

Astute New Energy Chinwag

Delivering the hydrogen economy on Orkney with Jon Clipsham

CR

Good morning everybody and welcome to today's new energy chinwag with myself Charley Rattan and joined today by Jon Clipsham on Orkney

Jon, welcome. Welcome to today's chinwag. Would you like to tell us a little bit about what you've been doing for the last few years?

JC

Well, thanks very much for welcoming me to this chinwag.

This is all done by the powers of tech. I see from the window here, and if I'm interrupted view of Hoy an the Sheep who are being fleeced – and shaved off today

There are agricultural components to our discussions today. So, journey so far out of recent years as the believable passage from the chemical sector into the rapidly evolving motion sector. I have a passion for years in chemistry, trying to reduce energy on chemical processes. And so I spend a lot of time with catalysts. Somehow we can use less energy to effect chemical transitions. So, found myself in all need for reasons which would take longer direction and from European green energy sector, we're recruiting our hydrogen development manager to enable projects we take forward, hopefully push the hydrogen agenda. So I applied was interviewed and was Julie offered a post there and spent two and a half very challenging, very rewarding years working with them, pushing forward some of the ground-breaking projects integrating green hydrogen produced from renewable sources through to power heat transport applications.

There is a long list of really innovative exciting projects you've been involved in all of the role is actually soon to be a tourist guide to hundreds of this each year wants to come up and explore and understand what the noise was about what is this harsh economy as it's being developed? From that, I think a lot of ..we see ..we are now maturing into some of the larger projects. starting to see appearing all over the globe right now, that signs up in Haitian world. Your back is

CR

So, so easy and so straightforward. But as I said, just now there is indeed a lot of noise around the hydrogen . John Massey and I have talked about it on podcasts while talking about the better strategies every day seems to be somebody coming up with a strategy or a roadmap or something. And a lot of it's quite impressive scale. They've got great names like 'gigastack'. and all these kinds of people actually delivered. It seems to me that if you were to look, this is on a global basis of an example of where a hydrogen economy has actually delivered rather than talked about. It is indeed Orkney is central to that process....

You were you were central to that process

.... for it. However, yes, it's certainly a lot of it. But there was a lot of food for thought once into economy. Prior to my involvement. Yes, I have the privilege of driving forward. So I should say, doff my cap in the direction.

Other folks that it come to Scotland.

I want to have this heavily involved as well as the local council. That's a team effort.

Yeah. For those of us that haven't been up to it, sad y, that sounds a bit about

this bit more about what it involves what is what is it exactly that often is as managed to get up and running and look together what bits of the economy constitute the hydrogen economy

for the project, so here, we're born out of an initial V shaped by Bright electrolyser the idea concept was to use that to produce hydrogen as a way of alleviating constraints. Initially it's a mix test centre, testing title, testing title and as you energy but what shortly afterwards it was recognised that I should have a volume reconverting the ocean back to electricity.

Certainly when you're all located at the end of electricity grid as well, yes, doesn't have great deal volume and that's where the other projects were born. So the system up here has got its title on sugar wit integrated through electrolysis. There is then compression hydrogen storage, transportations a key aspect of studying the costs of moving higher right now. So it's not it's not a trivial part of the discussion as is with your system by ferry, getting permission to do that, showing the gods safety cases as well as stablished, the DMCA regulations, boxes and ticks and so on. So a trivial exercise and so

this is one of the lessons learned from the system is understanding rules, regulations, policies are indeed what will lead to change as the economy expands not just in Scotland,

..

but so much further afield. Yeah, D so.

So to conclude the story.

The hydrogen produced enables us to develop applications

we will see a difference

you'll feel there is a heating systems deployed schools on all of the islands we have got dual fuel our range extended ocean vans which have been run restructure here

shortly

progress on this recently should be a plane arriving to do some demonstration flights around the place

CR

Wow it seems that just about every aspect is incorporated in this if you were to think dispassionate from from a utility points of view the islands perhaps only touched upon this a difficult to get electricity to I suppose you've made a lot of cable and you'd be at the end of the network and I suppose there are arguments therefore for having some elements of storage at the end of it and it seems to be You're saying I'm not quite sure whether you're using liquid or gas hardship at the end of the line but it seems to me that you're putting an element of a story it's also why you're saying that electrolysis is actually occurring on the island as well as well. O

nshore wind link to electrolyzers

JC

Yes, that's how it systems working.

And that is that stored how.

So at the moment the hydrogen is stored as a compressed gas which really suits the logistics operations that are in place right now. There are plans recently announced by and the incentive should be on the local wind farms here. So stop should read ammonium production should open up small CERN's, if possible As well, for some of you, it's far easier to store and transport mostly has got its own issues does offer another opportunity to explore how we can move this scenario car fuel around

Unknown

yeah liquid liquid and a liquid format some kind of container

Unknown

Yes. And

CR

then they will be taken out of the abode. So the ammonia will be used to some kind of carrier that it will be converted back with it or whatever used in the us the idea Yes,

JC

speedy delivery rates hydrogen.

ammonia molecule

was also mentioned the heating elements

CR

in there when I was reading through the Scottish energy strategy, and there's quite a strong, strong emphasis on the bigger feeling regarding zeros that would make great strides on the electricity side, right.

That make substantial route towards zero. We have to look at the customer Which obviously

sounds really well advanced on

JC

also on the heating side

talking about heating schools and into buildings here at side of things, how does that work?

Unknown

within any context? Yes, it says find a school site currently has fuel oils and at source corporate hydrogen as a backup. So that should be commissioned anytime now operational for further afield. If you think about the

Unknown

take the islands example of off grid

Unknown

heating

JC

One of the biggest use around sort of resonates with your community is fuel poverty. Yeah. When we check out statistics with over 60% of the properties Could be registered as being in fuel poverty that presents real challenges was defined as having 10% or more of your income going out on your energy bills. In this case heating is huge proponents of the energy bills impacted by the calls of housing impacted by income from salary levels impacted by the weather conditions also impacted by fuel prices, which do incur surcharges, patients, given the fuel has to be transported extra distances reach the islands. So all those factors do combine.

And this does presents real challenges. How do you decarbonize the heating of properties on islands basically those sorts of obstacles. This is not an easy challenge to overcome.

Yeah, I suppose and it's how the Hindenburg legacy I suppose of, of hydrogen. I suppose if you go to any meeting, I'm sure meeting people will raise this rather scary and whether or not

hydrogen was involved. So it's a

moot point. But really people just believe it was I would imagine there's a bit of an education piece for stakeholders in the community right up front of the process, not everybody's gonna go with something that might be expensive to get few loyal to the islands, but people familiar with it, some say no. And then somebody comes along and says actually, the most effective was trial hydrogen,

JC

So public awareness is spot on. It's huge amounts of work that needs to be done as this transition takes place towards a full-blown hydrogen economy. And it's not just all it's any of the other location

If you're really trying to talk about patience with your audience, first initial springs to mind is either a Led Zeppelin album cover or a large mushroom cloud that was ingrained in our psyche.

Contrast that with an example that refuelling station, there were two incidents last year, both well publicised. 1500 associations with regular filling stations didn't make excuses all. So are we dealing with something that is dangerous? Yes, we are, is it's as dangerous as things, probably a use of the moment. But yes, however, we've got used to use those other fuels safety systems bit of there's a axiom that I do want a different device dividing the sector, which is whatever we do, has to be as safe or So, what we're currently doing Yeah, with that sort of message in there and demonstrating what we're doing the levels of safety procedures policies that we're putting in place it helps us otherwise we're just don't really get that public line. Yeah.

CR

It's I think it's something that Keele university as well working on the safe side of things. The result have been impressive in the first year as well. And as people get more familiar with it, ..stuff around if you think about the fields and things like that, so something familiar with hazardous materials around and it says going to be no,

no different with hydrogen, which is perhaps better in

JC

some respects, it's got some different characteristics, but some favourable characteristics as well. The weight dissipates and so forth. Even the most publicised Hindenburg which come across time and time again, wasn't really I didn't I wasn't really Something else that that cause that will clearly make good progress on the public perception. Cyber an awful lot of other stakeholders to bring along on other projects have

integrated as you're mostly thinking about on the domestic scale and then the schools and so forth, I would imagine is a whole heap of stakeholders with something. So, elements such as that.

So the rights be many engagement events with local communities, school at each stage, projects p are advanced, as regular communication, discussions on any of these issues are resolved. tribute at this point to the council or council

I've dedicated resource out regularly

Community Schools in particular, it's really important that they stop their energy transmission, which is going to be a key part of our show by actively engaging, showing the community. This is the way we want to go.

And we believe in it. Yeah, it seems to be now something we must be aware of

CR

You are a trailblazer is because I'm sure, two or three years ago, weren't all these hydrogen strategies, roadmaps and all these things. They published almost on a weekly basis and they were people look and say, well, talk is cheap, in many respects, but when we want to natural basis as something that's delivered, the thoughts must

JC

light upon about it. So we'll look at something that is integrated that is working. seems to have gone well. There is a classic example to show at least proof of concept

That's exactly what the projects are about demonstrating what can be achieved. As the integration projects are so far unique. You now see all these reports, right? This is how we're going to do it. We're now starting to see big investment markets moving, recognising the dots. Again, this is something you will read daily papers of screen transitions happening. Massive increases in renewable expenditure aligned with that is hydrogen expenditure. amounts to Germany. I believe Europe will be hot on the heels of that strategy. Australia is making massive strides in this space as well. To say the position I'm in now, working as a consultant in the field, please the the numbers are being discussed. The finances being Port forward to these projects is eye watering? Absolutely. It's

nothing other than encouraging. So we can make this transition, we can achieve those 2050 targets. And we could do what is necessary to make sure that our political species can survive this this climate change monster that we're having to face at the moment?

CR

Yeah, it's interesting because before this talk started, you described, your view

looking out of the window, sheep being shared, and it was like almost a bygone age. But actually, when you think dispassionate if you want something that is scalable, which is obviously of interest to the utilities, or the gas companies coming into the sector and the nations of the regions from that same that he described at the start You do have something,

I think you have the word leadership and then people from heavily industrialised landscapes with deep pockets and big aspirations are looking, because they know from what you've achieved, you've shown proof of concept. And you can also say when I say that principles weren't, it's just a case of making it work going out, scaling it as well, as far as we've not touched upon is the as the cost of this because it does sound slightly counterintuitive, but sometimes more energy than you take out of the system. But that's not unusual for a utility for example, that is all the time with their service. So this is why suppose one thing coming from an offshore wind background, which is my background, we've come to the same things. People are very scared and always pictures of this house on fire, which didn't play well. But you've got to put that into context.

JC

..., but actually the safety record is very comparable. It compares to other Well, the tech and the industries kicked out from almost a niche to becoming almost as overheated as, as far as you can say that hydrogen is becoming. So everybody wants to be involved in in offshore wind, not many people have done it. The UK to an extent has been a bit of a trailblazer itself. And we're now starting to see I suppose, synergies.

CR?

..

Overspill? Wind

generates 24 seven Can that be used rather than wasterd.

Could it be used with people and so, there are big synergies now between offshore wind nation

We were ridiculed - marginalised,

rejected by

many people

But that's now mainstream. And people now start to look, could we kind of synthesise some other synergies with hydrogen production? You've already mentioned?

I think emac. And you mentioned I think, tidal. But what

about the Scotland leasing round? Jon what is on how things are shaping up in Scotland as well?

JC

Well, I think you're absolutely right. I think in terms of offering that transition from fossil fuel generates electricity, electricity, offshore wind is price that we need to pursue and the when the issue of course with its renewable, its has an intermittent CSU also is not being generate, essentially, we are generating the ends of the spokes. So all sorts of models.

Technology is necessary to do your best to get those electrons to market. So I say started talking about last year on the conference circuit before we all shifted to webinars or something I referred to as electron stewardship. Because if you've gone to the trouble of making electron, you should do your best to use this electron rather than consuming electrons make it into something else. So that's great. However we supply our variable grid that we manage, not just your supply side also your demand side that stops people from following forces and energy storage to balance make sure you are able to provide electricity when he needs to storage is key to that many Eminem's a very well qualified people out there will discuss the various merits and demerits of different battery systems on indeed hydrogen.

My view on all of this is that we need every single tool we've got in the box to enable us to transition away from fossil fuels that meet those climate change obligations. So yes, offshore wind, really awesome hydrogen key part of the story, along with batteries. What I think is interesting is that if you do transitions hydrogen, those powers to guess transaction, they'll have an opportunity to move your energy into different infrastructures that will decarbonize different systems. So it's a very, very versatile energy carrier. And I certainly see ridership is reset for demonstration projects now to a very harsh, real commercial reality.

CR

Yeah, you've got some almost counterintuitive things about their industry. And one of them of course, is the pilot gas is itself looking to decarbonize as opposed to think about the Scottish industry is as well, as you think about a little bit technological advances such as floating

point to deeper waters and perhaps less common,

you might start to think well actually there are other now joined up schemes involving oil and gas installations and assets floating

offshore wind and hydrogen as well, which would knock out some of the grid constraints and enables an industry that is carbon base to itself. decarbonizing San Francisco, but I think it's a number of companies and countries are the looking at just that.

JC

I would say as far from fanciful,

as blunt as that these sorts of schemes are being actively discussed. costed out and evaluated is very real solutions.

CR

Yeah, and they've been done by on a big scale.

JC

Absolutely.

I really support these initiatives that really exciting, this big engineering challenges. Yeah, it's great working with big engineering seems forced. So work on doing. Studying what those challenges are. This is not trivial, any of this. But then we've done non-trivial stuff now for decades, decades

It's, it's fun to pioneer stuff. But it's still.

CR

Yeah, I think I think a German minister gave for instance, took

call from Cape Canaveral for hydrogen, which I thought was an indication of kind of a scale of endeavour, involved if you're serious about this. No, no. As you described, the principle clearly works. It's just a case of now of scaling it. One thing we learned from offshore wind is that things came on the back of it because it wasn't it was right Expensive unstart cheapest source but if we can do that, as the as the scale went up and we learned where the costs were and how to drive down some of the costs a lot turbine costs, standardisation, bigger machines getting the cost of money bought by itself down facilities within the grid itself.

And the cost has now come down remarkably to think of as an SSE not 100 pounds per megawatt hour is absolutely possible can't be done. And I think on the latest leasing around in Scotland

Wales or England, or Wales, it was under 40

pounds per megawatt hour. So it's less than half

of what we not so long ago deemed to be impossible. So we know that scaling

can work.

It can reduce cost, isn't that something similar in general, it's not it's not cheap. price per kilogramme, as opposed to per megawatt hour, but to see that If you're to kind of scale up, you could reduce the cost of hygiene and self.

JC

Confidence I was going to have these discussions I have periodically is the key electronics supplies indicate that they see this trajectory as well. Right now they're producing actualize it. Singles double digits, megawatt scale. mentioned earlier projects in the scale.

If you're going to supply electrolysers, very large, highly technical words, say multiple 10s of megawatts of scales, upscaled going from the very local case of a 500 kilowatt system up to now, I guess the standard low five megawatts that's maybe 50 megawatts in the not too distant future. You see the scale at which these things are increasing trajectory that's up as well. With sector of onshore and offshore upscaling and with upscaling last standardisation moment systems are bespoke, designed to meet the requirements for system if you've got to buy off the shelf and they got lots of electrolyser and that means, standardisation, design sampling can reduce a lot of your costs. And that does present some real opportunities to drive cost down, which I fully expect to happen over the next five years, certainly, yeah, if you

CR

Look at some, some, I think some countries putting a stake in the ground has to be early adopters, if you like and I think China, Germany both spring to mind as opposed they by putting these strategies into place they encourage the market. say look, this is our introduction. The gentleman was particularly interesting with it set. You absolutely to exercise green hydrogen as well, which is Obviously, based on that seems to be more or less what's happening at all,

as well. So you say that

actually all these blueprints for the, for the German hydrogen strategy tend to take the lessons learned from what you put in place and work on a much, much bigger scale. And that scale will then help drive the cost and that will further encourage investors to come to the markets going to further encourage innovation and further

deployment technologies.

JC

Yeah, absolutely. Right.

What's going on Germany, I applaud, during this discussion, but it is great to see in the time I've been involved to shift from being Nish demonstrator of things just about conferences to becoming mainstream. When you see £7 billion governments pledged to a scale of investment, this is just an eye watering sums of money outgoing. Yeah. And that needs to be spent to enable the technology to upscale. And they will factoryies to be built, enable engineers to be trained, brought forward, and so on.

CR

I think it's just so exciting... sounds almost fanciful, but the same exact same trajectory happened in the wind, where it was expensive to reveal this great phrase. They called it a boutique. So the wind pop boutique, if you're talking about six 810 megawatt wind farms, to be talking about 14 megawatt turbines, that's pretty terrible. So these are mega structures by anybody's imagination, 30 kilometre high and there's a lot of them being proposed. It's not just the Scotland, Germans, Dutch leasing rounds, I think

Coming back in, you name it, and people are going to come back into it which is further. So the two, again offshore wind, the offshore wind and hydrogen seems to be a particularly good, a good combination to I suppose what I'm getting at is that we started out in when we didn't have climate change out and they were loose, but they've been firmed up with the policies. More recently with a net zero aspirations. If you're serious about wanting to get to net zero by 2050 and a lot of places a lot in advance of that. Then you've got to go now and you've got to go big that I can see how integral into getting guys to that journey to zero.

JC

Absolutely, absolutely.

CR

Thinking of some of the challenges that you face John over the last few years, what kind of

Unexpected.

On top of the risk register something that surprised you.

JC

I think the biggest challenge has been around regulation. be unfair to point fingers. However, if we are going to decarbonize the maritime sector meets the obligations of the IMO by 2050, then that's a sector that has really got to work hard now to enable new technologies to

be adopted

About the safe movement of hydrogen - trailer cylinders on the high street vehicle - in the tank.

I believe these sorts of things need working through pretty fast. So we understand, really these these safety cases. So we can go back with just a set of proposals. That's done, we've sorted it. Let's move on. Let's focus now. upscaling enabling technologies to move forward. So that was certainly something that I have physicians spending as much time on as has been done. I think also of studying the complexity of some of the harsh projects being worked on think in your case you know, wind turbine up but the blades you've got conversion system from one form of energy to another, and that wires with the highest systems, yes, they all pipes of wires, the complexity of what's going on in the electrolyser stocks, how you ensure those are operated effectively, water purification,

purification, the other punishments of the electrical engine, the hearing they these have not been trivial systems develop us those systems do standardise the learning. Certainly hubs within your projects will enable those to get there faster, and make that transition quicker. So I think the time is take.

Yeah, the court going back to looking at that, if you want to harsh and then we said that we might have an enviable wind speed results. But suppose the flip side of that is it's quite harsh

environment of people working people in metals and things like offshore wind. And this is global, I noticed that

CR

electricity and water don't necessarily go together. And then we're talking about building massive wind farms out in sea in harsh environments. And these things can be up to a third of a kilometre or higher, and then there's additional complexity on top of that, so the regulation, I suppose, was from a bygone age for solving different problems. And the National Grid was offshore, and people didn't worry about it.

Miles obviously it was actually relevant at the time,

people looking at space in the scene in a different way now and seeing something that there's a resource opportunity. And sometimes I suppose the regulation doesn't necessarily kept track of it and kept up with that.

Yeah, I think you're right. Gas for the electricity grid, or any of the works. We've got the rule books were written quite some time ago. Understanding how those need to be adopted to meet the changes in the transmission work. Because right now,

office work. No, I suppose if you're gonna start having these highfalutin national strategies and roadmaps all messed up on the wall

to look at the regulatory side

wants to be honest, I've looked at the circles being pragmatic, broken down into it's a part size chunk In large sector regulation besides today, it was also you don't proceed until you've nailed effectively number one to have all the strategies in the world unless you've got the basics in place shop, then

that's number three and number four money they nebulous. So those are rushing off mobilising supply chains and things for,

CR

you know, the big picture stuff until you've got the basics in place. So that might be a glamorous type not to be that interested in regulatory workshops

and things like that is a vital part of the big the bigger picture. I'm getting

zero.

I had related examples. There's a standard for natural gas pipelines. This is anecdotal to a friend of mine. Absolutely. Please feel free to read it. This is actually correct. But I was told that requires an Act of Parliament to change that specification whether that's correct or not, to say, Please edit that bit out. Correct specification that affects the shows enormity of the task has

CR

refined all kinds of things when we looked at that, and when we started to look at the code regulations and things were absolutely possible sometimes a blind eye was discreetly attached to certain things, but when you have service of the big inquiries, the consultant mutates into an area don't expect them to go in and say no, that's not the ones are the e Aberdeen the Trump boys are looking at some of the things so

CR

Regarding regulation that made them comfortable. Viewing sometimes for the for the wind farm developers did get their time and time obviously, delay

cost plus pose On the plus side delay it Enable the tech to evolve the tech to get better. So by the time things like seeing our growth that comes out with this turbine size, it's going to be far, far better

The basics was put in place 10 years ago. And that's when it can take these major projects, but it's not trivial. And sometimes things can come up at the regulatory source and not project back years, which is hard. For developers particularly hard when I've been involved with things like local supply chain and local content and lots of courage people to see the opportunity and say, Look, think about listening, and then it gets bogged down for years, and some arcane discussion about bird migration.

Most people don't follow that closely. This is what's happened to it. Where's it going? Well, I want to do something else. instead.

JC

The old side of it seems to be that you've got the engagement. Locally, people can see the benefits of having this hydrogen economy if you like on the ground.

Guess a simple answer to a long preamble, your I?

I really, I think what I'm seeing in the projects I'm working on right now public engagements is increasingly a large components of any of these proposals. My thoughts as you production are those areas regions that are looking at its deployment of high school technologies. There is a recognition this is this is not simply about shifting technology as a technology thing. Why would people make that transition? After looking at socialising the benefits?

You've got some lookouts, public buy it. You've got to have a full set of stakeholders completely sold. Understanding because there is a great collective wisdom now. Our social media to influence and shape things is enormous nowadays. So you will always get some new projects. ABC relocation firstly they will come up will be a picture of the Hindenburg

Don't mess because and that's a really good entry point to say, Well, if you'll talk to me, let's work through this. And if you still feel that way, then that means we still have more work to do. Yes. Okay as allied points, talking about public awareness, digressing about training and skills development. Yeah. Moving into this new world, say to take an example of petrol diesel vehicles as we used to pop down the road, garish, fixes things for us. We carry out them and we use a lot infrastructure, even with electric vehicles to go to special dealers now, if you have a high end vehicle, how many people are actually equipped to service a vehicle right now? It's very, very few indeed. So rolling out not just infrastructure, but servicing and maintenance technicians who can deal with this new technology. That's one example of many, because why shouldn't essential speech quite ubiquitous if the travels the convention to Keilar successful, as I'm sure they will be on the transition towards some essential aspects Forward, what do we need to do to transition boilers and cookers? What about those industrial departments that are currently burning natural gas or want to transition to hydrogen? How do we accommodate those with the right number of people, skills people trained equipped, so they can enable options to install the kit safely. Make sure that we're able to do the next stage without it's really, really important that we address that. challenge the Scottish Government's plans later cheers We're sorry and really understand what we need to have skills training qualifications to make sure we're equipped to make that transition.

CR

Dead right when again coming back to offshore wind.

There are several that is one of the most popular The things that we offer.

That kind of community benefit was the apprentices apprentice trip. And UK is one of our local community is really meant something about something they addressed on a local level. And then capability for the various bits of kit described

earlier. How do you maintain and how do you keep it ticking over?

JC

is the question so there has been a reliance on the equipment providers. Support with maintenance but of course access to sites actually will bring it over to Germany. can be a 24 hour journey to get here the lifespan of crickets That sometimes creates problems. Certainly, those who are kids aren't producing engineers, train engineers. people to say. As responsibilities, think as some of the cases still say demonstration, there is a need to have the product manufacturers engaged in appropriate service level agreement so that they can maintain a critical component.placements are needed.

Yeah. And what has happened is in maritime sector,

JC

slight satellites delay on metal On space, the local college college have been developing training courses for the crews to make sure they're well equipped to deal with any incident that may happen. So it's an awareness of hydration. Safety cases around. The towels are humble. It's from police firefighting put into those calls. Yes it says that's the local college

space Competing

National schemes, developing specific qualifications. So it's all starting to move in the right direction. So those chicken necks now, if we we raise a we Scottish Government You can't make commitments to a national rollout so far. infrastructure, whatever that's going to look like. Hello

So what accompanied by a timeline to ensure we've got right on eventually is fitters technicians available. And what's nice is we have, we have a new skill set developing engineers, that's wonderful fusion have used the term million pipes and wires to find develop people who are skilled in managing gases and electricity, high pressures, it is quite a sophisticated skill sets to be brought together, these people are going to be well qualified, highly capable.

CR

Really, really valuable. Yeah, and I suppose if you're looking at if you were involved in the oil and gas sector, you might already have that skill set. I've heard this phrase 'sector coupling. regarding hygiene as well. It just brings together people that perhaps are certainly not sure we never used to be the top people in the chemical industry or even the nuclear industry, but all kinds of people seem to be coming together because they can all see some

Benefits of their particular industry with hydrogen as an element. So you mentioned ammonia we see upstairs the fertiliser and mechanical industries being interested in that you look at oil and gas, we talked about refineries with hydrogen already use and some of the othe

industries out there quite pro hydrogen, they bring skills, texture to the skill set that you mentioned, that is some of the skills already exist out there. They might need tweaking and amending for the new skills that are going to be needed if there's to be hydrogen.

JC

I agree with everything you just said - the role I currently have, I've shifted to all sorts of people across different sectors throughout the day. I see a great thrill. And this is what I'm seeing now is learning that, you know, the longest excuse me volunteering information. So we've got

skills in this area? How can we use those to drive this transit forward? And that's been a complete shift from a couple of years ago.

On recognising that the world is changing, everyone's becoming an energy company now

that there is that's a view that we can pull together to make this happen. Because we're going to need to set early every tool in the box

to achieve those climate change targets. do what's necessary to

avoid getting that 1.5 degree temperature rise.

We got to work hard, we've got to work fast

together.

CR

I think that is a it's a pretty good summation, john of where we are, I was going to ask you to sum up. We've talked about a lot of issues in the last 45 minutes .

The way to summarise where we are I always think we're on the basis for take-off there with regards to proof of concept is there you've produced it largely all the pieces seem to fit together and still have it regulation but it's inconceivable to my mind that some of these strategies will solve the regulatory challenges ahead. And I suppose one of the differences is not talking about subjects delivering everything but delivered it's Bitcoin selves on okay that I've done that and show that it can be done. And so if you were to sum up where we're at now, where we'd like to be,

JC

Right - right now we are just about to start riding the crest, very big hydrogen wave.

The next five years a huge amount of projects moving very rapidly, rapidly through feasibility study, through two initial deployments. During that time, you'll see significant upscaling of the technologies implementation.

So I'm expected that by 2030, we will have some of these big projects, live delivering, showing what's possible. Hydrogen, I think what will come into its real shining glory from 2030 onwards

There's a lot of forecasts will also support. So it's, it's a medium term prognosis if you like.

I don't think it's terms of instantly I use a conference I was put on the spot about public awareness. Last year.

I coined the phrase we need to make hydrogen boring. Right now, everyone's talking about hygiene, everyone's buzz around the sector. Everyone's watching this as the other ones, other people, that sort of strategy. But the moment you get up in the morning, shower, you see and we're back to normal driving around in vehicles.

Just getting on with the daily life, taking everything for granted in the energy system is going on around us right now, as a real buzz with transition from fossil fuels to renewables. What's the role for hydrogen? Where's batteries and so on. So there's a lot of interest at some points will drift back to normality, a lot of points. All this buzz starts with quite mundane, quite boring about points.

Hopefully, we've achieved that zero. Hopefully we've achieved climate change objectives, and hopefully at that point, I hope my spurs make journey we will have really made harsh, very, very boring about this kind of things for my tombstone, I suppose.

But if we if we've achieved thoughts in the next 10 to 15 years, fantastic, because we've done our work well

CR

What better summary of where we're at now? Thank you very much indeed for engaging in something that on the chin were to do something we must. John Massey has a a tech issue When I started out in it at one time, the internet was very excited things like telematics, were buzzing and exciting. And now, if there's a utility, like any of them, I suppose is a success of where we've got too long on it and paving the route on that. But I'd like to thank on behalf of John. Thank you very much, Jon , for sparing the time to chinwag.