Transcript for #70. What Is the Future for Clean Fuels in Vehicles and Aircraft?
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Guest Mikala Grubb, Director, Clean Fuels Technology, Haldor Topsoe (confirmed)

Intro (00:01):

[Music] You're listening to Fueling the Future of Transport hosted by Tammy Klein, the Founder and CEO of Transport Energy Strategies. We'll talk all about the fuels and energy it takes to keep the world moving forward.

Tammy Klein (00:17):

Welcome to the show, everyone. So great to have you here. I am so excited today to have with me Mikala Grubb. Mikala is Director of Clean Fuels Technology at Haldor Topsoe and we're going to talk clean fuels, today. Mikala is the host with her colleague, Sylvain Verdier of the Fuel for Thought podcast. This is the Fueling the Future podcast, and we are just talking that there really aren't a lot of podcasts that are actually out there that are really digging deep into the transport energy space. So, I was on their show a couple of years ago, and now I am turning the tables. The podcaster is interviewing the podcaster and the expert. So Mikala, welcome to the program. Great to have you.

Makala Grubb (01:11):

Thank you so much, Tammy. I've really been looking forward to it. I'm also a little bit excited about being on the other side of the table!

Tammy Klein (01:18):

<laugh> Yes. Flipping it, flipping it as it were. Yes. So to get right into it for the listeners who may not be familiar with Haldor Topsoe. So can you talk about the company, your role within the company and then can you talk a little bit more about one of your main products, which is HydroFlex?

Makala Grubb (01:41):

Yes. I'd be happy to. So I'm working for Topsoe which was founded by Dr. Haldor Topsoe himself on the 10th of April, 1940. And the reason I know this date very well is that for Denmark, the second World War started on the 9th of April, and Haldor Topsoe was actually supposed to go to the US with his wife, but his kids were sick, so they couldn't travel. And then Germany invaded Denmark and Haldor Topsoe's wife told him, please go make a company. It should be a company that's a good place to work and it should improve the world. Wow. So like a wise man, he did. <laugh>

Tammy Klein (02:26):

I never knew that about the history of the company, which I know you guys are now Topsoe but old habits die hard.

Makala Grubb (02:32):

<laugh>. Yeah. And, he actually started the company in his parents' garage, like any other innovator. Oh my gosh. The first production took place in Sweden also during the Second World War. And our first product was as far as I recall, the sulfuric acid catalyst followed by the ammonia catalyst then followed by hydroprocessing. and we have expanded since then and provide a wide range of technologies and catalysts. But Haldor Topsoe firmly believes that a company doesn't mean anything unless it improves the lives of others and society. So this sustainability agenda has always been on our radar for us and has been a guiding star. Also, Haldor Topsoe was a very good scientist so we have really built our company on understanding what it is that we do. So Haldor Topsoe as a company, we have a very large portion of our

revenue going to R and D every year it's between eight and ten percent of our annual revenue that we invest in R and D. we have, I think, around 400 people working in R and D developing catalysts, developing technology, proprietary hardware. And, that is us. We firmly believe that we need to understand to improve. So that's our company.

Tammy Klein (04:23):

So tell me more about HydroFlex and where's the big draw for customers? I feel like Topsoe comes out with an announcement every week about a new customer that has decided to go with HydroFlex. So what is it for listeners who don't know, and what's drawing the customer?

Makala Grubb (04:46):

HyperFlex is a hydroprocessing technology that upgrades all kinds of renewable feedstocks. It upgrades the regular, the first generation vegetable oils it upgrades second-generation crude oil, animal fats, used cooking oils, all these feedstocks that contain oxygen that contains components that you don't see in the normal fossil industry. And our customers choose us because we have a very long experience. We started up the first experiments and also keep in mind that this area is pretty new whereas oil refining has been around for a long time. So we started up the first tests of vegetable oil in 2004, we designed the first unit in 2007. The first unit that we did was started up in 2010. So now we actually, and am proud to say, have more than a decade's experience,

Tammy Klein (05:56):

Right? The timing was so good.

Makala Grubb (06:00):

Yes. And, and this is actually one of the key points for our company is that we excel at doing what is really difficult, and it is difficult to upgrade these renewable feedstocks. So we have gathered quite a lot of expertise in this, and also due to the investment in R and D, we know these feedstocks. So that is what draws our customers. One of our other focus areas is, and keep in mind, I'm from Europe, we have a different kind of legislation here. We have a very strong focus on advanced biofuels. So now crude tail oil, animal fats, vegetable…that's known stuff to us. We know how to handle it. We've had experience running units. All of these what's crucial now is to understand and develop our process to accommodate all the advanced feedstocks that are coming and they're coming in Europe and they will be coming in the US as well. And so that's what we are doing.

Tammy Klein (07:12):

So what you're saying, you know, in terms of HVO or hydrotreated vegetable oil, which we call in the US renewable diesel, I mean, there's been an absolute explosion, I would say in terms of plant development, I mean, in the US, but even in Canada, even in parts of Europe, we're now seeing, some development in Asia, in China and even in Latin America. So what do you think of the scale-up that's happening with HVO around the world and how do you see it happening in sort of more emerging areas like Asia and in Latin America?

Makala Grubb (08:03):

Well....

Tammy Klein (08:05):

Keeping you busy I'm sure.

Makala Grubb (08:07):

Yeah. We're pretty busy at the moment. Well, the scale of this happening is one of the fun things about this or interesting things is that this is legislation driven. 100% it is, if there wasn't any legislation, there wasn't any renewable diesel. And I can't stress that enough <laugh> that this really has a large impact. So the scale-up is driven by legislation. In Europe, we see that there is a competition for a feedstock to have enough feedback available because in the US, there is enough feedstock as of now, and there will remain to be so for quite some time, I think in Southeast Asia, there is an excess of palm oil because Europe has banned the import of palm oil for fuels. And this means that there's a surplus in Asia, and they also have used cooking oils and all kinds of other oils that they also want to produce.

Makala Grubb (09:24):

So, okay. So getting back to the point in Europe, we see that there's a demand for feedstock, very large demand and it's actually very interesting to watch this sort of geopolitically. You get to sit in a little helicopter and look down and see these trends, that when Europe is banning palm oil, there's automatically some movement in Southeast Asia because you need to keep your people employed in each country. So they actually mandate in Southeast Asia for some countries to use palm oil.

Tammy Klein (10:04):

Right. We're looking very much also at China and when they start utilizing their own used cooking oil, because I think it's 40% of the used cooking oil that's used in Europe originates from China. So the moment that China has legislation that drives utilization of used cooking oil in China by Europe, like that feed. So, and in Europe, there's furthermore a cap on how much crop-based feedstock you can use. So, we really see that it's a challenge to get enough feed start in Europe, in South America, we see a lack of legislation favoring renewable diesel and sustainable aviation fuel. Because if you look at Brazil, they have a very good bio-economy already, it's just based on biodiesel fame and ethanol. So the question is when will that change?

Tammy Klein (11:11):

Yeah. Yeah.

Makala Grubb (11:12):

Will it change?

Tammy Klein (11:13):

Right. I wanna ask you about China. You know, you mentioned there's some production that is scaling up. There is some potential to use some of their own, or perhaps even all of their own, use cooking oil. I do know of one project where they are directly bringing in palm oil, you know, the palm oil that Europe doesn't want, they're bringing in for their project. I mean, do you see legislation happening in China, for example, or maybe in some of the other countries, you know, specifically on you know, to sort of help scale up HVO and, and then I guess by extension SAF,

Makala Grubb (11:57):

I think the legislation will more be about SAF

Tammy Klein (12:00):

I think so, too.

Makala Grubb (12:02):

Because flying or aviation is a global market. So if you're flying from Copenhagen to Beijing and you want to improve your sustainability numbers, and your customers, your passengers are asking to fly more sustainable, they will ask how much sustainable aviation fuel is there on this flight. And I don't think the answer is good enough to say, yeah, we got the double from Copenhagen to Beijing, but from Beijing and Copenhagen it's fossil. So I think that's the legislation that we're going to see, but I can't...

Tammy Klein (12:45):

Who has the crystal ball?

Makala Grubb (12:47):

Ooh, I would love to have one <laugh>,

Tammy Klein (12:50):

Very, very good for business development. Right, exactly. So the question that I wanted to ask you too, is, you know, you're right. I mean you know, we're coming to a point where, you know, there's plenty of, you know, there's some virgin oils you know, out there, they're being used in the US they will ultimately be, be kept under the legislation in Europe, there's only a certain amount of used cooking oil. And that seems to be rather, if not totally spoken for, the supply chain is developing quickly and it probably will be spoken for. And then there is, you know, animal fats and [indiscernible] only so many animals in the world. I mean, you see a lot of these producers that are especially in the refining sector that are just doing all of these deals, Fungi, ADM, Cargill, you know, traditional sort of agribusiness you know, companies.

Tammy Klein (13:57):

So you know, what you said at the beginning of the podcast was really, really compelling. It's like we know how to do those feedstocks, but it's these advanced feedstocks that really will be coming in the future and they're gonna have to. Because the RED2 - Renewable Energy Directive two and Renewable Energy Directive three will require them. So I think that's the question to move up the talk about feedstock. That's the question is how much, when, and what will those feedstocks look like? Will they go to Europe because of the constraints there, the refiners and other producers will just pay the premium to get those feedstocks and commercialize them because they have no choice. How do you see that all unfolding? I mean, there's just so much going on.

Makala Grubb (14:59):

That's true. And the advanced feedstocks are the holy grail because they are the key to unlock it all because of their finance amount of first and second generation. Also, I see that in Europe, a willingness, not enough willingness though, to invest in these development projects, the solid to liquid conversion as I like to call them. But we do see some emerging companies that are at the demo scale and a few that are at a commercial scale, but it's a rather small commercial scale because these technologies also typically difficult to scale. There are so many things that you need to take into account when you are converting this solid waste or solid biomass because I think to digress, a little, is all about greenhouse gas

emission. How do you keep your greenhouse gas emission as low as humanly possible? And this means that - I'm talking myself into a corner here...the advanced feedstocks are crucial to unlock this.

Tammy Klein (16:24):

Right.

Makala Grubb (16:25):

We will need to scale up the processes to a certain amount of capacity, but actually, what is most important is that the advanced feedstocks need to be stable so that they can be transported because the scale of a solid to liquid conversion plan may not justify an entire HydroFlex unit.

Tammy Klein (16:54):

Right.

Makala Grubb (16:56):

You may need to have a delocalized solid to liquid conversion facility. Have a stable oil and then transport it to a biorefinery.

Tammy Klein (17:09):

Right. Because so sort of a place that would process municipal, solid waste, it's got to sort of pretreat it or deal with those solids and liquid.

Makala Grubb (17:23):

Liquified, yes because the point is when you have, for example, <inaudible>, you have 50% water in it, unless you dry it. . So you don't wanna transport that over long distances. you wanna increase the energy density of it, and then you wanna transport it as short as possible, but still you need to transport it to a facility that has the scale where it's economically feasible to scale it up.

Tammy Klein (17:50):

Right. Right.

Makala Grubb (17:53):

So, I imagine a future where there will be delocalized, solid to liquid conversion plans, and some of them will be co-located with a HydroFlex unit, that is the future. I see. and yeah, that's, that's what I see,

Tammy Klein (18:15):

It seems like, okay you know, maybe there's enough incentive in RED 2 or 3 to really do that. But it seems like in the US, I don't know that there really is at this particular moment, unless, and until, you know you know, carbon intensity requirements tighten under the Low Carbon Fuel Standard. And then it becomes a little more economically justifiable and feasible. And then you ensure that credit prices, which have dipped in that program over the last year, probably

because of all the renewable diesel announcements out there, or at least in part, you know, that they really stay strong. So they need to really stay around $200 US per ton.

Tammy Klein (19:09):

And then, I think barring that because I think the RFS 2 Renewable Fuel Standard program in the US does not, is not enough, I think to incent that kind of thing. So it seems like to me, what is needed is if we want a refinery of the future or an HVO producer of the future, it seems like we need those programs RED two and three and LCFS, but we also need to incent somehow that aspect of the supply chain to really transition to those low carbon or no carbon or net negative carbon feedstocks. And I don't see that...maybe there's some recognition, but I don't see it translating into policy. And I think that's key to helping to unlock this as well if you want these annex you know, 9A I think if these stocks to happen, it's like there's gotta be some sort of targeted funding to get those projects off the ground.

Makala Grubb (20:23):

Yeah. And I don't see that happening. That's the US. Nope. And I see that as in the US and in Europe, there really is a very strong need for funding.

Tammy Klein (20:33):

Yeah.

Makala Grubb (20:34):

Yeah. So, that is absolutely correct. Yeah. Funding is needed.

Tammy Klein (20:41):

So if we...municipal solid waste things like that these other, woody biomasses those kinds of things, in the absence of any sort of support and incentive in this area and just with the programs that we, that we have now, what's your take on a timeline, you know, could we see more proliferation commercialization in, you know, by 2030, 2035 or is it a matter of these companies are going to have to invest because this is their pathway to staying alive, so it's just going to have to get done.

Makala Grubb (21:25):

So I think I've been in this space actually for quite some time. I think I'm also close to a decade now in this field and the development that I have seen over the last year or two has been amazing and has left me positive about the future, because I feel that there's been a lot of technologies that have been developed. They have lacked funding, but they have lacked focus. There's been no incentive. It has been people who are really passionate about trying to save the world, but now there's actually also legislation driving towards it, at least for Europe which means that in terms that there's a higher willingness to invest, and maybe they have also reached a certain technological maturity. So, it converts in the right direction. Now we just need to speed it up.

Tammy Klein (22:30):

Right. Right.

Makala Grubb (22:32):

So, I think we see more and more interest we see more and more happening in this area, so it will happen. And I hope, I certainly hope <laugh> that it'll be there by 2030.

Tammy Klein (22:47):

Yeah. If not even before, a few years before.

Makala Grubb (22:53):

Yes, exactly. I also think one of the important things to keep in mind is that a big part of what you do when you're hydroprocessing, especially for the renewable feedstock, is you consume a lot of hydrogen. The majority of that hydrogen originates from fossil sources. It originates from <inaudible> reforming of natural gas, which is fossil. There are many solutions out there and we have a few of them. We have our H2 bridge technology where we utilize the off-gasses from the renewable feedstock to produce hydrogen, which means that you need a lot less fossil hydrogen, so to speak. But now we also have a solution that we call blue hydrogen that's coming on the market, but that's where you capture carbon.

Makala Grubb (23:48):

And this is actually also really important. And makes a lot of sense if you think about it no matter which type of hydrocarbon that you are doing, steam methane reforming on to produce hydrogen, you will emit CO2, that's a fact that's how you make it. You can't really go against the laws of nature. So you have CO2, but if you capture that, you also get quite a big part of the way. And if you then utilize that CO2 to go via a different route, like the Fisher Tropes route to produce more sustainable fuel then it becomes better and better. And these technologies are out there, so they are available. So before we sort of get all depressed about not having enough advanced feedstock available, and what are we gonna do to keep in mind that there are also other solutions to capture the CO2.

Tammy Klein (24:56):

Right. And really sort of the circularity and its being carbon smart is sort of the turbine terminology and that'll bring down the overall footprint, at least at the production center or the refinery in this case.

Makala Grubb (25:12):

And, it's also a more holistic view instead of just looking at a high processing unit, it broadens the scope because we need to reduce the greenhouse gas emissions in every step of the way. And if we can capture this CO2, as well, we are even better. So, it is about opening your perspective somewhat.

Tammy Klein (25:35):

So, we talked a little bit, about policy and the impact of policy or the impact of a vacuum of policy. So I wanna ask you a little bit about sustainable aviation fuel. Do you see, especially on the refiner-backed HVO facilities, do you see them preparing to transition in the near future to SAF and again, do you think the policies are sufficient or will be sufficient in the next few years to really make that happen? What's your view?

Makala Grubb (26:15):

Well, over the last year, actually, we have seen...I'm not gonna call it an entire pivot, but sort of a half pivot.

Tammy Klein (26:25):

Mini pivot.

Makala Grubb (26:27):

Yeah. Mini pivot or at least we heard, oh, everything we heard was renewable diesel, let's go renewable diesel, let's produce some more renewable diesel someday. It was like, Hey, let's produce some SAF and that has really been a change in the recent years. And I think that's due to the legislation and also due to the fact that some European countries, Sweden and Norway have started to implement legislation. So in 2021, Sweden started out by mandating 0.58% sustainable aviation fuel in the flights to and from Sweden. That starts it. because the thing is also the question of, if you're a refinery, you really want to know that somebody will offtake your product.

Tammy Klein (27:16):

And, now we see that the legislation is coming and as far as I hear it's a rumor that there'll be some legislation in the US as well. And that's going to be very interesting to see the effects of that.

Tammy Klein (27:30):

Yeah. I think that's unfortunately that was part of the Build Back Better legislation that ultimately really didn't progress so far last year, but that wasn't because of those kinds of tax credits that was because of some other issues in the legislation. But I do think the way forward in the US is not going to be...RED 2 two and three complicated regulatory regimes, you know, Low Carbon Fuel Standard, California, complicated regulatory regimes. I really doubt, especially given the political environment in the US, whether we would see anything like that on a nationwide level, but incentives people can really get behind. They're a lot less controversial and there is a lot of momentum I think, behind a SAF - sustainable aviation fuel tax credit - that is really meaningful and provides enough of an incentive for producers and then also for the airlines. So I'm bullish on that. I don't know when that's gonna happen. I had thought it would come down this year and it's not too late. But I do see that happening in the, in the next year or so that coming to fruition and I think that will be a game-changer and how we'll have ripple effects around the world,

Makala Grubb (29:04):

I think completely. And we see that with the renewable diesel and the California legislation that has really been driving a lot of the projects. And I think if an incentive, in the same way, came for sustainable aviation fuel, that will also drive quite a lot. And I tried to compare a little bit, Europe is all stick, no carrot in the US, that's a carrot and a stick. And that really works. So it would be great in Europe if we also have a carrot.

Tammy Klein (29:38):

Yeah. Hope hopefully you'll get a few. I think carrots are probably gonna be the way to go. And I think it's going to be driven by, you know, again, our own political environment, which is highly divided and very partisan, you know, so it's, it's sort of like, we can get behind incentives. They're not likely to be legally challenged, but the moment you do an SAF mandate or a National Low Carbon Fuel Standard program, I think that's gonna be...it's not impossible, but it's you know, gonna be a little bit of a longer road and more fraught because, you know, we like carrots, but we like suing people as well. It's sort of our pastime here. <laugh> not as much in Europe, you know, we really like suing. <laugh>

Makala Grubb (30:29):

So when, when we talk about SAF one of the other challenges for Europe is the lack of feedstock, because when you look at the SAF certification...and I know it by heart CSAF, that's Certification for the Sustainable Aviation Fuel, and there are

some feedstocks that are approved. That's the virgin oil that's used, cooking oil, as soon as you have an advanced feedstock or something, that's not one of those, then you actually need to produce it fully on spec and produce enough to have a test flight.

Tammy Klein (31:10):

Yeah,

Makala Grubb (31:11):

This is hugely expensive. This is really millions of dollars to do this. And that is a challenge. That is one of the main barriers for sustainable aviation fuel worldwide is that it's so difficult to get it approved. And also I must say as a person who flies once in a while. I'm pretty okay with them being super strict on what they put in the engine, because if you're driving a car and it suddenly, the motors suddenly stops, then okay, you get out, you push the car, maybe <laugh>, but you can't really do that in a plane. So I think that's also...

Makala Grubb (31:52):

We need to find the right way to approve of these feedstocks, because it can't be so in the future that every time you change a little bit of the feedstock, then you need to go through all these certifications and approvals again. And again, then there's no business case.

Tammy Klein (32:10):

Right. Right. Actually, that's really interesting. I mean, I had never thought given a ton of thought about the how onerous...I mean, yes, there's a safety issue. There is a public relations and sort of marketing issue, public assurance, you know, assuring the public that this is a safe product and that's all understandable. But yeah, I question whether streamlining that process as these feedstocks come online if there's a way to do that and maintain the integrity of what you're trying to accomplish. And that's not something I personally have given tons of thought to just how difficult that is and how expensive it is. I mean, there could be government funding. I mean, heck I mean, Europe is funding...we just saw the Repower EU being announced and that's what $200 billion, like, we can't figure this out. I mean, <laugh>, you know, to maybe help with that process sort of beginning like targeted incentive, targeted funding at that critical juncture so that the testing can be done. I mean, that's, that's really interesting.

Tammy Klein (33:24):

Why aren't we in Parliament

Makala Grubb (33:25):

I really don't wanna answer that <laugh>.

Tammy Klein (33:33):

You're happy where you are. You'll just keep doing your thing.

Makala Grubb (33:35):

Me too, too. Let's go with that.

Tammy Klein (33:37):

<laugh> Let's do that. okay. So my last question for you, and this is kind of a fun one, what excites you most about this space and why?

Makala Grubb (33:52):

Yeah, I thought about this is what excites me is that this actually makes an impact. This is actually doing exactly what Haldor Topsoe wanted us to do. That is to improve the lives of others and the society around us. It makes a difference. And it also means that when my kids look at me, when I'm going away on business travel and looking at me and saying, mom, you know that it's not very sustainable to fly <laugh> I can tell them, well, I'm working on it, I'm working on it and it's getting better. So that actually excites me that I think we will, hopefully in a timely manner, be a better future for our children.

Tammy Klein (34:39):

Yeah, Well, that is great. That is great. And you know, I do think that it's, it's people's children that I think are really driving this because, you know, unlike me when I was a child, I mean, my parents told me to do something and I pretty much did it/ <laugh> there was no like, you know thoughtful dinner table discussions about greenhouse gas emissions. But the children today I think are so sophisticated and they're asking questions and they're holding our feet to the fire. And I think that you want to be able to look your kids in the eye, so to speak, and tell them what you're doing.

Makala Grubb (35:20):

Yeah. This week, my son's class has a theme week about garbage and pollution. So, and he's nine <laugh>. So we're educating these citizens that are actually conscious about waste and sustainability. So, that really excites me. And it also excites me to be part of this is a once in a lifetime opportunity, we are experiencing the energy transition. It's not every generation that gets to experience this and to just be a little tiny piece in that puzzle to help it move the right way that excites me so much.

Tammy Klein (36:08):

So we'll end it there. I agree. I feel the same way from my little piece of the energy transition puzzle. I want to thank you so much for being on the show today. It was great. Great to talk to you and have you, and I look forward to doing it again.

Makala Grubb (36:26):

Yeah. I'd be happy to, thank you.

Outro (36:34):

[Music] You've been listening to Fueling the Future of Transport. This show is hosted and edited by Tammy Klein, produced by Carolyn Schnare and engineered by Aleksander Nikolic. To hear more great episodes of this show, learn more, and sign up for a free biweekly newsletter. Visit transportenergystrategies.com.