
PODCAST

Why electrifying the freight network is the next stage in mobility revolution

ABB Decoded

Electric mobility is about more than just cars: in the near future all our daily goods could be delivered by electrified freight transport.

Anthony Rowlinson: Hello! And welcome to episode 10 of ABB Decoded – the podcast that tries to press pause on our fast-moving lives and shine a light on the technology and trends that are reshaping our world.

I'm your host, Anthony Rowlinson, and in this episode we'll be exploring an aspect of the electric vehicle revolution that's soon likely to touch every one of our lives, whether or not we drive an EV for personal use.

That's because the shift to EVs is about more than cars – it's also reshaping the heavy vehicle sector.

And while the majority of us will never have to consider ownership of an electrically powered delivery truck, the consequences of global road-freight networks going electric are profound. In the relatively near future, it's conceivable that every one of the daily goods that are currently transported by diesel lorries will be delivered instead under electric power.

The potential benefits of that shift in terms of reduced emissions of noxious gases and other environmental gains, such as reduced noise pollution, are massive.

And the technology to power this transition already exists, even if the infrastructure required to implement it is far from complete.

But such is the pace of change, that several governments are already trialing electrified highways that will support electric trucks – and companies such as ABB itself are field-testing electrified delivery networks.

Joining us to explain what could be a revolutionary change in the supply chains that feed and clothe every one of us, is Stephanie Medeiros, who's an e-mobility global account manager for ABB, working on fleet electrification projects.

And she's at the wheel...

Stephanie Medeiros: I'm Stephanie Medeiros, and I'm an e-mobility global account manager. And I work on fleet electrification projects all over the world. So, in my role, I primarily work on leadership and account management and business development, and I'm also an electrical engineer by training.

Anthony: Thank you, Stephanie. We're going to start by asking you why it's important to electrify the delivery fleet?

Stephanie: So, it's very important that the world transitions to electric transportation. The facts are that CO2 levels are at an all-time high. They keep rising, and that brings about negative effects such as the rise in the temperature of the earth. And just recently, actually, the U.N.'s Intergovernmental Panel on Climate Change, the IPCC, which is the most up-to-date assessment of how global warming will change the way we live, they just recently said that we're getting dangerously close to a rise in the temperature of the earth of 1.5 degrees, and that's going to happen within 20 years. So, what's surprising about that is that it's a whole 10 years earlier than what was previously estimated.

So, it's important that the world cuts down on its emissions, and that's why there's countries and regions that are coming together and putting very aggressive targets in place. Just like the European Green Deal that puts actions to curb emissions in the EU and make Europe carbon-neutral by 2050, there's also in the U.S. the Biden Administration that pledges to slash greenhouse gas emissions in half by 2030.

So, for us as a world to reach these ambitious goals, we have to look at transportation because transportation is a huge contributor to emissions worldwide. About 25% of emissions come from transport. And when we're looking at fleet electrification, there's actually really good projects around the world, and there's really good cases of fleet electrification. There is the Toronto Transit Commission that's in Toronto in Canada, and they have electric buses now in operation, and they're actually one of the largest electric bus transit operators in North America. There is also Amazon, and Amazon is planning to operate 100,000 electric vehicles, their delivery vans actually, for last mile in the U.S. and all over the world, and that's going to happen over the next 10 years.

So, of course, electrifying fleets and electric fleets are very important, but if we're going to hit the targets, these really ambitious targets, we have to look at how the electricity is generated. So, we have to make it as clean and green as possible, and that's why renewables is really part of this story as well.

So, there's a great example of this in Portland, Oregon. It's TriMet's Transit Authority, and they have opportunity chargers. They have depot chargers for their electric buses as well, and their opportunity chargers are powered by 100% wind energy, so really good examples that are going on around the world for fleet electrification.

Anthony: Great. Now, you mentioned the importance of reducing CO2 emissions and a number of ambitious climate targets have been set many governments all over the world – So, is it possible to quantify the benefits of heavy vehicle electrification in terms of CO2 emissions for example?

Stephanie: Yes. So, it's possible to put some numbers to that, and, and first, you know, when we're talking about heavy-duty vehicles, we're talking about vehicles that on average are about 3.5, over 3.5 tons. So, that fleet electrification is very important because even though heavy-duty vehicles constitute about 1% of the total fleets and vehicles, it actually contributes over 25% of global, ~~uh~~, emissions for road transport. So, it's really important that we electrify that, and you know, and putting more numbers to that, you know, if we replace one conventional truck, internal combustion engine truck, that'll save about 22 tons of CO2 or 500 liters of diesel per year. So, they're big numbers, and obviously, if we add all that up, there's a lot of emissions that we're cutting around the world.

Anthony: Right. And are there other benefits to electrifying heavy fleets, such as long-term cost reduction, low maintenance and other benefits that we already see with consumer EVs. Do they also apply to the heavy sector?

Stephanie: Yes. So, it does. So, costs are very important, especially to fleet operators because they're operating on very, very slim margins. So, when we're to looking at costs, we have to look at total cost of

ownership. So, it's not just the cost of the vehicle itself or the upfront costs. We have to look at the life-time costs, like you mentioned maintenance costs, charging infrastructure or fueling costs. So, we have to look at that big picture.

And today, with passenger vehicles or electric vehicles in general, it's possible to have the total cost of ownership of an electric vehicle to be equal or on par with a diesel vehicle or internal combustion engine vehicle. For heavy-duty vehicles today, that's not quite the case. So, at least the good news is that it's estimated that about the year 2026 or 2027, there's going to be cost parity, and the large reason of that is the vehicle costs for electric vehicles or even on the truck side are decreasing. So, year after year, they're decreasing, and that's largely contributed to the battery prices.

So, battery prices are falling. Actually, in 2010, battery prices were about \$1,100 per kilowatt hour. Today, they're roughly about \$130 per kilowatt hour, and it'll continue to decrease. So, there's good studies out there that estimate that the total cost of ownership for an electric, heavy-duty truck is going to be actually 15% to 20% less than the equivalent diesel vehicle in about the year 2030. So, that's really good news.

I'd also like to mention that outside of economics and also climate effects, there's a few benefits that are easily overlooked, but they're extremely important. And that's our health, and that's quieter cities, cleaner cities. And I think the world got a glimpse of that during the pandemic or the start of the pandemic because the first couple of weeks, there was a lockdown. So, that means there was very, very few cars on the road, and so what that meant was there was less air pollution. And you could see that. People could see that where iconic cities that used to have a lot of smog, so that smog started to go away. Waterways started to become clearer and clearer, and so people started to get a glimpse of what a world without combustion engine vehicles could be. So, that's definitely promising.

And also, when we look at auto emissions are toxic. They're polluting and they're toxic. And every year tens and thousands of people die around the world just from auto emissions. So, having that clean air is really important, and I think another benefit that's really important is having quieter cities.

So, yeah, overall, there's so many other benefits. If we looked at the full picture of electrification of transportation and heavy-duty vehicle trucks, there're so many good things to look forward to.

Anthony: And on a related point, in what ways is fleet electrification different from, or similar to, the consumer EV sector, where we're seeing such a rapid growth right now ?

Stephanie: And so, on the consumer vehicle side, of course, there's a lot more passenger vehicles that are out there. And so, what's great is that the heavy-duty trucks and the fleet electrification of heavy-duty trucks, there're so much of lessons learned and experience from the passenger vehicle electrification that can be taken and brought into that new segment. So, some examples, of course, are the standards. There're CCS charging that's used for our passenger vehicles, and you can see CCS standard for charging that's coming into trucks as well, especially at medium or low charging powers.

And the other thing is battery technology. So, battery technology and lithium-ion battery technology have been tested a lot with passenger vehicles, and you see that also coming into heavy-duty vehicles. So, those are just similarities.

And then, in terms of the differences, the main difference here is that, you know, heavy-duty trucks, they're much larger than passenger vehicles, and in some cases, the charging window is much smaller. So, you have much larger batteries on these vehicles, and then the charging power becomes a lot bigger, or the need for charging power is much bigger. That's one of the major differences.

Anthony: And are there technical solutions to those challenges? Does ABB have some of those solutions – on the charging side, for example?

Stephanie: On the charging side? Yes, you can charge heavy-duty trucks from 25 or 50 kilowatts all the way up, well much, much higher, of course. What's really interesting is that the industry is coming

together and looking at megawatt charging so one megawatts and higher. So, that standard is going to be a new standard where again the industry is coming together. ABB is part of that as well to make that happen.

Anthony: Okay so, is it correct that there are a number of ways in which we could electrify heavy vehicles? Could you talk us through some of those options?

Stephanie: So, there are different types of electrification other than battery electric vehicles. So, you also have hydrogen. You also have catenary overhead lines, and that's pretty interesting as well, and they're all part of the electrification of transportation story or journey. You really have different considerations and, also, benefits for each of them, and each of them also have their application when we're looking at the whole fleet electrification journey.

So, starting with hydrogen, hydrogen is quite interesting, especially if you have large vehicles that have to travel a very, very long distance, so there's a long range. And also, that their charging times are quite small today because charging times on battery electric vehicles is going to improve, but if we're looking at it today, then hydrogen definitely makes sense.

On the other side, we also have to look at those considerations because the cost of these fuel-cell vehicles plus the infrastructure cost and the cost to generate preferably clean hydrogen, that's quite high. So again, it's really a matter of looking at what the good application is there. And also, if we look at the total cost of ownership, so the total cost of a fuel cell or a hydrogen fuel-cell vehicle is set to be on par with a diesel equivalent after the year 2035. So, still a long way to go, but again, they have their specific applications as well.

And another interesting one is the overhead catenary lines. So, basically, it's overhead lines that power or send electricity to the vehicle itself. And you see that a lot in rail, and I know there's a couple of pilot projects that are going around the world. So, on that side, you know, that's really interesting because you have constant power or constant electricity to the vehicle, so your lines or your journey can be basically as long as you want as long as you have those overhead lines.

And also, another benefit is that you can have a battery that is very small, so there's no need for a large battery because you have that constant electricity source. Of course, on the flip side, infrastructure costs are extremely expensive.

So, it's the cost of the infrastructure, and then, it's also the upkeep that you have to look at. So, when you're looking at that, again, very niche applications, but they're very interesting to see.

Anthony: So, if we look forward to, say, 2035, what kind of electric trucks might we be seeing on the highway?

Stephanie: Well, there's different types of electric trucks, and going back to a heavy-duty vehicle is pretty much anything that's over 3.5 tons. So, you have the smaller vehicles or delivery vans, like first mile, last mile vans, and then, you have the much larger trucks or the lorries that they'll go much, much longer distances.

So, in general, what is the future going to look like for EVs and these electric, heavy-duty vehicles? You're just going to see a lot of them, but it's going to be overall quieter-and much cleaner, for sure.

Anthony: And you've already touched on the infrastructure question, but what are the specific infrastructure challenges related to electrifying heavy vehicles?

Stephanie: So, when you're looking at the infrastructure, of course, heavy, heavier vehicles equals larger batteries, and that, especially when you have just smaller charging windows, you need higher charging power. So, there's a few considerations that you have to look at, you know, especially when a fleet

operator is going electric. So, the charging infrastructure costs, and installations and also the operation of charging, those are going to be very, very significant because the last thing that you want to see is at a depot, at the end of the day, all the vehicles coming in and charging at the same time at maximum power because the power demand is just going to be through the roof. The demand charges are going to be extremely high, so you definitely want to avoid that.

So, those are challenges, but there's ways to work around that. So, the first thing is a smart charging, and smart charging basically refers to scheduling your charging or having charging ... You're spreading out charging throughout your charging window and maximizing your asset as much as possible. So, there's ways to do that. There's software and there's also tools that are out there to really spread out that charging and making sure that your vehicles are charged when they need to be charged, but you spread that out as much as possible.

And then, there's other solutions, too, of course, like battery energy storage to help out with the peaks and the peak demands, and then there's solar and renewable integration that'll help out with that as well.

Anthony: You talked about overhead power lines as being one possible solution – and we've seen trials of this technology underway in Germany and the UK, to take two examples – but the associated costs are very high, so do governments have to become involved if we are to see freight electrification at a transformative scale ?

Stephanie: Yeah. So, regulations and legislations are really important here, to help push that forward, but then, they can also help in terms of subsidies because, yes, the upfront costs are really expensive, and the infrastructure costs can be expensive. So, that's where governments can really help out and offer subsidies to help counterbalance that cost, and especially, since seeing today the total cost of ownership is not exactly at par with their diesel equivalent, so it's going to be really important for governments to step in right now and to help out with those costs and make that possible.

Anthony: And just to bring things back to a more local level for a moment, could I ask you about ABB's own trials with electrified fleet vehicles and how successful they have been?

Stephanie: So, first of all, this is a great project because it, first of all, goes in line with ABB's 2030 sustainability plans and sustainability targets, enabling a low-carbon society. And part of those initiatives is to be part of the EV100, and ABB commits to electrifying its fleet of more than 10,000 vehicles by 2030. And there's already projects that ABB is doing and initiatives around the world, such as in Sweden. For example, ABB has already started to convert its fleet of around 700 company cars into electric. And then, in the UK, ABB announced that it was going to transition its 500 fleet company cars to all electric by 2025.

So, that's on the passenger vehicle mostly. And so, if we're looking at great examples of electrification of heavy-duty vehicles, there's this pilot project that's in operation in Switzerland. And so, it's really great that this is moving forward, and there are some lessons learned. So, the outcome is that it is possible to have electric vehicles in operation, where the charging doesn't impact the operation.

So, the charging is seamless and the vehicles themselves in operation don't impact any operation. So, another lesson learned, also, is that there was great feedback from the drivers. So, the drivers were overall super happy to be in a vehicle that was, first of all, fun to drive.

I think overall, people can really see that driving EV is a really, really fun drive. The vehicle is super responsive. And then, also, the fact that there's less noise, that really helps to reduce stress and just, you know, make things a lot calmer around the drivers. And so, overall, it was very positive and good feedback overall.

Anthony: And what solutions does ABB offer to help with infrastructure building for electric HGVs and electric trucks?

Stephanie: So, there's a lot of solutions that ABB has that are surrounding the charging hardware. So, when we're talking about solutions to power up the charging hardware, we have electrical gear, and that goes from switchgear to panelboards and really solutions that are out there to power up the charger. On the other side, too, we have battery energy storage. Battery energy storage is important for peak shaving if needed, and then, there's also different solutions like fleet management that ABB can offer. There's an interesting partnership that ABB has with Amazon Web Services or AWS, and that's really to help with fleet electrification and manage fleet electrification as well.

Anthony: You mentioned 'peak shaving' – what is that?

Stephanie: So, peak shaving, as I mentioned before, the last thing that you want is to have all your vehicles come in at the same time and charging at max power because you're going to have high, high peaks in your power demand. Some cases, you know, there's smart charging, and then you can really offset that as much as possible or avoid that as much as possible. And in some cases, you really can't. You have to have those peaks.

And so, that's where it's interesting to have solutions like battery energy storage, and it essentially takes off that peak from the grid so we're not asking that power demand from the grid. It comes from batteries, and so that's where it can be very, very interesting in terms of a cost perspective. There's a trade-off there.

Anthony: So, given that so much of the necessary technology exists already to support the shift to electrified heavy vehicles, how long do you think it will be before we see them everywhere and they're just the norm?

Stephanie: So, very soon and probably sooner than you may think, and right now, it's a very exciting time because just like about 10 years ago when we started to see electric vehicles or passenger cars becoming more and more popular, the same thing is happening right now with electric trucks. So, we're starting to see electric trucks on the world road, especially with pilot projects, and very soon, there's going to be a lot of these on the road.

So, there's a few things that are helping to move this forward. Of course, I've already mentioned the decrease in total cost of ownership because that ROI or an ROI that makes sense for fleet operations operators is going to be extremely important. And then, the other thing is regulations and legislations.

So, it's great that the costs are going down, and then, there has to be a slight, nice nudge or push for fleet operators to also go electric. And so, that's where there's good examples where countries and regions are putting mandates in place to limit or outright ban the use of internal combustion engine trucks on the roads.

For example, there's the example in the UK, where new diesel, heavy-duty trucks will be banned in Britain by 2040, and that's, you know, as part of their plans to reduce carbon emissions by 2050. And then, there's also the OEM side, so the OEMs are the vehicle manufacturers. The heavy-duty vehicle manufacturers are also committing that they're going to only produce electric vehicles as of a certain date. So, vehicle manufacturers like Volvo, they plan to be fossil fuel free by 2040. So, this adoption will happen quickly, and again, it's a really exciting time to see this happen.

Anthony: It is, indeed. And Stephanie, thanks so much for taking the time to talk us through an aspect of the electric vehicle transition that might be affecting us all very deeply, sooner than we imagine.

If you've enjoyed listening to Stephanie's insights into the electrification of heavy vehicles, why not like, share, or subscribe to ABB Decoded wherever you get your podcasts. Until next time.