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Introductory Jingle

Innovate UK KTN connecting for positive change.

Steff

Hello again, listeners, and welcome to Episode Seven of the HydroGenerally Podcast, brought to you by Innovate UK KTN. So if you listened to the previous episode, then you'll know that I'm Steff Eldred. So I'm part of the Clean Energy and Infrastructure Team at Innovate UK KTN and also lead on our Hydrogen Innovation Network. Regular listeners will be well used to this by now. But just in case, you've stumbled across episode seven and jumped in straightaway here, then the HydroGenerally Podcast Series, it's the voice really of the Hydrogen Innovation Network, Innovate UK KTN. And what it's about is applications, opportunities and challenges for the hydrogen economy and how we sort of help to enable local, clean, hydrogen uptake at scale. And hopefully, try and find novel solutions or help to find novel solutions for these. If you haven't already, then if you go to the Innovate UK KTN website, there'll be a link in the description for this. So if you go to the website, then you can sign up to receive newsletters and updates there. You'll also find previous episodes and going forward to future episodes in there. So six episodes so far, we've covered hydrogen production, where it should be used or where you get the sort of biggest bang for your buck with hydrogen, in terms of decarbonisation, talks about marine, aviation and glass. The last one was slightly different, we stepped away a little bit and went to sort of Waste-to-X or Waste-to-Hydrogen. Today, we're going back into a sector but a pretty broad sector. So heat, and obviously hydrogen for heat. So with such a large area, I'm really glad to have a safe pair of hands on all things heat with me today, Jenni McDonnell. So Jenni, yeah, hope you're well. Can you introduce yourself to our listeners and tell them a little bit about your role? And then we'll get into introducing the guests for today's episode.

Jenni

Yeah, sure. Hi, Steff. It's great to be able to take part in the podcast today. So hi, listeners. As Steff said, my name's Jenni McDonnell, and I Lead on Thermal Energy at KTN. So I try to keep up to speed on all the new innovations being developed in heating and cooling, within homes, businesses, all the way up to heavy industry and manufacturing, that includes things like heat pumps, hydrogen boilers, solar thermal, bioenergy, but also the systems that support it. So thermal storage distribution and the end use applications. So if it relates to heating and cooling, then I'm interested. And I'm very pleased to say that we have Jeff House with us from Baxi Heating today. Jeff is a fountain of knowledge on all things heat related and is well up to speed on the move to hydrogen within this field. So Jeff, I was wondering, could you just introduce yourself and your role at Baxi for us?

Jeff

Absolutely. Thank you, Jenni. And good to talk to Steff, as well. So my name is Jeff House. I'm Head of External Affairs at Baxi Heating UK. So you'll know us in the UK for being Baxi Boilers effectively, but we have a whole range of technology across both the domestic and the commercial heating sectors. We're also part of BDR Thermea Group at a global level. So you might have seen some hydrogen talk around Europe, especially under the BDR [PLEASE CHECK], it's effectively all the same organisation. So my role really is looking at

policy and regulation. So I've been very close to hydrogen for a few years now, we've been part of the Hy4Heat Programme. But in terms of overall industry engagement, I've been in the industry for 23 years now, in a variety of sort of technical and regulatory roles. So a reasonable amount of experience to look back on.

Steff

Great, yeah, thanks both. Thanks for joining the podcast today. I will certainly very much value it today with the expertise. Just Jenny, before we get into the details and probably start bombarding poor Jeff with questions. Can you give us a quick sort of overview of the current drive towards decarbonisation of heat and where hydrogen fits into that?

Jenni

Yeah, sure. So for a long time, the government was focusing on decarbonising electricity. But in the last sort of four or five years, that focus has switched over to trying to decarbonise heat. Even today, 14% of the UK's carbon emissions relate to heating and powering needs in the home. So there's still quite a lot that we can do. The government had their heating building strategy that came out in October last year and that talks through some of the solutions, so that heat pump rollout 600,000 heat pumps per year being deployed by 2028, and also heat networks. But the other thing that was included in there, which led to this podcast today was hydrogen for heating, 85% of homes are currently on the gas grid. So getting them to switch to a low carbon gas as the strategy laid out by retrofitting homes by 2035, they're phasing out, being able to put in a new natural gas boiler. So that's not that far away. And actually exploring what the easiest way of changing your low carbon heating for your home is something that we're trying to help innovators to develop.

Steff

Cool. Thanks, Jenni. Yeah, it's really not that far away at all. I suppose it also links in with some other work we've done at KTN with the UK Science Innovation Network in Canada around sort of hydrogen and gas blending standards, you know, into the gas grid and the gas that's going to feed into these homes ultimately. So, yeah, that's great to start us off. Jeff, just in relation to hydrogen, what are the options for heating and hot water in homes, obviously. So could you sort of set the scene for us a little bit?

Jeff

Yeah, sure. So I mean, Jenni mentioned that 85% of homes are on the gas grid, and a decent chunk of the commercial building stock, or the non domestic building stock is also using gas for heat and hot water uses. So in terms of numbers, that's roughly 22 million homes. So it's no mean feat to get those onto something else. We absolutely have to move away from fossil gas, in order to meet net zero, there's no sort of option to keep that going forever. So 2035, as a phase out of the sale of standard natural gas boilers. That, for us, is a fundamental question for the business. It's something we've been very, very conscious of for the last few years. And we're in the midst of a real transformation really. So alternative options, you've got hydrogen, which we're talking about today, we've got electrification in the heat pumps. So it's not necessarily all heat pumps, there will be an element of direct electric as well in the right circumstance. Importantly as well, low carbon heat networks. So that could be driven by heat pumps and electrification, it could be driven by hydrogen, it could be driven by a mixture of both. But again, you know, the prevalence of heat networks will certainly start to ramp up in line with the government's ambition. So instead of hydrogen

then, effectively, what we're doing is taking a natural gas platform, a boiler range that we currently have in the market, and then seeing how we can adapt that to burn pure hydrogen. So the idea being that it operates in much the same way as a natural gas boiler today. So it looks the same, it's about the same size, it offers the same sort of performance and output. So you don't necessarily have to go about making changes to the housing stock to make it suitable, you can keep the same heating system, you can keep the same radiators. And if you've got a combi boiler, you don't have to worry about finding space for a hot water store. In several million homes, that is gonna be a big barrier to cure heat pump adoption, because homes have been built without space for storage cylinders, or storage cylinders have been taken out and then replaced with storage cupboards or even, you know, being added into rooms. So that's something we're quite conscious about. The main thing really is, from a consumer perspective, it's much the same, low disruption and that's the benefit really, in some respects, but it's also quite a different proposition to the other options, as hydrogen will be quite infrastructure driven, it'd be more of a top down, roll out more so than a consumer choice. You can't necessarily go to your favourite trade counter today and say can I have a hydrogen boiler please? You need the hydrogen coming down the pipe to make that play, really. So that's gonna be one of the key differences.

Jenni

That's great. And I know, Jeff, that Baxi is involved in some great projects to demonstrate 100% hydrogen boilers. What challenges have that highlighted and what still needs to be overcome do you think?

Jeff

Yes, so through the government Hy4Heat Projects, we've had a number of demonstration units around the UK, we also have demonstration projects around Europe as well doing sort of similar concepts. So what we've done is we've taken the hydrogen prototype. So again, we've said it's a boiler, what looks like a boiler, works like a boiler but runs on pure hydrogen. So there's no carbon output, so it's zero carbon at the point of use, which is obviously the reason for doing this. But it operates in much the same way. However, what looks fairly boring, stick it on the wall boiler and that's the whole thing, you know, it's familiar, which is the key thing. There's some really cutting edge innovation behind the case, in the internals of the product. So first and foremost, we've had to deal with the differences in hydrogen combustion, versus natural gas, so it's a different gas type. It reacts in a different way when you burn it. So we've got a higher flame speed, which means there's some stuff and resilience of burners and such. There's a higher volumetric flow rate. So the Wobbe Index for hydrogen is different to that of natural gas. So it's about a third of the energy density, so you have to move a higher volumetric flow through the product to get the same output. And I guess probably one of the bigger ones is flame detection. So today's natural gas boilers you're using ionisation current, so you'll pass an electric current over the flame, which effectively reacts with the carbon and you get a signal to prove that there's a safe flame being developed and working. With hydrogen there's no carbon, so you can't do that. So flame detection is probably one of the biggest changes we've had to make. So that's the internals then. So there's some key differences there, pretty much, you know, the burner, and some of the gas facing components have had to be completely redone. Then he starts to look at the output. So flow rates for a combi boiler, outputs on the central heating side, are very much the same as you'd get from a condensing boiler, which again, is a really big positive benefit, we still do have products of combustion there. So one thing that's interesting

is that the dew point for hydrogen is actually higher than natural gas. So you get a lot more condensing operation across the whole range of outputs. But that means you get more condensate produced as a result. So that's interesting insofar as we managed to handle that through the standard sort of condensed trap and drain situation. But it's something that we need to have a look at for sure. In terms of outputs in the flue, we've got a combustion process. So even though there's no carbon in the fuel, and we've got no carbon dioxide coming out, which is the end goal there, most of the flue output is effectively warm, moist air. But because you've got oxygen, as part of the combustion process, there is an element of NOx in there, because you can have oxidised nitrogen as a result of the process that goes on there. That's often raised as a concern with hydrogen based upon some pretty old American studies looking at commercial plant and atmospheric equipment. With a condensing design, which is what everybody in the industry is working on, we're all seeing very, very low levels of NOx, in our particular case, less than half that of our best condensing gas boilers. So it really is a negligible issue and not really something worth even discussing, to be fair, it's something that as we start to come forward with commercial launches of products and full technical data in the public domain, that will very quickly go away.

Jenni

I mean, that's good to know. Because air quality, again, is another big issue for the government and I have heard that raised as an issue before, so that's good to know.

Jeff

Yeah, as always, with these things, there's a lot of information that's perhaps out of date that's regularly regurgitated by people in the industry that aren't that close to it. So they sort of take it at face value. But there's more to come on hydrogen that will help to dispel some of these myths for sure.

Steff

Yeah, cheers. That's really interesting. I was familiar with the flame detection issue. I didn't know about the difference in dew point, so I should imagine that'll have some pretty big implications as well, and some industrial applications with stacks and things like that. But that's probably one for another day. Given that the switch from natural gas to hydrogen is, as you highlighted, in theory, should be fairly pain free for homeowners. As you said, there's a lot of very high tech kit behind the box, but hopefully, for homeowners, it's still a boiler on the wall as they're used to. And, you know, certainly compared to other options, like heat pumps and stuff that should be fairly straightforward to them. Do you have a feel for what sort of percentage of homes we think might switch in the 2030s? And then just on that, is that likely to be limited? You know, I guess to start with, maybe it needs to be limited around some of the industrial clusters, or do you think, you know, all 23 million homes currently on the gas grid can switch to 100% hydrogen?

Jeff

Great questions there. Thank you. That's a really interesting one. So from a technical perspective, there's no limitation on the number of homes. So if you're on gas today, you can take a hydrogen boiler tomorrow, the operation and such is very much the same. The industry is gearing up towards zero production. So production volumes are not concerned at all, you know, we do big numbers day-to-day as a matter of course. What we need to be mindful of, there's a couple of factors that play into this. So one is the Fifth Carbon Budget

and that leads on to the requirement for 78% emissions reduction by 2035. So hydrogen conversion at scale could well be underway by then. But it's not going to give us the emissions reductions to get to 78% in that time scale. That's why we're starting to see a lot of demand to get the heat pump market to mass market pretty quickly. Jenni mentioned this target of 600,000 installs per year by 2028. So complete one to one switchover for a home, you know, for all the homes on the gas network to hydrogen is probably unlikely in that regard. We can see it being a much more of a split between heat pump hydrogen and heat networks in the future. The other constraining factor, which leads us to the industrial clusters bit is going to be the quantity of clean hydrogen that's available. So there's gonna be a bit of competition for different use cases and there's obviously industry, aviation, HGVs, etc, all sort of vying for that space. So I think we'll start to see conversion really geared around the clusters because that's where the infrastructure investments are going in, in the short to medium term and that's where we start to see volume. I think another point to add into this, a really interesting point of reference, we've mentioned the heating building strategy. We also had the UK hydrogen strategy last year. And that covers all different use cases. But the interesting bit tucked away in there is demand scenarios for hydrogen by sector. And tellingly, the 2050 figure for heat is anywhere between zero and 210 terawatt hours per year. So that gives a fairly broad spread of demand. Because obviously, we could end up in a situation in 2026, where the government says, look, we're not doing this, however, it's highly unlikely, or it could be, full steam ahead, let's go for it. But to put some context on 210 terawatt hours per year, that's about half of the total domestic building heat loads a day. So there's potentially very big numbers in the future but there are constraining factors that we need to be mindful of.

Jenni

I was actually at an event yesterday with a food manufacturing sector, presenting to them and I told them to keep an eye on the winners from the Net Zero Hydrogen Fund because that could indicate where the hydrogen supply was getting to their area in time for when they need it. It is a challenge supplying the hydrogen. Okay, so the next question for you is around your experience with consumers. So the consumers that have been involved in the trials, how have they felt about using hydrogen in their homes? Have you seen any resistance? Or is the ease of switching over to hydrogen boilers winning people over?

Jeff

Sure. So the consumer experience is probably one of the most critical aspects of the future of heat in general, essentially, we're going to be asking homeowners, our home occupiers to make a radical change in some respects, or take something fairly familiar, but have a different sort of set up to it, in terms of how that's applied. So the 100% of trials we've been involved in today have been unoccupied. So the Hy4Heat stuff, it's in demonstration homes, there have been some occupied trials looking at hydrogen blends sought to 20% by volume, and we've been involved in that through high deployment. It's a really good one. So once we start to talk about, we've done focus groups, we've done a lot of work around consumer outreach, once we start to look at optionality for where the home heating future may go, and some of the costs and certainly upfront capital costs around some of the options, hydrogen starts to become quite favourable, because it's familiar, it's a boiler, people are used to it. And you don't need to actually necessarily change your lifestyle or aspects of your house to make it work. Safety always crops up as a conversation for sure. And it's really interesting that some of the gas distribution networks have done some really good social science work

on safety perceptions, and it's all coming out being really positive effectively. So once you start to have that discussion, that it's a flammable gas, you currently take a flammable gas into your home in the form of methane today and burn it. The safety case that we're seeing coming out of the Hy4Heat Programme is comparable in terms of, you know, risks, etc. The key point really, that's going to cross is the gas industry is very, very highly regulated and it's got a superb safety record. So from a consumer point of view, once that starts to be discussed, you start to see quite a high level of trust. And you know, we wouldn't be in the situation of putting an unproven or a questionable sort of situation into people's homes, because there's a lot of implications that go with doing that.

Jenni

Do you think there's any, because obviously, hydrogen at the moment is very expensive to produce, but hopefully with the fund scaled up some hydrogen production in the UK, the cost will come down. But I would imagine for a while it is going to stay more expensive than natural gas. Was there any conversation around that? Were consumers concerned about how expensive it might be to switch?

Jeff

It's something that's raised as a point of conversation for sure. Now, I'm not going to sit here and try to tell you what the energy price of any of the energy [PLEASE CHECK] is going to be in 10 years, because if I could do that, I wouldn't be sitting here talking to you. One thing for sure is that green hydrogen learning rates are going to kick in massively. So we've seen offshore wind go from being one of the more expensive methods of generation to arguably the cheapest today. And we're going to see a much higher penetration of offshore wind in terms of grid over the next few years anyway, which leads us to the issue of dispatch and the ability to keep them running. So you know, hydrogen for me is all about intraseasonal storage. If you look at things from a purely theoretical point of view, other options might be more attractive. However, when you start to look at it from a practical point of view, and the fact that we'd end up having to have masses and masses of generation plant, just to cover the winter peak that will be redundant for most of the year because you can't store electricity at that sort of scale, other than in hydrogen, that's when it starts to come into play. So, I think once we start to see costs down on green in terms of learning rates and infrastructure costs coming down with investment, obviously. And the ability to use effectively overspill generation in those months where it would effectively otherwise be a cost to the network to actually sort of constrain that supply, I think the cost of hydrogen will actually be highly competitive.

Steff

Cool. Great. Yeah. Just finally, I think, Jeff, think we've got time just for one more question. You never know who might be listening to this podcast. So is there anything that you think the government could do to help the hydrogen industry and homeowners switch in terms of heating? I mean, I know we're still awaiting a decision on whether hydrogen will be in the mix for heating homes in 2026. But is there anything else you'd like to see in terms of capital support, tax incentives, etc?

Jeff

Yes, all of the above. Being realistic we're in a situation at the minute where there's a lot of pressure on the Treasury across the entire economy. So I think it's unrealistic to start to ask

for significant input for any one given technology. However, hydrogen-readiness is a big thing. So we mentioned before that changing over the local areas of the grid be it by street, postcode or town level, that's going to be fairly top down. So it's gonna be an intervention based approach whereby you know, you've got to change over or have an alternative. When you start to go above 20% blend, looking towards 100%, or 98%, as you might be in the distribution network for pure hydrogen, that's a different appliance, you can't have today's natural gas boiler or work in a hydrogen has got to be changed out. So what everyone is working on is this concept of hydrogen-ready. So that's a boiler that can work on natural gas out of the box, can be installed by today's skilled workforce, and can quite happily work on natural gas for as long as you want it to. But at that point of conversion, it can be converted in situ, with a small number of parts, less than an hour's intervention, and then you're up and running on hydrogen. So getting those out there early, and effectively, sort of pump priming, the housing stock is gonna be a big thing. So the natural gas boiler market in the domestic term is roughly 1.6 million units per year. So for all of those 1.6 million units from a given date, were hydrogen ready into the market, by the time we get to 2030 or so when we start to see local conversions really kicking off, a decent chunk of that housing stock will be ready to do it. So it brings the time and the cost of that conversion rate down. So as we speak today, looming up summer recess, you know, we're waiting for a consultation from Bayes on what's been dubbed the boiler consultation, but effectively, one of the questions in there will be, should we mandate through regulation that all boiler sales from a given date are hydrogen ready? And that date is likely to be 2026. So what we really need, from the government from the appliance manufacturers point of view, is certainty around that point, as quickly as possible. So we can start to get, you know, we're obviously well down that journey, there are other manufacturers that need to sort of get caught up. So as a sector, we need that certainty. Once we start to get policy certainty around that, things will move very quickly. But I guess the other thing, which we've sort of touched on, is upstream. So you know, whatever comes down the pipe, we can handle it, that's great. And there's a big debate around green and blue, which we won't get into today. But business models for hydrogen production, and getting the upstream sector really kicking off at that speed is going to be pretty critical for all of the sectors. So we know that there's work going on with business models, which will be sort of similar to Contracts for Difference. So that will start to bring the cost of production down, which is obviously critical to everybody. But yeah, getting the supply side sorted, is probably our biggest ask at the moment.

Steff

Yeah, it absolutely makes sense. As you say, there's a lot going on at the moment with things like previously Hydrogen Supply 2 and Net Zero Hydrogen Fund and what have you, but yeah, understand and echo your thoughts. So, Jeff, Jenni, it kind of feels like we could carry on for a long time on this conversation. But we're trying to keep it sort of snappy for our listeners, so we can fit into their days. Thank you very much, Jeff, I really appreciate you making the time to join us and sharing your expertise with us and the audience. Jenni, thanks as always, for your heat and hydrogen expertise. I know those listening will really appreciate you being here.

Jenni

No problem, Steff. And thanks. Again, Jeff, I really appreciate you being able to come and join us on the podcast. Thanks to everybody for listening as well. Any information that we've spoken about today, we will pop links into the description below, as well as a link to the

Innovate UK KTN website so that you can find the other podcasts that Steff mentioned and also our newsletters and updates. But thanks again for following us and goodbye for now.

Outro Jingle

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