



## **S02E01: Driving the Electric Fleet**

Dakota Semler (00:01):

You have a lot of drivers that look at an electric truck the first time they see one, and they're a little intimidated to get into it. They're not sure about how it's gonna work what they have to do to operate it differently than diesel. But after one or two shifts driving in the vehicle, they don't want to go back.

Kyle Fox (00:28):

This is the 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 and 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. Today I'm delighted to be joined by Dakota Semler, co-founder and CEO of Xos Trucks, a Los Angeles based electric mobility company dedicated to decarbonizing transportation with the most durable trucking technology available. Welcome everyone, and a big welcome to you Dakota.

Dakota Semler (01:00):

Thanks so much for having us, Kyle. Really excited to be here and excited to talk a little bit more about the industry and how we're working with NXP.

Kyle Fox (01:06):

Awesome. Before we dive into it, so you're building an electric fleet all the way up to class eight haulers, big iron on the road. Can you tell us a bit more about you and the company, and what are some of the issues of today's world that you're tackling with this?

Dakota Semler (01:18):

Absolutely. So we started in this space because we were fleet operators ourselves. My co-founder and I ran a fleet, and I grew up working in my family's fleet. So we knew all the challenges that fleet operators have to deal with on a daily basis. Everything from managing trucks to hiring drivers to maintaining and servicing our vehicles out in the field. And we saw a lot of the new emissions regulations that were coming down the pipeline, and felt that there were no real solutions from the existing manufacturers.

(01:50):

So as we wanted to comply with these regulations, we started developing a solution that would work for our fleet and work for other large last mile and regional haul delivery fleets. So that's how we began the business, and we focus on the things that are most important to fleet operators. When you're talking about a fleet, they're rational purchasers. So the single largest thing that will actually influence their decision to go electric is the total cost of ownership. So



we've developed our vehicles, our technology, and even how we support customers in the field with charging infrastructure and service, all around reducing the total cost of ownership of their fleet assets. And that's incredibly impactful. When you take our proposition to a fleet and they see that they're actually going to be saving money versus their diesel trucks, it's a no-brainer for most of them.

Kyle Fox (02:39):

So talk to us about that. How are they saving money versus their traditional diesel approach?

Dakota Semler (02:42):

The technology today is still new, and the volumes are a lot less than the diesel industry. So there is still a price premium to an electric vehicle or acquiring an electric truck. However, it's a relatively small premium, and when you factor in the savings from the reduced maintenance cost of running an electric vehicle, and the reduced energy cost from charging an electric vehicle, in the first three to five years, you're actually spending less money to operate that truck. And that's incredibly important for these fleet operators because the acquisition cost is just one piece of running that truck. Over the life of a vehicle, there are several other costs to operate it, including the fuel, including the maintenance, including the driver, insurance, and other factors. So we really focus on the largest categories, which are fuel and maintenance, and the acquisition cost of the vehicle. And as long as we can deliver on reduced fuel savings and on reduced maintenance, we're able to deliver on that TCO promise to our customers.

Kyle Fox (03:39):

That makes complete sense. I remember seeing an interview you did where you referred to it as the triple bottom line; people, profits and planet, which I thought was so powerful. And what you just described for me may be a common misconception where you have an upfront cost, but really you need to look at this from a long-term life of the vehicle and what your overall total cost of ownership is. What are some of the other misconceptions along those lines that you've seen in the industry and the market?

Dakota Semler (04:02):

Yeah, I think electric vehicles are becoming really common and dominant now in passenger cars. Many folks have driven in them, maybe even owned one of them, or have experienced them in a taxi or a ride-sharing car. So it's pretty common to see an electric vehicle on the road today, however, far fewer people have seen electric trucks on the road because the industry is so new. And so when you come to a fleet operator, and you tell them that this electric truck can do the exact same job that their diesel can, there's a lot of preconceived notions. There's a lot of assumptions about the power, the range, the capabilities of these vehicles. And that's what we're doing today is really educating those fleet customers about the capabilities that electric trucks can provide already today. A lot of people think that they're going to have to make sacrifices on power or on efficiency or on ride quality, and that's just not the case.



(04:55):

We've come incredibly far even in the last few years with the efficiency of these vehicles, the battery technology that we've developed to put into our vehicles, and even the driver experience. One of the anecdotes that we often share is you have a lot of drivers that look at an electric truck the first time they see one, and they're a little intimidated to get into it. They're not sure about how it's going to work, what they have to do to operate it differently than diesel. But after one or two shifts driving in the vehicle, they don't want to go back to a conventional internal combustion engine. It's really things like ride quality, improving the noise environment inside a cab. You're not listening to a 90 decibel diesel engine that's heating up your cab all day long. There's a lot of qualitative and quantitative benefits for why people prefer electric today.

Kyle Fox (05:42):

I never even considered that. You're right. The loud diesel sound you hear when a truck goes by you is just a part of our daily life. And it seems like with electric there might be additional savings where idle time, how many times do you go by a truck that's sitting there idling, turning its engine over consuming fuel, I'm assuming with an EV, with one of your trucks, it literally is off until you hit the accelerator, correct?

Dakota Semler (06:02):

That is correct. So another great anecdote from one of our customers is this fleet, Loomis moves cash and valuables and they use armored vehicles. Because of the nature of their operations, they can't turn their vehicles off when they stop for safety reasons. So they'll spend 50% of their day driving just idling in a conventional diesel or gas vehicle that they operate. With our vehicles, they can still run their AC, run their security systems all without generating any incremental emissions. That vehicle can sit parked for five, 10 minutes outside of a bank or a restaurant doing whatever they need to do during the day, and ultimately not creating any noise pollution, and not any emissions for the neighborhood or the cities that it's operating in.

Kyle Fox (06:46):

Amazing. People that are listening to the podcast might be thinking how forward-looking is this in terms of development? But my understanding is you've been running vehicles since 2018?

Dakota Semler (06:56):

Yeah, that's correct. We delivered our first trucks in 2018, and we continue to deliver more and more trucks every day, really. It's becoming pretty prevalent to see an Xos vehicle now when I'm driving on the roads. I get folks sending me photos of them all over the country when they're in New York or Texas or Michigan. It's actually pretty cool to see the impacts of all of our efforts be out there driving on the roads.

Kyle Fox (07:18):



Taking a selfie with a truck, I completely agree. And now I'm going to start looking out for them. But it's not necessarily just your fleet. I also saw that you're also working with customers who want to go build custom vehicles with your drivetrain, forklifts and other ones that take all the advantages you provide and that we just discussed, but do it very specifically for what they need.

Dakota Semler (07:35):

One of the things we realized really early on was that customers and large fleets wanted to have the peace of mind and the warranty and reliability that they've come to expect from their diesel vehicles. And in doing so, we needed to build our own powertrain. We needed to build a powertrain that wasn't designed for the automotive market, which is frequently used a hundred, 150,000 miles, but really for the commercial vehicle market, which can range from 250,000 to 500,000 miles in last mile delivery vehicles.

(08:05):

So we had to make it a lot more durable, a lot more reliable, and that led to our battery systems and our software systems, we realized had broader applicability than just on-highway trucks. So we developed a division we call 'Powered by Xos', where we take all of that technology that's really designed for durable industrial use cases, and we allow other OEMs to utilize it. So they utilize our battery systems, our high voltage distribution systems, and all of our software that goes into building large powertrains. And it's not just commercial vehicle-sized equipment. We have some customers that are building a hundred thousand pound forklifts. So incredibly powerful equipment used in ports and marinas and industrial facilities all built on this same technology that we use in our trucks.

Kyle Fox (08:54):

And those types of vehicles, we as normal consumers don't see those all that often because how often are you on a dock? But they're vitally important to the overall supply chain of the whole planet. So infrastructure seems to be a key component to driving electric fleet because obviously the way we've been doing it for a hundred years is that you have a gas station, you have fuel, you're able to fuel up, that sort of thing. So talk to me a little bit about what are some of the challenges you've had, charging times, time to charge, what's the turnaround, and how do you solve those problems?

Dakota Semler (09:21):

Yeah, it's a really good question because it's a complicated area of deploying electric fleets. When we look at most of the vehicles that we're deploying, they're what we call 'return-to-base' vehicles. So if you look at commercial vehicles in the US, about 70% of those vehicles return to the same home base every night, and they'll do under 200 or 250 miles.

Kyle Fox (09:41):





I didn't realize that.

Dakota Semler (09:42):

So that means that they have dedicated dwell time and locations where they can be charging overnight, but that still means they have to have infrastructure in that depot. And we started learning this very early on when we delivered our first trucks, we actually delivered the trucks, and the customer didn't even think about the chargers or infrastructure to be put in. So we had to start helping customers with that process, making sure that infrastructure was ready by the time the truck was delivered.

(10:06):

And now that's actually become a separate division of Xos, which we call Xos Energy Solutions, where we provide turnkey infrastructure services. So everything from the engineering, planning, permitting, all the way up to construction and commissioning. We manage that process for a customer, and then we provide it to them as a service. And that's become a really fast growing part of the business because as customers start to deploy, a lot of these fleet operators don't have experience setting up EV charging infrastructure. So they're looking to folks like us to really help build that out to make sure that they can still meet their up times and their operational requirements with the charging infrastructure. Even since we started doing that, we still realize there's a delay between the time the vehicle is delivered and the time the infrastructure is ready. For a small simple infrastructure project, you may be able to get it done in a few months, for some of those more complex projects, it can take anywhere from six months all the way up to two, two and a half, even three years in extreme cases.

(11:04):

And when we're looking at those larger depots, fleets often are wanting to deploy 100, 200, 250 trucks in a single location. So we started thinking about how could we solve that bottleneck. Where the demand for vehicles exist, a lot of the electricity and generation infrastructure exists, but we don't necessarily have the distribution to get it there. So we developed a product that we call the Xos Hub. And the Xos Hub is a lot of the battery technology and software and power electronics we develop for our vehicles put onto a mobile trailer.

(11:38):

And what it does, it plugs into the grid, and it has a battery on board, so it slowly charges that battery on board from the grid power, and then when the vehicles come back to base, it has the ability to charge up to five vehicles at once. So that's kind of like one of those mobile power packs for your cell phone or your laptop, but for EV fleets, and the good thing about this is we can deploy these in less than a day. So we deliver it to a site, install it, the next day you have charging infrastructure for your fleets.

Kyle Fox (12:07):





That's incredible. And your analogy is perfect, right? It is like charging your phone, it's just on steroids, right? You're charging up to five of these large class eight haulers. I was thinking that the buildout for a very large facility might take a while, and what you're describing is the ability to just add water and get a fleet up and running even in some of the most remote areas as long as you have power that you can charge into this. So we've talked a lot about what you're doing and some of the challenges in the infrastructure, and let's talk a little bit about optimization. Obviously technology itself can help improve things, better efficiency, but what about battery management? Because this is so key to what you're doing, how important is that to your vehicles, overall, and how are Xos and NXP working together on that?

Dakota Semler (12:45):

So we talked a little bit already about how durability and reliability to commercial vehicle customers is paramount. It's one of the single most important things they think about. And when you're talking about these vehicles, they'll drive hundreds of thousands of miles. So managing the state of health of our batteries is one of the most critical functions we need to deliver on our vehicles. And the only way we can do that is by having a really robust battery management system that enables us to monitor the cells in a really proactive way, and then ultimately optimize the performance and the management of those cells based upon the data that we gather. And we've been working with NXP to develop that BMS that we build in-house, and NXP is one of the few providers that has a lot of the capabilities on the processor level to be able to provide the data that we need to manage state of health long-term.

(13:37):

A lot of us have heard state of charge or charge rate, state of health is a little bit different. It indicates how well is that battery performing over time, so not just it's charged to 80 or 85%, but from the day that battery was delivered to 10 years down the line, how is it actually retaining its original state of charge, and its original capacity? And that's a really important metric when you look at fleets. Because fleets are using these vehicles for five, 10, 15 years, but they also may be reselling them into the secondary market. So when you're starting to think about asset residuals and the value of a vehicle and its secondary life, ultimately that state of health of the battery is going to be crucial to making sure that residuals are high, and that they get a good return on their investment.

Kyle Fox (14:21):

I never thought about it that way in terms of looking at the battery as a living system that you need to take care of and monitor over time, it sounds like that it also gives you the ability to look for where perhaps there's something that's end of life or something that needs to be replaced and be able to proactively do something about that, right?

Dakota Semler (14:35):

It does. And we're working not just in the BMS system with NXP, but also on some of our communications modules to be able to have some of that proactive preventative maintenance



accessible to those fleet managers. So we've also developed what we call our telematics gateway unit, which is the base of Xosphere. And Xosphere is our connected fleet ecosystem where fleet managers can look at the health of the vehicle, the location, all the telemetry data, manage their service tickets, as well as even managing infrastructure. And the only reason we're able to do that is we're enabled by NXP's processors on our telematics gateway unit.

Kyle Fox (15:13):

To be able to communicate and be able to understand where each of these vehicles are. You just described a better way of doing fleet management. That's exciting technology and it sounds like it's absolutely necessary for what you're doing.

Dakota Semler (15:22):

It is. When you look at most of our customers, they need data to manage their operations. And now that we have these connected vehicles, not an asset that doesn't have any connectivity like we did in the past with diesel trucks, they can proactively manage, optimize, and overall, reduce their operational expense, reduce costs. And one of the most important things to fleets is improved safety. For them, if they can have that data and garner that data in a data warehouse, it enables them to operate much more efficiently.

Kyle Fox (15:50):

Much more efficiently and much more safely. There's been some talk about when we start moving to more of an EV-based vehicle infrastructure, in some ways the energy inside of those batteries represents cash on hand. The discussion might be are we looking at a potential for an economic ecosystem where unused battery charge could actually be sold back?

Dakota Semler (16:10):

Yeah, there's really a lot that you can do in this ecosystem. When you're talking about the capability, it already exists in the hardware on the vehicles. Now it's more about creating the payment systems, the exchanges, the interchange between how those systems interact. And oftentimes we find that the vehicle is sometimes the most advanced part of the network. When you start tying the vehicle back into the utility or into the physical electrical infrastructure on-site, that may be where it's a little bit dated, and not necessarily capable of doing some of those V2G or V2X type applications.

Kyle Fox (16:45):

Interesting. When I start thinking about the possibility of natural disasters, and if you have a fleet that has emergency supplies, they not only can deliver the supplies, they can actually deliver some of the energy that you might need to be able to operate first responders, that sort of thing.

Dakota Semler (16:58):





Completely. It's something we're actually already building into certain of our vehicles and a use case for our Xos hub where a lot of utilities are saying, "Hey, we're going to be able to charge this up in a centralized depot prior to a natural disaster or a storm event, and move it into place wherever it's necessary." That may be for delivering power to a local neighborhood, or it could even be for a customer of that utility who needs to charge their EV and ultimately isn't going to get power restored for several days.

Kyle Fox (17:25):

Not only are you helping the planet, you're going to be helping to save people's lives. Talk to me a little bit about where you see us, pick your timeframe, but 50 years from now, what does the world look like 50 years from now, 25, whatever the timeframe is, where do you think we're going, and where do you think you play a role as well?

Dakota Semler (17:39):

Yeah, this is a fun exercise and I always enjoy doing this because I find that even though I'm involved in the forefront of this technology and this industry, I'm never as aggressive as it ends up turning out. Five years ago or six years ago when we started the business, we couldn't have envisioned that the industry would evolve as quickly as it has and that the infrastructure and the demand for vehicles would be as strong as it is today. But I think if we really look forward 50 years, electric is really ultimately the baseline. Everything will be EV, and it's going to I think, play more into how are we connected and how is that connectivity spanned across ecosystems. So right now we think of mobility and we think of our handheld devices and our mobile phones and our smartwatches as disparate ecosystems. And I think creating a seamless transition amongst those different ecosystems is going to be much more prevalent in the future.

(18:34):

So you're not even going to think about when you transition from looking at your phone screen to your car GPS. You're going to be able to hop into a vehicle, it's going to take you exactly where your plan to go, where you wanted to go, and you're not even going to think about it. These are going to be subsystems to our daily lives. And I think that's something for us that is a little weird to think about because it contemplates autonomy, it contemplates electric vehicles, and all of the connectivity in the personal devices. But I think in terms of transportation infrastructure and really with commercial vehicles, that level of autonomy will be introduced, but there will still be a lot of applications that involve a driver. When we look at a lot of our fleet customers, we have several customers where the driver is doing some other job, 70, 80% of the day.

(19:21):

That may be a uniform rental company where they're going to deliver their uniforms, that may be a cash and transit customer or a food delivery customer where they're stocking orders and shelves. So we still envision the driver and the people being a big part of this ecosystem even 50 years from now. And I think that's a little bit of a kind of contrarian perspective, but I think the



importance of the driver and the role that they play is not going to go away. In certain applications like long haul, maybe that fades away, but I think in a lot of the last mile delivery applications, I think the driver will be here for some time.

Kyle Fox (19:56):

It may be contrarian, but that's the power in that statement, right? I actually never considered that. And conventional wisdom might be if it's a self-driving car, what am I going to be doing? And maybe that's the case for me if I'm driving up to see my parents. But what you're saying is that no, the humans will still be there and what it's going to do is free them up to do other value-add services, but they're still in the loop and they're still playing a role there. And I loved how you described it, the picture that was in my head was, in essence, this technology over the next 50 years blends into the background. Today, unless it's turned off, I don't really think about how the electricity's hitting my wall that I plug my computer into, and I don't really spend a lot of time thinking about how information is transferred over the internet. It is moved into the background.

(20:39):

And what you're talking about is the next big leap where transportation, energy usage, location information, all of that just becomes fact of life and it blends into the background. It is a fascinating topic, Dakota, you and Xos are absolutely on the forefront with breakthrough technologies, and that's why we're so delighted to talk to you today. This has been a wonderful time spent with you, and I encourage our listeners to go check out Xos, go take a look and maybe if you happen to see one of their trucks on the road, take a selfie, send it in. I'm sure they'll appreciate that. Dakota, it was an absolute pleasure talking with you today and I look forward to seeing you again.

Dakota Semler (21:13):

Thanks Kyle, appreciate the time.

Kyle Fox (21:15):

Thanks everybody for listening and we will see you next time.

