RioTinto

Transcript

Things You Can’t Live Without

Episode 3 – OJ Borg’s e-bike

No. of words	1,308	Time	26 minutes

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Dr Anna Ploszajski [00:02]
Hello and welcome to Things You Can't Live Without the podcast where I material scientist Dr Anna Ploszajski am joined by special guests to discuss the one thing they can't live without. It's essentially a nerdy version of Show and Tell as each episode we'll dissect these objects to find out the amazing mix of elements, compounds, chemicals and processes that they're made from, and uncover the true impact of extracting processing and making them but also talk to experts about how they're making sure we won't have to live without our favourite things as we transition to a more sustainable future. My guest today is one of the UK's most beloved overnight DJs on air every weekday night on BBC Radio. He's also a regular face on our TV screens. A fanatical cyclist with two world record attempts to his name, and the proud owner of more lycra than normal clothes. It's OJ Borg. So in this episode, we're going to be dissecting OJ's beloved e-bike. Not literally, you'll be relieved to hear but intellectually, to find out what's inside and where those materials come from. To help us in this quest. I'll later be enlisting bicycle historian and author Tony Hadland, and technical development expert at Rio Tinto, Jared Osborne, but first, OJ.

OJ Borg [01:22]
Hello.

Dr Anna Ploszajski [01:23]
Tell us why you can't live without your cargo e-bike?

OJ Borg [01:27]
For two reasons, one, I pretty much do everything on it now. Like I can't stand driving the car. Because it's so much quicker, it's so much easier to take the bike, I don't have to worry about parking it, you can normally nip down bike lanes, if you're lucky enough to have them in the city you live in, I get around quickly. And also the kids refuse to walk anywhere now. I've ruined my kids ability to walk anywhere, so I can't live without it because my kids would literally never leave home. If we want to go somewhere. It's like can we take the cargo bike? And the answer is always yes. Because it's way easier. Most of my daughter's friends they're like blagging me to try and pick them up to take them to school in the morning if I'm on the school run so it's been great. Unfortunately my kids are now getting rather large so it's now difficult to cram them into the bike. So if you can think of a bigger one that'd be great but that's why I bought the bike

Dr Anna Ploszajski [02:11]
Amazing and did you say it's an electric bike?

OJ Borg [02:13]
It is a pedal assist bike because when I, being a cyclist, when I first looked at buying one I tried out

a friend's and I and he said to me you want to buy one that's got battery and I said no, no, course not I don't want to buy a bike that's got a battery, what sort of cyclist you think I am? And then I tried it and it was hard work. And the thing is though I wanted to share the bike with my wife and the problem is you know however big your kids are the most dangerous part when you're at the lights is starting off. It really is. That's when you're wobbly, the most wobbliest, that's when it's not the best. So the fact you've got pedal assist just means you get ahead of the traffic and you are steady because the faster you go the steadier you are, plus having a battery means you will ride it in the wind, in the rain. I will ride it to work you know I will ride home at 3 o'clock in the morning past badgers and foxes and, and drunk people and it's something that I think having a battery on it just makes you use it more like I think, I think e-bikes, battery powered bikes, are the future of sustainable transport.

Dr Anna Ploszajski [02:44]
And do the badgers and foxes and drunk people ever try and jump in? Do you ever, you know, think about being a taxi service?

OJ Borg [03:10]
Do you know, I have to, well yeah, do you know it's, it's shouted at me a lot and the worst thing that ever happens is where I work I have to cycle past Manchester United the Theatre of Dreams, Old Trafford, and what will happen is if I've got it wrong, and I'm cycling past, basically football kicking out, it will just be shouts "hi, mate, give us a lift" and it's like no, I will not get you in my bike.

Dr Anna Ploszajski [03:33]
Wow, that's very impressive. And that's really painted me a picture of quite how obsessed you are with cycling. Tell me about your record attempts.

OJ Borg [03:41]
So the hour record is a very famous record attempt quite simply how far can you go in an hour and I have worked around cycling for ages and you do the hour record attempt on a velodrome so the banked, pine banks, you cycle round it, and when they changed the rules and everyone started having a go at it again, which would be about a decade ago now. So about 8 minutes into this hour record attempt and I have to say it was the first time I've ever ridden on a velodrome. It was the first time I'd ever ridden on one of the bikes where you laying out front like Chris Boardman in the Superman position. So there was a lot of new things going on, I realised I'd left my pants on and the rule of lycra is don't wear your pants underneath it. Now obviously you can't stop and take your pants off in the middle of a record attempt. So I kept going, but my seat then fell down. And I gave myself such bad cramps that at the end of the hour record attempt because I was trying to beat a record attempt by a guy called Oscar Egg. I gave myself cramp that was so bad that my mates literally had to put me in the back of his, back of his car, like it was an ambulance. And then I had to crawl up the stairs, not using my legs. Then my second attempt was basically the same where I fell off. So just to say two record attempts, still haven't broken the record, but you know, I'm hopeful.

Dr Anna Ploszajski [04:49]
Yeah, Tony, tell us more about the history of the bike. Where does it fit into the story of us?

Tony Hadland [04:54]
Right, well, there are lots of false stories about the origin of the bike, fake news. goes back a long way. If you've ever been in Italy, you've probably been or someone's tried to sell you a t-shirt showing that Leonardo da Vinci invented the bicycle, which is actually a modern sort of 1950s fake story. But the real ancestor of the bicycle was invented more than 200 years ago. 1817 to be specific in Germany, and it was known in Britain as a hobby horse that was basically like a balance bike but for adults, and it enjoyed a brief period of popularity, people did ridiculous things like going across from Pau in southern France to Madrid on one of these, you could go much faster, but it didn't have pedals. This was one of the things about it that about 15 years later, the French revived

the idea, but with pedals fixed to the front wheel. Now this was so successful that the cycle industry was born out of it, but the ride was uncomfortable. And so these fringe bikes became known as bone shakers. The next step was to make the bike go further and faster for each turn of the pedals. So the front wheel was made much bigger of keep the weight of that great big wheel down, wire spokes were invented. And that's how the high bicycle or pennyfarthing was born. But it was difficult to get on and off high bicycle, so consequently, chain drive was adopted. So for each turn of the pedals, the wheels rotated 2 or 3 times, the bike would therefore have smaller, equal size wheels with a much lower seat. This was a safety bicycle, which appeared in the 1880s and is the ancestor of most bikes we ride today. The first patent for an electric bike was taken out more than 150 years ago in France soon after the cycle industry started, but it didn't go into production. Because this was only 10 years after the first rechargeable battery had been invented. The technology just wasn't good enough, it wasn't there. And over the following century, many e-bike designs were tried, including in Germany, France, Netherlands and the USA, but none caught on in a big and lasting way. In the UK, the major problem selling electric bikes was that our legislation treated them as mopeds. So you had to have a driver's licence, pay road tax and be insured. However, in 1982, the law was changed to allow e-bikes to be ridden by anyone over 14 years of age, without the need for a licence road tax or insurance. But until 2020, takeup was very slow, and even now, we lag a long way behind countries like the Netherlands, and we are way behind China, where 50 million e-bikes were sold last year against a mere 155,000 in the UK.

Dr Anna Ploszajski [07:42]
Wow. So there's a lot more, a lot further to go then in the UK in terms of taking up an e-bike.

OJ Borg [07:47]
It's weird that they were, weird that they were, treated like scooters like, like mopeds for ages.

Tony Hadland [07:53]
Yeah. And companies like Raleigh campaigned with the government, against the government to try to get the law changed. And it took a long, long time. But eventually we did get there.

Dr Anna Ploszajski [08:04]
Yeah, fascinating. It's amazing to think about what the sort of future there might have been. So if we're on a campaign, then to to encourage our listeners to consider an e-bike. OJ can you paint us a picture of how it feels when you're, when you're out there on the roads?

OJ Borg [08:22]
When you're riding an e-bike it's like the wind is at your back. You know, we all have that, we all have that knowledge when you ride a bike and the wind's behind you. And it's just for a moment you think, oh my god, cycling so easy, you know, the wind's at your back, almost when you're cycling at the speed of the wind as well, the sound of the wind drops, because everything's going at the same speed. It's quite wonderful. And that's what an e-bike is like, it's not people think it's like a moped it's not, it is literally like you're the strongest person around. It's like your Chris Froome cycling a cargo bike about so the beauty of it is, and this is why I always say, that it's the future of what, you know, transport will be is because it's just easy. And I must admit, on days when the weather is bad, and the wind is howling, and I really don't want to be living in Manchester. It's let's, you know, it's not the Riviera, let's put it like that, that those days are the days where you can just jump on it. And you've got some battery power. That is great. The only problem is sometimes I've forgotten to charge it and then I have to pedal it back with two kids in it into the wind. And I might be screaming and using words which are not suitable for a family audience.

Dr Anna Ploszajski [09:18]
And do you spend, I'm wondering, I feel like there might still be a little bit of a snobbishness around the use of e-bikes, particularly in the elite cycling community. Do you feel that there might be sort of certain camps setting up you know, the pro and the ante?

OJ Borg [09:32]
I think there was, I honestly think there was for a long time of people who were against e-bikes but I think that over the past few years has massively changed. I think yeah, if you went, if you went back 5 years people were would not have done it. I think it's changed completely when it comes to commuting. I think even now e-bikes are, in you know, if you're of a certain age and you can't keep up or you're not a very good cyclist and you've got a partner who is good. You know, the fact that you can use an e-bike which is going to get you up to 26 kilometres an hour or whatever. I think that's the rule, isn't it? 26 kilometres an hour and keep you going on a 50 kilometre ride. I think why not? You know, unless you're the pro peloton and you're cheating, but that's not been proved yet.

Dr Anna Ploszajski [10:10]
That'd already be slightly harder to get away with.

OJ Borg [10:12]
Well, listen, Tony will tell you about that. It's a thing at the moment.

Tony Hadland [10:15]
Yeah, yeah, there that was that case a few years ago where the female Belgian mountain biker was caught out because she came off the bike and the bike went up in the air and the wheels were still being driven around when it was in midair. There was a motor stashed behind the seat. Yeah, there was a company in Belgium that used to make these motors that hide in the seat tube and act on the crank. Some, there are still companies that do this sort of thing, quite honestly, openly. But this this particular lady got drummed out of the brownies for that offence.

Tony Hadland [10:15]
So OJ, what do you think is in an e-bike? What are the crucial components in that battery?

OJ Borg [10:52]
So, so in my e-bike, there's dropped crisps. There's an old, there's an old headband, which has been ground into the floor, there's going be a motor, which I believe on my bike is a Bosch one. And there will be a battery, which I have to take off and charge. And they asked me when I bought it whether I wanted the second battery. And I said no, and I sort of now wish I'd bought the second battery. [musical interlude]

Dr Anna Ploszajski [11:16]
At this point, I'd like to bring in Jared Osborne, who's going to take us through the materials that make up the e-bike. Welcome, Jared.

Jared Osborne [11:22]
Thanks, Anna, lovely to join you.

Dr Anna Ploszajski [11:24]
So tell us first what is it that you actually do?

Jared Osborne [11:27]
So, Anna, I think I've got the coolest job in Rio Tinto, my role as General Manager Technical Development, I have all subject matter experts in my team here in Melbourne that are doing all the de-risking of our future operations. So the new ore bodies that we're discovering, designing the extraction to get the critical minerals out of those, those ore bodies and, and into bikes like OJ's e-bike.

Dr Anna Ploszajski [11:50]
Ah okay, and what elements in OJ's e-bike are you actually responsible for sourcing?

Jared Osborne [11:56]

If we break down the main components of the bike, so the frame itself, it's probably made from aluminium. That's a metal that's lightweight and durable. That cargo box that's either for the kids, the pets, the supplies, or that, that stray person from Old Trafford that's made of expanded polypropylene and that's a lightweight but impact resistant. And the wheels they're probably made from aluminium with some stainless steel spokes. The bike's pretty sturdy looks like they're about two and a half inch wide rubber tyres, all really important to keeping you on the straight and narrow, so you don't come off, like you did in those record attempts on the two wheel bike. The tyres, we can't avoid the fact that probably made for some rubber compounds, either natural or synthetic. And then at the guts of it or the battery, it's probably a lithium ion battery. In fact, it is a lithium ion battery, your battery itself that packs some punch. It's got lots of energy 500 Watt hours, so it can expend that energy really, really quickly for you so you can take off quickly at the lights.

Dr Anna Ploszajski [12:50]
So, lithium, then is perfectly placed at the heart of the battery. Why is lithium particularly suitable for batteries, Jared?

Jared Osborne [12:58]
It's because it's, it's so reactive, I suppose is why it actually forms the heart of this battery and is so ideal for it. Lithium, the metal itself, that was discovered 200 plus years ago, it was initially not used for any of these sorts of processes. It was useful lubricating greases. Today, it's one of the mainstays of rechargeable batteries. So what's really interesting is where is the lithium and how can we extract it, because it comes in many different forms. The ores that it comes from there's two general sources of it. One is either in mineral form, and the other is within brines or very, very salty water. And the minerals, they can be hard rock or they can be clay. Now ores they're typically really low grade, there might be one or 2% of lithium oxide within them. What that means is to get the lithium out, we have to apply a fair bit of energy and chemistry to extract the lithium from it to make the lithium carbonate or lithium hydroxide that goes into the batteries. There's also other ores which are more clay like so these are sediments where lithium's adsorbed into the layers of the clays. And again, they require a fair bit of energy to get the lithium out of those clays. Emerging from the pack is the brine based deposits. So the salty water.

Dr Anna Ploszajski [14:09]
Yeah. So I heard Jared that. I don't know if this is true. Maybe you can debunk this for me. I heard that there isn't enough lithium that we know about on Earth right now, for us to convert every internal combustion engine car into an electric car, let alone electric bikes as well. Is that true?

Jared Osborne [14:27]
So if we look at lithium supply and demand reserves, there's known reserves around the world. There's probably 80 to 100 million tonnes of identified lithium globally. That's probably about 400 different deposits. The various types of described them so hardrock, sedimentary clays, brines, and the like. That's more than enough, for us to convert everything that we need. What we need to do is, is actually start those mines and get them to keep up with the demand.

Dr Anna Ploszajski [14:59]
So if we're almost certainly going to need more lithium in the future, we're going to need to get that from somewhere. And, Jared, I'm really interested in, can you paint us a picture in? Like, what would this look like what what a big lithium mine look like?

Jared Osborne [15:13]
So, Anna, if we move perhaps to the new style of operations, the brine type operations, a big direct lithium operation, that would currently be something around 25,000 tonnes per annum, lithium carbonate equivalent. So if we're thinking about somewhere north of 2 million tonnes per annum increase in lithium carbonate required, sort of by 2030, 2040, we have to put a lot of these mines in or expand production in the existing ones.

Dr Anna Ploszajski [15:41]
How much of a challenge does that actually represent to you guys?

Jared Osborne [15:44]
It's a pretty big challenge, because when nature put some of these deposits out there, it didn't put them right next to the coast, it didn't put them right next to a power supply. But there is one potential advantage in some of the parts of Argentina, Chile, Bolivia, which is solar power, and we are seeing large investments in solar power in those areas, they're very, very good for solar power. So that is one of the trump cards that could potentially help this industry and working in conjunction with government and communities to get those renewables in those places will help enormously.

Dr Anna Ploszajski [16:19]
I'm very pleased to hear that we won't have to imagine a future in which we don't have any lithium, it sounds as if we've got enough, it sounds as if we know what we're doing to extract it. We're starting to decarbonise that process so that we can make it more sustainable. But I want us to imagine a terrible future for a moment, in which for some reason, there is no more lithium, right? Everybody wants an e-bike, everybody wants an electric car, there's some new technology that takes all of the lithium that we would have put in our electric bikes into something else. OJ, would you ever go back to a non-e-bike?

OJ Borg [16:55]
Well, if I had to, of course I would. But the problem is, I think you get used to the luxury of being propelled along. And you know, and it really does. And I mean, I go back to my earlier point, which is the beauty of an e-bike, whether it be cargo bike or any bike is if you are not fit, if you are maybe a little bit older, and you want to keep up or just simply you just want it to be easy to get from A to B like I remember that the earliest e-bike I ever saw was I was on my road bike in town and I was trying to cycle home and a guy in front of me kept beating me off the lights and I didn't know what an e-bike was at the time and he was smoking a cigarette as he cycled along I think he was wearing I think he was dressed as a decorator, obviously decorating, and I couldn't work out why he was so fit and I was absolutely you know, like, you could see the veins on my head as I tried to keep up with him between the lights. It just makes getting around easy. And it always will and I think going back, which like if you've got a nice sofa and you go back to sitting on a park bench. Yes, of course, you can still sit on the park bench, but you're gonna get a splinter in your bum. It all goes back to lycra.

OJ Borg [17:55]
It all goes back to bums.

Dr Anna Ploszajski [17:57]
Well, clearly, this is not a future that you want to partake in, OJ. You are not ever hopefully ever gonna have to live without your e-bike. But if we're all gonna get e-bikes, which is what we're pushing for in this podcast apparently, that's gonna have consequences for the planet, right. Tony, can you tell us, what are the trends in e-bikes at the moment? How much are they going to take off in the next few years?

Tony Hadland [18:20]
Well, it's quite an interesting thing that. The market is growing quite slowly. In the 1980s after the UK legislation was liberalised several companies set up, entered the market. None of them was a big success. And then in the 1990s Raleigh was the first major UK maker to launch an e-bike. But it was too expensive for a market where nobody knew what to expect about e-bikes. E-bikes were something which were looked at as kind of weird and marginal. In fact, I went to the bike show in 1983 at Harrogate, just after the liberalisation and the early products there were sort of tucked away in one corner. They were, they had sort of car batteries more or less, great big lead acid batteries to drive them. And they, there was a 20 inch wheel shopper and a 20 inch wheel trik people kind of looked at that out of the corner their eye and went on to something more exciting. I

think the general feeling was that they were, they had a market for people with disabilities or quite frankly, and that stayed for a long time, in contrast to Raleigh's experience it should be said there was a company called Powabyke which started up as a maker of relatively inexpensive e-bikes and they went on to outlast all their competitors. They've been around for 20 years or so. They're the longest established e-bike brand in Europe now. So it showed that you could run a successful business selling affordable or relatively affordable e-bikes. So if we fast forward to 2020, COVID-19 is something which has had a big impact. To quote from a report to the Bicycle Association it turbocharged the e-bike trend. E-bikes have been the only major growth segment anyway in recent years. And that was from a very low base anyway. But in the first year of the pandemic, there was a 92% year on year rise in the number of e-bikes sold, and a 5th of all spending went on e-bikes. In fact, that was what was described as a feeding frenzy with people trading up to get their hands on a bike, and at the same time pushing the prices up. Because any bike, we've got all this time, the only thing we're allowed to do is to go out and have a bit of exercise. Let's get an e-bike. And today, the Bicycle Association, which is the UK cycle trade body sees e-bikes as, and I quote, an unstoppable force with huge growth potential.

Dr Anna Ploszajski [20:42]
I think one thing that's going through my mind is when we think about, I don't know, sustainability, and kind of being sort of more responsible with our stuff in the future. I feel like we should always be aiming for increased simplicity, increased recyclability. And I wonder whether there's an unintended consequence of the uptake of e-bikes that actually is, potentially, although we think of them as being quite green technology, potentially going to have a negative impact on sustainability. And the climate. Jared, what do you think in terms of the unintended consequences for the environment of lithium?

Jared Osborne [21:23]
So there's, there's a range of potential and unforeseen or unintended consequences, and one of them that we're thinking about the complexity of it, let's just rewind to how we're actually going to cope with making enough lithium in the first place for it and creating the energy to actually put into those those batteries. We're going to need a combination of renewable energy available for exstraction, that's going to rely on battery storage, because we're going to need that to have efficient production, because we can't just run our processing plants when the sun shines, or when the, when the wind is blowing. And to do that, we're gonna need more copper, we're gonna need the electrification of it, we're going to need lots of critical minerals for solar production. And the rate of growth needs to happen such that we don't hit a constraint along the way, if we do, we won't be able to keep up with green lithium production along the way. I think there's some good consequences that could come from this as well, though, there's going to be jobs to create that infrastructure and the raw materials, less cars, perhaps in the future infrastructure as an asset. So we're going to build these infrastructure for the mines, perhaps they're there for communities post mining, as well for them to use. And that electrical infrastructure that could be some good unforeseen consequences in there as well.

Dr Anna Ploszajski [22:37]
Yeah, Tony, what's your take on the unforeseen consequences of increased e-bike use?

Tony Hadland [22:43]
It's a difficult one really, isn't it? Many people have come adrift re(garding) the prophecies and all these sorts of topics. But I think one of the one of the things that we need to bear in mind is that, batteries normally need replacing fairly regularly. And one of the things that could cause a little bit of a hiccup to the takeoff of e-bikes is if the word gets around that, you know, I've spent 1500 hundred quid, 2000 pounds on this bike, and three years in I've had to spend 300 quid on a new battery. And even worse, perhaps the lack of standardisation in batteries, that I'm quite a believer in getting more to the sort of synergy with the makers of power tool batteries. And indeed, the, the setup I've got on my electric bike uses Bosch power tool, 36 volt batteries, which are advertised as being droppable from several metres onto a concrete floor and surviving quite happily, because

people drop them when they want and work on building sites and that sort of thing. They, they're designed to run cool. You can buy those at any branch of a well known builders merchant knocking around the place, there's a huge market, they're interchangeable, and perhaps more of that, because a lot of e-bikes you look at, you see the batteries have been nicely styled into a particular casing or there's different looks very swish, you know. Are you going to be able to get a replacement for that battery? What's the level of support? Is your bike going to be put aside as a result of, well, just the fact that you can't be bothered to, to buy another battery? Then it's like the flat tyre syndrome that we see so often with bikes. When people have the enthusiasm, they buy a bike, they ride it in the summer, they get a puncture in the autumn, it goes to the back of the carriage and 5 years later, they find it when they move out, you know, you don't want that sort of thing happening. But I think that there could be an element of that.

OJ Borg [24:40]
I think there could be. I mean, I counted that slightly as an e-bike evangelist in the sense that if you make the bike so core to your life, that you know you're saving money because yeah 3, 3 years in you don't want to be buying a 300 quid battery. But you buy any car 3 years in, I guarantee you're gonna be spending 300 quid on something and possibly more. So I do think the costs are way low, but only if you can build it into your life and the infrastructure is there to ride the bike safely. The problem a lot of times is when it gets to winter and this is coming about to e-bikes is the fact that it gets cold you know it gets cold and it gets wet. So if you've got a bike that's going to get you to a to b and this bike is so engrained into your life that you know you're going to get there quicker then you know, then I would say the flat the, flat tyre syndrome isn't going to happen. [musical interlude]

Dr Anna Ploszajski [24:56]
So, OJ, so take us home then. What's next for you and your bike any record attempts on the cards?

OJ Borg [25:28]
Well, I don't know. I think we're going to try and get up to 20,000 kilometres it's just weird that this bike which I bought as a form of transport to get the kids about and do the big shop on has become my primary, my primary form of transport. The one thing I've been trying to do for the past 3 years is take the kids camping on it, where basically they ride their bikes, I pile all the camping kit into it and we go and have a lovely trip away. The only problem is, we would need to also recharge it when we get there so I need to find a campsite that's got a plug in the ground. So that's what's next for me and my cargo bike.

Dr Anna Ploszajski [25:57]
Or some solar panels? Would those fit?

OJ Borg [26:01]
Or some solar panels can you imagine I could carry it. I could maybe put, maybe if I carry a trailer with me with solar panels on it. I could just cycle forever and never stop.

Dr Anna Ploszajski [26:10]
You coud, you could. It's an exciting future for sure. Fantastic. Well, thank you all so much for being here for sharing your expertise and your adventures with the e-bike. OJ Borg, Jared Osborne and Tony Hadland. This has been Things You Can't Live Without with me Dr Anna Ploszajski. Follow Things You Can't Live Without on your favourite podcasting platform. And remember, always wear a helmet.

–Ends–