcase their services, visions and future projects goals and where they can attract potential employees while supporting the development of young talent.
Don't miss out on this exciting opportunity to connect with top companies and explore your future career options! Join us at the student technical congress and take advantage of all the resources our job fair has to offer. We look forward to seeing you there!

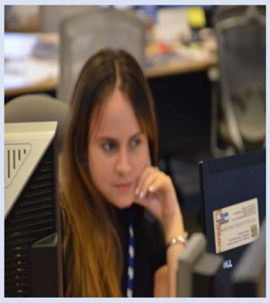


Young Professionals Panel

From student to a professional – Expectations, Pitfalls and Experiences

Thursday – 16:00-17:00

Renas Ibragim
Drilling Engineer
Wintershall Dea



Carmen Elena Vieitez Lopez
Service Delivery Technical Manager
Baker Hughes

Hendrik Bohnet
Managing Director
Multiline

Marlene Wolf
Carbon Storage Geoscience Advisor
Exxon Mobil Production GmbH

GSSPE Young Professionals Committee: Who we are and what we do

The Young Professionals Committee is an integral part of the GSSPE, with a primary focus on programs dedicated to or presented by young professionals (YPs). The current committee comprises six enthusiastic YPs from diverse backgrounds who are eager to share their time and experience to actively contribute to the society.

During lunch breaks at conferences such as DGMK and DGG, we host Lunch 'n' Learn sessions, which provide YPs with opportunities to network and benefit from insightful presentations by experienced managers. At DGMK 2022, we go a step further by providing a dedicated session for YPs called "Youngtimer Garage." This session is designed to cater specifically to the interests and needs of young professionals, offering a valuable platform for their growth and development.

In addition to these activities, we participate in the Ambassador Lecturer Program (ALPs) to educate students about the SPE and guide them through their early career stages. During ALPs, YPs not only share information about SPE and the advantages of professional membership but also discuss their own journeys and transitions into professional life.

Furthermore, we are excited to announce that we are organizing a special event called "Beyond the Borders" In 2024. This event aims to bring together young professionals from all across Europe in Germany, providing a unique opportunity for knowledge sharing and experience exchange.

Thursday's Group Dinner

Formal dinner for all STC participants. The dinner will be buffet.

Location: Mensa TU Clausthal, Leibnizstraße 3, 38678, Clausthal-Zellerfeld

Time: 19 – 21 (and later)

Beer, wine and food is on us and good appetite is on you.

Keynote Speaker

Joanna Jedrys

Innovation Manager – Wintershall Dea

Thursday – 9:00 - 10:00

Joanna Jedrys (Graduated from and holds a PhD in Geophysics at AGH University of Science and Technology) is an Innovation and Change Manager at Wintershall Dea, where she supports colleagues in developing business cases for their ideas. She likes to be in contact with people from all the disciplines and possibility to learn new skills and methods of working.

Furthermore, she is an active member of the companies Women's Network where she contributes in raising awareness about gender equality, women's networking, increasing their visibility, empowering women to help them reach their full potential.

She will speak about her personal career path from starting as a seismic interpreter to becoming an Innovation Manager and the skills, which she developed and which helped her along the way. Also, she will elaborate on ways of working together as a team, with focus on the scrum-method, which she applies in her team.

We are looking forward to her insightful talk and interactively exchanging our views on interpersonal skills at the workplace.

Presenters on Friday

Friday, 10:00

Name: Manafi, Masoud

University: Politecnico di Milano

Role of Hydrogeological Traits in Numerical Simulations of Aquifer Thermal Energy Storage

Recent literature works suggest that the implementation of Aquifer Thermal Energy Storage (ATES) systems for heating and cooling purposes can yield reasonable substantial energy savings, leading to a significant reduction in greenhouse gas emissions. Low temperature ATES systems (i.e., operating at low to moderate temperature levels) can act as energy buffers for managing solar, thermal, combined heat and power plants, and intelligent district energy systems. Indeed, evaluating the potential of geothermal resources is a multifaceted challenge requiring interdisciplinary expertise, with reservoir engineering playing a pivotal role.

Present study aims to elucidate the influence of inherent shallow aquifer characteristics on the efficiency of installing ATES systems. Our research involves a comparative analysis of performance across diverse subsurface hydrogeological settings through numerical simulations. We perform numerical simulations of ATES in shallow aquifers for three test cases in Milano metropolitan across diverse subsurface hydrogeological settings. Utilizing data collected from three selected locations within the Milan metropolitan Area, we construct simplified box-models of confined aquifers for our three test cases. Simplicity assumption of confined aquifer is not entirely accurate for shallow aquifers in Milan metropolitan area in Italy; for comparison purposes, semi-confined aquifer models are also constructed and tested to assess responses of the ATES system under varying conditions of (i) heterogeneity in rock properties, (ii) aquifer average temperature, (iii) average hydraulic gradient due to aquifer natural flow, (iv) effective rainfall recharge of the aquifer, and (v) the impact of water/air capillary pressure. Our simulations employ in the ECLIPSE 100 (i.e., black-oil formulation of the mathematical models) software environment. To constrain variation of the simulation responses solely to the above-mentioned characteristic parameters of our interest, we maintain consistent well placement and control settings across all comparative test cases. By isolating the influence of key aquifer characteristics on ATES numerical simulations, our research can provide valuable insights into the role of different hydrogeological attributes in the performance, e.g., recovery efficiency, of ATES systems. Our study confirms that simulating a numerical box (confined) model characterized by a homogeneous distribution of permeability/porosity fields can yield notably different recovery efficiencies compared to the open-aquifer simulation model due to the complex interplay of multiple factors, including rock attributes, hydraulic gradients, thermal parameters, temperature fields, effective rainfall recharge, and capillary pressure effects. Our numerical results indicate that heterogeneity of the rock attributes exerts the most significant influence on efficiency of the ATES system. The impact of effective rainfall recharge and capillary pressure within the aquifer varying depending on the specific circumstances, resulting in negligible efficiency changes. Present numerical study can shed light on how various components of hydrogeological characteristics impact the efficiency of ATES systems. This work can constitute a preliminary step toward a comprehensive technical feasibility assessment of installing ATES system in Milano metropolitan.

Friday, 10:30

Name: Jones, William

University: TU Clausthal

Experimental Determination of Density and Viscosity of a Geothermal Fluid in te North German Basin (NGB) With and Without Dissolved CO2

The density and viscosity of a synthetic geothermal brine, designed to mimic the fluids in the Wealden Formation of the North German Basin were measured. The findings of this thesis can be used to accurately validate PVT data to model fluid flow for geothermal energy generation and Carbon storage in deep saline aquifers. Density measurements were conducted with a vibrating U-Tube Densimeter, while the viscosity was measured using a HPvis150 High Pressure Viscometer. The measurements were carried out under operating conditions, with pressures from 1 bar to 300 bar and temperatures ranging from 303.15 K to 353.15 K.

Literature review on the possible brine concentrations, salt types, and the types of gases present in these brines in the NGB was done. The concentrations of the salt mixture that was used for the density and viscosity measurements are 3.25 mol/kg NaCl(aq) and 0.09 mol/kg CaCl2 (aq), mimicking the geothermal fluid concentration of the Wealden Formation of the NGB. CO2 was the investigative gas that was used in this experiment for saturation.

For the determination of the viscosities, the Hagen-Poiseuille Equation was employed and the measured differential pressures from the experiment were used. The densities were also obtained by means of an oscillating tube densimeter which measures the frequency of the excited U-Tube, that is filled with the sample fluid. The density is calculated from the oscillation period and the densimeter records the calculated densities. The resulting densities and viscosities, including those for the CO2-saturated fluid samples, were reported against the various temperatures and pressures under which the experiments were conducted. Density values were seen to have increased, as expected, upon the addition of CO2 to the brines.

Friday, 11:00

Name: Ali Alkhawaja, Charalampos Soilemezidis, Farouk Jamali

University: TU Clausthal

Studying: Energy Systems/ Petroleum Engineering

Drillbotics® International University Competition 2022/2023 (Physical Rig)

In the past year, the TU-Clausthal Drillbotics team designed and built an autonomous drilling robot capable of navigating both straight and deviated trajectories. After winning last year's Drillbotics competition, the team documented their work, which is presented in this paper. At the heart of this work is a novel algorithm and a corresponding network that enables control and monitoring of the system, independent of its location. This decentralized control system enhances the flexibility of operating the TUC's small-scale drilling rig. The aim was to create a framework that provides an easy introduction for future users to the development and implementation of new control algorithms. While primarily designed for miniaturized drilling rigs, the framework is versatile enough for other applications, leveraging the advantages of decentralized control. This paper delves into the construction process, highlighting our innovative BHA concept and its mechanics. Also discussing our steering approach, based on the "push the bit" method, commonly employed in industries for down-hole steering. We will also discuss data from initial test wells, pinpointing areas for enhancement. The discussion emphasizes superior performance in maintaining consistent hole diameter and faster drilling speeds compared to manual methods.

Clausthal / Goslar Walk

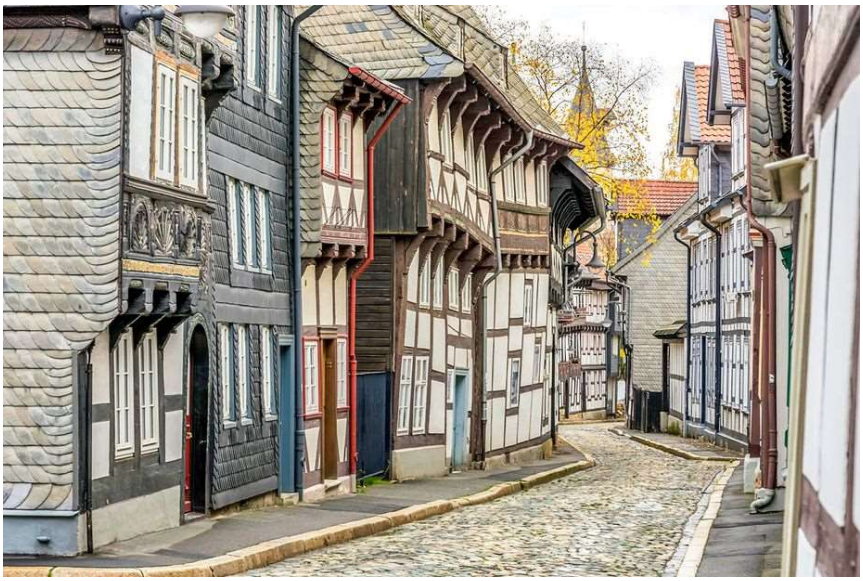
One exciting point on the agenda for the STC is the opportunity for all attendees to embark on a two-hour walk that will lead us through the picturesque landscapes of Clausthal or Goslar.

Clausthal landscape

For those who have never had the chance to explore this region of Germany, it's a unique opportunity to experience its charm. During this agenda point, students will have the unique privilege of choosing between two equally enticing options: a leisurely stroll through the idyllic landscapes of Clausthal or a journey into the historical heart of Goslar.

It's also important to note that, in preparation for the walk in Clausthal, attendees are advised to bring a heavy jacket to ward off the brisk mountain air and to fully enjoy the experience of lakes and nature.

The primary purpose of this excursion is to introduce our diverse group of students, hailing from various corners of the world, to the less-explored facets of Germany. This choice allows our attendees to cater to their personal interests and comfort, ensuring that the final day of our congress is not only a delightful exploration of Germany but also a celebration of individual preferences.



Goslar city center

Farewell Party

Location: Corps Montania, Erzstraße 45, 38678, Clausthal-Zellerfeld

Time: 19:00 – open end

STC'23

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