

2019 NFiP Annual Report

Petroleum Research School of Norway

Nasjonal forskerskole i petroleumsfag (NFiP)

Introduction

Petroleum Research School of Norway (NFiP) includes PhD students from all of the five universities in Norway that provide PhD education within petroleum related disciplines. Education of petroleum researchers at Norwegian universities benefits from coordinated, interdisciplinary collaboration between the Norwegian universities graduating PhD's in petroleum related scientific disciplines. In 2016, NFiP obtained financial support from The Research Council of Norway (RNC) amounting to NOK 23mill for the next 8 years. This support enabled NFiP to continue and expand the educational efforts.

The Petroleum Research School of Norway was established to provide a national tool to improve the PhD education within petroleum related sciences in Norway. This is achieved by coordinating lectures given by the different universities and providing intensive courses, seminars and conferences for all PhD students in Norway with research projects related to petroleum. The objective is also to establish discussion groups, collaborating opportunities and interdisciplinary meeting places for PhD students and their supervisors in Norway and internationally, for more information please see <https://nfip.no/>.

Adhering to the new transparency strategy of the Research Council of Norway, NFiP strongly supports open-access of scientific contributions to the public at large. Thus, current and previous scientific presentations related to NFiP activities are freely available at <https://nfip.no/> under the specific course/seminar.

Members of the Petroleum Research School of Norway; include University of Bergen (UiB), University of Stavanger (UiS), University of Oslo (UiO), Norwegian University of Science and Technology (NTNU), University of Tromsø (UiT), and the University Center at Svalbard (UNIS).

More than 1500 students (PhD and MSc students) have participated in NFiP activities in total. In 2019 ca 210 students participated at NFiP arrangements.

2019 NFIP Activities

2019 Courses, Conferences and Seminars provided by NFIP and in NFIP collaborations.

In the period of January 1st - October 1st 2019, the following courses, conferences and seminars were provided by NFIP. Additionally, the IOR Norway Conference was financially supported and co-hosted by NFIP as a collaborative effort with The National IOR Center of Norway at University of Stavanger.

| DATE | Event, Location | COST [NOK] | # STUDENTS | Universities attending |
|-----------------|--|--|------------|---|
| March 19-20 | IOR Norway, Stavanger, Norway | 500 000 | 70 | Universities in Norway and international students |
| March 26-28 | Sedimentary Gas Hydrate Workshop, Tromsø, Norway | 110 000 | 17 | UiB: 5 UiT: 4 NTNU: 3 UNIS: 1 DTU: 1 TU Delft: 1 Equinor: 1 U. of Rochester: 1 |
| May 27-28 | Rhetoric course, Oslo, Norway | 50 000 | 9 | UiB: 1 UiS: 3 UNIS: 1 U. of Naples: 4 |
| September 23-24 | Interdisciplinary CCUS Workshop, U. of Houston, Houston, TX, USA | (part of CO2 for EOR as CCUS Conference) | 55 | Stanford University: 1 CSM: 3 Imperial: 1 NTNU: 7 NETL: 1 New Mexico Tech: 2 Rice Uni.: 2 UiB: 9 University of Houston: 8 University of Tulsa: 2 UiO: 1 UiS: 2 UiT: 2 UT Austin: 7 U. Federal Fluminense: 1 U. of Louisiana Lafayette: 1 TU Delft: 3 University of Kansas: 1 U. of Western Australia: 1 |
| September 25-27 | CO2 EOR as CCUS Conference, Rice U., Houston, TX, USA | 700 000 | 60 | Stanford University: 1 CSM: 3 Imperial: 1 NTNU: 7 NETL: 1 New Mexico Tech: 2 Rice University: 12 UiB: 9 University of Houston: 3 University of Tulsa: 2 UiO: 1 UiS: 2 UiT: 2 UT Austin: 7 Uni. Federal Fluminense: 1 Uni. of Louisiana Lafayette: 1 |

| | | | | |
|------------|--|----------------------|---------------------|--|
| | | | | TU Delft: 3 University of Kansas: 1 Uni. of Western Australia: 1 |
| SUM | | 1 360 000 NOK | 211 students | |

2019 Seminars and courses

1) Sedimentary Gas Hydrate Workshop 2019

The Workshop was held in Tromsø, Norway. This workshop had the primary objective to gather PhD students at Norwegian Universities for presentations and networking within the research field of marine and onshore sedimentary gas hydrate systems. The workshop facilitated an opportunity for young researchers to present their own research and connect with colleagues in Norway. The focus was on characterization of gas-hydrate-bearing sediments and their response to induced changes in physical and/or chemical conditions.

The workshop was organized by NFIP, Geir Ersland (UiB) and Giuliana Panaieri (CAGE, UiT), with a total of 24 participants, including 17 students from: UiB: 3 PhD, 3 master; UiT: 1 Post doc, 3 PhD; NTNU: 1 PhD, 2 master; DTU: 1 Phd; UNIS: 1 PhD; University of Rochester: 1 PhD; and TU Delft: 1 master.

Link to the event: <https://nfip.no/2019/02/12/sedimentary-gas-hydrate-workshop-2019/>
Scientific presentations from the workshop are available at <https://nfip.no/>

2) Practical Course in Rhetoric 2019

The course is intended to help participants to be more precise and feel more confident in oral and written communication. The course lecturer was Siri Blindheim from Rhetoric Institute; she has been conducting rhetoric courses for more than 15 years.

A total of 9 participants attended the course: UiB: 1 PhD; UNIS: 1 PhD; UiS: 3 master; and Uni. of Naples: 4 master.

Link to the course: <https://nfip.no/2019/02/14/practical-course-in-rhetoric-2019/>

3) Interdisciplinary CCUS Workshop 2019

An interdisciplinary workshop on CCUS between Universities in Texas and Norway, oil industry in Texas and Norway and other CCUS stakeholders was provided at University of Houston, TX, USA, Sept. 23-24th, 2019. The two-day workshop gathered about 60 students from petroleum, law, economics, political and environmental sciences.

A total of 74 industry, governmental and academic representatives participated, including 55 students from the following universities: Stanford University (1), Colorado School of Mines (3), Imperial College (1), NTNU (7), National Energy Technology Laboratory (1), New Mexico Tech. (2), Rice University (2), University of Houston (8), University of Tulsa (2), UiB (9), UiO (1), UiS (2), UiT (2), UT Austin (7), Uni. Federal Fluminense (1), Uni. of Louisiana Lafayette (1), TU Delft (3), University of Kansas (1), and Uni. of Western Australia (1).

Link to the course: <https://nfip.no/2019/07/08/interdisciplinary-ccus-workshop-2019/>
Scientific presentations will be made available after the workshop at <https://nfip.no/>

2019 Conferences

1) IOR 2019 Conference

NFiP co-hosted, together with the National IOR Centre of Norway, the 6th Annual Improved Oil Recovery (IOR) conference in Tjodhallen, University of Stavanger, 19-20 March, 2019.

Almost 250 attendees debated openness, sharing, uncertainty, recovering, application and creativity within the oil and gas industry. International experts and Norwegian researchers discussed the future of IOR, especially highlighting the importance of CCUS. A total of ca. 70 students attended.

Link to the conference: <https://www.uis.no/category.php?categoryID=24586&s=24586>

Link to proceedings: https://www.uis.no/getfile.php/13511801/IOS-senter/Vedlegg/Proceedings_19_final.pdf

2) 4th Biennial CO2 for EOR as CCUS Conference 2019

The CO2 for EOR as CCUS Conference at Rice U., Houston, TX, USA, is a collaborative on CO2 EOR between universities in Texas and Norway, oil industry in Texas and Norway and other CO2 EOR stake holders. The symposium objectives were to accelerate CO2 research collaboration between Norway and Texas, and to provide opportunity for experts in industry and academia to collectively discuss CO2 research. In addition, post docs and PhD students were provided with current research status and the way forward, and the oil industry was provided with an opportunity to communicate needs to the next generation engineers. Emphasizing CO2 as mean to mitigate negative climate effects in oil production was the main part of the agenda.

A total of 94 industry, governmental and academic representatives participated, including 60 students from the following universities: Stanford University (1), Colorado School of Mines (3), Imperial College (1), NTNU (7), National Energy Technology Laboratory (1), New Mexico Tech. (2), Rice University (12), University of Houston (3), University of Tulsa (2), UiB (9), UiO (1), UiS (2), UiT (2), UT Austin (7), Uni. Federal Fluminense (1), Uni. of Louisiana Lafayette (1), TU Delft (3), University of Kansas (1), and Uni. of Western Australia (1).

Link to the conference: <https://nfip.no/2019/04/24/co2-for-eor-as-ccus-2019/>

Scientific presentations will be made available after the conference at <https://nfip.no/>

2019 Student/ Researcher Exchange

NFiP promotes and supports collaborative international petroleum research initiatives; preferentially between universities that have signed MoU's with NFiP, by providing financial travel support for students. NFiP has negotiated 3 additional MoUs during the project period: U. of Texas A&M at Corpus Christi, U. of Barcelona and Danish Technical University, the latter two still pending. Previously NFiP has signed MoU with 8 universities in the USA and 3 universities in Europe.

NFiP's Short Term Exchange Program (STEP) financially supports students to spend collaborative research time in counterpart countries of international research collaborations. During 2019 the following new student exchange programs were granted financial support:

| First Name | Surname | Affiliation | Destination | From | To |
|------------|---------|-------------|-----------------------------|------------|------------|
| Peter | Betlem | UNIS | Vrije University, Amsterdam | 11.11.2019 | 25.11.2019 |
| Solveig | Riisøen | NORCE | UT Austin, USA | 23.09.2019 | 23.10.2019 |

During 2019 the following student were supported with maximum 10 000 NOK to attend conferences:

| First Name | Surname | Affiliation | Destination | From | To |
|------------|------------|--------------------|------------------------|------------|------------|
| Anna | Van Yperen | University of Oslo | AAPG, San Antonio, USA | 18.05.2019 | 23.05.2019 |

Additionally, 6 PhD students are currently or have recently completed exchange terms approved last year: Helene Meling Stemland (UiB), Metin Karakas (UiB), Ricardo Vasconcellos Soares (Norce), Fredrik Wesenlund (UiT) and Ilias Gavrielatos (UT).

2019 student exchange programs

PhD student Peter Betlem, UNIS, Svalbard, Norway – visit at Vrije Universiteit Amsterdam, Holland

Project Name: Fault-related CCS leakage risks
Institution: UNIS, Svalbard
PhD student: Peter Betlem
Project Supervisor: Kim Senger, Alvar Braaathen, Elin Skurtveit
Institution Visited: Vrije Universiteit Amsterdam
Hosted By: Kei Ogata, VU
Period: Nov. 11th - Nov. 25th, 2019

Project Summary:

The focus lies on the creation of i) detailed geometrical rock physics models of faults in shale-dominated successions, ii) correlations between geological input and geophysically-detectable properties such as resistivity and elasticity, and iii) the representation thereof in industry-standard geological models. Early, constructive input from co-supervisor Kei Ogata (Assistant Professor in Tectonics of Sedimentary Rocks; Vrije Universiteit Amsterdam) and industry advisors (Niko Kampman, Reservoir Engineer; Kees K. Hindriks, Sr. Geomechanicist; Kevin Bisdom, Geomechanicist; Shell Global Solutions) is vital to the project and facilitated through a short-term stay in Amsterdam.

PhD student Solveig Riisøen, NORCE, Bergen – visit at UT Austin, Texas, USA

Project Name: Large-scale drilling fluid flow-loop
Institution: NORCE, Bergen
PhD student: Solveig Riisøen
Project Supervisor: Fionn Iversen, Rune Time
Institution Visited: Department of Petroleum & Geosystems Engineering, UT Austin
Hosted By: Eric van Oort, UT Austin
Period: Sept. 23rd - Oct. 23rd, 2019

Project Summary:

The objective of this collaboration will be to study the fluid frictional pressure loss in a flow-loop and compare the results with the modelled frictional pressure loss based on the rheology of the drilling fluid. The main objective will be to investigate the effect of particles (both concentrations and particle size) and the impact on the investigated pressure loss in a flow-loop with two different diameters. The test fluid will be a KCl/polymer water-based mud with addition of solid particles. A series of measurements, in both the rheometer and flow-loop, will be investigated using different concentrations of particles in combination with changing the particle size. The rheology curve will be fitted using Herschel Buckley model. The uncertainties will be investigated, mainly with focus on the experimental error and the propagation of these on the modelled frictional pressure loss.

2019 Board Meetings

February 11th 2019 and November 2019 (planning in progress)

2019 Chairman Activities

NFiP was promoted by visits and presentations at: Univ. of Texas A&M, Corpus Christi, TX, USA, Rice Univ. and Univ. of Houston, TX, USA, AGH U. in Krakow, Poland, ConocoPhillips, Bartlesville, OK, U. of Tulsa, USA, USDOE, Pittsburgh, USA, Occidental, Houston, TX, USA and OED, NPD and NRC in Norway.

Chair of the Executive Board of NFiP has participated/presented at various occasions and events.

Selected talks by the Chairman where NFiP was presented; Oct. 2018 – Oct. 2019:

1. Arne Graue: *“CCUS Enables Petroleum as Energy Security for More Sustainable Energy in the Future”*, Whole Value Chain CCUS Student Week, Oct. 15th - 19th, 2018, Golden, CO, USA.
2. Arne Graue: *“Energy for the Future – CO₂ Sequestration in Hydrates with Associated Methane Gas Production”*, Whole Value Chain CCUS Student Week, Oct. 15th - 19th, 2018, Golden, CO, USA.
3. Arne Graue: *“CO₂ Foam EOR for Mobility Control”*, Whole Value Chain CCUS Student Week, Oct. 15th - 19th, 2018, Golden, CO, USA.
4. Arne Graue: *“Field Experiences from CO₂ Injections in Hydrates: North Slope CO₂-CH₄ Exchange Project”*, Whole Value Chain CCUS Student Week, Oct. 15th - 19th, 2018, Golden, CO, USA.
5. Arne Graue: *“CO₂ Foam for Mobility Control in EOR - Upscaling from Lab to Field Pilots”*, NIOR Seminar on CO₂ EOR, Equinor, Stavanger, Norway, June 11th, 2019.
6. Arne Graue: *“ENERGY for the FUTURE - CCUS Enables Petroleum as Energy Security in More Sustainable Energy for the Future”*, Norwegian Consulate General, Houston, TX, USA, February 27th, 2019.
7. Arne Graue: *«Petroleum Research School of Norway»*, Opening Address at IOR NORWAY 2019, U. of Stavanger, March 19-20th, 2019.
8. Arne Graue: *“CO₂ Enables Petroleum as Energy Security in More Sustainable Energy for the Future”*, Occidental Corporation, Houston, TX, USA, January 17th, 2019.
9. Arne Graue: *“Opportunities for Offshore International Whole Value Chain CCUS”*, Interdisciplinary CCUS Workshop at U. of Houston, Houston, TX, USA Sept. 23-24th, 2019.
10. Arne Graue: *“CO₂ as a Commodity for Methane Production from Hydrate Reservoirs”*, 4th Interdisciplinary CCUS Workshop at U. of Houston, Houston, TX, USA Sept. 23-24th, 2019.
11. Arne Graue: *“CO₂ for EOR as CCUS”*, Welcoming address, 4th Biennial CO₂ for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25th- 27th, 2019.
12. Arne Graue: *“CO₂ Foam EOR and CO₂ Injection in Hydrates – CCUS Enablers for Efficient, Cost Saving and More Sustainable Oil & Gas Production: Offshore International Whole Value Chain CCUS Collaboration”*, 4th Biennial CO₂ for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25th – 27th, 2019.
13. Arne Graue: *“CO₂ as a Commodity for Methane Production from Hydrate Reservoirs – CCUS Enabler for Efficient, Cost Saving and More Sustainable Oil & Gas Production”*, 4th Biennial CO₂ for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25th- 27th, 2019.
14. Arne Graue: *“Northern Lights – Whole Value Chain CO₂ Storage on NCS”*, 4th Biennial CO₂ for EOR as CCUS Conference, Rice U., Houston, TX, USA, Sept. 25th- 27th, 2019.

NFiP Web-site

The NFiP web-site has been further improved and updated through 2019: <https://nfip.no/>

The NFiP secretariat, at Dept. of Physics and Technology, UiB, with Prof. Martin Fernø as coordinator, and Jarand Gauteplass as secretary, has been of great value for the 2019 activities.

September 30th, 2019

Arne Graue

Chair NFiP Executive Board