Note: this transcript has been produced verbatim and includes all the quirks and idiosyncrasies of the speakers.

Steffan
Connecting for positive change. Hello, everyone, and welcome to the second episode of the Hydrogenerally podcast series brought to you by Innovate UK KTN. So I'm Steff Eldred from the Clean Energy and Infrastructure Team at Innovate UK KTN. And along with my colleague, Simon Buckley, who leads on zero emission mobility, we'll be with you throughout, along with our guest for today's episode. So we've made it to episode two, we had a great discussion in episode one, with Sam French from Johnson Matthey. So if you missed that, follow the link on the page to a really useful sort of back to basics view of how hydrogen is produced and what the colours mean. Before we get into today's episode, just remind us about the podcast and the network Simon.

Simon
Yeah, thank you, Steff. So the Hydrogenerally Podcast Series, we are the voice of the Hydrogen Innovation Network, Innovate UK KTN. We're primarily looking at applications, opportunities and the challenges of the hydrogen economy. And we're trying to enable local clean hydrogen uptake at scale and make sure that that is at a comparable cost. To help that we need to find novel solutions in technology and business models. If you haven't already, then please go to the Innovate UK KTN website through the link in the description and sign up to receive newsletters and updates. You'll also find previous and future episodes of the podcast there too. So, over to you Steff.

Steffan
Cool. Thanks, Simon. So yeah, in this episode, we continue with our sort of back-to-basics approach, but we want to delve a little bit deeper now to understand where hydrogen should be used. So rather than could be used, as with any technology or fuel, sometimes we find discussions can get carried away, implying that they're the solution to all things. But I know Simon and I and I expect our guest today believe passionately that we should ensure we use hydrogen where it can be most effective for decarbonizing energy, industrial and chemical industries. Simon, do you want to add any further thoughts? I know you're you're keen on this or you want to jump straight in and introduce our guest.

Simon
No, I mean, I completely agree with what you said, it's a very complex issue decarbonisation. And we haven't unfortunately, got unlimited energy, so we need to be careful about how we use it and where we use it. And to help us understand this a bit more today we're really pleased to welcome a real experienced guest in this field. Joanna Richart is the Head of Hydrogen Business at Ricardo. So Joanna, would you like to tell us a bit more about yourself and your role?

Joanna
Hello, well, first of all, thank you very much for inviting me to share some of my thoughts on the hydrogen industry. I'm really looking forward to the questions you have prepared. So my role at Ricardo is quite reaching across our units. So from energy divisions, where we are looking at all the mixes of, is it really hydrogen the answer? So the sort of questions you allude. The energy is not unlimited. So that part of our business is looking at is it energy? Is it hydrogen? Is it batteries? And then I lean on to our engineering division, which is more

looking at the practical applications, the solutions and helping companies bring more buses, more cars, more aeroplanes, more boats, with the hydrogen as a powertrain.

Steffan
Thanks, Joanna. Yeah, let's, as is the format for these, people will hopefully be starting to get used to this. Now we've got a few questions to prompt the discussion, but hopefully, we'll just have a good conversation about where it should be used. So without further ado, Joanna, to maximise impact, where do you think hydrogen should be used? Is there a kind of priority order that you have in your head for it?

Joanna
It's a very, very interesting question and I'd probably fire back with a question because when you say to maximise impact, impact on what? Is it impact on hydrogen pricing? Is it impact on the global economy? Is it impact on my life and your life? Ultimately, if the global economy adopts hydrogen it will impact us all. But on a personal level, the best impact I will see, is if I can sit on a bus, that takes me to work and it's hydrogen powered. But on a global level 44% of hydrogen is utilised in the industrial applications. So, if you're talking about what to industrialise first, in order to have biggest demand of hydrogen sorted, probably industrial will be the first sector.

Steffan
Yeah, I think that's an absolute fair, fair challenge and great to come back with that, because it can mean, you know, when we have this conversation, it could mean different things to so many different people. I think personally in my head, and I think for the Innovation Network, when we talk about sort of maximise impact, I'm thinking about about decarbonisation really, so sort of whether that's UK or global, but you know, what's the biggest impact on decarbonisation? And where can hydrogen play the biggest role in that?

Joanna
I think we all know the numbers for a different industry, what percentages of, you know, decarbonisation, they can play. And I think lots of the global roadmaps are following that pattern. So the industries that are the most polluting are being pushed hardest to start decarbonizing first, but then that is probably the level of the biggest impact might be where it's easiest to implement. So let's say automotive industry, there is definitely a lot of cars on the road but in order to change them all, is a massive task. Meanwhile, if we're looking at it more local level, and the buses that go in city centres cleaner zone, it's probably a lot more enclosed environment. And therefore, it's a lot easier to combine the supply and demand and actually make the change happen, be it on the local level, but it's something that can be done and in my mind, the biggest impact is when the talking stops and doing starts.

Steffan
Yeah, great. Thank you. I mean, a picture I've got, in my mind is I'm sure you're familiar, and our listeners will be familiar with the clean hydrogen ladder, sort of picture from Michael Liebreich, where, you know, it talks about the the industrial side, fertilisers, that type of thing where it's, you know, it's a no brainer, absolutely hydrogen is going to sort of win out there. Whereas as you move down, and you get through shipping aviation and then into sort of local urban, you know, transport solution and that type of thing. It's, um, you know, it just doesn't necessarily make sense, or it's not competitive against other solutions. Yeah. Have you got any thoughts on that Simon?

Simon
Yeah, I was going to add in on the bus front, because obviously, there's two technologies at play and they're actually, they combine really nicely as well. So we should acknowledge that. But there are hydrogen buses, or there are electric buses. There are hydrogen HGVs, there are electric HGVs. And I think those use cases must be really important, depending on what energy source you're going to choose. So do you have any thoughts on what would be most suitable for hydrogen? In terms of like that use case maybe?

Joanna
Well, I think we have already seen that happening in real life, and we don't even have to go abroad. So we have seen buses working perfectly fine in London, where you have lots of traffic, therefore, they crawling around the whole day. And very often, the batteries are fine, the routes are shorter. So perfect, batteries will do it. The same buses were taken up to Liverpool where it's a little bit more hilly and actually less congested, the buses start going faster, therefore the energy consumption goes up and the same bus just doesn't do the daily route. And that's the same pattern that's happening everywhere around the world. So we see people from Cyprus come and go, forget about electric buses, we have so many hills, that just electric buses wouldn't be applicable. So indeed, that sort of looking at the duty cycle and application and finding the best solution is really, really good. I would probably point out also another aspect, and that's the whole TCO. Because very often, people still feel like batteries will be cheaper. But actually, we have done several simulations now for people when you balancing the size of the battery versus the size of the fuel cell, and you involve the ageing effect. So very often, the batteries if used too much as well, it gets aged very quickly and then you need to start replacing them a lot faster than when you use a hydrogen fuel cell. So looking at it, not just the end user case can it do day one and day five, but can it do in one year's time? And what impact does it make to the end user from the cost point?

Simon
Thank you. And what would you say to those people who say that you need kind of three times or four times as much energy to run a vehicle? If you're using hydrogen versus electrics, you might be able to have three electric buses versus one hydrogen bus. What would you say to those people?

Joanna
I think the people who need to buy three electric buses versus one hydrogen bus already have the answer. They probably know the hydrogen bus will be a lot cheaper than three electric buses. But, again, we don't like to generalise because it's really case by case. So we always advise people before you go into any implementations, any city, just stop for a while, do that energy analysis. Do you even have enough electric connections? Will you be able to charge so many buses? One or two is fine. If you suddenly have 300. Is it not just better on the global landscape to have a hydrogen refuelling station, that filling time is a lot shorter? So you need to look at it from the whole supply and demand together and not just the buying three buses versus one bus.

Simon
Okay, thank you. And then aviation, maritime, something the Government is focusing on and how to decarbonize, they're really hard sectors to decarbonize. So what do you think hydrogens role will be in those two sectors?

Joanna

It's brilliant that you asked that. It's one area where we now see a lot of demand. It's precisely that, like you say, it's hard to decarbonize, so people need a lot more energy packaged on board. So marine is little bit tricky, because it's a massive number of options. So very often people just say marine, but they don't realise the differences that there are between small taxi ferries versus, or massive sort of Viking Cruises type of ships, they will all have very different energy demands, they all going to different ports, different routes, we don't have all the cargo and the bunkering. It's a huge industry. So just trying to cover it here in few minutes on the podcast is very, very difficult. There might not be just hydrogen, they will be ammonia. So that energy mix there is very worried hydrogen will definitely play a role and can play a role and we are already seeing applications of multi megawatt on some of these big ships looking at using hydrogen. So marine definitely, aerospace as well, big demand now, the beauty of hydrogen fuel cells over batteries is that actually you can get a lot less weight and therefore you can fly further with the same sort of payload. And that to people who want to fly, matters. So can they carry the passengers? Can they fly from A to B? And it needs to be done very safely. So finding companies who can do that sort of support of safety, hydrogen, it's all very novel. It's very tricky. But the demand is there and people who are starting to play in that field will definitely see lots of business coming their way.

Steffan
I was interested to move on to aviation and shipping because I thought your favourite topic of buses was clearly going to come up at some point. So I think it was around that previous conversation, I just thought maybe I'd jump in with a shameless plug, really, which is just to say that I think I think Ricardo and KTN probably share this, this sort of overlapping view that it's not all about one and not the other. So in terms of batteries and hydrogen, they can work in harmony. And actually, we need to make sure we're working together to develop the solutions. So the shameless plug comes in to say that actually, we have a sister Innovation Network here at KTN, which is the Cross-Sector Battery Systems Innovation Network. So again, you'll be able to get details of that on our site and then on shipping and aviation. We feel it's such a sort of key topic, really and as you say, Joanna, we probably can't do it justice in, you know, a small part of this podcast. So we're aiming for the next episode to focus on those two sectors specifically because you know at KTN we've got a lot of a lot of good friends in those areas, people like Zero Avia, and many others, which we're sure we could think of. So what do you think Joanna, these sort of sectors or hydrogen I suppose for these uses will look like going forward? So perhaps to 2040 or something like that? What do you think the picture will look like then?

Joanna
It's very often people think in sectors rather than in countries and I like to kind of reel back, there will be more sort of national approaches and you can see it in maritime you know, you have The IMO, which is making targets for 2050. Now, they might be revised next year in 2023, to see whether they bring some of the decarbonisation targets forward. But actually, some of the nations like the EU and other nations Norway etc, are imposing their own national legislations, which basically pushing that industry forward. And they don't do it just for one, they do it across sectors. So how will the sectors look like? There will be applications available in every one of those sectors, but not necessarily in every country address at the same time.

Steffan
Yeah, okay. No, absolutely. Makes sense.

Simon
Okay, so, yeah, and how can the government help those sectors? And you've just mentioned the country area as well.

Joanna
Yes, those sectors, I think any sectors and there is always that little bit of stick and little bit of carrot. If the stick is big enough, then the industry will do something because they have to. And it's the unfortunate thing so far, I think there is not that many people who decarbonize because it's a good thing to do. They decarbonize because they see some stick, and those who are really clever, they also find the carrots, which the government issues in terms of various subsidies, and then they align their strategy along with that and become the industry leader. But I think where government could help more is maybe trying to find two things. One is applications where they really tie the industry more together the supply and demand side, we still see that is quite a lot of programmes which goes on do a bus or do this, there is a start of that. So we have seen the Teesvelley coming with the station coming with some of the applications. But I feel that is more of that car needed. So we can have that network of hubs, which then they all kind of have their own ecosystem and slowly start spreading that hydrogen in divided regions. So trying to make a more level playing field, not just one hub, more hubs and at the same time, more level playing field on the subsidies. So the example I would give here is, for example, the retrofit for buses. So few companies doing it, Ricardo is doing it as well, but we are struggling, because there are currently subsidies for new buses but no subsidies for retrofit. So from the taxpayers point of view, same amount of money can either buy twice as many buses which are zero emission, or half of them. But right now, the subsidy is pushing everyone to buy the new bus instead of two retrofit ones. So having the level playing field, if that receipt in money for retrofit, that should be the same same money as for the new buses, so everybody gets a chance to do something. The other area where I see is not so level playing field is for example, the renewable hydrogen funding. So if you're using renewable hydrogen for buses, great, you get, you get the offset and it's quite large, you get quite a lot of money per kilo of hydrogen. But if you are a test house like Ricardo and we running 400 kilowatt facility on our hydrogen engine, another 400 kilowatt on fuel cell, we are not eligible, because we don't run a bus. And yet the consumption of hydrogen is very, very large. And it's not very good for the business because if we can't access the green hydrogen, then we will be using blue hydrogen, other alternatives and it's just not helping the industry. And it's not helping us as a business. So level playing field. I know it's very hard to achieve but as long as the conditions are the same for everyone, I think it will help everyone.

Steffan
Great, thanks. Yeah, no, that very comprehensive answer there. I think particularly the retrofit one really strikes a chord because I think that's key not not even just hydrogen, not just transport, you know, it's the same in decarbonisation of buildings, all sorts of things. Retrofit needs to be given a fair chance to, you know, to compete. I've just noticed the time to be honest, it's amazing how time flies when you're having fun. So thank you so much, Joanna. It's been great having you along today, and great to sort of discuss where we can maximise the benefit, whatever that might be if it is decarbonisation or otherwise. Thank you everyone for listening. Any links mentioned today and a direct link to the Innovate, UK KTN website have been added to the description. Don't forget to sign up to receive the newsletters and updates. And as I said earlier, actually in the next episode we'll be delving into the specific use cases of aviation and marine. So thanks again for following us and please come back for more and bye, goodbye. Connecting for positive change.