Q: Tell me a little about yourself and your background in oil and gas.

I am a petroleum engineer by background, and by that I mean by academic training and also by industry experience. I started working in the oil and gas industry back in 1999, where I gained experience working in the North Sea, as well as onshore, with different majors. I have remained in the oil and gas sector, although I decided to move the ‘other side’, meaning academia, in 2006. Whenever people discuss oil and gas, they invariably end up talking about the United States of America. In this respect, I am no different as I headed west, to Texas, to one of the largest universities in petroleum engineering in the world (Texas A&M), and from there one thing led to another and now I am here at Cranfield University.

Q: Yes, you’ve recently been appointed head of the Oil and Gas Engineering Centre at Cranfield University – can you tell us about what you will be working on there?

I will be leading the oil and gas engineering centre, where I will lead a team of academics and specialists, ensuring that they have a platform from which to give their best. In parallel, I will be developing new research and activities in the area of petroleum engineering, and also at the interface with renewable energy resources, as I believe that’s going to be the future. Topics that this centre has already been working on prior to my arrival, and themes which I can bring, include multiphase flow systems, flow assurance, computational fluid dynamics, and production optimisation. I want also to expand in the areas of liquid loading in gas wells, and mature fields, which are very important topics particularly in regions of advanced production, such as the North Sea. In addition, we will be working on subsea engineering, automation of sensing and instrumentation, and geothermal energy exploitation.

Q: What makes Cranfield so well-placed for this research and development?

I believe that Cranfield definitely offers something special, and I’m saying this as someone who has worked at several other universities in Europe and the USA. It’s because Cranfield is so research-focused, not just fundamental research, which is well covered of course, but more specifically applied research that serves the industry and delivers solutions. I’m an engineer, and engineers are always seeking solutions, so when I came here and saw the amazing facilities of industry scale, and saw people trained and focused on delivering, I knew straight away that Cranfield was a bit different.

Q: You have a strong background in geothermal energy systems – could you give an overview of what geothermal energy is for any readers that may be unfamiliar with this?

My introduction to geothermal energy was a case of ‘jumping in at the deep end’, as I’m a petroleum engineer and I was happily working for the oil and gas industry. Yet, it is normal in an academic environment to look around for topics where your skills may be applied, and at the time in question, there was a major push towards carbon capture and sequestration (CCS). Also, at Texas A&M where I was working, there was a growing interest in geothermal energy engineering. CCS and geothermal energy seemed natural areas for me...
to develop my expertise as they both have to do with the subsurface. With the former, we want to capture the CO2 at the surface and inject it underground in what we call a reservoir project, medium to long-term. We are dealing with “geos”, which is the geo-source, and we strive to produce the heat trapped underground and bring it to the surface. The processes involved are very similar to those we employ in the oil and gas industry. For example, we are dealing with the subsurface, the flow of fluids through the underground media, and this flow arrives all the way surface via wells that are drilled like those for oil or gas. When we go through these fluids to the surface, we can process them to extract the heat, which is a product we can sell, either for heating or as electricity both. Then whenever I looked more closely at this global picture from reservoir to surface, I realised that my background in petroleum engineering was an advantage. Yes, there is more to geothermal processes, in that these thermodynamics are a bit different and resource exchange is complex to predict, for example, but we are still dealing with water, steam, some impurities, changes of phase along the way, from bottom to top. So I was able to quickly get up the learning curve and use my skills as a petroleum engineer in the area of geothermal engineering.

Q: Is there scope for an interface between new existing O&G and geothermal systems? If yes, how can you see this technology evolving and developing?

This is something that I find fascinating, and which may represent a good path forward for systems. When we produce oil and gas, we are not producing just oil and gas as we also be co-produced most of the time. This water is typically from the aquifers that lie beneath or is surface induced water, and we can also improve recovery efficiency by maintaining reservoir pressure and squeezing oil towards the production wells. These fluids arrive at the surface at a certain elevated temperature coming from below the earth’s surface, so we have hot water associated with the oil and gas produced from petroleum systems, and we often have lots of it. We can consider this abundant hot water as a “geothermal” production that is co-produced with the hydrocarbons. Why not use it?

This is not a new idea, but it is still in its infancy. There have been a few pilots around the world, where small test plants have been able to produce electricity from this associated hot water. So could this concept become an interesting business model for an oil company? It all depends on its commerciality. As an oil producer, I will have sunk capital investment already in drilling my wells and installing processing facilities onsite, so I would have access to a new potential income stream from the co-produced hot water. I could sell electricity by extracting the heat from the water, heat that is currently wasted. Alternatively, I could use the potential income to reduce my normal operating expenditure, by generating my own green electricity, rather than buying electricity from the grid to run my facilities. An added bonus would be if we had the pipeline infrastructure already in place by offering incentives to reward energy efficient oil producers, who are being “good boys”, taking steps to reduce their carbon footprint.

Q: I assume that geothermal energy has its own particular characteristics and any form of energy available to us. Is there anything we have learned from the oil and gas industry that we can apply to geothermal energy systems to improve efficiency etc.?

Absolutely, and vice versa. In the oil and gas industry, we are now able to exploit the gas and condensate from deeper high pressure high temperature (HPHT) reservoirs. This expertise and knowledge from the oil and gas industry is directly transferable to meet the challenges of developing geothermal systems, which are typically at greater depths, meaning elevated pressures and temperatures. Another important area is deep drilling. As the oil and gas industry seeks to exploit ever deeper resources as the shallower ‘easy’ resources have been depleted, so the geothermal sector has also focused on going deeper. Increased depths mean a much hotter and more hostile operating environment, as we are getting closer to the earth’s core. Subsea technology has now become a real challenge for both sectors. Drilling deeper forces you to go for smaller borehole sections; you need to spend a lot more money as you stay on site longer, and you will encounter hard rock formations that consume drill bits very quickly. These are just a few of the transferable areas of expertise from oil and gas to geothermal.

Yet the geothermal world has also led way when drilling in urban environments, showing tact and innovation in its operations in close presence of people. This compact modular drilling rigs and noise reduction technologies.

Q: Can you tell us more about the United Nations Economic Commission for Europe (UN/ECE) Bureau of the Expert Group on Resource Classification – how you are involved, the work and purpose of this group etc.

The purpose of UN/ECE is a noble one, in my opinion, as it is all about the sustainability of energy. Its premise is that if we aim to make energy accessible to the world and end the energy poverty, everybody has the same access to energy, independently of their location.

UN/ECE is developing stands and a framework for comparing, or equal terms, energy resources of different types. For example, consider country A, which would like to understand how much of its oil and gas resources are yet to be produced. Country A also would like to know how much wind energy it could produce, how much geothermal energy it could produce, and how much solar energy it could produce. The government of country A, for security purposes or for independence purposes, could then take a portfolio overview and announce “this is my energy portfolio.” Although this concept of resource specification is well established in the mining and petroleum sectors, it is not that well known, nor accepted, in the renewables sector. Yet, being able to compare fairly between the different resources would actually facilitate investment and help prioritise where the money should go. This would also address the questions what energy is available now, and what energy could be available if more R&D were done. It was completely serendipitous that I got involved with this group. I was presenting at a geothermal conference in Germany just after moving there, and there was someone from UN/ECE also giving a talk. They heard my presentation and said “Wonderful, we are looking for somebody in geothermal” and that’s how I got invited. UN/ECE is totally voluntary; we don’t get paid for our services, but if funds are available, I can sometimes claim back travel expenses. Our task is of course to deliver this data. You get to know amazing people, work on high level problems, and you have a chance to make a difference.

Q: You mentioned renewable energies such as wind and solar - do you see a future for O&G technologies when so much pressure is on governments and energy providers to move further towards these “green energy” options? Do you think the energy industry can ever be truly separate from oil and gas or should it be hand-in-hand with renewables?

I think the latter for sure. The two sectors can and should co-exist. The oil and gas companies have the expertise and technology to access the resource, generate it, and deliver it, and I don’t envisage a sudden change to green energy and renewables. I do think this is now accepted knowledge. Many countries have other options to pick up. If you start thinking about solutions like solar - do you see a future for O&G technologies when so many renewables are able to go into sensitive areas without making a mess, this can be done. The oil and gas industry hasn’t started doing its homework, and we certainly don’t want to have a Macondo number two. One would like to think the oil and gas companies are able to go into sensitive areas without making a mess, and they do need to be there to provide time for the use of renewables to pick up. If you start thinking about solutions like the one I mentioned earlier, using geothermal energy from oil and gas systems, who knows how things may evolve without any dramatic demise of the petroleum industry. There are still avenues in the petroleum sector that we haven’t explored yet, and with all these technology breakthroughs that have happened, then why should we underestimate our ability to reinvigorate the North Sea? I think we can come up with new solutions to revamp what we have, to breathe new life into the remaining ageing infrastructure, and work closely with the structural energy people. We must keep HSE as a priority, which is an increasing challenge in the current low oil and gas price environment. Subsea systems can be worthwhile, as long as we focus on monitoring, inspection, automation of these processes, and by making the systems more affordable - that’s what has to happen. Subsea technology must become cheaper and more flexible, so there has to be more openness to swap experiences and knowledge. The UK government needs to keep pushing for this collaboration to happen or it will never happen. For example, the UK had a fantastic North Sea database that reported monthly petroleum production on a well-by-well basis. This was stopped in December 1999, if I remember correctly. The replacement, a ‘dumbed down’ system at a holistic field level, doesn’t increase understanding of the regional subsurface complexities, it fails to educate investors about the particular risks, and it doesn’t help promote research. Government, industry and academia all need to work together to ensure the North Sea survives (initially), after which we will be in a position to go forward.

I would encourage all countries, and especially the UK, to promote collaboration, access to data, and the sharing of knowledge and expertise. When everything is made open and accessible, you will always find experts, volunteers, practitioners, willing to propose ideas, possibly for free. You never know, if the oil and gas sector remains closed, untrusting, and overly competitive, then it becomes a race to the bottom of the barrel. I’m afraid that niche markets don’t survive in situations like we are experiencing now.