# Into the Headlines_ Episode 9: Energising the Future

**Speaker 1: (00.02)** In 1973, the first Offshore Europe took place right here on campus at the University of Aberdeen. No-one really knew then how the discovery of North Sea oil would change the fabric and fortunes of the region. Now 50 years on, the focus is firmly on how to accelerate the transition to a cleaner, greener energy future. I'm Laura Grant, join me in this latest episode of Into the Headlines as we consider how energy has shaped our past and how we are determining its future.

**Intro music: (00.46)** Episode 9 – Energising the Future

**Speaker 1: (00.49)** I'm joined today by a number of guests, notably Alex Kemp, Professor of Petroleum Economics and Director of the University's Aberdeen Centre for Research in Energy Economics and Finance; Dr Alf Martinez-Felipe, Senior Lecturer in Chemical Engineering at the School of Engineering and Dr Rachel Brackenridge, Lecturer at the School of Geosciences; as well as Professor John Underhill, director of the Interdisciplinary Centre for Energy Transition. Alex, let's start at the very beginning. What was Aberdeen and its economy like before the oil industry really took off?

**Speaker 2: (01.24)** As a very young academic, I was involved in what was a major study for the Scottish office. They commissioned studies on regional economies and so the economics department was asked to conduct what ended up as an interdisciplinary study on the prospects for the north-east economy of Scotland, and that was undertaken in the 1960s and the main points that emerged was that, well, the north-east of Scotland economy had been stagnating really for a long, long time in the post-World War II period with employment and population going downwards. The traditional industries like farming, fishing, textiles had been just keeping going but losing employment over the years. Aberdeen itself was holding up because it had more manufacturing like textiles, fish processing, paper manufacturing but for the medium term, looking ahead 10 years into the mid-1970s, all our studies were showing that, at best, the economy could hold the population and employment constant, and it depended on the manufacturing sector holding up reasonably well, because the primary sectors like agriculture, fishing, forestry, would continue going down. So it was a fairly sombre picture. Then, of course, everything changed when the oil was discovered but at the time there were a lot of uncertainties about would it become big or not big, well nobody knew. But in 1970, the Forties field was discovered and it was a giant field by any way of measuring it. And similarly, just a little later, the Brent field was discovered, and it was also by any standards a giant field.

**Speaker 1: (03.20)** How well prepared were we at that stage for what was to come?

**Speaker 2: (03.21)** The local economy did not really have expertise in offshore engineering and geology and so on. And so when the activity of exploration started it was activities that like supply boats. So for example the Wood Group, a local company involved in the fishing industry, they could do supply board activities, food and materials being transferred out, and there could be bases, but Aberdeen was not in the forefront of that. The first bases were actually in Dundee. BP and Conoco opened bases in Dundee because Aberdeen Harbour was tidal and the supply boats then, still smaller than they are now, required a 24 hours per day service and deeper waters and that required a very big investment and the Scottish Office actually persuaded the Harbour Board to spend a lot of money deepening the harbour and also strengthening the walls; and the Harbour Board, which was a Trust, they had in fact to borrow a lot of money in order to make Aberdeen a port suitable for oil activities.

**Speaker 1: (04.35)** In 1973, the Offshore Scotland exhibition – what we now know as Offshore Europe - was held for the first time. What are your memories of it?

**Speaker 2: (04.43)** It was held in Aberdeen and on the campus of the University of Aberdeen, it was quite, quite small. The activity was promoted by the University because we had been interested in the local economy going back to what we called the Gaskin Report, of which I was a member. And my abiding memory is seeing a helicopter landing and then, a little while later, taking off again. So why would a very senior figure come to this event? Because Shell and BP had made what they knew were very big discoveries and they wanted to encourage the supply chain to develop, to do all the servicing type work that was necessary to get the exploration going, to get the field developments going. That was the situation in 1973 and nobody knew if the activity was going to become very big or not. In Economics, because we had expertise looking at the economics of regional economies, we were successful in getting a big research contract with the Scottish Office, as it was then, to look at the long-term future of what might evolve from the oil industry in the North Sea and what the opportunities might be for the north-east economy and for Scotland more widely. So that was in the early days. There were mixed views including within the University about whether it was all going to be great, or not. We certainly were on the side where we could see there was going to be a very big potential, and so we emphasised that. Interestingly, even within the Chamber of Commerce there were mixed views because what they could see was from local industries like paper manufacturing, like agriculture, like textiles, they were going to those workers to work in the offshore, because the salaries were very much bigger.

**Speaker 1: (06.45)** Why was that?

**Speaker 2: (06.47)** The salaries were big because they felt there weren't many local people trained there and so they had to get workers mostly from United States, but some from France, they had to get a premium to come and disrupt our lives and come away over here to work in the embryonic North Sea activity and spend time offshore; and when they were onshore the locals could find them out with very big hats and very big boots and very big voices and asking for Southern Comfort in all the pubs. And the pubs in Aberdeen had to get Southern Comfort, which was then starting to compete with our own whisky. 1973-74 the reservoir went up by 400% and so therefore there was a tremendous requirement by the oil companies to get the fields developed because the price was very high and the government, the UK government, was anxious for that to happen as well because we were importing all our oil then, a very high cost if the price had quadrupled, and so getting to first oil was the be all and end all and what that meant in terms of equipment, the UK did not have a history of manufacturing all the equipment required for offshore work so quite a lot were imported from the States in great big airplanes because that was the quickest way to get things going. When 75 came, then we got first oil initially from one of the smaller fields, but then then amidst much, much publicity the Forties Field went onstream in 1975. After that production started coming up at a very strong pace and the jobs available in the sector increased as well because the more the number of fields being developed, the more the jobs there would be. That applied not just to Aberdeen but elsewhere in the UK and elsewhere in more parts of Scotland where construction yards for platforms were being built. They had their booms, but then also they had the busts because in the 1980s, when the oil price collapsed then a lot of investment had to stop. In Aberdeen, for example, a big effect was on the housing market. House prices had rocketed up in the 1970s and with a lag, more houses were built. But the house builders had a big problem because they needed more skilled workers, more brick layers and so on to do the work, but there was nowhere to house them to get the work going. So there was a bottleneck. Eventually, more houses were built. Bridge of Don,

Westhill, for example. But then in the 1980s, the oil activity went right down and the housing market falls as well. So comparing the 70s and the 80s, this region experienced both the boom times and then the down times.

**Speaker 1: (09.55)** So right from the get-go the energy sector had a huge impact across the board not just investment and jobs, but housing provision and even what was for sale in pubs and in shops changed. I imagine that influence played a part in the internationalisation both of Aberdeen but the University also?

**Speaker 2: (10.13)** Yes, supply chain activities were geared towards the North Sea for sure and gradually expertise was built up, so it wasn't just supplying pipelines and the equipment and supply boats, we get into engineering work at the higher technology level. And then the idea was that, well, should we not also be involved internationally, and I can recall that from quite an early day, Ian Wood was promoting that idea that the supply chain, of which he was a leader, should not just concentrate on the local North Sea market but see the world market. And so that took quite a bit of time to get going, meaning it took quite a bit of time to get a major response and for local companies to get involved overseas. But eventually it did, and so subsea technologies which were developed for the North Sea then became competitive in markets in all kind of overseas countries. So there was, to use a phrase we use in economics, a learning by doing process in the North Sea, but then going to other countries. And of course, in terms of employment, well in the early days it was like people working on supply boats but of course we then did have courses developed at RGU, the University of Aberdeen and so on in offshore engineering and that meant that local people could get employment here whereas before they would have to emigrate. So when I was a student at the University of Aberdeen the great majority of us had to emigrate out of the area and one of the big effects of the coming of North Sea oil was that it reduced the extent of outward migration and more employment opportunities for graduates were available locally and of course, the University of Aberdeen and RGU have both since then developed all kind of courses relating to oil and gas, which has meant that they have grown and also, because of the expertise, have attracted students from other countries, including developing countries in Africa where we have a lot of students here, because of the expertise we've developed in the North Sea. So that's been a big spin-off effect on the University over the maturer years of the North Sea.

**Speaker 1: (12.51)** It's the 50th anniversary of Offshore Europe and this year's show is very much focused on the pillars of energy security, future talent, innovative technology and the energy transition. Alf from an Engineering perspective and Rachel, from a Geosciences one, are going to help me dig into – not sorry about the pun - some of those themes in a bit more detail, and I'm going to start with you Rachel, by asking you to tell me about the work that you are involved in.

**Speaker 3: (13.18)** Yeah, so I'm a geologist by training so I'm looking at the subsurface, the ground beneath our feet and beneath the North Sea in this particular case. So I look at what we call the Zechstein salts. So this was over 250 million years ago we had a big salt basin where the North Sea is today and it deposited all these carbonates and these salts and these have historically been really important for the oil and gas industry. Salt's a very good seal, it doesn't let fluids pass through it, so it's been used to trap hydrocarbons, generate traps to accumulate hydrocarbons and indeed at the moment it's the hot play in the North Sea so there's been a couple of recent discoveries in the carbonates associated with the Zechstein. What my research looks at is, so I'm looking at the forward-looking energy storage solutions that the Zechstein salt can provide, particularly looking at hydrogen storage. So hydrogens want one of many, kind of, aspects of us achieving net zero, I think

quite an important one. So we want to up our generation of probably blue and green hydrogen going. And we need somewhere to store that hydrogen until we need to use it and these salt deposits can provide a really good location to store large volumes of hydrogen and other gases as well. We can use it to store methane, for example. Main problem is that we don't have very many salt deposits onshore here in the UK. There's a few down in England, certainly none in Scotland. So my research is looking offshore into the North Sea to see if we can move this technology offshore and assess the geological feasibility of the offshore for hydrogen storage projects.

**Speaker 1: (15.14)** Hydrogen is one of the big themes at this year's conference. What are the benefits it offers?

**Speaker 3: (15.19)** Many benefits, there is also a lot of debate over the use of hygiene. I believe it's going to become really important in electricity generation and decarbonisation of industry. So in an ideal world we would generate all of our electricity from renewable sources, from wind, solar, tidal - but in reality, these sources, they only generate power when the conditions are right and that doesn't necessarily link up with when we have the demand. So if the winds not blowing, we can't generate wind power for example. So where hydrogen comes in is if we can generate excess electricity when the conditions are right, we can then convert that electricity into hydrogen and store it until a later time when demand exceeds our generation capacity. So we could store this energy by other means, we could use batteries, for example, but we don't really have the technology or the resources to store a whole nation's worth of electricity on batteries. Batteries are very resource heavy, so hydrogen really offers a good solution for large scale energy storage with really minimal environmental consequences, so it's a bit of a no brainer for me.

**Speaker 1: (16.35)** What's the difference between blue and green hydrogen?

**Speaker 3: (16.37)** That's a good question. So blue hydrogen we can generate from methane directly from natural gas and when we convert that methane into hydrogen, we get a byproduct of CO2, so we need to then capture that CO2 and store it in a subsurface -so carbon capture and storage. Green hydrogen that comes directly from renewable sources so from wind power from solar power, tidal power for example. So I think both probably have a place we want to get to a stage where we can really ramp up our green hydrogen in the future though.

**Speaker 1: (17.15)** And is North Sea, particularly good area for this sort of initiative?

**Speaker 3: (17.19)** Yeah, absolutely. The North Sea is a fantastic location for, potentially for hydrogen storage. So my own research and that of others that have looked in other areas of the North Sea show that we have the right geology to make it work. What needs to happen now is the technology needs to catch up but thanks to the oil industry we have great infrastructure and fantastic expertise and skills within the UK so we can really implement that - once the technology catches up - we can implement it safely and rapidly, I'm sure. There are many other basins around the world where there is this potential and every salt basin is different. So we need to do localised studies on each salt basin, but it's a proven technology and it's already being used in various locations around the world, so no reason to suspect that we couldn't do it in the North Sea at scale.

**Speaker 1: (18.16)** This seems like an appropriate juncture to bring Alf into the discussion. You obviously come at this from a slightly different perspective. Tell me about the work that you've been involved in?

**Speaker 4: (18.25))** Well, I suppose I wear a few hats here. So on the one hand, I'm trying to help colleagues in the School and at the University to support their research in hydrogen in particular, and I mean, just to try to get people together, make some connections with industry if I can and get the students to know about this technology. But also have my own piece of research on new materials for electrolyte technologies and trying to improve how they behave in electrolysers and fuel cells, and that's what I kind of do in my lab as well with my students. And very recently I joined the Just Transition Lab where we work across different disciplines, try to get, you know, the energy transition into the communities to understand social aspects and how the technology can help develop these projects locally as well.

**Speaker 1: (19.21)** You're also a director on the board of AREG, the Aberdeen Renewable Energy Group. What does that involve?

**Speaker 4: (19.27)** Well, very exciting as well, so the Aberdeen Renewable Energy Group has been here for decades before the energy transition was even anything, pioneering renewable energies here in Aberdeen. Actually the offshore wind bay that we have in Aberdeen, AREG was a really big part of it, pushing for that. So we are almost 300 members. We put together people from industry, from academia, from the supply chain and we try to connect them as well to help them in projects to do some formative aspects and informative opportunities for them. It's a really good place to be if you really want to be part of this energy transition here in Aberdeen.

**Speaker 1: (20.13)** You've also mentioned the H word, hydrogen. As an engineer, why do you think it's something we should be excited about?

**Speaker 4: (20.19)** Well hydrogenous extremely versatile as it is the smallest molecule you could that you could get in the in the universe and that has a lot of advantages as an energy vector. So you could eventually use it to transport and store the energy to generate from renewable sources like wind and solar, which, you know, change with time and place so you can store and transport this energy using hydrogen and then you could be using hydrogen as well as a brick to be a lot of new fuels or new materials, new compounds like fertilisers that that can be used in other sectors. And again, I think the key thing for hydrogen is that you can use it or you can obtain it from renewable sources and it doesn't have a carbon atom at all, so when you transform it into energy or you burn it, then you get this water as a subproduct. So the carbon footprint of this stage is very low and if you do things properly and I think obviously Offshore Europe is kind of a representation of what happening all over the world and hydrogen is a big topic in Europe, but also across the globe.

**Speaker 1: (21.42)** You mentioned it doesn't have a carbon footprint as such, but is it completely clean?

**Speaker 4: (21.47)** Well, that is a very interesting and tricky question which we discuss in our lectures and at conferences. So it depends on what states you take it from. At the moment there is always a component that's going to have a carbon footprint because, for example, if you're talking about green hydrogen, I mean, in principle, you know the energy source is wind, which is renewable, but you need to think about the footprint of the production of the plates and the turbines and the materials of the electrolytes that are going to have metals and carbon based materials as well. So obviously, you know, if you really want to have a complete zero carbon footprint you need to do a proper lifecycle assessment and there's always going to be a point when you can improve that. But you know, in theory in the paper, the last stage of transformation is clean. You only produce hydrogen. That's why it's so important to have a multidisciplinary approach here, it all comes to covering all the

stages of.the cycle of reducing energy, in this case from hydrogen. But you know if you compare it to other fuels that we're using right now,  the advantages are incredible as you are not producing CO2. The other thing I would like to mention here is when you produce CO2 locally in your boiler or your engine using our fuel, it's very difficult to capture, whereas if you produce it centrally it's easier and more effective, so using hydrogen can be definitely very important to abate carbon footprint.

**Speaker 1: (23.30)** Specifically for the North Sea, what's the potential for the hydrogen markets?

**Speaker 4 (23.34)** It's huge. We do have a lot of wind, obviously, and we do have a lot of water in the coast and we also have a lot of biomass and some sun. So we've got a lot of energy resources that we could use to turn this into hydrogen. I mean again, not necessarily the hydrogen could be more than that, you could use the electricity just to put it into the grid but definitely in terms of hydrogen, you have a great potential. We also have the infrastructure and the skills because we got this oil and gas legacy and a very important industry network that that we can use. We obviously have the culture and I think I think this is important, we also have, you know, academia behind us. The universities, University of Aberdeen, Robert Gordon University, behind us, supporting this hydrogen economies and the links we have obviously with offshore industries and offshore companies and in the rest of Europe, they're really playing in, in our favour.

**Speaker 1 (24.40)** Sounds like we've got everything we could possibly need to make this work, but it can't be that easy. What are the challenges?

**Speaker 3: (2446.)** I guess for me the main challenge going forward is that we're really need to up our communication between the surface and the subsurface specialists. It's getting very busy offshore in the UK with oil and gas, offshore wind, carbon capture and storage and we need a bit more integration of the providers and the regulators who work at the surface and in the subsurface to make sure there's no conflicts, basically. So at the moment wind farms, they get, they get placed where there's no oil and gas operations so that they don't interfere, and where you know the ground conditions are sufficient and safe for them to install and at an economical cost, but that's not necessarily where it's going to be optimal for hydrogen storage down the line, so, the wind operators they haven't thought about the subsurface and where hydrogen storage might be feasible. So there needs to be some more early communication here. Same issue with the carbon capture and storage so the recent carbon capture and storage licencing round the acreage that was on offer was specifically designed to avoid wind farm infrastructure and I think that was mainly driven by the need to monitor that the carbon was safely stored for a long timeframe so that there was no conflict between the monitoring operations and the wind farm operations. And again, that's not necessarily linking good geology or the best geology with where the infrastructure is, so a bit more communication and interaction between the regulators and providers would really help maximise our ability to use the North Sea to its maximum potential.

**Speaker 4 (26.37)** Yeah, well hydrogen has been a topic in Aberdeen for a long time because we were pioneering the hydrogen buses project, for example, in 2015 and we do have now a fleet of hydrogen buses around the city. We do have hydrogen production centres and stations at the core of our communities in Kittybrewster, literally 10 minutes away from Aberdeen University and that is really good because that that makes people aware that the technology is safe and it can work. So one of the changes is actually telling people, you know, this, this can work, this can be good, be part of it; and that's why I think the Just Transition Lab is so important as well in this work to make awareness of the relevance of these technologies. I think if you ask anyone in hydrogen where the main idea

that has been floating around for the last years has been scaling up, there's a kind of chicken and egg situation. If you don't have a big market to sell hydrogen the price is high. But if the price is high, no one is going to invest in it initially so we need investment from authorities, we need clarity on the regulations as well. But I think this has changed. I mean the last few years we've seen much, much more support from the UK and Scottish Governments not only in hydrogen but in general in the energy transition. So I think the challenge is trying to reduce the cost of production which you know can be abated partially at least by this scaling up, improving efficiencies as well, including all the regulatory aspects and the connectivity within Scotland, you know in the UK we need to be part of this hydrogen network but also with Europe which are our, you know, neighbours and definitely will be part of it.

**Speaker 1: (28.36)** Are there other places around the world which are equally as ready and as poised, do you know? Are we in a race here?

**Speaker 4: (28.44)** Well, probably politicians want to see this as a race but I think it's just a cooperative effort because energy transition is a global challenge. You know, we cannot leave any country behind. But I mean, if you ask me, I think Scotland is doing really well. The UK is definitely doing well, but I think we're behind countries like Germany, for example. Germany, the north of Europe. If you go to the Netherlands, go to Denmark. I mean, they've been investing in hydrogen and for a longer time than we have. The EU obviously have very strong research programmes and initiatives and platforms where they are doing massive projects on, to be honest it is establishing regulatory framework and establishing a network of how to distribute hydrogen, but once you start connecting the dots then you can have a really synergetic effect. So Europe is definitely a big player, but again we can benefit from that because you know we could sell our hydrogen, we could get their hydrogen for our own use as well. But also Japan and Korea, they are pushing very hard on that too, and the US obviously, the United States are obviously going to boost that, they have a lot of resources as well. They've got natural resources they can use for hydrogen production, Canada too with the waterfalls, etc. So I think I think the big economies are all of them have already a plan for this. So we cannot just lose space here.

**Speaker 1: (30.26)** What are some of the other big-ticket discussions ongoing at the moment from your perspective?

**Speaker 4: (30.30)** Yeah, well, I mean just to put it in a framework, we talk normally about the energy quadrilemma. So there are these four things you need for the energy transition. One is energy security. So we're going talk about how much natural gas and oil based resources we're going to need in the next few years, and that's a political debate, as you probably know already, so that that's going to be in the news that that's going be again a question on how we cope with that, this is part of the conversation on current capture and storage, which for Aberdeen and the north-east is quite relevant through the ACORN project. Then we have environmental impacts, that's also going to be a big issue. I mean we need to think about what we do and how we do it. At the moment I think people are probably more focused on the feasibility of what we are doing, how we need to do it properly. And the scaling up this this technology is definitely going to make a commercially available technology too, so that's going be on the on the table too. But the fourth topic for the quadrilemma is the social acceptance, that's also a big discussion that we should put on the agenda to put forward. There is also this discussion about whether we need to generate molecules or electrons, so whether we want to use gas like hydrogen or even natural gas or other e-fuels like methanol or ethanol that can be produced from these renewable sources or we can just improve the grid so we can have more electricity floating around and improve the

transmission of the electrical power. But to me this is really a kind of void debate because we need both. So we need to work on both aspects.

**Speaker 1 (32.21)** And what are your thoughts, Rachel, what are the other big-ticket items?

**Speaker 3 (32.25)** I guess the one that I'm most excited about that will be discussed at the conference, no doubt in great detail, is carbon capture and storage. So we've had a recent licencing round here in the UK and there's been, very recently within the last few weeks, project funding announcements. So it really feels for the first time we've got momentum and a number of projects here in the UK, which is hugely exciting. Carbon capture and storage is a proven technology, we've been doing it for decades in the guise of enhanced oil recovery and there are now specific sites around the world where carbon capture is being is actively being done, but really, in the UK, we're still in that learning process so until we start getting these projects up and running, we don't really know how it's going to work in great detail. There's still a lot of learning to be done. So I think there's yeah, great opportunity there and very exciting times ahead and I'm sure lots of discussion at the conference on this topic.

**Speaker 1 (33.29)** Jobs were mentioned. The workforce of the future is going to be hugely important in delivering the transition. Is it something students are interested in?

**Speaker 4 (33.37)** Yeah, so I was recently in in a couple of events talking about reskilling and the workforce for net zero and there are studies which point that 90% of the skills needed are already here. If you think about for example, engineering, hydrogen engineering projects are similar to projects that deal with natural gas, for example, in the sense that we are still going to be using compressors, we're still going to be using pipelines, safety is very important as well, obviously. And these things are part of the projects that we are dealing with already and people have been dealing with for the last 40 years. It's about changing the mindset on how we connect this sector to the rest of society and the rest of sectors, because the energy future is about interconnectivity and I think again, most of the skills we already have them. But also these projects may be slightly more complex because of this interconnection with different sectors, so I think project management is something very important and is one of the skills that I think companies are looking for, and the critical thinking and having an overview of all the picture globally but also locally is very important and that's what we're trying to do in some of our MSC programmes like the recently launched Energy Transition Systems and Technologies, but also Sustainable Transitions in New Science and in so many others in different schools.

**Speaker 1: (35.25)** Now my final guest today is Professor John Underhill, director of the Interdisciplinary Centre for Energy Transition. John, Alex Kemp has spoken about the impact of oil and gas on the Aberdeen City region over the years, and we've heard from Rachel and Alf about hydrogen and the potential it offers in terms of the energy transition. What's your focus on as we look at the next 50 years of energy provision and North Sea activity?

**Speaker 5 (35.50)** Well, first thing I say, Laura. I mean, in 1973 at the time of crisis in the UK, we had an oil crisis, we had a three-day week, we had coal mine strikes. We also had the first ever Offshore Europe took place in and on the grounds of the University of Aberdeen. Fifty years on, you know, we're proud as a university to continue our association with an event of this magnitude and it aligns so well with what we're doing at the University. That is we're seeking to accelerate the energy transition to a better future and that goes to the very heart of our current research and training programmes, our Centre of Energy Transition, we're dedicated to innovation that ensures countries and communities have secure access to the energy they need, at a cost that they can afford, whilst of course not destroying the planet and its climate in the process. These key requirements of energy

security, affordability and sustainability are absolutely vital in ensuring a transition that works for us all and at Offshore Europe we'll be showcasing our research and training in key areas seen as critical in achieving the same including hydrogen, carbon capture and storage, data and artificial intelligence and other aspects of the energy transition like geothermal, and indeed the role of oil and gas in that transition given the difficult starting point that 75% of total energy that we need to fuel the economy in the UK currently still comes from oil and gas. That is a challenging starting point on our energy transition journey through a renewable decarbonized low carbon future.

**Speaker 1: (37.43)** We've spoken quite a lot about hydrogen but tell me about the carbon capture and storage work that you're doing.

**Speaker 5: (37.47)** Yes. so as you're probably aware, the industrial emissions are large in the country, not just Scotland, but across the whole of the UK. There are a number of industrial clusters that currently, unfortunately the carbon that is generated from those sites goes up into the atmosphere. What we seek to do, of course, is to capture, to transport and to store it safely in the subsurface rather than putting it into the atmosphere. It is really important to decarbonize these particular technologies, these particular areas. Now the UK actually has a fantastic advantage in this regard, because we've had an oil and gas industry that over the last 50 years has produced from subsurface sites, some of which actually contain carbon dioxide, naturally. In in other words, it's proof of concept that carbon dioxide can be stored safely on geological time scales in some locations. What we've been seeking to do with the research that we've been doing at Aberdeen University and the Centre for Energy Transition is to screen the North Sea using data, that is seismic data, well data, albeit acquired in the pursuit of oil and gas, but actually to use it for a different purpose to characterise the subsurface so that we pick the right sites for the right reasons, where carbon dioxide can be stored safely and put up a red flag and say actually don't use these sites if there is a risk of leakage at those particular points. So the work that we've been doing is basically to do a subsurface characterization of the North Sea and other parts of the UK Continental Shelf and we've recently published our outputs from the Southern North Sea, which faces the largest industrial emissions at Teesside and Humberside. They produce over 50%, over half of the UK industrial emissions and adjacent to it in offshore waters buried in the subsurface there are carbon storage opportunities, carbon storage sites. We've been characterising those and then ranking them so that we can propose, which should proceed first and which are more challenged. And they may be challenged not only geologically, but also because there is a competing interest in the use of the offshore real estate, the marine spatial planning. What do I mean by that? Well, if we've got a wind farm on the seabed and a carbon store below, if we put the wind farm above it, we have turbines certainly in shallow water of the southern or sea that have fixed the seabed. That's a bit like a ski slalom if you want to take a boat to shoot sound waves to look at the subsurface to measure, monitor and verify the carbon store. It also means there's a competition between the joint venture that owns the wind farm and the carbon store below. That might mean because of regulation or insurance that it's a little bit more difficult to do or more expensive to deliver. So we've been identifying those sites as well and try to avoid the areas where there is a conflict between different renewable technologies. And finally the work has been looking at well integrity over the last 50 years, something of the order of 4,000 wells have been drilled in just the North Sea, and 8,000 in the UKCS. Now, wells that were plugged and abandoned when they didn't find any hydrocarbons 40 years ago were abandoned, compliant with the regulation at the time but not necessarily with any thought that 40 or 50 years later we were going to come back and actually reuse the stained site for a different purpose. So we've had to also look at the well legacy well integrity because if any of them have a flawed cement or plugging when abandon they could effectively be straws to the surface. So if you put any carbon dioxide

down in the ground, it's going to come out again, and so we want to avoid such sites. So that's the work we've been doing. We've been doing the geological characterization, we've been looking at the co-location issues and we've been looking at the legacy well integrity and as a result, we've come up with proposals that the North Sea Transition Authority and companies have welcomed and embraced because it highlights areas that are more attractive, carbon storage and those that are challenged or should be ruled out. That's the importance of the work.

**Speaker 1: (43.02)** And is this something that could be replicated globally?

**Speaker 5: (43.04)** Yes, absolutely. So a few years ago, Laura, when there was a CCS opportunity in the UK and that project was abandoned, Treasury decided there was no commercial case for it. Now, I used to go to the States and internationally and present at conferences on carbon storage and you know, to be frank, quite often the lecture theatre would be semi deserted with tumbleweed lying through it. In the States they introduced something called the 45Q tax credit which gave tax rebate to companies to put carbon dioxide into the ground rather than vent it into the atmosphere. So in 2020, when going across just before the COVID pandemic to the States to present on carbon storage, something quite different was in place. The lecture theatre was packed. They wanted to know everything about carbon storage and the licence from the North Sea, and the work that we've been doing in Aberdeen and in in this particular research theme now has got traction in Brazil, in Egypt and it contributed to the recent COP in Sharm El Sheik, in Indonesia, in Malaysia. So yes, the answer would be that the lessons we're learning and the advantage we have in the North Sea with 50 years of data, characterization of the subsurface and the appetite to decarbonise to with the Net Zero targets that the government have put in place in law, are all meaning that there is expertise, understanding, data methods and the appetite and ambition in the UK, which can be exported overseas. So it's a case where the research and the training that we do in this area, there is an appetite for internationally.

**Speaker 1: (44.55)** So you've mentioned expertise, skills, training - how are we supporting decarbonisation through the skills provision?

**Speaker 5: (45.05)** Yeah, so it is one thing to say that our world leading research is delivering solutions but it it's really important and I think that Aberdeen is contributing enormously to the re-skilling and upskilling of people to equip a workforce that currently is focused on oil and gas with the skills, the knowledge and expertise they need to lead the way in the transition, and I think the universities play a vital role in providing the intellectual capacity and skills that can propel the UK energy industry into what we need to do over the next 50 years. And there are a number of initiatives that we as a university are doing. In terms of PhD scholarships, we lead the Geo Net Zero, that is geoscience and its role in the low carbon energy transition PhD programme. We have industry funded scholarships towards Masters programmes across the Centre of Energy Transition, we have 28 Masters programmes across four schools that qualify for those scholarships; and the University is also a partner in the National Energy Skills Accelerator, something called Nesa, which is a collaboration between RGU, North East Scotland College, the University of Aberdeen and is supported by key partners Skill Development Scotland and the Energy Transition Zone. Nesa works with relevant businesses and training organisations to help to create a more flexible and resilient workforce for the UK's energy sector and seeks to deliver the skills development programmes which are required to ensure that business is ready and has access to a competent workforce to accelerate the long-term drive towards meeting Net Zero targets. All of these initiatives are relatively new, very exciting and I think directly relevant to the transition pathway that we're on.

**Speaker 1: (47.12)** And that is the time we have, I'm afraid. My thanks to everybody who has contributed to this episode of Into the Headlines. I hope you've enjoyed listening and found it interesting, don't forget to check out the shownotes for links to more information on the various things we've spoken about and, if you were of a mind to, please do like, share or rate the series. If you are listening to this before Offshore Europe and are planning to attend, make sure to stop by the University of Aberdeen stand at 2E68 in Hall 2, we have lots of people from across numerous disciplines there who would be delighted to speak to you. As for me, I'll be back with another episode soon but if you just can't wait, you know what to do – visit abdn.ac.uk slash news to see all the latest stories and announcements.