**Hydrogen and the Energy Transition:** Podcast transcript

This is Collabor8, a Net Zero podcast brought to you by the ECITB. In this series we will talk to experts at the forefront of the energy transition. We will cover a wide range of topics from technologies that are key to unlocking industrial decarbonisation to regulation policy development and, perhaps most important of all, the skills needed to help industry deliver Net Zero. Thanks for listening.

**Carol:** Hello. Welcome to Collabor8: Transitioning to Net Zero. I'm Carol Sinclair, Net Zero Project Manager at the ECITB.

In this, our third podcast, our focus is on hydrogen and the energy transition.

Hydrogen is considered one of the low-carbon energy solutions and an essential element to help meet the energy transition to Net Zero.

We discussed in our first podcast that production of low-carbon hydrogen offers an attractive decarbonisation option across many sectors, especially those that are harder to electrify.

So it's important to understand that case for the hydrogen economy, including technology, social acceptance and investment needs to support delivery of the UK's hydrogen ambitions.

What actions government and industry can take to facilitate its deployment and also how do we prepare the workforce?

So today I'm really pleased to be joined by Debnath Pal of Stopford and Caragh McWhirr of Xodus to discuss hydrogen and the energy transition - providing that engineering construction industry context and considering the impact for employers and workers.

Deb is Stopford’s Director of consultancy services and brings more than 30 years’ consulting experience in chemicals, oil and gas, fuel storage and renewable energy sectors.

Caragh McWhirr leads the Xodus Hydrogen Excellence Hub and has over 20 years of experience in the energy sector. Caragh is Head of Hydrogen Strategy for Xodus globally and this role involves leading a small team of hydrogen experts, commercial engineering and market insights, monitoring policy and marketing.

So a fantastic wealth of expertise on hydrogen on board for today. Caragh, Deb, welcome.

Thank you.

So hydrogen, it's not new in the UK, but we're aware of pockets of hydrogen industry activity across the country that are long-established. But we're increasingly hearing about the expanding hydrogen economy and its role in delivering a sustainable future. So where does hydrogen for energy transition make sense and why?

Deb did you want to kick us off?

**Deb:** Sure Carol. Yeah, as you mentioned, hydrogen is not new to UK industry. It's been used for decades in the oil and gas sectors, the pharmaceutical sectors and in the manufacture of fertilisers. So it's not new.

The main difference and why we think it's going to form a big part of Net Zero achieving those targets by 2050 is that instead of hydrogen just being used as a process gas used for chemical reactions, it's now going to be used as an energy source to help decarbonise industries across many sectors.

So that's one of the main reasons why there's going to be a huge expansion in the use of hydrogen.

And as far as emissions are concerned compared to natural gas, obviously, when you combust hydrogen, you do not get any harmful greenhouse gas emissions, you just get water vapour.

So, those are a couple of pointers of why the growth of hydrogen is important for us to meet the objective of Net Zero by 2050.

The demand varies across the world. The UK government, so a couple of months ago, the UK hydrogen champion, Jane Toogood, published a report on the status of the various metrics for the hydrogen economy. And the UK government predicts that by 2050 almost up to a third of all energy demand in the UK will be satisfied or be gained from hydrogen.

At the moment it's less than 1%, so as you can see from less than 1% up to a third of all UK energy use will be supplied by hydrogen. That's a huge expansion in the manufacture and use of hydrogen.

As Carol mentioned in her introduction, hydrogen is not the silver bullet. There are lots of situations, lots of industrial applications where electrification makes more sense.

However, the sectors of industry, especially the high-temperature process sectors, such as the manufacturing of cement, of steel, where electrification is not possible, the technology to electrify those processes is at a very low technology readiness level.

So, in those - what's called hard-to-abate sectors, the only option is to use hydrogen.

The demand for hydrogen in the future will all be green hydrogen. And when we talk about green hydrogen, that is hydrogen produced using renewable power, either from solar or wind.

That powers an electrolyser, which then splits water into hydrogen, so that is green hydrogen.

Most of the projects that have been sanctioned recently in the next few years will actually be for blue hydrogen, which use natural gas.

The steam reforming process, CO2 is formed. However, this carbon dioxide is captured and is not emitted. So it's not called green hydrogen, it's called blue hydrogen. But it's also termed low carbon hydrogen.

As far as the development of the hydrogen economy in the next few years is concerned, long term, a lot of the developments will be on generating green hydrogen. But in the short term a lot of focus, especially in the UK and in America, is on the generation of blue hydrogen, which uses natural gas but captures the CO2 from the process.

The other important aspect of hydrogen and why the energy transition makes sense is its impact on energy security for countries around the world. Energy security over the past, especially in the past two years, has become the focal point of many governments due to the war in Ukraine.

Green hydrogen provides an opportunity for countries to increase their energy independence. They can use their own solar They can use their own wind power to generate green hydrogen and use that as an energy source.

That isn't strictly true with blue hydrogen. Blue hydrogen still uses methane. It's still linked to the fossil fuel market, so it doesn't really provide you energy independence compared to green hydrogen.

**Caragh:** I can see a potential beyond the UK demand as well. So while the UK has laid out some targets for hydrogen production really from 2030 onwards, increasing up to about a third of our energy supplies, the EU has gone, particularly as a response to the Ukraine Russia war, has gone more strongly towards hydrogen as part of its repower EU plans.

And by 2030 the EU is looking to import about half of its hydrogen needs from outside of the EU, which would include the UK. And that demands about somewhere between five and ten times what the UK is planning for its own production needs. So there's also an export opportunity that's coming up quite quickly for our near neighbours in the EU and our position in having both gas resource to produce blue hydrogen and storage resource from carbon that's captured from that process and in having large amounts of offshore wind which is starting to develop.

It puts the UK in a good place to build a big new energy industry targeting that export market as well.

**Deb:** Yeah, as Carol mentioned, I think there is a huge opportunity for the UK to export technology and the expertise. A big part of the hydrogen economy is that the huge scale up required from the current low levels of hydrogen production.

So it is carrying out carbon capture at scale which is quite limited at the moment and it's also upscaling how you generate green hydrogen as well and the changes required to the grid system.

In this country, it has been quite successful in generating renewable power. A lot of that is from wind and it has been a great success story of the UK.

However, a lot of the R&D and manufacturing processes in the wind industry are based overseas. So, I think a lot of the focus and a lot of the government incentives are to make sure that doesn't happen with the hydrogen economy.

That actually we are involved and the UK is at the forefront of innovation of manufacture and supply. As Caragh said there is a huge export potential that the UK can capitalise on.

**Carol:** Fabulous. And as you say, even to meet the ambitions for UK in terms of hydrogen production that's a huge scale up. So, to be going beyond that and into the export market is going to require a massive scale of investment to get us to those targets within 2045 Scotland, 2050 UK.

So what are the main active and planned UK hydrogen projects just now? What's happening across the various regions at the moment and what does that road map look like to accelerate that scale up of the hydrogen economy?

**Caragh**: The largest areas of activity at the moment are around the two carbon capture clusters that have been announced and are being fast-tracked and supported by governments.

So Hynet in the Northwest of England and the East Coast Cluster on the east side of England. Those are industrial clusters where there is a helpful combination in terms of location of demand for carbon to be captured, so from industrial sources, but also demand for hydrogen to be used.

So that by having those things close together you eliminate any issues with transport of either CO2 or hydrogen for long distances around the place.

That model of those clusters which will both involve CO2 offshore, CO2 stores, effectively blue hydrogen is a key part of those clusters because that gives a steady customer to those CO2 stores as well as the industrial sources.

And we're also producing hydrogen that can be used in those industrial processes locally as well. That's a nice neat combination because those are relatively large-scale industrial big companies involved. That's, in some ways, an easier thing to get going blue hydrogen in their side is more advanced in terms of the technology and the size and scale.

So, we can get relatively large projects going quite quickly through that mechanism but they are very specific geographies.

We've also seen, as part of the longer road map for the development of hydrogen, there are quite a number of policy and regulatory-type things starting to stack up in place and there's a road map out for those.

We've seen things like a low carbon hydrogen standard be published by the UK, which basically says these are the conditions that must be met for you to be able to claim that your hydrogen is indeed low carbon – so it is really achieving a certain standard of emissions and then that qualifies you for support.

We've seen the first round of the net zero hydrogen fund which is effectively like a contract for difference type rounds, similar to what's been used in renewables.

The first shortlist for this has been announced and that's expecting to announce about 250 megawatts worth of project.

Just to put that into context, that first round is looking to achieve something like one and a half terawatt hours annually of hydrogen production and that compares with something like 30 terawatt hours, which is our target for 2030.

So, you get a bit of an idea for we're starting to get there, but there’s still a way to go to get to that 2030 type target and those additional projects include green hydrogen projects and they are throughout the UK.

We've got a number of projects in Scotland and different locations in England and Wales as well. And so you're starting to see those smaller electrolytic power from renewables type projects starting to develop and that will just continue to scale up as more and more rounds come out.

**Deb:** So yes, as Caragh said, governments approved two of the clusters. Obviously, the ambition of the government is to provide funding for other industrial clusters. So there's a cluster in South Wales, the West Midlands, the Humber as well as Scotland.

Hopefully this first round of funding is just the start for two of the clusters and that will expand. I think the timetable is that definitely by 2030 the first two clusters, Hynet and the East Coast will become operational. So 2030 hopefully those plants will be up and running, capturing carbon and generating blue hydrogen.

The other advantage I think of tackling it from the perspective of the clusters is obviously in these large industrial zones within the UK there is already a skilled workforce in those areas.

A lot of these projects are existing operational plants. There's obviously an expansion of resource required and there may be some transfer of skills required as well, but I think it just makes the transition a bit easier as well.

There's recently been new funding to look at the generation and the use of low carbon hydrogen outside the industrial clusters as well. This is crucial because if they are to be viable businesses going forward, (i.e. how are they going to decarbonise their processes in the next 5 to 10 years) however outside the clusters different solutions may be required.

An important aspect of decarbonising the UK will be what happens outside the clusters and also that that plays into the skills and the resources required which will be a challenge as well.

**Carol:** Yes, everything just needs to be brought along in parallel, doesn't it? The clusters being heavy emitters, they are a priority, but actually, as you say Deb, there is hydrogen-related activity that's required across the country in support of a wide range of end uses. So for this sort of scaling up, what do you see as the main challenges for the realisation of these hydrogen projects?

**Deb:** Yes, over the past few years the government has invested quite heavily in undertaking and facilitating trials in the hard-to-abate sectors such as the cement industry and the mineral sector to see if hydrogen can be used instead of fossil fuels in their processes.

This has been a very successful programme. Hydrogen can be used in these hard-to-abate sectors. The main barrier for its continued use of hydrogen in these sectors is the cost.

Hydrogen is just too expensive at the moment. There's also a supply issue with green and blue hydrogen. So the commercial aspects of making hydrogen competitive is a challenge in the short term. Across the world there's different tax being taken on by governments.

Last year in America they place they passed the IRA, which is known as the Inflation Reduction Act, and this has provided an enormous boost to the clean energy sector in the US. It has provided federal funding of about $370 billion. On top of that, it also provides a very healthy tax incentive for every litre of sustainable aviation fuel.

For every kilo of clean hydrogen that's generated, you can get up to $3 per kilo as a tax incentive. So this is huge. It is a game changer. A lot of other countries are playing catch up.

The Europeans are going to be setting similar incentives to the IRA, although not at the same scale. And the UK needs to do something similar to ensure that the UK gets its fair share of world investment and capital to ensure that the capital doesn't all flow to the US and Europe.

That is extremely important for the commercial incentives to be set in the UK to further develop the UK's hydrogen markets.

Those are the commercial aspects. Earlier on Caragh also mentioned the huge infrastructure that is required in the UK to meet net zero by 2050.

In order to build the infrastructure required, there's obviously the skills and the number of skilled people that's required to ensure that the infrastructure is built effectively. But also there's a regulatory aspect to this. With these projects there's potential bottlenecks with the planning and permitting process.

The planning and permitting process needs to be fit for purpose. It needs to be as efficient as possible so that it doesn't create additional barriers for investment into the UK and it doesn't cause excessive delays for these large infrastructure projects that are required for us to meet net zero by 2050.

**Caragh:** And I think some of those challenges are not specific to hydrogen. They're related to the fact that we're trying to transform entirely our energy systems and get our energy across the board from different places than we've been used to in the past.

That's across all energy industries, reaching into the consuming industries as well, into transport, power generation world as well. Huge scale of change.

That in itself, hydrogen is one of the parts of that is going to need a lot of effort, maybe not wild reskilling, but a lot of movement of people from industry to industry as older energy industries reduce in terms of what they're producing and these new energies take off.

There's always that old energy trilemma problem of everyone wants cheap energy, low carbon energy and secure energy and trying to hit all three of those has always been a challenge.

Hydrogen isn't any different there, it just has a slightly different place. Its challenges in some industries could be competing with other sources of energy and writing off those other sources might be better matches and it will find its place.

But there's going to have to be a constant focus on those three things and making sure that we're getting it as cheap as we can, making sure we can provide that security of supply and also making sure that we are indeed producing low carbon energy through monitoring and regulation around that.

**Deb:** Definitely, and as mentioned before, it's a huge impact and the huge investment required in the infrastructure that is needed for hydrogen.

As Caragh said, we've been used to for decades and decades of using fossil fuel and the end use everything is designed around the fossil fuel system. So it's a huge change. I know the previous podcast that Carol conducted was on project collaboration, which was about how to get successful projects to deliver at the end.

I think that is key because these are huge infrastructure projects across the UK so it would require more collaboration, which perhaps hasn't been visible or hasn't happened on large projects in the past.

There's been a lot of projects that have overspent that have run behind schedule. If we are to meet net zero by 2050, there's going to be a lot more of these mega projects and they need to be delivered more successfully.

So collaboration is, is a key aspect of that across the different stakeholders. And then from there we get on to, I suppose, it may be considered one of the biggest challenges, but it is the skills required to build the infrastructure that is required as well.

**Carol:** Absolutely. You know, looking at some UK government analysis, the hydrogen sector could support over 12,000 jobs and by 2050 it could increase to 100,000 jobs. And that's just the hydrogen sector.

As Caragh mentioned, we need to look at that in the broader context of the full energy sector. There's going to be significant workforce demand, so that's going to require transitioning and repositioning of existing workforce but also a requirement for increased volume as well.

We're seeing a significant workforce demand and support. What do you think this means for engineering construction, for skills in the short, medium, long term?

Caragh: I think in the short term, as you said, there are relatively few projects being built now and there'll be a bit of a slow build up.

We're already seeing though a lot of interest. For example, I'm working in the oil and gas sector in Aberdeen which is obviously heavily involved in oil and gas and we see a lot of interest from people in understanding how their skills as maybe process engineers or safety engineers or subsea pipeline engineers, how those translate into a world where hydrogen becomes a reality. And we're starting to see early phase type studies happening looking at how these projects could develop.

Lots of different ideas. There will be a lot of exploration as to how do we construct these plants and what type of projects make sense in terms of where we locate the production facilities; how do we export that hydrogen into other areas.

We're certainly seeing study type work in the short term and technical knowledge needing to be developed so that those studies can come up with good answers.

So within Xodus we want to make sure we can give good advice. We need to make sure that we understand what the needs are and then maybe in the medium to long term we will start to see these projects really begin to take off.

We should see the first tranche of the projects supported by the National Hydrogen Fund start to be constructed about 2025, which isn't that long, and then that will grow.

Expect to see a more distributed energy production system than we've got at the moment because we will have a hydrogen production on the green hydrogen side likely located close to where the renewable energy resources.

That could be near large onshore wind farms or offshore wind farms that are in coastal areas with good access to offshore wind. Could be nuclear, associated with nuclear plants but I think we will see areas which haven't had that energy production local workforce start to be a reality, as well as, as Deb said, existing industrial areas being used as some of the production sites.

That comes with it all the construction side and then the operation of these plants. There's a lot of crossover with existing either chemical, oil and gas, any processing plant type skill set - that's what these hydrogen production plants are.

They will involve a lot of pipes and pumps and compressors. There's a lot of water handling. I think the water industry is going to be a big place to learn from and to take skills and knowledge from because you cannot produce green hydrogen without water. That's what you're making it from.

The transfer of skills from different areas for sure but net, it's an expansion of that type of skill set from what we've got today.

**Deb:** Yeah, definitely. And it's across the whole supply chain. It's from the manufacturer of electrolysers through to the storage of hydrogen as well. The UK has very low capacity to store natural gas for example.

For the hydrogen economy to grow and to be robust the storage elements need to be resolved. There's obviously a lot of work being done on using or converting old salt caverns, using liquid organic carriers.

There's also work being carried out in the North Sea on deployed, depleted oil fields as well for areas where hydrogen could be stored as well. So it is across the supply chain from the generation of hydrogen through to its end use.

As far as the impact on jobs and development, I think, it does start with the innovation side, the collaboration with the universities, which is already happening to a high degree.

Obviously the UK is well established as far as having world-class academic institutions. It is about the whole supply chain.

The issue at the moment is estimating the demand over the next few years. We all know what the estimates are required as far as hydrogen production is concerned in 2050 to meet net zero.

But what’s going to happen over the next 5 to 10 years and the resources required in which sector is more difficult to predict.

**Carol:** We'll have some skills research and activity ongoing. We’re seeing the IDRIC supported research not only into all the technologies, as you mentioned Deb, working in partnership with the universities are also looking at that skills for industrial decarbonisation and drilling into the hydrogen economy as well.

We’ll see ECITB's forthcoming demand-supply modelling for workforce demand, based around various scenarios that will help to inform that nearer term picture. And maybe that work of the Hydrogen Skills Alliance looking at the forsighting around the different technologies’ implications for skills and picking up on those elements that Caragh was saying about, people working within other areas of energy and process industries what further knowledge do they need or top up of experience or exposure do they need for working in new areas of the energy sector?

**Deb**: A big part is the numbers. I think the skills required that's quite easily mapped. It's the numbers, the shortfall, that is the challenge.

Obviously, there are various initiatives. There's the apprenticeship schemes and I think in the short term it's making sure that these existing schemes are fully utilised.

There's obviously a lot of work required to get people interested in getting into the profession because in the short to medium term there's obviously a huge numbers gap.

It's how that is resolved that will be key. So I think understanding why there isn't the required number of candidates going for apprenticeship is quite key, obviously that goes back to schools and how the sector is being explained or portrayed.

I think the advantage is that the younger generation, the Gen Z you know, my teenage son, they are very passionate about net zero.

The other aspect that we need to be aware of as far as the skills and the numbers, is the demographics as well. Currently in engineering, in the chemical sector, the oil and gas sector there is an ageing workforce. So that also needs to be factored in when looking at what the gaps are, the numbers required.

**Carol:** Absolutely. Apprenticeships are absolutely fantastic as a new entrant route but also needing to pump prime in other areas. In other entry routes I suppose into industry whether that's through boot camps, work ready programmes and careers transition from other sectors and backgrounds.

I think probably just the young people coming through the education system, the volume is not going to be sufficient in itself, is it?

**Deb:** No

**Caragh:** It’s a struggle, collectively, to make the engineering world a really attractive place for people to go for. If you call to vocational drive that people have, and I think this is a good chance for people to see that there's something they can get involved with, it's got a long-term future and that is helping us meet those Net Zero ambitions.

There's a big whole career opportunity here that's also doing good in terms of helping us reduce our emissions and help keep us as close as we can to the warming pathways we're trying to hit to avoid the disastrous consequences of global warming.

**Deb**: Exactly as Caragh said I think key is to ensure that there is a more diverse workforce in engineering and construction.

There is an obviously large percentage of the population, for whatever reason, isn't interested at the moment in entering these types of careers. So we definitely need to change that and I think compared to many countries across the world probably the number of women in engineering is actually quite low compared with most European and other sort of G7 countries.

So again, if we are to meet the Net Zero targets and deliver the infrastructure projects required then there definitely needs to be a more diverse workforce to make sure that we make the best use across the board of who we have across the different aspects of the education system as well.

**Carol**: Excellent. I think probably those points that Caragh, Deb that you've just brought us round to in terms of that attractiveness piece and the diversity of the workforce and making engineering careers an attractive prospect probably rounds us off quite nicely in our discussion.

We’ve set that overall scene of the hydrogen economy and its huge expansion that's required to support industrial decarbonisation, where we're starting to see activity ramping up, what are the challenges and then really drilling down into that skills piece. I think that draws us nicely to a conclusion.

Do you have anything else that you would like to see or add before we finish up?

**Caragh:** I see lots of opportunity and lots of excitement to be had for getting involved. So, share the story with people that you think might be even slightly interested in getting involved in the industry because I think there's there is lots more to come.

**Carol:** Thank you and Deb.

**Deb:** On the same theme as Caragh mentioned really - as an engineer it's really an exciting place to be really – energy. Because it could go down so many different routes to meet net zero.

Hydrogen's got a very important part to play in that. But there's so many different types of technologies, so many different ways that hydrogen can be stored, can be distributed, there's different types of carries of hydrogen.

So it's a very exciting place and area to be involved in and going forward it requires a lot of innovation as well which should hopefully help attract the younger generation into this field.

**Carol:** Wonderful. Well, goodness. Thank you both so much. I really appreciate your time and sharing your knowledge and expertise and I appreciate your time today. Thank you.

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