ISSUE 3
2022

Al Azhar University
SPE Student Chapter

Petrocraft

THE DEVIL'S TAR

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“ We always strive to achieve the best, striving to academic life with practical knowledge in the labor market. ”

Prof. Dr.
Tarek M. Aboul Fotouh
SPE AUSC supervisor

The Associate Professor **Tarek M. Aboul-Fotouh** has been awarded the Ph.D. from Chemical Engineering Department at Azerbaijan State Oil Academy.

Dr.Tarek has been working as an Associate Professor of Petroleum Refining Engineering in Mining and Petroleum Engineering Department at Al-Azhar University.

Moreover, he has been working as an Associate Professor in Chemical Engineering Department at The British University in Egypt and in petroleum Engineering Department at The Future University in Egypt.

In addition, he has published more than 40 articles on Petroleum Refining Engineering and Fuel Technology. Furthermore, he was the Chairman of the 2nd International Conference and Expo on Oil and Gas, Rome, Italy, Conference-series, October 27-28, 2016.
Now, he has memberships at the society of Petroleum Engineers (SPE) commitment to preparing distinguished engineers who are able to develop themselves and competitors in the labor market and are committed to Islamic value.

The vision of Al-Azhar-SPE team is to develop students’ skill and train them in scientific research to create a generation capable of publishing papers in scientific research in the field of petroleum in various topics such as Co2 emissions ,blue hydrogen and work on making use of offline and online lectures and to hold many workshops with many specialists in the petroleum sector in various fields online to benefit from their experiences and compensate students’ field training, and also to conduct non-technical courses for enhancing the skills of the students.

In the end, we look forward to repeating what we have achieved in 2021, 2019 and 2018, by obtaining the International outstanding Award, to become the third time, and we wish everyone success.

“ Our goal is to provide golden opportunities to develop students in soft skills and academic life, and to provide opportunities and qualify them in the scientific research. ”

Eng.
Ahmed Ali Hassan
SPE AUSC President

This is **Ahmed Ali**, The President of the Society of Petroleum Engineers, Al-Azhar University. I am proud of being the head of one of the best branches in SPE , As we won the Outstanding Award in 2021,2019 and 2018 Now, we are focusing on scientific research and development in the field of petroleum. We also do a lot of online and offline events targeting students and fresh graduates.

We have done more than 40 events in the field of drilling, production, reservoirs, logging and scientific research. We have done training for students and fresh graduates in cooperation with oil companies such as Schlumberger and Combo.

Curve and Stream Lines, and in cooperation with training centers such as GTSC, we also help students to talk English language Fluenty, in cooperation with training centers such as Passion and OTO coursesOne of our main goals this year is to obtain the Outstanding Award and to publish many important articles in the field of petroleum and to participate in the largest number in the paper contest and all SPE competitions and obtain advanced positions in those competitions.

We also seek to create a qualified generation for the labor market and we are working on training more than 50,000 people around the world

Moreover, one of our biggest achievements in this season is the presentation of Petrocraft magazine that offers a great content in the field of oil engineering, especially the modern technologies of the biggest oil companies in the world.

In addition to the success stories of some petroleum engineers who added much to the field.
The magazine represents our journey for this exceptional season and the most important achievements and goals in addition to the events and workshops that we have already done.

We hope you enjoy our magazine, wishing you a good useful reading

Interview with MR.

Kamel Ben Naceur

SPE President 2022

Ben Naceur is a former member of the World Board of Directors of the Society of Petroleum Engineers and Vice-President of the Institut des hautes études scientifiques de Paris.

He is also co-author of 120 publications and 13 books, including Global Energy Assessment (2012), Resources to Reserves (2013) and Future Energy (2014).
On January 29, 2014, he became Minister of Industry, Energy and Mines in the Jomaa government. In it, he defends the gradual abolition of energy subsidies.
On 14 September 2015, he became Director of Sustainable Energy Policy and Technology at the International Energy Agency.
In July 2017, he became the chief economist of the Abu Dhabi National Oil Company.10.

In April 2020, he was elected **head of the Society of Petroleum Engineers** for a period of three years (2021-2023).

Could you please tell us about yourself, your education, career and responsibilities?

I am born in Tunisia, and studied there until finishing high school. I then moved to France and was successful in the challenges of admission to the top French engineering countries.

You need 2 very tough years of preparation before passing the exams, and you are competing with the top country's talent. The schools were Ecole Polytechnique de Paris and Ecole Normale Superieure de Paris. Following the graduation from those 2 institutions, I went to do 2 years of R&D at the French Ecole des Mines de Paris. I joined Schlumberger in December 1980 in their R&D center in France, followed by US and UK centers, where I was leading multi-national and multi-disciplinary teams to investigate and find new solutions and technologies for well construction and production.

After 9 years of R&D, I moved to operations and management around the world, including Africa, the Americas, Europe, Russia and the Middle East. In 2003-4, I started the company's operations in CO2 Capture, Utilization and Storage. I subsequently became the company Chief Economist, before taking on the position of Technology President, based in Rio de Janeiro. In 2004, there was a major change in my career, as I took the position of Minister of Industry, Energy and Mines in Tunisia to help the country through a difficult period with a government made of "technocrats". It was a fantastic experience, which was an opportunity to give back what I had enjoyed receiving in terms of free education.

Subsequently, I became the Director of Sustainability, Technology and Outlooks at the International Energy Agency in Paris, where my team was developing the famous long-term energy outlooks.

I then joined ADNOC in Abu Dhabi as the Chief Economist, before starting an energy consulting company, Nomadia Energy, advising governments and companies on sustainable energy development.

What are the difficulties that you encountered? And how did you deal with them?

The first difficulty was in the studies when I got through a very intense competition with very bright people, and I was not necessarily prepared for that. I managed by imposing myself a strict study-life balance and time management. I made sure I was also up-to-date with all the courses, and that I always left time to practice sports.

Another difficulty was in working in different countries around the world, where you needed to communicate effectively both in the professional as well as in private life.

I was blessed with having learned Arabic, French, Italian and English when I was younger. It was easier to add to those, Spanish, Portuguese, Russian ...

What do you identify as the challenges and opportunities for SPE members as the energy transition progresses?

Energy transition should be viewed as an opportunity for the SPE members to expand their horizons into new disciplines, that are close to their areas of strength. Technologies such as CO2 Capture, Utilization and Storage (CCUS), geothermal energy, renewables, hydrogen, digitalization are all required for a sustainable future, and they require the skills of our members.

What do you see as SPE's role in guiding our members into a sustainable future?

SPE has a major role in sharing knowledge and creating networks amongst the members. We have created several initiatives related to sustainability, such as the Sustainable Development Technical Section, CCUS, Geothermal, Diversity & Inclusion, Business Management and Leadership. More recently, a great addition is the GAIA sustainability platform, and I invite you to liaise with your region GAIA champion to learn more.

What is the status of the potential merger of AAPG and SPE? Why does the merger make sense for SPE and its members?

The Boards of the two organizations have agreed in September to continue the merger process between the 2 professional societies, and develop a common mission and vision. The next phase is to detail the organization and functioning of the combined society. This will be presented to the vote of the members in the first part of 2022 for approval.

The merger is a logical evolution of our relationship for more than 40 years, and it corresponds to what is already happening in the corporate world, with geologists and petroleum engineers working together in multi-disciplinary teams. We also share similar perspectives about the role of our professional societies in emerging themes and in the energy transition.

What do you think about student chapters in egypt, especially SPE Al_Azhar who won the outstanding last two years?

I am very pleased to see Al Azhar, which is a prestigious name in the world, also shining in petroleum engineering, and I want to extend my congratulations and thanks to all the volunteers that made it happen.

What advice do you have for students and Young Professionals?

Strengthen your core disciplines, and engage in new energy technologies that will be required for a sustainable energy future.

What about funding student chapters?

We appreciate the support given by the Sections, generally through corporate sponsors. Another important element is the sponsorship provided by Chevron to cover student dues.

Could you give the students some advices about what should be done during Starting a career? And what is their requirements?

Develop your soft skills, as a complement to your technical knowledge. Be flexible, identify mentors.

What points of weakness that need to be treated and developed ?

Generally there are really to inter-personal skills such as communication, human resources management, negotiation...

Is there is any plan to fund SPE chapters, and how we achieve all activities without sponsor existing?

There are no new plans related to fund SPE Chapters. We rely on the creativity of the chapters, the support of the sections and the corporations to identify sources for funding.

Is there is any plan to improve members opportunities to be qualified enough for practical life?

I recommend to our Student members to be familiar with some of the programs that can help them, such as Business, Management and Leadership, where they will find great resources.

What is your goals that you seek to achieve?

My Presidency year is under the theme of "Sustainable Recovery". Recovery as the world and the energy sector have been significantly impacted by the pandemic, and Sustainable as we want to be viewed as an essential component of the energy transition

What is the roll of oil and gas for energy transition, and the phases about it?

Oil and gas represents 56% of the primary energy mix today, and it will be a strong component in the next decades.
We need to work together to reduce the emissions from our sector, and work towards the implementation of technologies that are essential for the transition: CCUS, Hydrogen, Renewables.

What do you think about our Petrocraft magazine?

I like the variety of articles provided by Petrocraft, as well as the excellent use of social media to interact with your readers.

Interview with Eng.

Sameh Sabry

Senior Vice President
Managing Director Egypt
at WinterShall Dea company

Sameh Sabry is Senior Vice President, managing director at WinterShall company and an Engineer by background, graduated in **2001** from Ain Shams University, acquired an MBA afterwards in **2006** and have been always working in oil & Gas industry since I started **20** years ago.

Started first with a career in Downstream business, in Exxon Mobil then Chevron and moved afterwards to Upstream business. Most of my career, I was focused on business development, planning, business analysis, as well as commercial activities and negotiations. I have worked in different regions, including two times assignments to the company Headquarters in Germany. 5 years ago, I moved up to general managerial roles, and have been the Managing Director of Wintershall Dea business in Algeria and then Egypt.

I am currently running all our business in Egypt and leading a diverse team of technical, business and administrative experts for that purpose.

What are the difficulties which encountered you? and how did you deal with them?

I would rather call them "challenges" than " difficulties. The main challenge was to always to keep challenging myself to take more responsibilities and leave the comfort zone, working in different cultures. The second was to gain the trust of my managers and colleagues that I can add value in a creative manner and sometimes take calculated risks to achieve the maximum success. The third, was not to rest after achieving some success, and continue to strive for more!

what is your opinion about Consolidation of petroleum companies in Egypt ?

Merger of companies with complementing scopes makes perfect business sense. You can achieve a lot of optimizations, and improve productivity, through synergies and economy of scale. However, this has to be done only with companies of similar scopes and be conscious not to create over-massive companies which could be counter-produc-

tive when it comes to agility and ability to adapt and take quick decisions.

What are Wintershall Dea actions after having joint exploration rights at East Damanhor ?

Wintershall Dea has re-evaluated the area seismic data and started a drilling campaign of 5 to 7 wells, which we hope to encounter commercial discoveries allowing for a quick field development.

Can you tell us about investments that Wintershall Dea will do to support Egypt economy ?

Winterhsall Dea investments are considered to be the second highest from any German investor in country. Whether in our own operated field in Disouq or in our partnership in the mega multi-billion operations of West Nile Delta in offshore Mediterranean region.

We are also keen to expand our investments further to more and more exploration activities as well as energy transition projects in Egypt.

What do you think about student chapters in Egypt, especially SPE Al-Azhar?

I am very proud with the level of awareness as well as activeness of the student chapters in Al Azhar university. This does not come as a surprise to me as Al Azhar has always been a main source of knowledge and enlightenment to Egypt and the whole region.

Could you please give the students some advice about what should be done when starting a career? And what are its requirements?

I advise them to be as flexible as possible, always be keen to learn and explore their potential and never try too fast to settle to less challenging jobs just because they are comfortable!

What are your expectations for the percentage of job opportunities in the petroleum field for the coming years?

With the current increase in hydrocarbons prices, and phasing out of the COVID-19 crisis, I hope this will increase the level of investments in the petroleum sector for the coming years

What do you think of our Petrocraft magazine?

I think it is an interesting magazine with a lot of potential for more!

PETROCRAFT SUPPORTING DIAMOND SPONSER

wintershall dea

Al Azhar University SPE Student Chapter

About Wintershall Dea Wintershall Dea is Europe's leading independent natural gas and oil company with more than 120 years of experience as an operator and project partner along the entire E & P value chain . The company with German roots and headquarters in Kassel and Hamburg explores for and produces gas and oil in 13 countries worldwide in an efficient and responsible manner . With activities in Europe , Russia , Latin America and the MENA region (Middle East & North Africa) , Wintershall Dea has a global upstream portfolio and , with its participation in natural gas transport , is also active in the midstream business . Wintershall Dea was formed from the merger of Wintershall Holding GmbH and DEA Deutsche Erdoel AG , in 2019. Today , the company employs around 2,500 people worldwide from over 60 nation.

OUR VALUESMAKING US STRONG At Wintershall Dea, our values are more than just words. They help us stand up for the things we believe and underpin our commitment to behave in an ethical and sustainable manner. We care. We trust. We are open-minded. We are brave.

Our colleagues at Wintershall Dea in Norway believe a shared set of values can steer the company towards its full potential.These are our four corporate values:We care. We trust. We are open-minded. We are brave.At Wintershall Dea our values are more than just words. These values help us stand up for the things we believe, and underpin our commitment to behaving in an ethical and sustainable manner. As well as being a good corporate citizen, we live our values by empowering our teams, exploiting new technologies and making safety, environmental responsibility and sustainability part of our DNA.

ETHICS AND COMPLIANCE

Wintershall Dea in Norway has an unwavering commitment to behaving in an ethical way. The company is one of the leading operators on the Norwegian Continental Shelf and prides itself on caring about being a leader in the way it interacts with its employees, partners and the world. As a leading operator on the Norwegian Continental Shelf, Wintershall Dea in Norway is committed to conducting its operations to the highest ethical standards. Being an active player on the shelf, with responsibility for operating North Sea platforms, drilling operations and construction of new producing facilities, Wintershall Dea is trusted to comply with one of the most robust petroleum frameworks in the world.

SUSTAINABILITY

Wintershall Dea in Norway is committed to supplying Europe's energy needs in the most sustainable way. We see it as our responsibility to work alongside European and global citizens to help safeguard the planet's future. Delivering a sustainable energy supply means being open-minded about using the latest technology and smart engineering to supply the energy we need. As the operator of three "tieback" fields in Norway, Wintershall Dea uses existing pipelines and platforms to produce new hydrocarbons, securing best possible use of resources and infrastructure. With two new tiebacks under construction, Nova and Dvalin, Wintershall Dea will continue to sustainably deliver Europe's energy needs for the long term.

SOCIAL RESPONSIBILITY

Wintershall Dea takes its responsibility for Norway seriously. We are here for the long term and believe in contributing to Norwegian society. We employ and train the best local talent, focus on local charities and support Norwegian art and amateur sports teams. Headquartered in Stavanger, the company is a key sponsor of the Stavanger Symphony Orchestra, which leads the way in bringing classical music to people. Wintershall Dea also believes in supporting Norwegian artists, with an impressive collection of pieces in Stavanger and its office in Bergen.

Eng. Mostafa Fouad

Global director at BGS Energy Services

Could you please tell us about yourself, education, career and responsibilities?

I graduated from Suez Canal University which I am a proud alumnus of and where I received my BSc in Mining engineering. I also hold a Higher Diploma degree in Geophysics from Cairo University as well as a Master's Degree from Ludwig-Maximillian's University in München, in the field of Geophysics and Seismology. I was also awarded a Master's Degree in Business Administration and Management from Texas A&M University.
Currently I'm the Global Director of BGS Energy Services yet before my current position, I held several operational and managerial roles both locally and internationally.
I started my career in the field, gaining hands on experience and wide technical and operational experiences in Frac Services and Pipeline and Process Services. Formerly with Halliburton I held the positions of Egypt's Country Operations Manager for PPS, Middle East and North Africa Regional Manager for PPS, Global HSE Manager for Productions Solutions Division, before moving to my current role with BGS Energy Services.

what about situations that act as turning points in your career?

Perhaps the most impacting situation was the injury I sustained in my back, after only 8 months of starting my career with Halliburton where I thought my career has been ended early before I reach any of my targets. It turned out to be the biggest turning point; as it shifted my discipline from the Frac Services to the Pipeline and Process Services where I could progress much faster and develop multidisciplinary and managerial skills. Since then, I became a strong believer that each crises could turn into a great opportunity only if we used it properly.

What do you think about (Petrocraft magazine)?

I admire the work and content your magazine provides for the readers. It sponsors students efforts and guide them in the proper direction and add to their soft skills what the market would needs.

Al Azhar University
SPE Student Chapter

BGS Company

In 2017, I had the feeling I have enough experience and market understanding that would enable me to take an outstanding decision to leave Halliburton and start my own business. it toke me longer than six months evaluating associated risks and convincing my management in Halliburton to accept the fact that I am leaving the company that I became an important individual of.

BGS Energy Services started in 2017 at a very challenging time for the oil and gas industry. There were a lot of problems from the previous downturn, which left a lot of gaps and needs that needed to be filled in an efficient and quick manner. I am a firm believer that each challenge holds an opportunity within it. BGS Energy Services embodies this belief and hence the inception of the Company occurred to address and capitalize on these opportunities.
My vision for BGS was crystal clear. it will be a technology driven company that focus on filling market gaps the big players cannot fill due to their high overhead running cost. That technical path will be driven through best in class engineering, planning and flawless execution.

AUSC partenership

Student activities are very important as they provide students, who we see as future leaders, with the soft skills and exposure to the market that they need at such critical stage of their lives. In reciprocity, It helps introduce the best future candidates to companies too. SPE Azhar is no stranger when it comes to providing its students with such vital technical and non-technical skills sets, they need on their career paths.

THE RECENT NEWS IN THE PETROLEUM INDUSTRY

Shell plans to move the headquarter to the UK

Royal Dutch Shell has announced a plan to move its headquarters to the UK as part of proposals to simplify the structure company.

The oil giant will ask shareholders to vote on transferring its tax residence from the Netherlands to the United Kingdom.

It also wants to get rid of its dual stake structure in favor of just one class of stock to enhance “fast and flexible” payments shareholders.

Ben van Beurden, CEO of Shell, will move to the UK.

Schlumberger

Schlumberger places a $2 billion bet on strong growth in demand for its field services oil

Schlumberger prepares for worldwide growth as No. 1 oilfield contractor expects recovering economies to result in Ignite several years of expansion in demand for crude oil.

The company, which is based in Houston and Paris, will increase spending by up to 18% to $2 billion, It serves North American oil explorers who should dominate the activity in the first half of the year, followed by growth international in the last six months.

3 modern technologies in the field of oil technology

Saudi Aramco revealed the presence of 3 modern technologies in the field of oil technology, which raised the rate of decision-making by about 50-60%, stressing that these technologies are present in 13 research centers in the world, working to innovate modern technologies, including two centers in the Kingdom (Dhahran - Thuwal).).

She stated that the three new technologies are the development of virtual reality and augmented reality to train human cadres, and simulate fields and wells to support the management of oil reservoirs, “land and sea.”

Oil spill in Peru after the eruption of the Tonga volcano is an environmental disaster

The authorities said an oil spill off the coast of Peru had caused an “environmental disaster”.

La Pampila refinery spilled more than 6000 barrels of oil after an oil tanker was hit by waves linked to the volcanic eruption in Tonga on Saturday.
Authorities closed three beaches affected by the spill and said they had discovered dozens of dead animals covered in oil.

Five major oil discoveries in Africa in 2021

- Namibia - 120 billion barrels
- Côte d’Ivoire - 2 billion barrels
- Ghana - 700 million barrels
- Angola - 250 million barrels
- Gabon - millions of barrels

PetroChina discovered 7 billion equivalent barrels of oil resources in the south of the Tarim River, making it the largest oil discovery in the Tarim Basin in the last 10 years, according to the Chinese Xinhua News Agency, in June.

The Canadian company Recon Africa announced in April one of the largest oil discoveries on the continent this year, after its preliminary results of exploration wells drilled in the Kavango Basin in Namibia showed the presence of approximately 60 to 120 billion barrels of oil.

Dragon Oil, the exploration and production platform wholly owned by the government of Dubai, has implemented innovative plans based on the use of artificial intelligence techniques in exploration, drilling and production operations in its fields in Egypt, Iraq and Turkmenistan, and is one of the first companies operating in the oil and gas sector to apply these technologies.

The Mexican oil company, In North America, Pemex, reached quantities of crude in the reservoir estimated at one billion barrels in Tabasco in the Gulf of Mexico, in March.

The total volumes of global oil and gas discoveries recorded in 2021 the lowest level since 1946, reaching 4.7 billion barrels of equivalent, according to reports by Restard Energy. Compared to 12.5 billion barrels equivalent in 2020.

Ivory Coast has been home to an oil and gas discovery. In September, Italy’s Eni announced the discovery of 1.5-2 billion barrels of oil, and 2.4 trillion cubic feet of associated gas, in the Palin field offshore Ivory Coast.

Norway topped the oil discoveries in 2021 in the continent of Europe, the largest of which was the discovery of 135 million barrels of oil equivalent in the South North Sea off Norway by Far Energy, in June.

ACHIEVEMENTS OF AUSC

SPE International
Egyptian Section

CERTIFICATE OF APPRECIATION

The Society of Petroleum Engineers Egypt Section's Young Professionals expresses its gratitude to

Society of Petroleum Engineers Al Azhar University

for their outstanding performance on

November 2020

President of SPE Egypt YP

AUSC AWARDED FROM DR. MED-HAT KAMAL AND ENG. ASHRAF AB DEL-GAWAD FOR THEIR OUTSTAND-ING AWARD.

SPE AL-AZHAR DID THIS GREAT HUMANITARIAN WORK, WHICH IS THE AWARENESS AND BLOOD DONA-TION CAMPAIGN.

AN IMPORTANT EVENT IN THE FIELD OF PETROLEUM WHERE WE TRAINED 2,700 PEOPLE ON IMPORTANT TOPICS IN PRODUCTION.

SPE DID INTERNSHIP FOR ITS MEMBERS TO IMPROVE THEIR ENGLISH LANGUAGE SKILLS WITH THE FULL SUP-PORT OF PASSION COMPANY.

SPE DID INTERNSHIP FOR ITS MEMBERS TO IMPROVE THEIR ENGLISH LANGUAGE SKILLS WITH THE FULL SUPPORT OF OTO COURSES CENTER.

SCHLUMBERGER TRAIN-ING FOR STUDENTS IN ALL IMPORTANT TOPICS IN PE-TROLEUM INDUSTRY.

Schlumberger

IT WAS A GREAT EVENT ABOUT SCIENTIFIC RE-SEARCH WHICH WAS AT-TENDED BY 15 SPEAKERS AND 900 STUDENTS.

WELL CONTROL FREE SIM-ULATOR FOR FACULTY OF ENGINEERING AL -AZHAR UNIVERSTY PETROLEUM DEPARTMENT.

The art of Reservoir Engineer

Dr. Mazher Ibrahim
Chief Reservoir Engineer with Shear Frac Group

Dr. Mazher Ibrahim is currently Chief Reservoir Engineer with Shear Frac Group.

He has 27 years of experience of working in petroleum engineering discipline that includes field experience and various advisory roles. Mazher's working experience includes 5 and half years with Apache Corporation as Senior Advisor Reservoir Engineer, several years with BP America as Senior Reservoir Engineer in Unconventional Research Flagship, 3 years with EOG Resources as a Staff Reservoir Engineer, three years with BP Egypt as Senior Reservoir/Petroleum Engineer and one year with El-Paso Energy, Houston, TX, USA.

Also, He has 10 years of teaching experience at Texas A&M University and Egypt University.

Abstract

The main goal of this article is to provide to reader what's the definition of reservoir engineer and provide the challenge facing the reservoir engineer to perform his daily job. Also the new data analytics method which could eliminate the job of reservoir engineer.

Reservoir engineers try to optimize reservoir can not see by his eyes like civil engineer or road and car engineer which reservoir engineer is difficult to achieve his goal. Also the total he uses to achieve this goal also challenges like the existing of accurate geological model or fluid properties model.

Introduction

Before we talk about reservoir engineer, it will be good idea to talk about the definition of engineer and what does it mean to you to be engineer. Who the first world engineer?

Engineering is the use of scientific principles to design and build machines, structures, and other items, including bridges, tunnels, roads, vehicles, and buildings.

The term engineering is derived from the Latin ingenium, meaning "cleverness" and ingeniare, meaning "to contrive, devise". The first engineer known by name and achievement is Imhotep, builder of the Step Pyramid at Saqqārah, Egypt, probably about 2550 bce. Think back 2550 year before our current calendar, what's kind of tool this genius engineer owns from the tool we have these days but he's outcome design till nowadays still big mystery to all engineer in the world. Now it's the time talk about reservoir engineer after we understand what's it means by engineer.

Reservoir Engineer

Reservoir is placed to reserve water, oil, and gas either underground or at surface. Oil and gas reservoir is commonly located underground which is geological structure called trap. This reservoir holds the escaped hydrocarbon which form in source rock.

Now if add reservoir to engineer we have reservoir engineer. So the reservoir engineer is the engineer responsible about knowing the reservoir type, size and how to produce the hydrocarbon from the reservoir with economical value.

So reservoir engineer should apply scientific principles to the fluid flow through porous medium during the development and production of oil and gas reservoirs to obtain a high economic recovery. As shown in Fig.1 the reservoir engineer workflow.

The working tools of the reservoir engineer are geology, applied mathematics, and the basic laws of physics and chemistry governing the behavior of liquid and vapor phases of crude oil, natural gas, and water in reservoir rock. Of particular interest to reservoir engineers is generating accurate reserves estimates for use in financial reporting to the SEC and other regulatory bodies.

Other job responsibilities include numerical reservoir modeling, production forecasting, well testing, well drilling and workover planning, economic modeling, and PVT analysis of reservoir fluids.
Reservoir engineers also play a central role in field development planning, recommending appropriate and cost-effective reservoir depletion schemes such as waterflooding or gas injection to maximize hydrocarbon recovery.

Reservoir engineering is more of an art than an exact science due to non-existing of exact word in oil and gas such as the exact size of reservoir, the exact shape or hard.

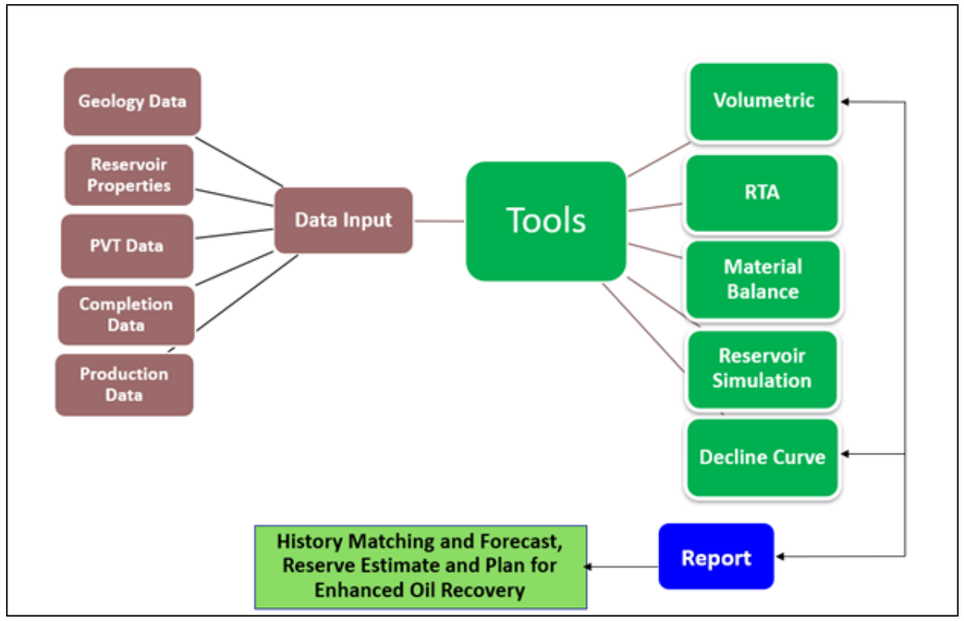

Figure 1 – Reservoir Engineer workflow

to define the pore size and volume. So reservoir engineer dealing with approximate approach not exact approach for example when you estimate reserve we use statistical approach of p10, p50 and p90

Reservoir Engineer Challenges

The main goal of reservoir engineer is optimizing the reservoir, or it called the asset of the company.

The purpose of reservoir engineering is to provide the facts, information, and knowledge necessary to control operations to obtain the maximum possible recovery from a reservoir at the least possible cost. Since a maximum recovery generally is not obtained by a minimum expenditure, the engineer must seek some optimum combination of recovery, cost, and other pertinent factors. How one defines "optimum" will depend upon the policies of the various operators and is immaterial to the views presented in this paper.

From an operator's point of view any procedure or course of action that results in an optimum profit to the company is effective engineering, and any that doesn't is not. There are two reasons why a company may not receive effective engineering (Essley, P.L 1963).

Reservoir engineers may be poorly trained to deal with the current market challenges of new technology such as programming skills, analyze big data which make reservoir engineer hard to find new job.

Some of college try to adapt new market required to produced qualified reservoir engineer suitable for current market.

Another challenge facing reservoir engineer is the oil and gas price due to new trend in generate power from other resources like wind and solar for seek of protecting environment from global warm.

Future of Reservoir Engineer

The Future our industry is currently in big challenges and not easy to make predication these days as many parameters going on in the floor which include current situation in middle east region, COVID status and the present of renewable energy market.

These current conditions put a big challenge for the market of reservoir engineer which you think about the career path. But if you already in the middle of this career what you need to do to be prepare for the job market:

1- Be familiar with current technology
2- Add programming skills to your tools kits
3- Be familiar with statistical analysis
4- Trained in big data market
5- Be open mind to work in any place and location
6- Build your network

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Essley, P.L.. "What is Reservoir Engineering?. "J Pet Technol17 (1965): 19–25. doi:https://doi.org/10.2118/920-PA .

Nuclear Magnetic Resonance

(NMR) and Its applications

Dr. Tharwat Hassan
Professor of petroleum engineering
at Egyptian Chinese University (ECU)

Dr. Tharwat is currently Professor of petroleum engineering at Egyptian Chinese University (ECU) as a Head of the petroleum engineering department at (ECU) Egypt, Tharwat holds BSc. In Petroleum Engineering, MSc. Petroleum Engineering and Ph.D. in Reservoir Engineering from Heriot-Watt University (UK).

Dr. Tharwat has more than 25 years in oil industry in technical and managerial positions worked for Schlumberger more than 15 years and 4 years with BP and 2 years with Baker Hughes worldwide in the Gulf and North Africa in Well logging, and 2 years with Beicip frannlab and one year in Haliburton as Petrophysics, and Reservoir Simulation.

Dr. Tharwat is an author and co-author for many published papers covering many aspects in Petrophysics and Reservoir engineering. He is a member of SPE, AAPG, and SPWLA. also, he supervises more than 20 researches in both conventional and unconventional reservoirs.

Introduction

NMR (Nuclear Magnetic Resonance) is a good tool for describing the properties of reservoir rocks such as porosity and permeability.

It provides an estimation of permeability index, clay bound water, pore size distribution, irreducible water saturation and fluid typing So, what is the difference The difference between the NMR and the other conventional tools such as Neutron and density is that NMR tool provides a subdivision of the pore space that is not available from the conventional logging data. The most important gain of using NMR tool is that NMR provide direct, continuous, and noncore permeability measurements for rocks, but peer in mind that Permeability is an index that is qualitative and it has to be calibrated with Core data. In addition to providing viscosity profile at reservoir condition.

What will happen if the protons are exposed to External Magnetic Field?

*For the CMR (tool) permanent magnets, B0 is approximately 540 Gauss ~ 0.054 Tesla, about 1000 times stronger than the magnetic field of the earth.

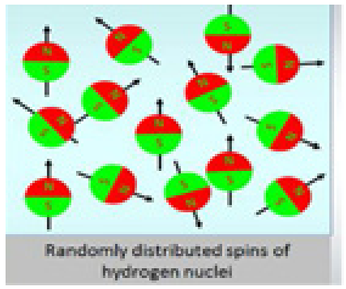
*One gauss corresponds to 10-4 Tesla (T)

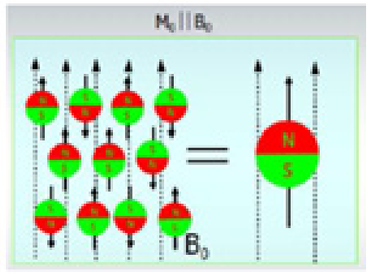
*Therefore, protons will preferentially align in the tool's magnetic field. After the protons are aligned in the magnetic field they are said to be polarized.

*polarization does not occur immediately but rather grows with a time constant called the longitudinal relaxation time, T1.

*where t is the time that the nuclei are exposed to the B0 field.

$$\text{nuclear polarization} = \left(1 - e^{-t/T1}\right)$$





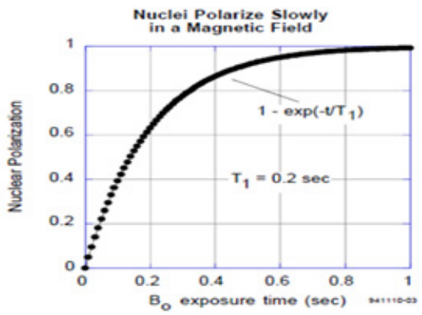


Fig 1: Indicate the polarization process

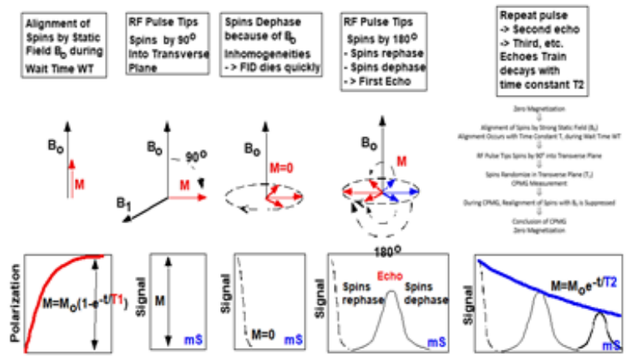


Fig 2: Indicate the complete cycle of NMR measurement

For the case of hydrogen nuclei in pore fluids, polarization takes up to several seconds and can be done while the logging tool is moving. After that the Proton lose energy due interaction with other nuclei and relax. T2 Relation is the transverse relation -T2 decay rate. time constant for echo train to decay.

What we measure?

The NMR logging tool measures the total population of hydrogen nuclei in the formation, including the hydrogen atoms of the water and oil in the pore space and those in the clay. And not affected by hydrogen in the matrix, and measure the decay rate of the proton.

NMR logging cycle?

The NMR logging measurement done by several steps (**Fig.2** indicates those steps in sequence).
The protons are aligned in a magnetic field
The protons are tipped out of the field by 90
The protons process back into line. during this time, they 'diphase' with each other.

Different types of relaxation mechanism contribute to T2 and T1?

Surface relaxation it occurs due to interaction of the hydron proton with grain surface which leads to energy loss. the term in T2 and T1 surface relaxation times is given by equation in fig 3.

Different types of relaxation mechanism contribute to T2 and T1?

Surface relaxation

it occurs due to interaction of the hydron proton with grain surface which leads to energy loss. the term in T2 and T1 surface relaxation times is given by equation in (**fig 3**).

Bulk relaxation

it is results from the interaction between the hydrogen proton itself It is controlled by the physical properties of the fluid, such as viscosity and chemical composition.

Diffusion Relation:

The 3 different fluid types such as Gas, oil, and water, have different diffusion values when they are in a gradient magnetic field. The water has constant diffusion and the gas but the gas has higher diffusion value. but the oil diffusion depends on the Viscosity of the oil.

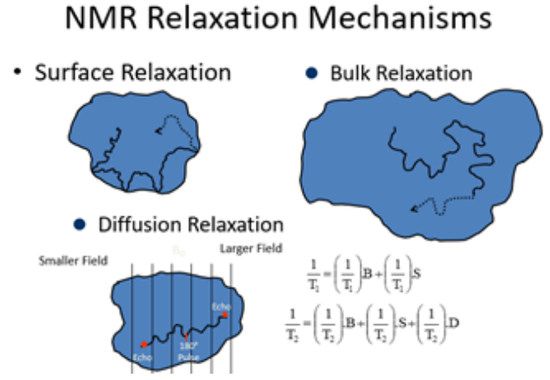


Fig 3: Indicate the relation Mechanisms

NMR Applications for reservoir characterization

There are several applications of NMR in term of reservoir characterization such as:
•Lithology independent porosity, do not see Matrix

•NMR Sees Fluids (Hydrocarbon Identification) Hydrogen Index

•NMR Measures Pore Size Distribution, Irreducible Water Saturation, Permeability, K and Capillary pressure calculation.

•Reduce / eliminate coring costs

•Optimize well completion

•Increase net pay in then bed reservoir

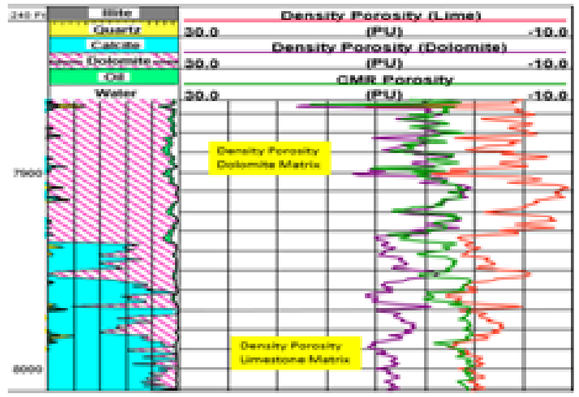
•Perforate high SW zones and produce dry oil (Bounded Water)
•Optimize MDT testing and sampling

•Avoid perforation disasters (shooting tar zones)

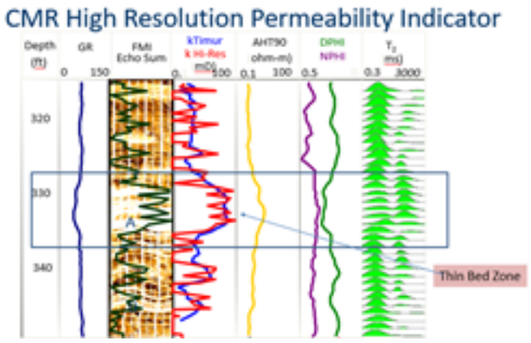
•Gas detection in shaley sands and thin bed zones

•Locate reservoir quality rock and geosteering process in LWD

•Characterize oil viscosity at reservoir condition. And Tar Detection.



(a)



(b)

Fig 4: Example of porosity (a) and thin bed (b)

Recent Advances in Simulating TAHI In-Situ combustion Process

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Assistant Professor Future University in Egypt

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Previously, he was working as petroleum reservoir engineer with the North American Unconventional Resources (NAUR) Team at Apache Corporation's San Antonio Region, USA.

Before joining Apache Corporation, he worked as graduate research assistant/PhD candidate at the Harold Vance Department of Petroleum Engineering, Texas A&M University, USA. Before that, he worked for 8 years as assistant lecturer and teaching/ research assistant at the Faculty of Petroleum and Mining Engineering, Suez Canal University, Suez, Egypt.

He also served as petroleum engineering intern at Apache Corporation (USA) during the summer of 2017. Mahmoud has a demonstrated history of working in the higher education and research industry in addition to a good experience of working with international petroleum companies.

Summary

This article presents highlights of 2 papers by Muhammad Rabiu Ado.[1, 2] Both of them discussing new advances in simulating the toe-to-heal (TAHI) in-situ combustion process. The first discusses the effect of reservoir pay thickness on the performance of the THAI process.

The second investigates improving heavy oil production in THAI process using wells configured in a staggered line drive (SLD) instead of direct line drive (DLD).

In the first study, air was injected at constant rate into three different models with the thicknesses of 24, 16, and 8 m. The results showed that with decreasing the air injection rate by the same factor the reservoir thickness is decreased (i.e., keeping the air injection flux constant) results in a more economical THAI process operation compared to when the air injection rate is kept constant (i.e., allowing increase in air injection flux).

In the second study, reservoir simulations of the THAI process were performed with the wells arranged in SLD and DLD. Over the 834 days of operating time, the cumulative oil recovery in SLD is 32% of oil originally in place (OOIP) whilst that in DLD is 27% OOIP, which shows that an additional 5% of OOIP was cumulatively recovered in SLD compared to in DLD model. Additionally, higher quality oil was found to be produced when the wells are configured in the SLD pattern.

Introduction

Due to their relatively high viscosity and very low API gravity, the heavy oil and tar are considered as unconventional oil resources that have different production difficulties especially within conventional temperatures. Increasing temperature, either through steam injection or heat generation in the reservoir, reduces their viscosities to an extent that facilitates their production, so that the thermal recovery methods are commonly used.

The most widely used techniques for producing these resources are the steam-based processes; steam-assisted gravity drainage (SAGD), cyclic steam stimulation (CSS), and steam flooding (SF), with the SAGD process as the most popular and bitterly performing than the others.

But unfortunately, each method has its disadvantages. In the steam-based technique, different problems arise, among them are:

a) heat loss,
b) generation of CO2 in large amounts,
c) large amount of waste water generated,
d) the dependency on large amount of water to generate steam.
e) limitation to the used reservoir thickness should (not exceed 15 m), and
f) surface upgraders are necessary to overcome the lack of heavy-to-light oil upgrading.

In-situ heat generation such as, the conventional in-situ combustion (ISC) process and the toe-to-heel air injection (THAI) process do not show the disadvantages mentioned with the steam-based method. However, it is found that the ISC method has some disadvantages not found in the THAI process.

Some of these disadvantages are; excessive gas override and pressure build-up, high probability of fingering in the combustion front, and problems due to the long-distance displacement. The main challenge in the THAI process is the very low oil production rates despite it being far more energy-efficient than SAGD.

In the next two sections a brief discussion is given about two recent studies by Muhammad Rabiu Ado,[1, 2] concerning new advances in simulating the toe-to-heal (TAHI) in-situ combustion process. The first section will give a brief insight about how the numerical models are built, while the second section will present the main results of the two studies.

Fig. 1 shows schematic representation of the TAHI in-situ combustion process. In this technique, the fireflooding starts from a vertical well, while the oil is produced from a horizontal well having its toe in close proximity to the vertical air-injection well.

Numerical Simulation

In both studies [1,2], a representative volume (RV) of the reservoir under investigation was established using a combination of the Computer Modelling Group (CMG) Builder in combination with the CMG STARS. The horizontal producer (HP) was placed at a fixed position above the base of the reservoir with a distance equals 1.5 m. A proper discretization was applied to the RV reservoir with 90 mesh points in the i-direction, 57 mesh points in the j- direction and 7 mesh points in the k-direction giving a total number of 38,500 of grid-blocks (1.667 m×1.754 m×3.429 m for

1.This article contains highlights of 2 papers; "Effect of reservoir pay thickness on the performance of the THAI heavy oil and bitumen upgrading and production process" https://doi.org/10.1007/s13202-020-00840-5 and "Improving heavy oil production rates in THAI process using wells configured in a staggered line drive (SLD) instead of in a direct line drive (DLD) configuration: detailed simulation investigations" https://doi.org/10.1007/s13202-021-01269-0 by Muhammad Rabiu Ado, King Fahd University of Petroleum & Minerals (KFUPM). The papers have been peer-reviewed and published in the Journal of Petroleum Exploration & Production Technology. Copyright 2020 and 2021 Journal of Petroleum Exploration & Production Technology.

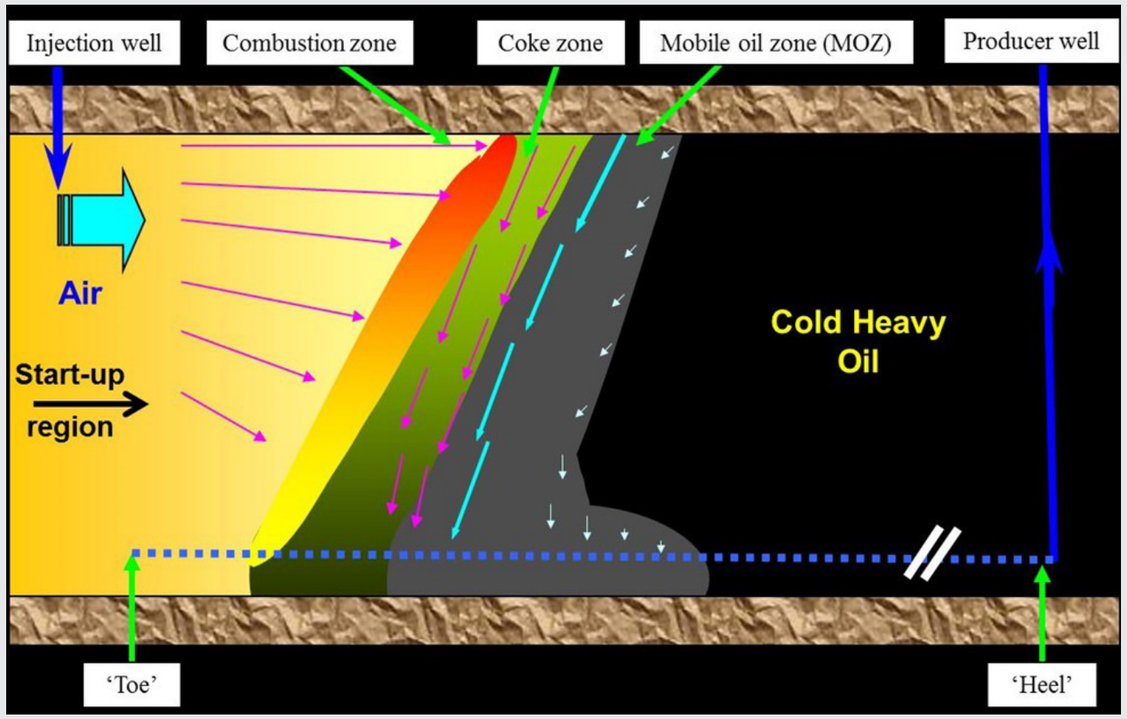


Fig. 1 Schematic representation of the TAHI in-situ combustion process.

each block). Parameters such as porosity, horizontal and vertical permeabilities, relative permeability curves, oil and water saturations as well as the model boundary conditions were specified and added as inputs in the constructed models.

To resemble the common practice, both models were steam pre-heated at the rate of 495 bbl/day cold water equivalent (CWE) for a period of 104 days before air injection. The steam injection pressure was 5500 kPa with a quality of 0.8, and the horizontal producer back pressure was 2800 kPa.

Combustion period of two years was applied. At the end of the PIHC (pre-ignition heating cycle), a 20,000 Sm3/day of air was injected via the single vertical injector well and the two vertical injector wells in the direct line drive (DLD) and staggered line drive (SLD) models, respectively. In the first research,[1] the effect of the reservoir thickness on the performance of the THAI process was studied.

The reservoir was arranged in a staggered line drive (SLD), and the thickness of the RV reservoir was the only variable considered and was selected to be 24, 16 and 8 m, which is represented by x Fig.2. The second article,[2] on the other hand, studied the heavy oil production in THAI process using wells configured in SLD compared to that in the DLD. A schematic representation of both configurations is shown in Fig.3. The internal diameter of the wells in both domains was taken 178 mm.

Typical Canadian Athabasca bitumen was implemented in the models as a mixture of extremely large number of individual hydrocarbons. The mixture was divided into a small number of oil pseudo components in which their physical properties e.g., their boiling temperatures, their pressure, volume, and temperature (PVT) properties, viscosities, thermal properties, and vapour-liquid equilibrium K-values, etc. were specified and

used. The chemical changes taking place during the operation of the THAI process were considered depending on their reactions' schemes and their Arrhenius kinetics parameters.

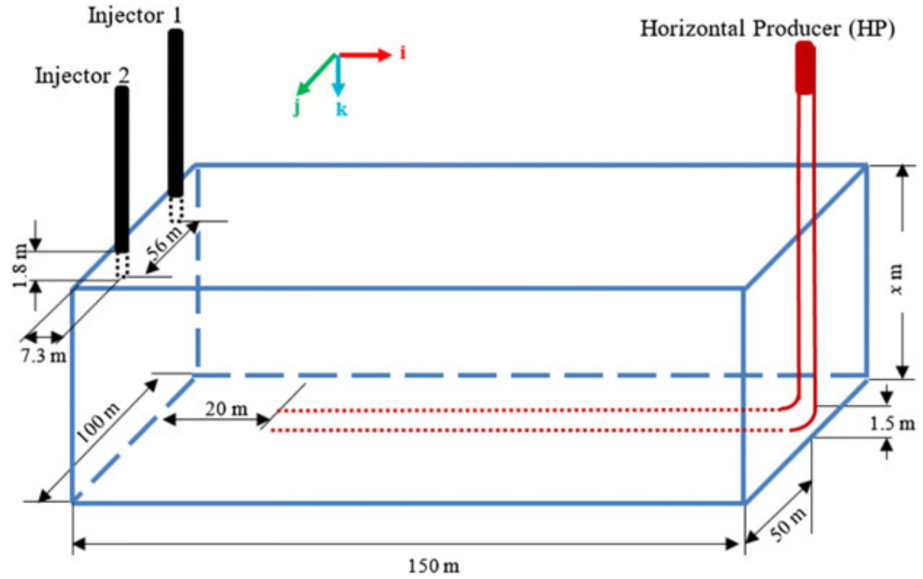


Fig. 2 Reservoir model dimensions in the first study showing the wells arrangement, where x has values of 24, 16, or 8 m, respectively.[1]

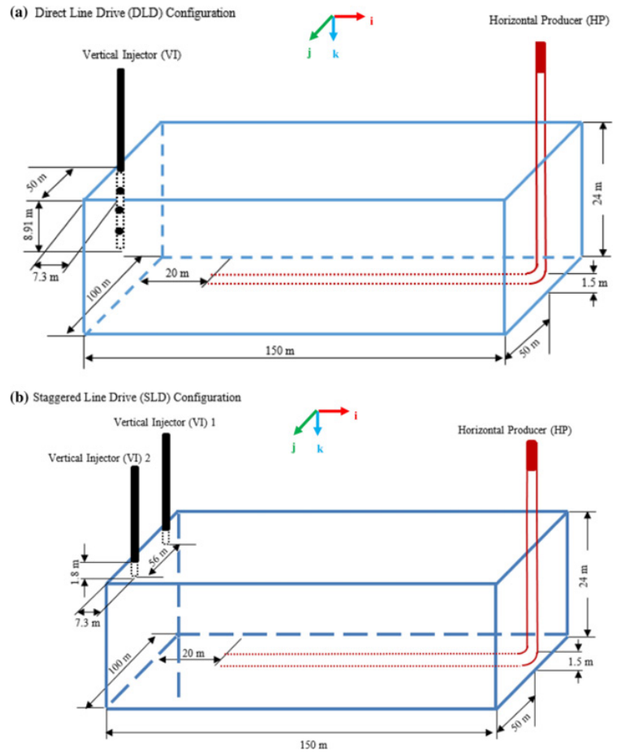


Fig. 3 Reservoirs dimensions and the schematic diagrams in the second study showing arrangements of wells in a DLD configuration (top) and b SLD configuration (bottom).[3]

Selective Results

Fig. 4 shows the Cumulative oil production for the three reservoir thicknesses (24, 16, and 8 m) at constant air injection rate, Fig. 4 (a) and constant air injection flux, Fig. 4 (b). in the case of constant air injection rate (i.e. increasing air injection flux with the decrease in reservoir thickness) increasing the reservoir thickness decreases the cumulative oil production and increases the cumulative air-to-oil ratio (cAOR).

However, keeping the air injection flux constant (i.e. decreasing the air injection rate with the decrease in reservoir thickness) resulted in a decrease in cAOR with the decrease in reservoir thickness. This shows that the decrease in the air injection rate with the decrease in the reservoir thickness resulted in a decrease in the rate of heat generation which in turn resulted in a decrease in the temperature gradient between the reservoir and both overburden and underburden.

A more general conclusion could be addressed: A constant air injection flux results in a more economical THAI process operation compared to when the air injection rate is kept constant (i.e. allowing increase in air flux).

production rate in DLD process. Thus, it is expected that more oil should be recovered in DLD during the Pre-ignition heating cycle (PIHC). In the same figure, prior to the start of air injection (i.e. at cumulative injected air of 0 m3), 6.5%OOIP was recovered in the DLD model, which is higher than that in the SLD model by 1.4%OOIP.

This difference is not only due to the delay in the oil production in SLD but it is also because the vertical injector (VI) and the horizontal producer (HP) well in the DLD are both on the same plane (i.e. on the same vertical mid-plane) and they are separated by a shorter vertical perpendicular distance compared with in SLD. After ~ 24 days from the commencement of air injection and ignition, the oil production rate is higher in SLD compared to that in the DLD and hence, more oil should be cumulatively recovered in SLD.

At ~ 338 days from the start of the process (i.e. after approximately 4.7 million Sm3 of air was injected) the SLD model overtook DLD model. This could be due the large effect of the heat from the combustion and that from the combustion gases created from the distance of 28 m offset between the two vertical injectors in SLD and the vertical mid-

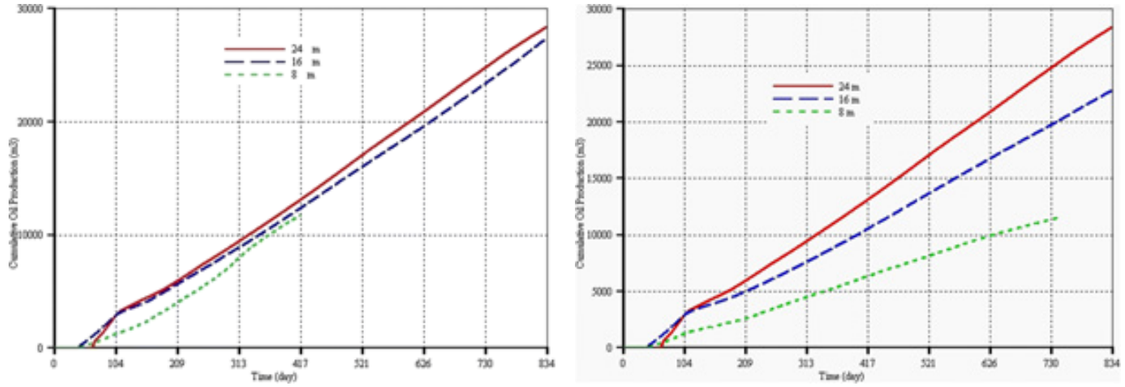


Fig. 4 Cumulative oil production for different reservoir thicknesses at constant air injection rate (left) and constant air injection flux (Right).[1]

The percentage cumulative recovery of oil originally in place (%OOIP) as function of cumulative air injection for the DLD and SLD wells configurations is shown in Fig.5. A time lag in the oil production is pronounced which resulted in a light increase in the oil

plane. Thus, higher cumulative oil recovery is achieved in SLD compared to in DLD in ~ 338 days. It was also found that, Over the 834 days of operating time, the cumulative oil recovery in SLD is 32% of oil originally in place (OOIP) whilst that in DLD is 27% OOIP,

which shows that an additional 5% of OOIP was cumulatively recovered in SLD compared to in DLD model.

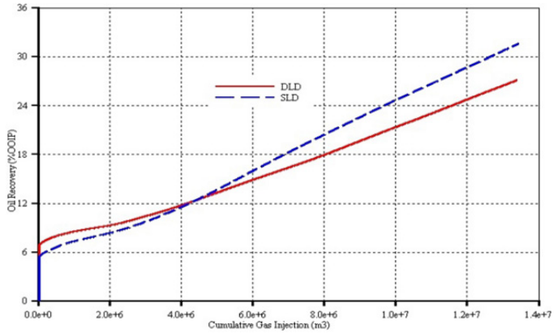


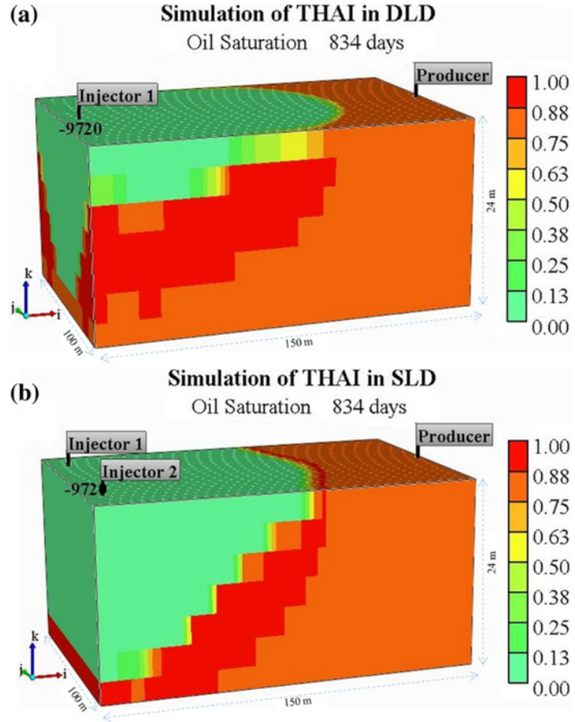
Fig. 5 Percentage cumulative recovery of oil originally in place (%OOIP) as function of cumulative air injection. Solid and dashed lines are respectively for the DLD and SLD wells configurations.[2]

Fig. 6 shows three-dimensional (3D) oil saturation distribution profiles at the end of two years of combustion in DLD and SLD models. In DLD, most of the oil is preferentially produced from the top horizontal layers and the mid-vertical plane which is axially (i.e. in i-th direction) along the HP well and its immediate adjacent planes on either side.

Most of the oil at the axially vertical planes at the edges of the reservoir and their vicinities are not displaced despite the fact that the oil saturations there are at least 88%. These are caused by the preferential advance of combustion front in the top of the reservoir leading that at the bottom (i.e. gravity override). Thus, larger volume at the top and around the mid-axis of the reservoir is affected by the heat of combustion compared to around the base of the reservoir.

In the case of SLD, oil is displaced not only from the top horizontal layers and from around the vertical mid-plane but also from the j-th vertical planes at the edges of the reservoir. These have shown that larger volume of the reservoir is swept when wells are arranged in an SLD compared to in a DLD pattern. Another factor

that results in more efficient oil displacement and production in SLD model is the fact that heat loss is considered to take place from the overburden and underburden only. That means, heat loss in the DLD model is larger than that in SLD because of the pronounced gravity override of the combustion front. This is despite the fact that the shoe of the vertical injector (VI) in the DLD model is located at a deeper depth than those of the SLD model.



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