



S02E06: Building the Car of the Future

Louise de Laat (00:00):

A group of 35 students that never worked with each other and never built a car before, and we still accomplished to develop this car in less than one year.

Kyle Fox (00:26):

This is A Smarter World podcast focusing on breakthrough technologies that make our connected world better, safer, and more secure. I'm host Kyle Fox. Each episode we introduce bright minds in their approach to a more sustainable world. We discuss the opportunities and challenges they face and how technology can change the world for the better. For today's episode, I'm joined by Louise de Laat, the Team Manager of TU/ecomotive. This is a student team, which is based in Eindhoven University that challenges the automotive industry by implementing cutting edge innovations from within and outside the automotive industry into proof of concept cars. Each year a team of students is tasked with creating concepts for unique sustainable car. In 2022, for example, the team created the ZEM, zero emission mobility EV that actually captures CO2 straight out of the air. It cleans the air as it drives. This year's concept car will be revealed in just a few weeks and I'm hoping Louise is able to tease a little bit about what we can expect. Hi Louise, and welcome to the pod.

Louise de Laat (01:30):

Hi, Kyle. Thank you.

Kyle Fox (01:31):

I am so excited to talk to you today and learn more about what you do over in TU/ecomotive. It's a really cool group, right? It's a group of students that's making a real impact. So can you tell us a little bit more about what TU/ecomotive does and how you got involved?

Louise de Laat (01:45):

Yeah, maybe it's cool to tell a little bit more about what a student team exactly because from our journey there are a lot of people that get mixed up with oh, this is just a group of students that are working from a lecturer of a facility from the university. But no, we are really a self organized origin that is really working with setting up the team 'til touring with the vehicle that we made. And so this is a nonprofit organization where technical University of Eindhoven is one of our sponsors likewise as NXP. Every year a new group of students within TU/ecomotive can work on the challenge on what is your future concept of sustainability and mobility and [inaudible] was really focusing on CO2 neutrality in general. How can we make a CO2 neutral car from head to toe in all the life phases of the vehicle?



(02:40):

And I first got involved by a silly WhatsApp question in one of the student WhatsApp group where I'm in, "Hey, we are really looking to have an account manager in team." And I was like, "Okay." And I already experienced something of accounting in my previous jobs that I had, so let's do it. And eventually ...

Kyle Fox (03:01):

You said yes.

Louise de Laat (03:43):

Yeah, I said yes and it turned out that I also could be a very nice team lead. So I got chosen as a team lead of the whole student team and it was a group of 35 students that never worked with each other and never built a car before, and we still accomplished to develop this car in less than one year.

Kyle Fox (03:21):

It's amazing. I really liked what you said. People's first impressions might be oh hey, this is a bunch of students getting together. What are they going to be able to accomplish? But I think it sounds like that's the power in what y'all have done is these innovative young ideas that come in to be able to build these cars. And as you pointed out, they're not just creating PowerPoint cars, they're actually building real metal and real wheels that are going on the road.

Louise de Laat (03:43):

Yeah, indeed. I see us as the underdogs that challenge the industries. Right now really would like to shake up the car manufacturing industry by showcasing what is possible because still we are a very small team, we didn't have many resources such as time and money, but that is not an excuse to hold you up in your innovations.

Kyle Fox (04:05):

I always root for the underdog myself. So let's unpack a little bit about what you and your team accomplished. As I understand you are the team manager for last year's ZEM car, so I want to go right to it. Tell me more about that. I'm excited. How does a car clean the air?

Louise de Laat (04:19):

So ZEM stands for zero emission mobility and the focus points that we had was for ZEM to be zero to neutral on all life phases of the vehicle. So from the car manufacturing, the driving, and the end of life of the vehicle itself. And among those three different phases, we developed



different types of technologies. One of them was in the car manufacturing mainly based about additive manufacturing, so 3D printing the whole chassis of the vehicle, but also the body panels from already recycled granulates. So the material that you use for printing, and because it was already recycled and we 3D printed the components, you can recycle it in a very closed loop and without having waste within the manufacturing and also in end of life.

(05:06):

And during the driving phase, yes, indeed we developed a technology that has the superpower to clean the air of CO₂ while driving. That was very controversial. People thought this ... Like the other way around, right? It has the ability because on the front behind the grill we developed the technology that is the CO₂ capture, a filter while wind is driving towards the front of ZEM, it will go through a gap and within that gap, the filters behind it and then the air, what flows to that filter gets cleaned from CO₂ and gas from CO₂ will stick in that filter, and then clean air will come behind the filter. And when the filter is saturated, we can clean the filter while charging ZEM because ZEM is also an electric vehicle. While cleaning, the CO₂ gets extracted from a filter, so the filter is empty again and can be reused, but the CO₂ that you capture from the filter can also be reused. And that is a whole new world because CO₂ right now in gas forms can be recycled or reused for making carbon materials for feeding the plants.

Kyle Fox (06:20):

You put a ram scoop behind each wheel to pull the air in and now you're filtering it. It almost feels like an oil change for a gasoline powered vehicle, but in this case you're changing out the filters with real carbon in it.

Louise de Laat (06:27):

Yeah, indeed. So you also get a blink on your [inaudible] port, note the cars need to review it. Now you get a blink in our ZEM vehicle with you need to empty the CO₂ filter to regenerate the CO₂ that you captured.

Kyle Fox (06:40):

There's lot to talk about how to make things carbon neutral, reduce the carbon in the overall manufacturing cycle, and y'all certainly have gone very far on that, 3D printed materials. I also noted that the leather in the car itself is vegan, made from pineapples.

Louise de Laat (06:54):

Yeah, indeed. Pineapple waste.

Kyle Fox (06:56):





In essence, you're growing your own leather, right? It's amazing to think about it in terms of it's not enough to have the materials be manufactured, you've actually got to do something that has a net positive, or I should say negative benefit, on how much carbon is in the air itself. So the device itself, in this case a car, has to participate after it's been manufactured in pulling carbon away.

Louise de Laat (07:15):

Yeah, you have thresholds throughout all the life phase because we calculated our footprint of the vehicle itself from all those different life phases, also stimulated the behaviors of the vehicle. What you see is that you have an offset already in car manufacturing and we tried to lower that as much as possible with new technologies such as the additive manufacturing, which we're already reusing recyclable materials and then still, we saw that the offset is still too high, so we need to come up with a technology that can restore that offset. So ZEM is a bidirectional vehicle so it can give energy but also capture energy, or the grids by that. But then still we saw okay, we need to do something with capturing CO2 out of the air.

(08:02):

It was a very crazy idea. We made it into reality. There's still a very concept based technology at the end of life, we saw the keys to reusability like reuse a lot of components. We also reuse a whole infotainment system off of partners. It can still be sexy to have secondhand materials in your fancy looking car because it is still like huh, do you have a secondhand entertainment system? Yeah, it can still be sexy. The car nowadays could be more sexier with a lot of recyclable and reusable materials than everything new, new, new.

Kyle Fox (08:35):

Well, you make it a brag point instead of something you want to hide. Check out what this car can do.

Louise de Laat (08:38):

Yes.

Kyle Fox (08:38):

I totally get it. It's getting me excited about it. I'm sure we could spend another hour on how you might unpack this technology into all different types of things that move, trains, planes, automobiles. But what really came to my head is that the more you drive, the better it is for the environment, which is counterintuitive in the gasoline powered vehicle mindset. Amazing.

(08:58):



We've talked about your team and we talked a little bit about the reuse of infotainment, that sort of thing, and I saw that you are working pretty closely with different sponsors. Obviously, this is going to be very collaborative to bring these concepts to life and one of those sponsors is NXP. Can you tell us a little bit more about what you're doing with NXP? How's that collaboration going?

Louise de Laat (09:16):

So NXP is already our long-lasting sponsor because they worked with us in the early stages when we started as a student team and they already know all the generations that we had. And because they know already us, they like to challenge us also, so that's something that I really like about the attitude that we have together with NXP because we really would like to set up the bar high and higher again to keep the innovation as high as possible. To get more in detail, we work a lot with the microcontrollers of NXP such as the LPC11C24, which is the beating heart of each vehicle with the embedded sulfur and canned communication. Also with the electronics that we have from other partners such as [inaudible] with the side view mirror. We also see that had an NXP microcontroller in it.

(10:12):

So we really could integrate all those functions together, but it really started already in the early phase of our concepts, so NXP is one of the first sponsor where we really like to [inaudible] because they know already us a lot, they already know our mistakes that we made in the bus, and they really can help us also with hands on tackling challenges, et cetera. So we also work with the [inaudible] board on the small prototyping and already testing the electronics in a very early stage of [inaudible] car development, but still because we have just that small time spent of developing the full vehicle, NXP like to work also with us on that high level. So yeah, that is really nice.

Kyle Fox (10:54):

So been along for the entire journey. I realize I talked so much about the carbon capture, the ZEM vehicle, but you kind of hit nail on the head, you've done seven of these. So in addition to what you did last year, which we've unpacked, you've created some very unique sustainable cars over the years and I'm assuming they each have their own revolutionary concept. This is why we're building it and why you should care. So let's spend a little bit of time on that. Can you highlight a couple more in this lineage of cars you've built that you're particularly proud of and the problems they're solving?

Louise de Laat (11:25):

Yeah, in the first three years for student team, we competed in the Shell Eco Marathon, so our vehicles were developed to be as light and efficient as possible, efficiently in terms of the energy use while driving in the vehicle and also with the weight distribution of the vehicle itself. But we



saw that competition also had a lot of restrictions that hold us up in our innovations that we want to develop. We really would like to step out of the box by really making very sustainable vehicles, such as one of the first vehicles was Noah. Noah was a fully circular vehicle, which was made out a sandwich panel at Chelsea, and the sandwich panel was flux, it was a bio fiber with a honeycomb structure of a sugar. So sugar and then the POA size, and then that was the structural component of the vehicle itself and it was freely circular. Then we had Luca, and they changed the honeycomb structure with PET, PET bottles. So Luca was really focusing on how can we make cars out of waste.

Kyle Fox (12:29):

You just described the materials that you would make out of waste, like literally take something that we've discarded and turn it into something we care about.

Louise de Laat (12:37):

Yeah, indeed. And that was also our challenge because what are you going to make after a Luca concept and vehicle? Because Luca itself was a very cute yellow vehicle and already had that great attention, international but also national, with all the publications that they had. And then yeah, we started after COVID with a new team and then still, what are we going to do? And we saw that now currently in Europe, but also internationally there are a lot of problems in terms of the emissions that we have and how can we reduce those. And we saw that the car manufacturers right now are very focused on the driving phase of the vehicle, make that green as possible, but they lose track of the manufacturing and the end of life because what are we going to do with all those batteries? Do we think about the recyclability and the reusability aspect of it and those kind of things. Also, the friction with pollution of the car tires because electric fuels.

Kyle Fox (13:40):

Oh, yeah.

Louise de Laat (13:41):

Get heavier. That was also a little bit the trigger of making ZEM like showcasing what is possible in reaching suture neutrality.

Kyle Fox (13:47):

That makes sense because the world has an e-waste problem with just lithium ion batteries coming from the phones that we've been building and ...



Louise de Laat (13:53):

Yeah.

Kyle Fox (13:54):

We're just going to make that just a little bit more challenging by putting in much larger battery stacks into all these cars and what do you do with it? Interesting.

(14:03):

So your teams have built seven cars, right? With an eighth on the way, and as you've been describing this, I'm just thinking about how incredible that pace of innovation is. What's the most challenging part here? It would seem that there's a bit of a time element involved with how long the students themselves can implement a project. They've got their academic careers to deal with and they may be graduating, that sort of thing. Or is it simply coming up with new ideas each year? What's the biggest challenge here for you?

Louise de Laat (14:28):

I think we know how to build cars, so that is something that we've already proven and we can also learn from the past years that we created vehicles within TU/ecomotive. But I think what you've already recognized is that having those new innovative concepts over and over again, that is something where the new team is also struggling with, but we still see that when the pressure is very high to come up with a very innovative concept, you still can accomplish something great and that is something that we for sure already proved in our ZEM vehicle and I strongly believe that the next team is also going to do that with their new vehicle.

Kyle Fox (15:06):

Clearly, and so I've realized this is top secret, and of course, we'd love to have a scoop on this, but this next concept, car number eight that's under works, my understanding is it will be revealed in July of 2023, so just right around the corner. Any chance you can give us a little hint of what it'll be? Even just a slight touch of what it might be? Or is it completely top secret and we just need to wait?

Louise de Laat (15:28):

Yeah, this is a combination of both. I really would like to give the team the full pleasure of revealing the full concept, and maybe in another podcast next year. They're also going to tour in Europe together with NXP. They're going to travel along the roads to showcase their vehicle in Europe. I don't want to spoil too much, but they are really going to step up a little bit more on our reusability and recyclability.



Kyle Fox (15:53):

I will not be the one responsible for revealing the hard work of a bunch of students too early. So I will be watching for the announcement with bated breath. You hit on something that I was going to ask you. I was going to ask you, does the team ever hit the road with these prototypes? But it sounds like you were saying touring Europe. It's not like you're just sticking this in a showroom and having people come to you, you're putting these wheels out there. Can people outside of Eindhoven or even the Netherlands, can they witness this firsthand? How does that work?

Louise de Laat (16:17):

Yeah, so we have our test tracks at the university ourselves where we build and develop our own vehicles. You can also test there freely because our cars are not road legal approved and that is because of the new technologies that we developed ourselves and tested also in that early stage in our vehicles. So we couldn't get the road legalness within the time spent of our concept. We tour a lot with our vehicles to events, also on test circuits. We did that in the United States with ZEM, for example, at the TMC track, so that was really cool.

Kyle Fox (16:50):

Thank you so much for all the details here and what you're doing. It's incredible what your team has accomplished. You've got an interesting view of what's possible and what's not in the automotive industry and it's not theoretically, you're actually building stuff. I would consider you an expert to be able to answer this question. When you look at the current state of the automotive industry, where do you see the biggest potential to make an impact? And I'll ask the hard question, is the automotive industry doing enough to create a more sustainable future?

Louise de Laat (17:18):

I think they have to because otherwise we are not going to buy their cars anymore. I'm personally from the next generation and I strongly believe that we really need to challenge the industry in terms of our consumer behaviors. No, I'm not going to buy a gasoline truck anymore because it looks cool and it has a lousy noise. No, I'm now going to invest in cleaner vehicles, and that is a little bit my point of view and I hope that there also more people are thinking that way. But in terms of regulation as well, we see a lot of things happening right now in terms of the calculating your footprint and emissions that you make with your vehicle throughout the life phase of the car itself.

(17:59):

I think people need to prove right now that they really hit those CO2 neutrality targets and that they are working towards it. I see already a bit that people are working a lot in terms of reusability and recyclability, bring it back again to see if you can recycle and reuse components. What I'm seeing right now is that there's a big trend coming up of predictive maintenance, so



you can predict those batteries of that type of vehicle are on a certain type of level that we can recycle it back, or newest additional vehicles or we are going to look for a new use case for that type of battery.

Kyle Fox (18:40):

There's a very clear signal that it has changed and it's not necessarily coming from government regulations or the corporations saying, "This is what we want to do." It's the people themselves that are asking the questions and saying, "I'm not going to put up with this. I'm going to make employment decisions. I'm going to make product decisions. I'm going to make lifestyle decisions that are based on ...," what you being the person creating the product or service or whatever is doing for sustainability. And that movement gives me a lot of hope as this next generation takes over the reins.

Louise de Laat (19:10):

Same. Because if we really need to wait on the industry itself and all those regulation of government level international, nationally, I think it will take us too long. All the steps that we are making right now as a consumer, I think it has a big impact for our future. So I'm totally agreeing with you, Kyle, and that also gives me some hope.

Kyle Fox (19:32):

That's a lot of hope. And so before we close, the question we always ask our guest is I'd like to hear from you, how do you envision what this greener world looks like 50 years from now?

Louise de Laat (19:44):

Yeah, I hope to see more technologies that can capture CO2 or other types of emissions out of the air while using a type of service or project. I hope to see also a lot of recyclability and reusability, and the trends that were already indicated, Kyle, that people are stepping up more now within our own beliefs and our own values. I hope that we can do that more closely with each other, so more interconnections among countries from Europe to America, et cetera, and that we can make some big steps throughout sustainability together because you cannot do it alone, and that's something where I really hope for the future.

Kyle Fox (20:22):

Well, your passion on this is coming in loud and clear, and as I said, it gives me hope because you are not just saying the words, you're doing something about it. And I think of this as an interconnected web of influence and people that are inspired. Your students think what they're going to do when they hit the working world and what their friends do and their coworkers, and it just spreads, and that gives me a lot of hope. So you've done something wonderful here and



it's an honor to have a chance to talk with you about it and understand a little more about what your team has accomplished, and I am waiting with bated breath to see what car number eight is going to do. So maybe we'll have you back on the show in the near future to talk about that. That will be amazing. Thank you for being here with us, for taking our listeners through your journey, and giving us some hope for the future.

Louise de Laat (21:21):

Yes, great.

Kyle Fox (21:21):

We'll see you on the next one.

