

Transcript for #96 Decarbonizing with DME (Dimethyl Ether)  
Guest Rebecca Boudreaux. President and CEO, Oberon Fuels  
July 3, 2023

Tammy Klein (00:01):

Hi everyone. Welcome to the show today. I am so happy to have with me Rebecca Boudreaux. Rebecca is president and CEO of Oberon Fuels and we're gonna talk dimethyl ether or DME today. So you're probably wondering, for some of you anyway, what is DME so Rebecca's going to talk to us all about that. Rebecca, welcome to the show.

Dr. Rebecca Boudreaux (00:42):

Well, thank you so much for having me, Tammy, and I hope everyone's not scared, thinking we're gonna have a chemistry lesson today. <laugh>. Everyone's having flashbacks, <laugh>. Exactly,

Tammy Klein (00:53):

Exactly. That comes after the show. No, I'm kidding. So can you talk to us a little bit first and foremost about Oberon Fuels and what Oberon Fuels does? I kind of gave it away a little bit, but you can talk a little bit more about it.

Dr. Rebecca Boudreaux (01:11):

Yes. So thank you again, Tammy, for having me here. Oberon Fuels is a California-based company that started almost 13 years ago in 2010. and it was really focused and continues to be focused on providing innovative solutions to help companies, industries, and countries decarbonize. So how can everyone reduce their carbon footprint? What are innovative ways we can do that? and the innovative solution we have focused on comes back to where we started today with dimethyl ether. so we have a production plant today in Southern California producing the world's only commercial renewable DME today. It was the first renewable DME ever produced in the United States when it started producing it in 2021. and we are excited to work with partners around the world: Suburban Propane, the third largest company in the US, Lipic Gas in South America, and in 2023 we announced we are working with DCC, one of the world's largest LPG companies in looking at European production and sales of renewable DME.

Tammy Klein (02:28):

Okay. So what is exactly DME and why is renewable DME so important for those who may not know?

Dr. Rebecca Boudreaux (02:41):

Yes. So DME, again I know everyone's having flashbacks to high school chemistry and they're starting to sweat right now. <laugh> just thinking about it. but all you have to remember, is <laugh> DME is just the small molecules that carbon connects to oxygen and carbon, and there are some hydrogens around it. You don't even have to remember that. But what's important about DME is it's actually a very useful molecule that can help industries decarbonize. So, for example, DME actually looks a lot like propane, and propane is used for transportation, home heating, there are a lot of uses of propane. And it looks, DME looks very similar except you can make it from a lot of renewable feedstocks. So, you can blend it in with propane, leverage existing propane infrastructure to utilize that DME and so that's a really important key thing about DME. It's really easy to move like propane, a very portable molecule. So it also could be a way to move renewable hydrogen because there's hydrogens of a molecule. So besides the

organic chemistry lesson, the carbons and oxygen hydrogens, one of the most important things as we think about how are we gonna decarbonize the world, is creating a more portable molecule from a lot of different waste streams and that molecule's DME that can leverage the global LPG or propane infrastructure.

Tammy Klein (04:06):

So how do you make a low-carbon-intensity DME?

Dr. Rebecca Boudreaux (04:11):

Low carbon density is all about the feedstock with which you start. So when you think about DME you can make pretty much any organic waste or organic product that can be used to make DME. So you think of cow manure, pig manure, chicken litter, wood waste from trees when you make pulp for cardboard boxes that Amazon delivers to your house every day. Or maybe that's just me. but there's a lot of different organic waste streams that you can use to make DME. So currently, the renewable DME we produce at Hora in southern California takes waste streams that come from trees. So it's naturally occurring in trees. There's a source of methanol, you break down those trees to make pulp, there is methyl there that didn't have a use. And so we clean that up and we're making renewable DME out of it. Our next production facility, which we will announce in 2023, we have shared that its name is Titania and it'll be the world's first carbon-negative renewable DME that will come from a biogas. So the breakdown of manure and methane and carbon dioxide make DME.

Tammy Klein (05:27):

So one of the reasons why I really have been wanting to have you all on is that you in part serve a market with all of the discussion and talk about decarbonization, there's lots of focus on decarbonizing liquid fuels, like gasoline and diesel, electrification or e-fuels or transitioning to hydrogen, which I also wanna ask, ask you about. But it is pretty significant, when you look at it, and I can't remember the percentages, but there is a significant pool out there of LPG and propane being used out there in this market. And it's like, how do we reach decarbonization of that pool as well? And I think sometimes that gets a little bit lost in the decarbonization shuffle. I mean, it's not like, you've seen President Biden, for example, in the US out there on the podium talking about <laugh>, "oh we really need to decarbonize LPG," but this is a market that is going to be needing this, as well.

(06:38):

So I guess that's why I'm just really intrigued about this because it's sort of like this little blip of space around, "well what are we doing with LPG? And here we have a really good solution." So the question to you is, how do you see the RDME market growing in particular for LPG replacement? And then I'm really intrigued to learn more about RDME as a hydrogen carrier because hydrogen's like Visa, "it's everywhere you want to be" right now and it's all about what are the carriers in the future going to be like, so can you talk about those two sort of market dynamics going on?

(07:27):

es. And Tammy, you raised a great point and there hasn't been a lot of discussion at the government level or how are we going to decarbonize LPG or propane. But it's fascinating because the global LPG industry has comparable emissions to the aviation industry.

(07:46):

Oh wow.

Dr. Rebecca Boudreaux (07:47):

Yes.

Tammy Klein (07:48):

So I didn't know that Wow.

Dr. Rebecca Boudreaux (07:50):

<laugh> and so, but aviation is very exciting to see all the work that's been done on sustainable aviation fuel has gotten so much focus. You have President Biden and governors across the country are always talking about it in the US about sustainable, aviation fuel. you see it elsewhere in Europe and around the world. and I love flying objects and So it's a lot more fun to talk about planes sometimes, but when we're thinking about how do we decarbonize the world, what innovative solutions are we gonna bring to a comparably sized industry and to help them decarbonize, and that's why we find it very exciting at Oberon to be able to offer renewable DME as a way for LPG to start blending in product today. It is actually happening today.

(08:40):

Suburban Propane started in 2022. They started blending in Oberon's renewable DME and selling it to forklift customers and to on-road vehicles for use. Now they're up to 450 customers in southern California, continuing to expand the rollout of the product. And we're excited because as I mentioned earlier, we have new production announcements this year. So more products come on the market. And so it's happening today. and it gives an opportunity to help this industry decarbonize. But as you said, it also sets the stage for other things like renewable hydrogen, another again, talking about flying objects is very attractive and sexy and people wanna talk about how we decarbonize the aviation industry and it's very important. But we also have to talk about decarbonizing the LPG industry, but also leveraging this global network of assets, tanks, trucks, dispensers, how we can use that existing equipment and the 4 million people working globally in this industry who have been safely transporting molecules for over a century in some places. And, leveraging that knowledge on how to move molecules safely is very valuable. And they can use that knowledge to move other molecules that have a lower carbon footprint. So renewable DME and then transporting renewable DME with those existing assets, they also can be transporting renewable hydrogen. Because at the point of use, you can pull the hydrogens off of renewable DME and then you don't have the challenge of transporting renewable hydrogen that you have if you pull off the hydrogens earlier.

Tammy Klein (10:33):

Wow. I mean, it's just so, so interesting. I mean, for years the focus has really been on the LPG industry, but it's really exciting with everything that's kind of been happening around hydrogen to be able to leverage that existing infrastructure. It's already there. And by the way, it's kind of interesting, like if you look at studies or you look at market reports, there's like a giant blank spot. I feel like you guys might be the only ones right now talking about how you can leverage this infrastructure and you can bring that into the hydrogen value chain. I'm not really seeing it outside. I'm not really seeing that discussed in the trade media or in the public domain outside of maybe some academic studies. But it's really exciting because I think that's where the transition happens. It's building on what we have you know, along with creating additional infrastructures that may be needed to support other aspects of decarbonization. But you've got this whole global network of people who kind of know how to handle this stuff and it can be leveraged for this whole other purpose.

Dr. Rebecca Boudreaux (11:57):

And it's exciting too, to see, so you have, you can start decarbonizing LPG today with renewable DME and by them getting used to hailing the product by these markets taking off, encourages more production with companies outside of Oberon and others coming into the marketplace and then teeing it up for renewable hydrogen. And so I agree with you, Tammy. You know, we don't hear others talking about it <laugh>, we see this amazing opportunity. and that's why we started building in 2022, the world's first renewable hydrogen renewable DME to renewable hydrogen reformer, which is just a fancy way of saying the machine that pulls off the hydrogen <laugh>. so you need some catalysts and you need heat, that's all you have to do to pull it off. And so we said, well, you know what, we're not just gonna talk about it, we're going to build it and we'll be deploying in the second half of 2023, we'll be deploying that reformer at our site in Southern California to show nothing like educating about the concept, but also to have real steel in the ground to show people this is how you do it and then that could be deployed to a customer site who's using the renewable hydrogen. and the LPG industry has an important role to play in this. and so it's exciting to see and just to keep pushing forward and again, coming back to our roots of what are the innovative solutions that we can offer the world to help and decarbonize.

Tammy Klein (13:25):

So let's go back to what's happening within the company. What have been some of the big milestones for the company, especially over the last few years? And can you talk about your expansion plans? Because I mean, in 2010 it was that 2010 to 2015 pre-Paris Agreement period, having worked in biofuels for many, many, many years. I mean, oh, those were some lean times, <laugh>, <laugh>, those were some tough times. I mean, and there are companies that sort of didn't make it out of that R&D and TRL <laugh>, <laugh> Valley of Death as it were. So you guys have seen a lot. You have done a lot and so what are you guys planning for the future? Where have you been? Where are you going? <laugh>?

Dr. Rebecca Boudreaux (14:24):

Yes. Well, it's been quite a journey. Yes. As you said, the early days could often be lean for us. You know, there was a pivot that happened in 2018. So in the early days of Oberon, we really focused on DME as a diesel replacement and DME continues to be an excellent diesel replacement. But what we zoomed out in 2018 and said DME is actually enabling molecules. It can be blended with propane to enable the global propane LG industry to decarbonize, but it also can be the source of renewable hydrogen to leverage that infrastructure we talked about. And so we started telling the bigger picture story of renewable DME and its superpowers. And that's in 2019, we actually won our first public funding ever from the state of California because by telling that bigger picture story, we could offer a solution to the state of California that's driving innovation, trying to find other ways to reduce the carbon footprint in many industries.

(15:25):

And so it was very exciting for us after over eight or nine years to receive public funding. So we were excited when the grant 2019, 2020, things were getting kicked off in a real way and it was an interesting time to scale because then a little friend called Covid entered the picture <laugh>. And it was interesting because right at the time we were sparked to bring on the additional plant operator. So the funding from the state of California allowed us to upgrade our existing facility, which we first built in 2013 to be able to handle renewable feedstock, this new renewable feedstock I talked about that comes from trees. And now is time to bring the plant operations team on and get the plant up and running. Since June 2020 and the region where our plant was located, one in four people have tested positive for Covid and there's 27% unemployment. So

people needed to get back to work about how to do it, and hire safely. And so the things we now take for granted about virtual interviews and hiring people you've never met <laugh>. but we were figuring that out. But we were able to build a production team during this very challenging time for the world. and that team, less than a year later in 2021 May, 2021 the team that produced the first renewable DME ever in the US and it was an exciting milestone for us. In 2022, we announced with Suburban that they're selling the blended product to their customers in Southern California. and excited to continue to see that progress. In 2023, we announced the partnership with DCC for renewable DME production and sales in Europe.

(17:18):

so expanding geographically, as I mentioned will titan our next production facility world First, carbon-negative renewable DME will announce our partners' volumes, additional information later in the year. and also being able to deploy our renewable D-meter, renewable hydrogen reformer in the second half of 2023 at our plant, in Southern California. And so again, innovation, continuing to drive forward even during the most challenging times for our world, enables us to keep moving forward, making progress to help the world decarbonize. So those are some of the exciting milestones that we've had and some that are to come later this year.

Tammy Klein (18:01):

So you're CEO, obviously. What are some of the biggest, both challenges, but also successes that you've had as CEO? You've been in the role for over 10 years and I mean, quite honestly, there aren't that many female CEOs in energy period. To me, there's like an extra sort of dimension there. So for you, what has that been like, and what have been the challenges and also the successes?

Dr. Rebecca Boudreaux (18:37):

It's been an interesting journey. So I've been focused on commercializing new technologies for now 20 years. and I started during my graduate studies. I started my first company with three of my colleagues in biotech. We were making new molecules that could make existing chemotherapy drugs work better. And this was my first adventure in early-stage company world and building something out of nothing. But, what it really taught me was becoming uncomfortable, or excuse me, being uncomfortable with being uncomfortable. Like being able to take steps forward without knowing what's gonna come after that step. And when the path isn't clear. Because in innovation right, they, no one has done it before. And so if you're waiting for a clear path, it's never gonna happen. And I think actually that's where my scientific training came into play is, because again, you're discovering new things as science, solving really complicated problems and trying to break it down

(19:42):

and so yeah, I have I guess been a fish outta water <laugh> throughout my journey. There aren't that many women in science. And as you go higher in further the education level they're less and less women. I know the trend is changing for the better. and so in some ways I was accustomed to it, but I definitely got more evident as I went early stage company world that went into the energy space. I mean the bright side is when I go to conferences sometimes there's not a long line in the women's restroom. So I always take that <laugh>, but I look forward to the day when there's a long line <laugh>.

Tammy Klein (20:21):

That's funny. Yes, that's true. That's true. Having been to some of those conferences myself. Yeah. no waiting,

Dr. Rebecca Boudreaux (20:28):

No waiting. So it is, you are often I think the challenge is that sometimes people remember you and it's a little hard for me to remember people because I <laugh> if there's only five women's speakers at the event, they often remember you. but, and you know, it's just interesting because sometimes I just have to remind myself, I want the world to be different for my daughter and it's definitely easier for me than it was a generation before me and two generations before that. but I do have two young children. so my daughter is six and my son is three. And so I would go to conferences and not just being a CEO who's female in energy, running an energy company, but then I was pregnant <laugh>.

Tammy Klein (21:16):

Wow. Yes.

Dr. Rebecca Boudreaux (21:20):

But things, like I said, often were like, "Ooh, that's kinda weird. Why would you say that?" But people just hadn't seen it before. and so I really try to just take it with a grain of salt and have a sense of humor about it and sometimes it feels a little bit like a reality show, but knowing that there's a real opportunity to be a role model for other women and as they're coming up and talking about my journey and hopefully that will help them say, "oh wait, that is possible." Sometimes they're hard for us to imagine what we don't see. In my undergraduate studies, I went to Southern Miss and I was part of their honor college and I had a Dean, Marine Ryan, with whom I still stay in contact.

(22:05):

And she helped me see what I didn't even know was possible. and encouraged me to think outside of the box as far as my career, what I wanted to do, encouraged me to pursue. Are you interested in doing scientific research? So there's summer science programs. The Dean or the chair of the Palmer Science Department encouraged me. So I ended up doing research, which led me to pursue a PhD. So I had those people in my life who encouraged me to think bigger as I hope that I can encourage others to think bigger as well.

Tammy Klein (22:36):

So I wanna go back to talking a little bit about the company and some of the policy dynamics that are kind of around decarbonization, especially here in the US but really globally as well. First and foremost on my mind is how the Inflation Reduction Act is impacting your and your team's planning for the future. and is there enough, and, and maybe I could ask as well for, for what's been happening in Europe under Fit for 55 as well, do you feel like there's enough policy support in place even with those types of programs, existing programs like the California Low Carbon Fuel Standard to really support renewable DME?

Dr. Rebecca Boudreaux (23:36):

The short answer is yes. actually, I do think that there is enough support there. but it's been interesting because in addition to innovating on technology along the journey overall, we've also had to innovate on the regulatory framework and policy because policy typically isn't written for innovation Because it's not there yet when they write the rules. And it's, again, hard to imagine and it's hard to write rules for things that don't exist.

Tammy Klein (24:04):

Right.

Dr. Rebecca Boudreaux (24:04):

So during this journey we have had to work very closely with regulators across the United States, and particularly the state of California to adapt the roles for this innovative fuel, renewable DME. and so we have worked extensively, we had to change the California Code of Regulations and partnership with the state which happened in January 1st, 2015, to allow DME to even be legally sold in California as a fuel creating consistent standards. What does the pure DME look like? How do we make sure we have the right quality product? and, so it now qualifies under the renewable fuel standard. Oberon received a pathway to convert biogas, the DME by theron process, back in 2014. It will qualify for the local carbon fuel standard. You go through the pathway process. So it's been a journey just to the existing regulations to make sure it qualifies and adapts the rules. but then also now the Inflation Reduction Act. And there are definitely opportunities both on the production tax credit side for renewable DME also, depending on what market we go into, whether we blend for with propane or if we go to renewable hydrogen, there's opportunities well for credits there. So there's a great opportunity and we stay, stay close to it as the rules are being written and provide comments like many other people do, just to make sure that we aren't unintentionally excluded from it. That there's a great opportunity for us on multiple fronts.

Tammy Klein (25:38):

Yeah. I would imagine that would be because you know, just like we were talking about earlier, it's like gasoline, diesel substitutes, LPG, blank spot. <laugh> and like like, huh. but it's important too, so it, I mean, I guess from Oberon's perspective, I mean it's really technology neutrality in these regulations are really, really important. It's a total example of why we need to be careful to ensure that Policies are technologically neutral because you never know what's going to come out of the void in terms of technology development and application as, as you know, renewable-, RDME for hydrogen renewable hydrogen sort of shows.

Dr. Rebecca Boudreaux (26:28):

Right. And that's where we think it's important to just set the target. So what's the goal? Okay, the goal is reducing carbon intensity. Well, let us just shoot for that goal. Do you really care how we get there? <laugh>, What is the technology pathway because as we say at Oberon, we're focused on waste conversion to renewable DME today. That's the innovative solution. And we continue to be successful and continue to drive more and more volumes in the market in five and 10 years. That's not innovative. And we're gonna keep pushing the envelope on how we further decarbonize. So even when we are working with regulators, when possible, it's like, okay, let's have a carbon intensity target. Like, encourage us to keep doing better. Let's not name molecules and pathways. Let's just help make the definition future-proof when possible. So it's not always easy to do, but it is really important that we think beyond the here and now so that we don't discourage innovation in the future.

Tammy Klein (27:26):

So last question. You have talked about quote "decarbonization without disruption." So can you talk a little bit more about what you mean by that phrase?

Dr. Rebecca Boudreaux (27:40):

Yes. It's interesting when people think about innovation generally, they think about the new shiny object is something really cool that's being released. And so naturally when we think about decarbonization, we think about something completely new. What is a completely new thing we're gonna do to help the world decarbonize because we love new things and we love

shiny objects. but I think it's more important that we say, how are we gonna decarbonize really quickly and when do we have that partly exists that we can leverage to help that happen faster? And that comes back to our conversation earlier, Tammy, when we were talking about how do we leverage this global LPG infrastructure to move lower carbon molecules and, and make newer products and distribute them. And so when we think about decarbonization without disruption, it's about innovating, leveraging what we have today, the infrastructure that tanks, dispenser, trucks, the knowledgeable workforce of 4 million people globally for the LPG industry. and to leverage that to, unlabel the world, to keep having sources of energy. We don't want people, all of a sudden they're being heated, they're off the grid, they need propane for heat in the wintertime, all of a sudden you're like, oh, I'm sorry. That's not possible. , you can't heat your home <laugh>. That just doesn't make sense, right? And so how do we help them decarbonize but still get the energy they need for their world and whatever that world may look like. And so it's really about leveraging what we have today and continue to innovate within those systems, but be able to do it in a faster way.

Tammy Klein (29:18):

So there's one really, really last question that I forgot to sort of think about. But one we've been asking all of our guests and that is, what is fun about this space here? What's the best thing about being in this space and what sort of keeps you going every day and why? So that's the really, really last question.

Dr. Rebecca Boudreaux (29:46):

<laugh> There are many fun aspects about this space. And being able to do things that people haven't done before is really truly amazing. I remember in graduate school I was, I spent two years trying to make a certain molecule and it was supposed to encapsulate DNA to enable it to go into cells because the goal was visually helping disease cells be cured. So I made this molecule, spent two years making it, and then I had to put it into cells and then the way you were gonna be able to tell if it worked, the cells were gonna light up. So I waited, that amount of time, I go into the microscope and I see the cells light up like it had worked. And nobody had ever done this before. And so with what we're doing at Oberon, people haven't done this before.

(30:33):

And we see real steel, real renewable DME molecules coming out of our facility, getting new partners, new continents engaged in renewable DME. It's exciting and the best part of it are the people you get to do it with. And some of the people I've been doing with for over a decade. We've been in the trenches together, newer people are joining the team. And it's just really fun to see how innovation doesn't just enable industries to decarbonize, but it affects all of our lives and makes our lives better. And we get to do something really proud of and talk to our children about because we're changing the world.

Tammy Klein (31:11):

Rebecca, thank you so much for coming on the show today and talking about what Oberon is doing, and I look forward to continuing to follow the company and, and all the great things that you're doing.

Dr. Rebecca Boudreaux (31:22):

Well, thank you so much, Tammy, for having me. It's been a great pleasure.