

## Passion push in electrified haulage

By Jack McElinn 1 DAY AGO

MANUFACTURING

The origins of a WA diesel haul truck's conversion to a battery-electric operating system can be traced back to a North Queensland banana farm.



Clayton Franklin (centre) with Austin Engineering's Brad Higgins (left) and Steve O'Hara in front of the EPCA truck fitted with an Austin haul tray.

Clayton Franklin's passion for tinkering with machinery goes back decades, but the founder of Electric Power Conversions Australia has not always viewed his work through the same lens he does now.

His is a story of a passion turned business, born amid the humidity of Queensland's north and developed and refined in the dry heat of Western Australia.

The proposition is relatively straightforward and came off the back of the support of a slew of WA companies and businesspeople.

In August in Kalgoorlie, EPCA showcased a full battery-electric mining haul truck retrofitted from a 100-tonne Caterpillar 777 and fitted with an Austin Engineering lightweight haul tray.

A WA-based firm founded by Mr Franklin only a few years ago, EPCA considers the truck a game-changer for industry, enabling the electrification of existing mining haul fleets without the need for replacement machines.

It hopes to facilitate the transition away from emissions intensive and increasingly costly diesel haulage to electric haulage.

Electric may not yet be an emissions-free alternative, but the electrification of a mining haul fleet could provide a gateway to renewably powered electric haulage as generation projects like solar farms supplying mine sites are rolled out.

EPCA estimates the cost of ownership of a battery-electric haul truck over 20 years will come in at \$11.5 million, versus \$25 million for diesel.

The retrofit cost \$2.5 million.

The project was a collaborative effort, and a Franklin family affair completed in five months.

"It was five months from the time we said, 'let's do it,'" Mr Franklin told *Business News*.

"We went and bought all our long-lead items, and they started to arrive, and we did our detailed design.

"Pretty early on we started coding. We knew the coding would take a long time, so we started that very early in the project.

"As soon as the gear started to arrive, we tore down that truck, everything was in and out of the paint bay, and then we were ready to start fitting it out.

"We did a lot of things in parallel, and there were obviously a few late nights, midnight, there was even a 2am getting the upgrades done.

"But you know, that's all worth it, right?"

Work to retrofit the haul truck was carried out with the support of EMJC Earthmoving and Plant Hire, which gave EPCA access to its main bay after its interest was piqued when Mr Franklin ordered a haul truck with little regard for its diesel engine run hours.

[EMJC managing director] Ron Clarke was sort of the first one who could understand what I was saying and could see the vision of what I wanted to do," Mr Franklin said.

"He said, 'yeah, we're on.'"

Austin followed, supporting the project with a custom tray that facilitated the installation of battery technology underneath the retrofitted vehicle, and supported an even distribution of its weight profile to assist the electric motor.

They were two among several local businesses to throw their support behind the project, which at time of launch was being prepared for a demonstration at Bakers Hill sand mine north of Perth.

"They probably think you're half mad, but, you know, at the same time, they're like 'this is cool, we need to do this,'" Mr Franklin said of the organisations that partnered with EPCA on the development of the truck.



Maurice and Clayton Franklin on the family's North Queensland banana farm in 2006.

"Let's do it. Let's get behind it."

During its Bakers Hill trial, the retrofitted truck averaged more than 10 hours of run time on a single charge, with a 50-minute full-charge timeframe.

"It's the quickest way to market, retrofitting," Mr Franklin said.

"We can go and wait for one to roll off the production line and get all the bells and whistles, or you can go and put the bells and whistles on something that's already out there operating."

### On a Mission

The outer streets of Kalgoorlie, where Mr Franklin introduced *Business News* to the electrified Cat 777 alongside Austin general sales manager Brad Higgins and sales manager west Steve O'Hara, are a long way from Mission Beach in Queensland's north.

It was here the Franklin family made a name, working for more than 40 years as one of the area's seven pioneering banana farming families.

"I actually did my first electrification on the farm's four-wheeler, 25 years ago," Mr Franklin said.

"I grew up on a mechanic banana farm.

"My old man, I thought it was just normal, but I do realise now that he comes from a long line of inventors – they're all mad.

"We were always inventing stuff. Flame weeders, steam weeders, walk-around mowers, self-dropping and catching bloody implements and all sorts of different systems."

Clayton's innovative streak reflects that of his father, Maurice, a mechanical engineer in his 70s.

"My dad farmed that land for 40 years," Mr Franklin said.

"But he's tight. We bought a tractor when I was born, it was secondhand, and he's rebuilt it three times in my lifetime.

"That's what he does, and that truck is a tribute to him in a sense.

"He actually did a lot of the mechanical design for it.

"He's a mechanical engineer, but he's a fitter and turner, but he's a farmer – you throw that in the mix, and you end up with someone who's 78 and should retire, but he's on top of that truck, driving around, and walking around the workshop."

While Maurice's focus has always been mechanical, Clayton's has tended towards electrical.

His tinkering with known quantities has translated well for an industry on the precipice of significant transition.

In a sector notoriously slow to adapt, the ability to offer an electrical retrofit without significantly modifying haul truck controls is a major plus for those who operate the vehicles.

Mr Franklin said the feedback on the controls system of the modified Cat 777 was true to the diesel model – giving it a significant advantage when it came to training a workforce with an existing skillset.

"One mechanical fitter who came out, who was in charge of a large fleet, says to me 'I don't really believe in this electric stuff, Clayton,'" Mr Franklin told *Business News*.

"I said, 'that's alright, no worries, mate'. So, I talked to him, showed him the truck, he had a look and said 'I can maintain this'.

"He said, 'I thought I was in for Bob's electric truck, but this is just a Caterpillar truck without the stuff that I don't want.

"I don't want to maintain a diesel engine, that looks a lot easier to maintain to me, and so does that motor'.

"That's why it's important to keep it Cat.

"One day and bang, they've got it. They're already familiar with it."

### Innovation

EPCA's electric truck retrofit is not the first piece of mining haulage technology with Franklin fingerprints attached.

Mr Franklin once worked on Sonic, Fortescue's revolutionary hydrogen-fuelled 220-tonne haul truck, which was a world first, famously converted to its new fuel source in less than 100 days.

The initiative was impressive, and Sonic was on display when Chinese Premier Li Qiang visited Fortescue's prototype facility earlier this year.

A follow-up hydrogenpowered prototype, Europa, was subsequently rolled out at Christmas Creek in August.

Mr Franklin acknowledged the progress made by Fortescue, but said he had challenges getting his message heard.

"That was the first in the world," he said of Sonic, which was designed to prove the hydrogen fuel concept.

"It was a 220-tonne machine, but I was never happy with the design, and management weren't interested.

"They just wanted to keep appeasing Twiggy and running forward, doing a whole bunch of other projects to make more LinkedIn videos.

"They said, 'you've got 100 days, make it happen'.

"And we made it happen. But I was never happy with the engineering of it."

Fortescue has subsequently pushed ahead in the pursuit of its goals and announced a green equipment partnership with Liebherr in September, worth more than \$4 billion.

Mr Franklin's departure from Fortescue led him towards EPCA, at first in a collaborative effort with other engineers and eventually on his own.

"Me and a couple of other engineers wanted to do our own thing, so I started doing my own thing," Mr Franklin said.

"The other engineers helped but they never committed.

"We ended up with the Curtin EV race team, which was really the engineering team behind it. And here we are."

Despite some aspects of the Sonic experience, Mr Franklin said Fortescue had the right idea when it came to the need to modernise haulage at its mining projects.

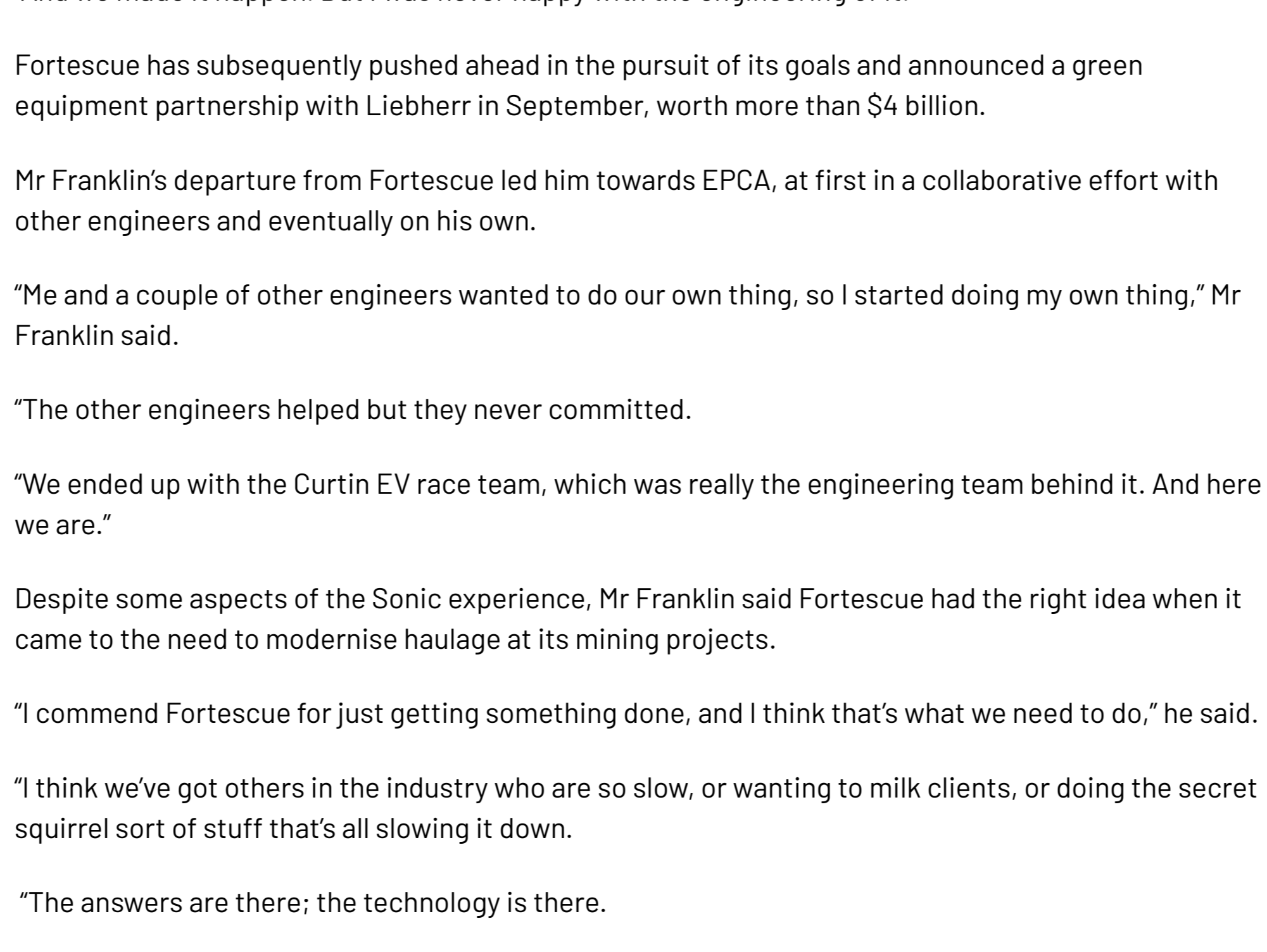
"I commend Fortescue for just getting something done, and I think that's what we need to do," he said.

"I think we've got others in the industry who are so slow, or wanting to milk clients, or doing the secret squirrel sort of stuff that's all slowing it down.

"The answers are there; the technology is there.

"There's no reason why they shouldn't just adopt the technology.

"I think a lot of it is an education piece. The miners are starting to get their heads around it.



The team that delivered the haul truck retrofit, including both Maurice and Clayton Franklin.

"Electrification is not about moving tonnes, per se, it's more about energy dispersion. Where do I place my energy?"

"If you take a big truck and you burn heaps of diesel, or you take three smaller trucks and they're all using the same amount of electricity, it's about where do I deploy the energy to make my mine work efficiently.

"That's a different mindset."

### Drivers

The push to facilitate the decarbonisation of haulage vehicles through electrification is increasingly the result of stakeholder expectation, and in some cases boardroom pressure.

But the on-ground success of an electrification push can often be traced back to the vision of one or a couple, according to Mr Franklin.

"It doesn't matter whether it's a big company or a small company, it's generally driven by an individual," he said.

"If you look at the amount of EV powertrain expertise worldwide at the moment, it's a small pool. It's going to grow, right, but right now it's small.

"So, if you're in Caterpillar or a Komatsu or any company like that, it's probably just one guy or a couple that's got the brains."

The big company mentality does not always gel with the mindset of one pushing to make significant change.

Mr Franklin used the apt metaphor of a large engine, operating slowly, methodically and with little by way of agility.

While designing within the parameters of the Australian standards expected by industry and regulators, EPCA can move more quickly than those electrifying within the big organisations.

"When you take a big machine, you'll find it has slow-moving cogs," he said.

"That's as opposed to, I accept your Ts and Cs, I'm ordering it.

"Here's the product order, I'm doing the transfer tomorrow.

"This is how quick I can do something when I want something, or make a decision and hit go, or change a code based on client feedback.

"We just go and do it if we don't already have it, because we're a startup and we're small and agile, we don't need to have all of those processes."

So too is EPCA able to be flexible with the materials it sources and the technologies it draws on.

Mr Franklin said his passion for tinkering, and developing solutions to big problems, was better served at the helm of his own company.

"I've always had a passion for it, but I certainly got a major exposure to it while I was working for Fortescue, and then rolled into my own company," he said.

"The beauty of it is, I didn't buy Williams Advanced Engineering [the Formula 1 team offshoot acquired by Fortescue for \$310 million in April].

"I don't have to buy those batteries. I can have the batteries I want, the motors I want, the chillers I want.

"There's a lot of freedom in what you're doing [when you operate independently].

"It allows you to do the best engineering that you can."

### Pioneering spirit

Western Australia's inventive streak is long held, as a visit by a colleague to Kreepy Krauly's Perth facility highlighted a few years ago.

It was here that two prototype electric vehicles, decades old and created by pool cleaner visionary Terry Jackson, were uncovered in a storeroom.

Mr Jackson would ultimately bring Kreepy Krauly to Australia, adapting it to local conditions with a redesign before its launch into the local market in 1976 and ultimate expansion abroad.

What might have been in the worlds of both automobiles and pool maintenance if Mr Jackson's locally pioneered EVs had taken off instead.

The zinc-bromine battery, which for more than a decade has been pushed by the ASX-listed Redflow in a bid to meet significant demand from the commercial and industrial markets, also has origins here.

Established in 1981, ZZB Technologies had threatened to break through as a major commercial player in emerging zinc-bromide battery technologies before a run of misfortune and the passing of its founder, the late Jim Parker, extinguished the dream.

Redflow entered administration in September, after it hit hurdles attracting the funding it needed to build a larger factory to scale up its X10 battery.

Then there's OKA All Terrain Vehicles, which picked up the pieces of the innovative OKA vehicle manufacturer established by Mike Walker in 1985.

The WA-pioneered vehicles were given a new lease on life in 2017, after it was bought by managing director Dean Robinson.

# GREEN AND LEAN:

## EPCA LEADING THE WAY IN ZERO-EMISSIONS MINING EQUIPMENT CONVERSIONS WORLDWIDE

**E**lectric Power Conversion Australia (EPCA), a Perth-based innovator in the mining industry, is turning heads with its groundbreaking work in electrifying heavy machinery. Recently, the company unveiled its latest project: a fully retrofitted CAT 777 haul truck, now powered entirely by batteries. This project represents a big leap forward in sustainable mining, demonstrating EPCA's commitment to reducing the industry's environmental footprint while enhancing operational efficiency and cutting costs.

The retrofit of the CAT 777 is not just an incremental improvement; it's a radical transformation. The traditional diesel engine has been removed and replaced with an electric motor powered by high-capacity batteries. This retrofit offers a

superior alternative to diesel-powered trucks, boasting significant advantages in environmental impact, efficiency, and operational viability. Beyond these benefits, the electric truck also promises reduced maintenance costs and a decrease in the overall operational expenses for mining companies.

EPCA is looking to improve efficiency on new and old technology alike, with its retrofitting services that extend to active and inactive Caterpillar mining trucks. Globally, approximately 20,000 inactive trucks could be repurposed through this process. By retrofitting these idle vehicles, EPCA not only brings them back into productive use but also reduces the demand for manufacturing new equipment, which itself generates carbon emissions.

This approach not only recycles valuable resources but also contributes to a significant reduction in greenhouse gas emissions. EPCA's powertrain technology is versatile and can be applied to a wide range of mining equipment, from graders and dozers to drill rigs and loaders. This adaptability positions EPCA as a leader in the transition to battery electric power across the entire mining sector.

### Leading the charge

Diesel-powered mining trucks are among the largest contributors to greenhouse gas emissions in the industry. For context, a standard 100t mining truck consuming around 64l of diesel per hour would lead to 1260t of carbon dioxide per annum.

EPCA's retrofit project directly targets

these emissions. The CAT 777, with its 100t payload capacity, is one of the most widely used trucks in WA's mining operations. By converting this model from diesel to electric, EPCA addresses a critical need to reduce carbon emissions in a sector where mobile machinery, particularly trucks, accounts for up to 50% of total emissions. The retrofitted CAT 777, now dubbed the "Green Machine," doesn't just match the performance of its diesel predecessor — it exceeds it. The electric version sees a power increase from 746kW (1000hp) to 850kW (1140hp) and a torque boost from 4,700Nm to 5,200Nm, all made possible by integrating six high-capacity batteries delivering a total of 1,746kWh. EPCA proudly touts this setup as having the world's highest energy density.

The benefits of EPCA's "Green Machine" extend beyond raw power. The electric truck offers significant advantages in terms of reduced noise and vibration, which enhances operator comfort and improves safety on site. After completing an 8-hour shift, the truck can be recharged in just 50 minutes using advanced DC charging technology, allowing it to quickly return to operation. This fast recharge time is crucial for maintaining the demanding production schedules typical of the mining industry, minimising downtime and maximising operational efficiency. Moreover, the truck's charging system is designed to be versatile, accepting both DC (solar) and AC (existing mine grid) inputs, which ensures compatibility with renewable energy sources and further reduces the environmental impact.

From an economic perspective, the shift from diesel to electric power offers substantial cost savings. Diesel fuel is a major expense for mining operations, with the cost per litre currently hovering around \$1.60. For a 777 operating under heavy duty, typical mine burn is 64l/hr giving a cost of \$102/hr for diesel which is significantly more compared to electric which is \$22/hr (assuming \$135/MWhr — the typical electricity cost in WA's Pilbara operations).

In contrast, maintenance costs for diesel trucks are \$104 per hour, while the battery electric truck (BET) reduces this to \$62/hr. Over 20 years, the total cost of ownership for a diesel truck reaches \$25m, whereas EPCA's BET comes in at \$11.5m, highlighting its long-term economic advantage.

The efficiency of BETs further amplifies

their appeal. Electric motors are inherently more efficient than diesel engines, with an efficiency rate of about 95% compared to just 35% for diesel. Additionally, the regenerative braking system in electric trucks captures energy that would otherwise be lost as heat during braking and stores it back in the batteries. This extends the truck's range and reduces wear and tear on the braking system, leading to lower maintenance costs.

### Ten times quieter

Beyond the economic and environmental benefits, EPCA's project also addresses the significant health and safety concerns associated with diesel-powered mining trucks. One of the most pressing issues is noise-induced hearing loss (NIHL), which is the most compensated occupational disease in Australian coal mines. Miners are routinely exposed to noise levels ranging from 80dB(A) to 120dB(A), putting them at high risk for developing NIHL. The quiet operation of EPCA's electric trucks — ten times quieter than their diesel counterparts — has the potential to drastically reduce the incidence of NIHL in the mining industry, leading to better health outcomes for workers and lower compensation costs for companies.

The mining industry has taken notice of EPCA's achievements, with considerable interest in the 100t electric truck. This enthusiasm is driven not only by the potential for significant cost savings but also by the broader implications of adopting greener technologies. EPCA's retrofitted CAT 777 is currently on-site undergoing performance testing at a mine site just north of Perth.



EPCA's Full-Battery Electric truck operating on mine site near Perth.



WA member Reece Whitby officially introduces EPCA's truck at The Electric Mine Conference 2024.



EPCA FULL BATTERY ELECTRIC TRUCK TRIALS ON MINE SITE AT BAKERS HILL.



### Close to home and across the globe

WA, with its strong mining sector and skilled workforce, is uniquely positioned to lead the transition from diesel to electric. The state's workers, already experienced with diesel-powered machinery, can quickly adapt to the new requirements of battery-electric technology. This transition not only preserves existing jobs but also creates new opportunities in high-tech manufacturing, maintenance, and operations related to battery electric vehicles. By fostering this shift, WA can attract investment, drive economic diversification, and ensure long-term prosperity for the region.

EPCA's ambitions don't end with WA. The company has formed a strategic partnership with a multinational corporation that operates on every continent, ensuring that clients worldwide

can access its cutting-edge retrofitting services. With a growing client base in Africa and plans to begin full-scale production once endurance testing is completed in 2025, EPCA is well-positioned to meet the global demand for battery electric mining trucks. This production capacity, supported by a robust distribution network, will enable EPCA to fulfil its order book, which already includes over 600 trucks, and continue to lead the charge in the electrification of the mining industry. **AMR**

Source:



www.epca.net.au

# EPCA demonstrating real-world battery haulage business case at Bakers Hill mine

Posted by Daniel Gleeson on 23rd September 2024



Electric Power Conversion Australia (EPCA), a Perth, Western Australia-based company, is gaining attention for its advancements in electrifying heavy machinery, with its biggest project to date, a fully retrofitted Caterpillar 777 haul truck operating entirely on battery power, taking another step towards becoming a commercial proposition.

Founded by Clayton Franklin, who also leads its engineering team as Chief Engineer, the company plans to retrofit up to 70 trucks annually from diesel to battery-electric.

Having initially showcased this vehicle at *The Electric Mine 2024*, in Perth, in May, followed by an appearance in Kalgoorlie at *Diggers and Dealers*, the company has now progressed to trial operations.

At Bakers Hill, a sand mine located just 40 minutes north of Perth, EPCA's fully battery-electric 91 t haulage truck has been hard at work for the past month. This test phase marks a significant step forward for the company, demonstrating EPCA's commitment to sustainability, efficiency and innovation while enhancing operational efficiency and cutting costs, the company says.

The retrofit of the CAT 777 represents a complete overhaul, not just a minor upgrade. The diesel engine has been entirely replaced with an electric motor powered by high-capacity batteries (supplied by Xerotech), marking a radical shift in the truck's operation. More than 5.9 t of components were removed and replaced by six batteries, each weighing 1.4 t. In the end, the truck is now 2.5 t lighter, thanks to the reduced weight of the custom-designed tray made by Austin Engineering, EPCA says.

This transformation offers far more than environmental benefits; it significantly enhances efficiency and operational viability, the company explains. Additionally, the electric truck is expected to reduce maintenance and operational costs for mining companies compared with the diesel equivalent, providing a cleaner, more cost-effective alternative to traditional diesel-powered trucks. EPCA assures that, over 20 years, the total cost of ownership for a diesel truck will be approximately A\$25 million (\$17 million), while the battery-electric truck's total will come in at A\$11.5 million.

## Performance data and results

Bakers Hill, a privately held sand mine, provides the perfect environment for EPCA to push the limits of its technology, according to the company. The eastern side of the mine was prepared for testing, with a grader pushing up a ramp featuring a 17% incline and a turnback. Though it is a sand mine, the conditions and setup at Bakers Hill are comparable to a bauxite mine in terms of depth and incline, offering a realistic representation of the challenges this truck might face at commercial-scale mining operations.

In these conditions, the electric truck has shown impressive performance metrics, according to EPCA. During standard operations, the truck has consistently delivered over 10 hours of runtime on a single charge, with the battery taking just 50 minutes to fully recharge. This quick turnaround time ensures that the truck can maintain its productivity, minimising downtime while still offering substantial energy savings.

One of the key tests involved driving the truck on a 17% incline, where it consumed 252 kWh of energy. On the descent, the regenerative braking system was able to recover 35 kWh (15%). When stationary, with the auxiliary systems running, the truck consumes around 20 kWh/h.

The truck is designed for 91-t payloads, with the testing at Bakers Hill revealing that it can handle inclines of up to 27% under full load. This makes it an ideal candidate for some of the most challenging mining operations where steep inclines and heavy loads are standard, EPCA says.



## Scalable fast-charging solution

Delivering charging infrastructure on mine sites is challenging. Mining companies are forced to deploy large and expensive infrastructure to be able to charge large electric fleets. EPCA has collaborated with Western Australia-based integrated energy solution provider UON Pty Ltd, who has developed the SMART™ (Scalable, Modular, Automated, Renewable, Temperature controlled) CELL DC Fast Charging solution, which can charge the CAT 777 haul truck in less than 50 minutes, according to the company. The UON charging solution has been designed to operate in harsh Western Australian mining conditions, ensuring reliable charging power at all times.

The UON SMART DC Fast Charging can be seamlessly connected to the existing grid or be powered completely by 100% renewable energy, such as solar, providing much-needed charging infrastructure in grid-constrained locations, the company says. Its all-in-one mobile Battery EV charging solution is fully mine-compliant and can be easily redeployed on any brownfield or greenfield mine, which enables mining companies to avoid a large investment in infrastructure, UON says.

## Real-world demonstrations and future steps

EPCA has already showcased the truck at Bakers Hill to several Tier-One mining companies, all of whom have expressed very positive reactions, according to EPCA. "These real-world demonstrations are designed to showcase the truck's capabilities and the benefits of electrification in reducing carbon emissions and operational costs," it says.

Following the Bakers Hill trials, EPCA plans to move into endurance testing in 2025 and run this design for many thousands of hours before moving into mass production.

The company concluded: "EPCA is well positioned to meet the increasing demand for battery-electric mining trucks. Supported by a robust distribution network, the company is set to fulfil its order book of over 600 trucks, reinforcing its leadership in the electrification of the mining industry.

"The future of mining is electric, and EPCA's work is leading the way in making that a reality."

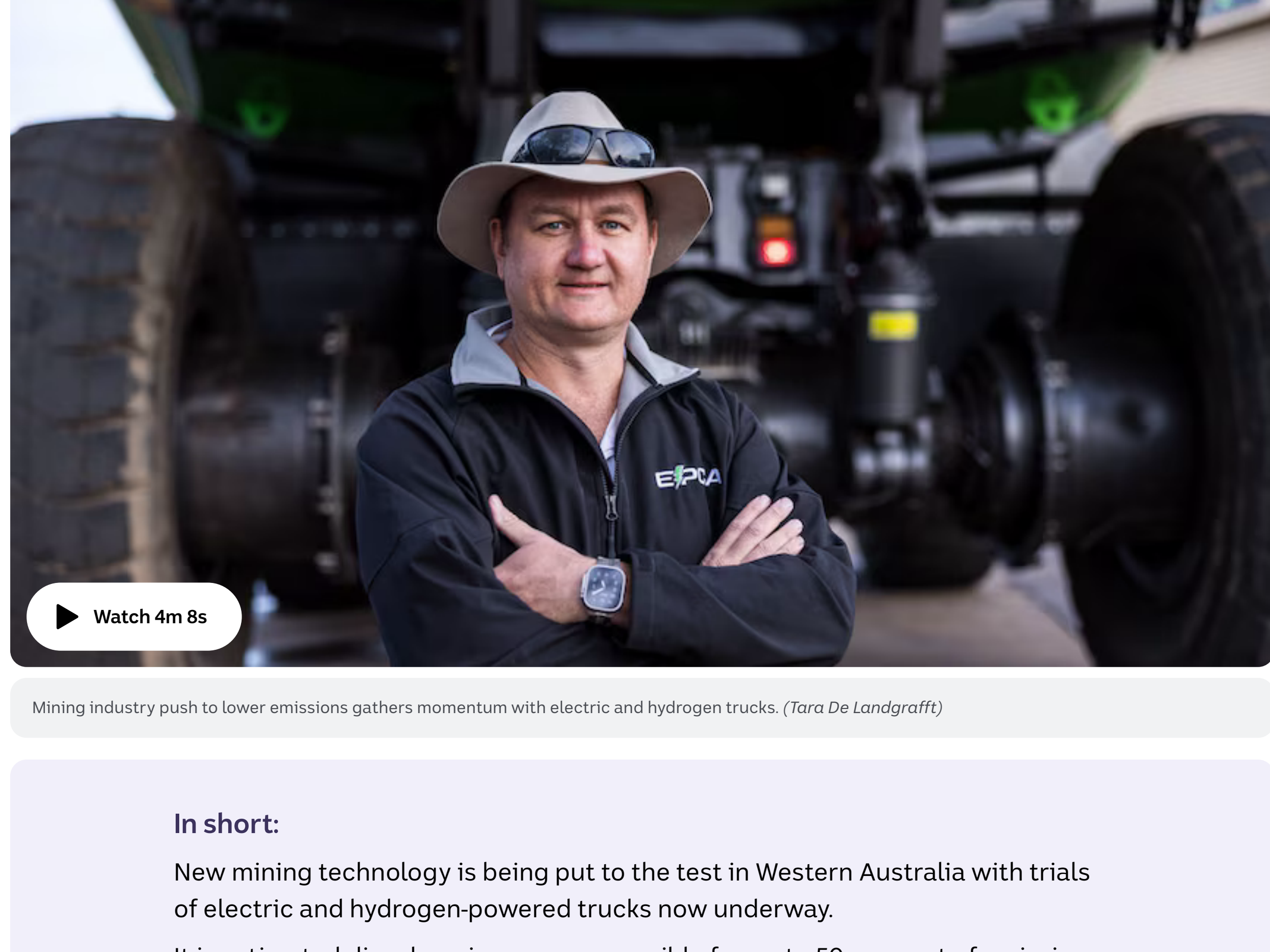
# Electric and hydrogen truck trials roll out as mining industry pushes to lower emissions

ABC NEWS

By Jarrod Lucas and Tara de Landgraaff

ABC Goldfields Mining and Metals Industry

Wed 28 Aug



Watch 4m 8s

Mining industry push to lower emissions gathers momentum with electric and hydrogen trucks. (Tara De Landgraaff)

## In short:

New mining technology is being put to the test in Western Australia with trials of electric and hydrogen-powered trucks now underway.

It is estimated diesel engines are responsible for up to 50 per cent of emissions from the global mining industry.

## What's next?

The founder of a company behind one of the new truck trials says it's only a matter of time before the mining industry goes fully electric.

abc.net.au/news/diesel-mining-truck-converted-to-electric-... [Share article](#)

The push to lower emissions from Australia's mining industry is gaining momentum with trials of large-scale electric and hydrogen trucks now underway, and the race on to find the best solution.

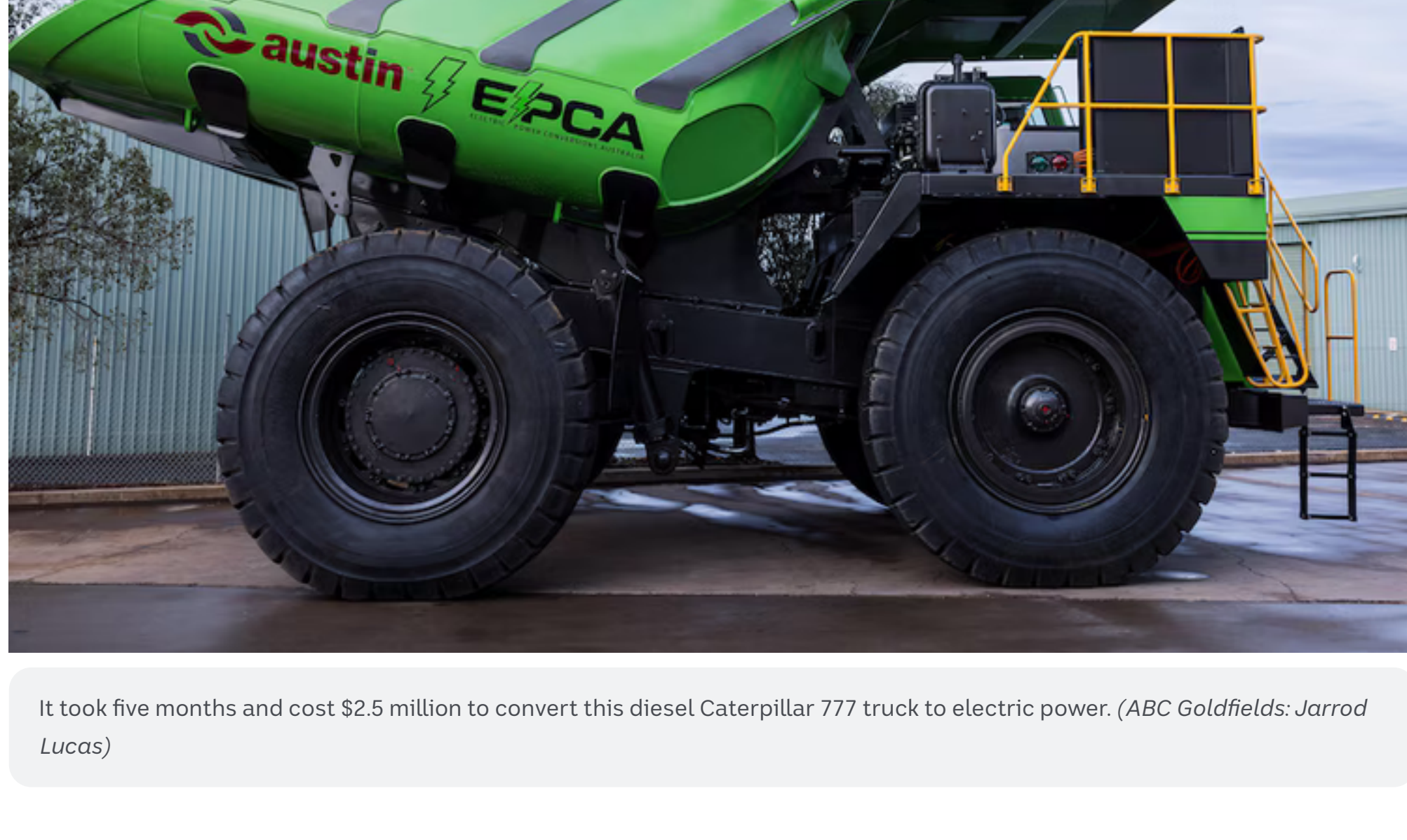
Electrical engineer Clayton Franklin has had a foot in both camps.

He worked on a 220-tonne hydrogen battery hybrid mining truck for billionaire Andrew Forrest's Fortescue Metals Group.

But since 2021 when he formed his own company, Electric Power Conversions Australia, Mr Franklin has shifted into his own lane.

He spent five months and \$2.5 million converting a 160-tonne Caterpillar 777, one of the most commonly used haul trucks in the Australian resources sector, from diesel to electric.

This month, as Fortescue's hydrogen-powered T 264 prototype truck arrived in the Pilbara for testing, Mr Clayton was pitching the benefits of his own electric truck to delegates at the Diggers and Dealers Mining Forum in Kalgoorlie-Boulder.



It took five months and cost \$2.5 million to convert this diesel Caterpillar 777 truck to electric power. (ABC Goldfields: Jarrod Lucas)

With the mining industry believed to contribute up to 3 per cent of carbon dioxide emissions worldwide, Mr Franklin is adamant the transition away from diesel will not only lower emissions but costs as well.

He said the Caterpillar 777 truck used to guzzle 64 litres of diesel an hour.

"The mines have got to move to electric, not only just for saving the turtles and the environment, but for cost," Mr Franklin said.

"On one hand you have diesel, which costs \$112 an hour, or do you want to go electric at \$22 an hour?"

"This truck burns through \$650,000 to \$700,000 worth of diesel a year. It's a huge amount of diesel burn."

That diesel burn was highlighted in a [research paper earlier this year by Pranav Jaswani](#), a technology analyst at UK-based IDTechEx, who estimated 40–50 per cent of emissions produced by the global mining industry were from diesel engines.

He said the global haul truck population numbered about 55,000 and emitted 174 megatonnes of carbon dioxide annually — the equivalent of almost 38 million cars on the road.

"The electrification of haul trucks will be key to achieving meaningful emissions reductions in the industry and assisting mining companies to meet their sustainability objectives," Mr Jaswani said.



It's estimated up to 50 per cent of emissions produced by the global mining industry are from diesel engines. (ABC Goldfields: Jarrod Lucas)

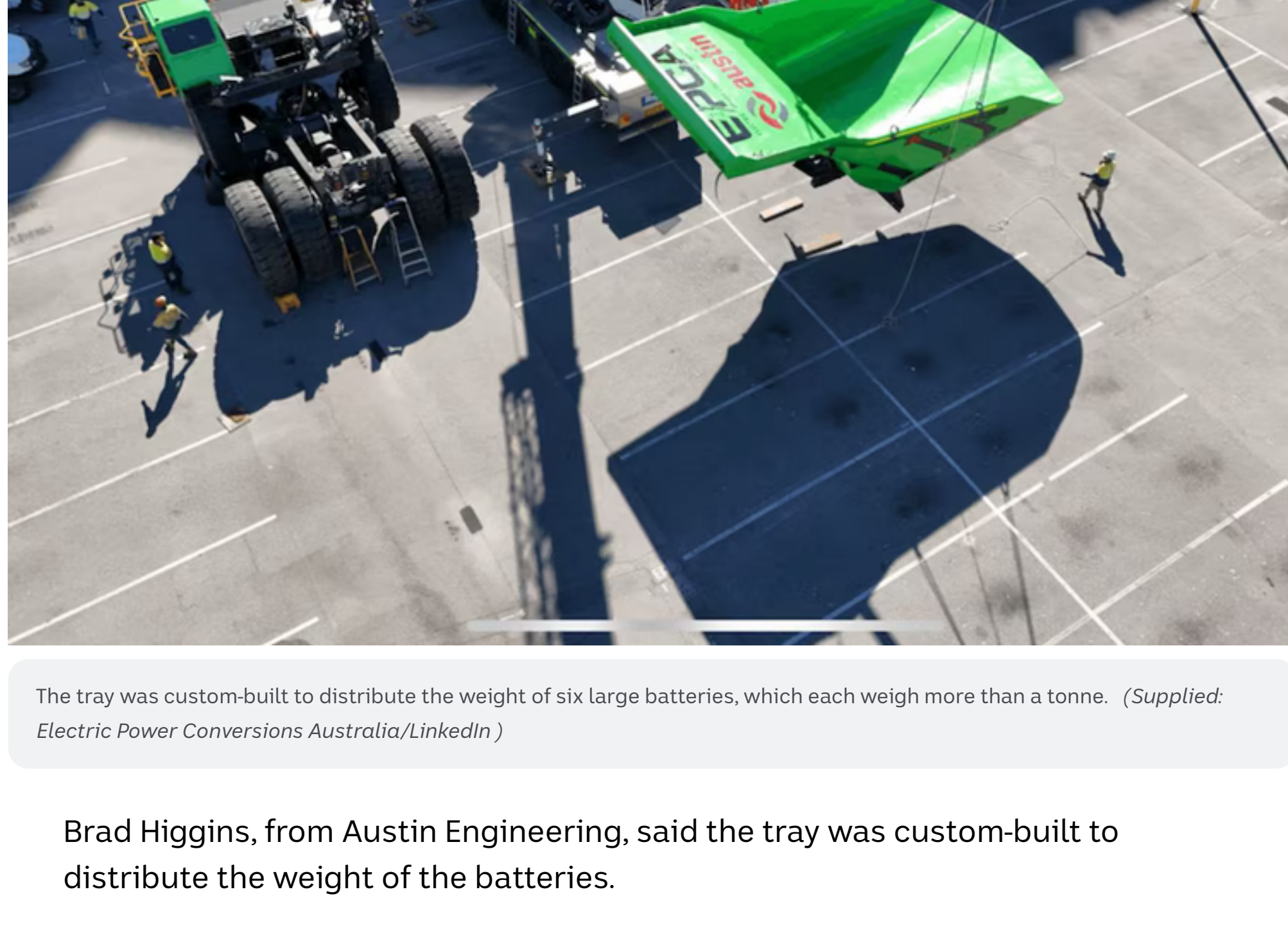
## Like charging a Tesla

Mr Franklin's conversion of the diesel truck to electric saw more than 5.9 tonnes of components taken out and replaced with six batteries, each weighing 1.2 tonnes.

Overall, the truck is now 2.5 tonnes lighter, as the weight of the tray has been reduced.

Mr Franklin said charging the truck was straight-forward and took less than an hour.

"We use a standard CCS2 plug, and it's exactly the same as though it's charging your Tesla," he said.



The tray was custom-built to distribute the weight of six large batteries, which each weigh more than a tonne. (Supplied: Electric Power Conversions Australia/LinkedIn)

Brad Higgins, from Austin Engineering, said the tray was custom-built to distribute the weight of the batteries.

He said it had not changed the payload capacity, which was still up to 100 tonnes, and the green paint job was designed to make the electric truck stand out on a mine site.

"When Clayton first came along and said this is what we're doing, we jumped at the chance, knowing that there's a step change needed in the mining industry," he said.



Clayton Franklin says the electrification of mining equipment provides cost and emissions benefits. (ABC Goldfields: Jarrod Lucas)

Mr Franklin said it was only a matter of time before the industry went fully electric.

"Why would a mine want dirty, diesel, expensive?" he said.

"They can go clean, green, cheaper — so they'll be out of business in 10 years if they don't go electric."

## Hydrogen trial begins

In the Fortescue camp, the T 264 prototype, known as Europa, is being trialled at the Christmas Creek mine, near Nullagine, after making the 1100 kilometre journey from Perth.

It contains a 1.6-megawatt-hour battery and 500 kilowatts of fuel cells, and can store over 380 kilograms of liquid hydrogen.

The truck is refuelled with liquid hydrogen from a gaseous and liquid hydrogen plant at Fortescue's newly-minted Green Energy Hub at Christmas Creek.

"What do you think about my truck, mate?," Mr Forrest asked ABC News Breakfast earlier this month.

**"That's the world's first green hydrogen truck, powered by the sun and wind of Australia, more energy than Putin could ever export."**



Fortescue's hydrogen-powered truck prototype is being trialled at the Christmas Creek mine in the Pilbara. (Supplied: Jessica Hayes/Channel 10)

The Pilbara trial began a month after Fortescue cut 700 jobs, which Mr Forrest said was [not a sign he was pulling away from his green hydrogen ambitions](#).

"There's clearly going to be redundancies when you make something much more efficient," he said.

"Don't confuse that with the fact that we're growing our company rapidly, and we're growing it into green energy, growing it into green metal.

"We cannot keep going down the oil and gas path, just because we know it, because we're too lazy to do anything else."

# EPCA electrifies 100-tonne mining truck

The Australian conversion company Electric Power Conversion Australia (EPCA), based in Perth, recently electrified a 100-tonne mining truck. EPCA plans to offer 50 to 70 battery-electric mining trucks per year in the future.



Image: EPCA/Xerotech

The mining truck in question is the diesel-powered CAT 777, with a total permissible load of 100 tonnes. In the project, which the company calls a 'Green Machine,' EPCA faced the challenge of delivering high performance for long operating times within the constraints of the existing truck design.

EPCA worked with battery manufacturer Xerotech. The solution consisted of installing six Xerotech batteries with 290 kWh, the largest single pack, which are connected in parallel and generate a total of 1,741.8 kWh and 671 V. That transforms the CAT 777 into an electric vehicle with "the world's highest energy density," as Clayton Franklin, chief engineer and founder of EPCA, explains.

The conversion to battery operation has increased the truck's power from 746 kW to 824 kW and the torque from 4,700 Nm to 5,200 Nm. According to the company, this increase in power and efficiency from 35 to 95 per cent underlines the Xerotech battery system's advantages.

EPCA says the 'Green Machine' offers numerous advantages for operators, such as less noise and vibration, which increases comfort and safety. The vehicle can be operated for eight hours on a full battery charge. It can be recharged in just 50 minutes with the built-in charging technology, making it ideal for continuous operation in mining, according to EPCA.

Having recently presented its 'Green Machine' at two major events in Australia, EPCA plans to produce 50 to 70 battery electric mining trucks per year. Franklin said: "Our mining clients here in Australia are ecstatic that this truck's being built and manufactured right here in Western Australia."

# EPCA plans to convert 50-70 mining trucks to electric power annually



Jo Borrás | Aug 24 2024 - 4:55 pm PT | 9 Comments



Located in Perth, Western Australia, EPCA became famous for its “Green Machine,” a CAT 777 100-ton haul truck it converted to electric power. Now, the company says it has plans to produce 50-70 more of the battery electric mining trucks ... each year.

After showcasing its Green Machine at two major mining events in [Australia](#) recently, EPCA (an acronym that stands for Electric Power Conversion Australia) a recent case study commissioned by one of the company’s key suppliers says it has plans to produce 50-70 of its 100-ton battery electric mining trucks annually.

There might be demand, too. Switching the CAT from diesel to battery electric power boosts the haul truck’s horsepower from 1,000 hp to 1,120 hp, and bumps torque from 4,700 Nm (3,400 lb ft) to 5,200 Nm (3,835 lb ft), and that torque increase comes at 0 rpm.

The electrons powering those motors are provided courtesy of six 290 kWh Xerotech batteries running in parallel. The combined battery pack is good for some 1740 kWh of energy storage, [which makes it one of the biggest vehicle batteries we’ve ever heard of](#).

For their part, the EPCA team seem pretty proud of their new truck. Clayton Franklin, Chief Engineer and Founder of EPCA, said, “We’ve now got the world’s highest energy density, full battery-electric mining truck ... our mining clients here in Australia are ecstatic that this truck is being built and manufactured right here in Western Australia.”

With 5,500 mining trucks currently operating in Australia ([and more than 55,000 operating globally](#)), finding buyers for 50-70 trucks per year seems pretty doable. The only question now is whether EPCA – or, more accurately, Xerotech – can get them built.

## Electrek’s Take

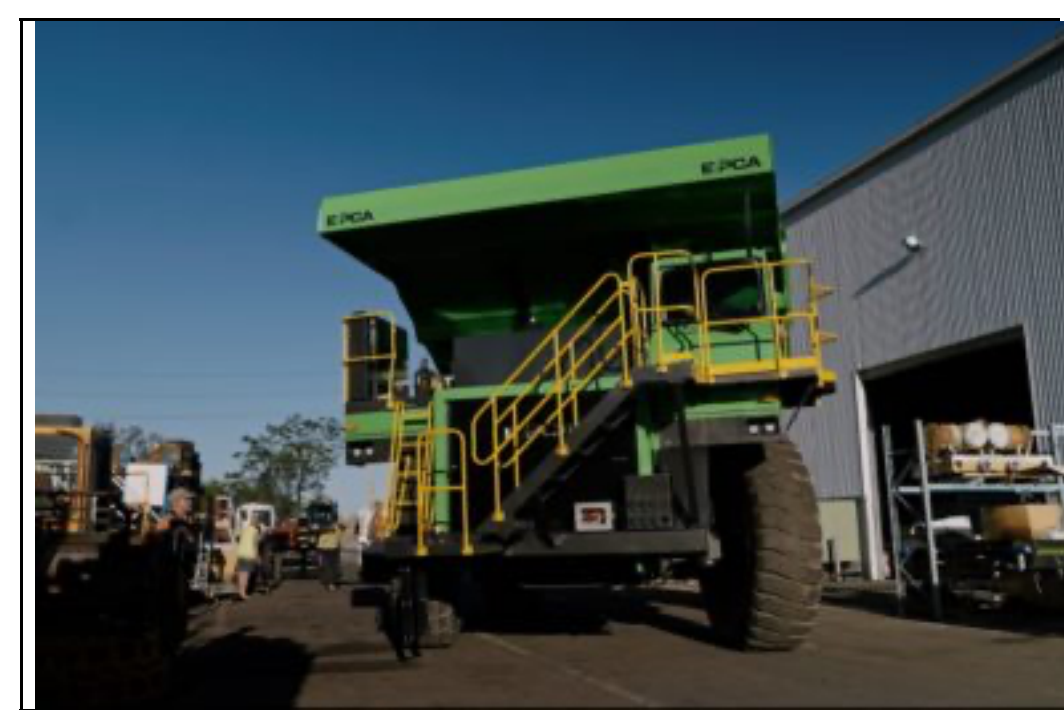


EPCA Green Machine, with dump body by Austin Engineering; via [Austin Engineering](#).

As we discussed in our special mining episode of [Quick Charge](#), mines are great applications for battery-electric vehicles, and massive electric vehicles like this one from EPCA and similar models from [Caterpillar](#) and [Liebherr](#) are filling out the market nicely. That said, I think I made these points well enough there to repost the video, below, and argue out the details in the comments. Enjoy!

# EPCA to produce 50-70 battery-electric mining trucks a year, Xerotech says

Posted by Daniel Gleeson on 9th August 2024



Having showcased its “Green Machine” to attendees at two major events in Australia recently, Electric Power Conversion Australia (EPCA) now has plans to produce 50-70 battery-electric mining trucks annually, according to a recent case study from one of its suppliers.

EPCA, located in Perth, Western Australia, recently electrified a CAT 777 100-ton (91-t) mining truck using a Xerotech Battery System. Known as the “Green Machine”, this project marks a significant advancement in mining truck electrification and showcases EPCA’s expertise in converting diesel mining equipment to fully battery-electric systems, Xerotech says.

EPCA faced the challenge of delivering high power levels for extended operations within the constraints of the existing truck design. Space is a key factor in battery system integration and the widespread adoption of battery-electric applications. The solution was to install six 290 kWh Xerotech batteries, its largest single pack, running in parallel to generate a total of 1741.8 kWh and 671 V. This installation transformed this CAT 777 into the world’s highest energy density, battery-electric mining truck, the supplier claims.

Clayton Franklin, Chief Engineer and Founder of EPCA, said: “We’ve now got the world’s highest energy density, full battery-electric mining truck.”

This truck was first showcased at *The Electric Mine 2024*, in May of this year, with attendees of the event at Crown Perth able to see the machine in the iron. The company has since gone on to display the machine at *Diggers & Dealers*, in Kalgoorlie, Western Australia, this week.

Switching to battery-electric power increased the truck’s horsepower from 1,000 hp (746 kW) to 1,120 hp and improved the torque from 4,700 Nm to 5,200 Nm. This performance boost, along with an efficiency leap from 35% to 95%, underscores the advantages of the Xerotech battery system, the company said.

The Green Machine offers numerous benefits to operators, including reduced noise and vibration, enhancing comfort and safety. It can run for eight hours on a full charge and recharges in just 50 minutes using smart charging technology, making it ideal for continuous mining operations, EPCA says. “For an operator operating this machine, the advantage is no noise, low vibration,” Franklin said, emphasising the improved safety features, including a SIL2-rated functional safety system.

EPCA plans to produce 50-70 battery-electric mining trucks annually. With 5,500 mining trucks in Australia and 55,000 globally, the potential impact is substantial, it says. Franklin said: “Our mining clients here in Australia are ecstatic that this truck’s being built and manufactured right here in Western Australia.”

Xerotech’s vision of a fully electric future is, the company says, supported by its scalable and configurable battery platform, enabling every OEM and integrator to embrace electrification. With no recurring engineering and design costs, electrifying prototypes or entire fleets is both feasible and cost-effective.

# The Electric Mine Consortium and EPCA to run Cat 777 electric truck trial

Posted by Daniel Gleeson on 23rd June 2023



The Electric Mine Consortium is looking to bridge the gap between the testing of electrified ultra-class haul trucks and continued rollout across industry of battery-electric underground trucks with a project to develop and trial a retrofitted 100-ton (91 t) haul truck as part of its consortium work in Australia.

It has teamed up with Electric Power Conversions Australia (EPCA), an Indigenous electric battery conversion company in Australia, to run a Caterpillar 777 haul truck electric vehicle demonstrator project.

The consortium explained: “The Electric Mine Consortium are focused across all fleet sizes when it comes to electrification. In our recent work, we have uncovered that in the area of larger surface in-pit trucks, there are some trials underway, however there is a lack of focus on the smaller trucks. Making sure we understand and trial electric technologies in smaller fleets is important to our members, and we were recently presented with an opportunity to do so by Electric Power Conversions Australia, an Indigenous electric battery conversion company in Australia.”

The conversion of the vehicle – one of the most commonly used surface trucks across the Tier 2 and Tier 3 mining company market, according to the consortium – will see the 750 kW diesel motor switched out with a 1,000 kW electric motor and 2 MWh of batteries, according to Clayton Franklin, founder and CEO of EPCA.

Franklin said he was expecting this configuration to allow for an eight-hour average run time, providing 30% more power than the diesel equivalent and the ability to move material quicker. He also predicted a 50% reduction in total cost of ownership on the battery-converted truck when compared with the diesel truck.

EPCA was founded in 2021 with the vision of providing a practical solution to the growing environmental impact of the Australian mining industry. Franklin himself was the lead engineer on a 220-t hydrogen-battery hybrid mining truck and also for an Epiroc D65 drill rig that was electrified.

The Electric Mine Consortium is a growing group of leading mining and service companies. These companies are driven by the imperative to accelerate progress towards the fully electrified zero CO<sub>2</sub> and zero particulates mine. Mining companies Gold Fields, South32, OZ Minerals, IGO Ltd, Evolution Mining, Iluka Resources, MMG and Sandfire Resources are among the participants.

In the short time since the establishment, the consortium’s membership has grown almost two-fold, with over 40 ongoing equipment trials in 15 different locations having been mobilised.





Leaders

June 23, 2024

Top image :  
Snug fit: Clayton Franklin thinks BE mine trucks and Western Australia's huge mining industry are made for each other

# Innovator sees green light for massive retrofit industry

**'It's not a race to be second. Do it now or you're going to lose your competitive advantage'**

At the world's biggest mine electrification forum in Perth, Western Australia, recently, there was plenty of talk about what the future of mining could look like. But for Electric Mine Consortium founder Graeme Stanway, there is nothing like sitting in it.

"No amount of analysis and telling people about disadvantages of the current system will work until people actually see the future," Stanway says.

"That's what you get here. This is very tangible; very visceral."

Stanway had just disembarked from the "Green Machine", a battery-electric, circa-90-tonne-payload (Caterpillar 777) retrofitted dump truck built by Electric Power Conversions Australia. EPCA founder and principal Clayton Franklin was previously lead engineer on Fortescue's hydrogen-powered mine-truck project in WA. He thinks the state can be a global powerhouse in a market worth billions of dollars.

"The technology wasn't here a few years ago, but it is here now," he says.

"I've been in WA mining for 25 years. The state is ideal. It's got the right labour. We've got the mines right next to us.

"We've got people here who want it to happen.

"It's not about big trucks moving more dirt anymore. Electrification of mines is about energy usage.

"A small truck uses 212kWhr [for 50 litres of diesel per hour] and a big one 600kWhr (150U/hr) so ... in terms of moving tonnes for energy usage it's the same to use three small trucks.

"Less maintenance [versus] more drivers. The silver bullet is a 100-ton or 150t rigid dump truck that's electric and driverless."

The EMC was formed in 2021 to bring together a collaborative network of miners and suppliers to try to speed the industry's momentous switch from diesel equipment to EVs. It has already initiated more than 40 equipment trials. Stanway wasn't the only one struck by the EPCA truck's relative quietness and acceleration. A small diesel-powered crane vehicle that started up during a demonstration completely drowned out the truck and any conversation among onlookers.

"I think once you hear this thing [and] you see the size of the motors compared with [the diesel engine block that was removed]; you look at the costs and at the numbers ... People will tend to move more quickly.

"It's great that [EPCA is] really taking the risk to do this. There needs to be more of it," Stanway says.

EMC principal Michelle Keegan says: "It's a smart risk around an industry that needs to change.

"We know this is the way forward.

"But I think even a couple of years ago, at the beginning of the Electric Mine Consortium, I jumped in the Bortana [utility] electric vehicle and I was convinced that electric vehicles are the way to go because they are quiet and you get that fast uptake [acceleration].

"You jump in this truck, and it's the same.

"I really think that it does take that experience of being in the vehicle. You can learn a lot from [Clayton] and can get over the first hurdle. You get into the vehicle and I think you get across the next hurdle. And then the next one is going to site and running [the truck]."

Franklin self-funded the first EPCA battery truck in the belief that "we've got to get it out there, get it working, get it moving tonnes".

"Our pipeline [for] this size truck is 470 trucks.



EPCA founder Clayton Franklin: 'Electrification of mines is about energy usage'

"We want to be able to do 80 a year out of this facility. With this facility here we would just keep punching out electric trucks.

"We've got to go from the 100t to the 150t. We've also got to do a loader. We've got to a grader, a dozer, a drill rig. But haulage is the first step and if we can solve haulage then that's the bulk of [mine scope one] emissions sorted. The 100-150t truck is pretty straightforward.

"The truck runs for eight hours or can run for 12 hours [off battery power and charging].

"It's a similar capex cost to buying a new diesel. It's lower maintenance [and] lower operating cost. You can have a solar farm [to power a fleet]. It's zero emissions.

"There's nothing that stops you from taking up the technology.

"It's not a race to be second. Do it now or you're going to lose your competitive advantage."

Franklin says a major Australian bank is prepared to provide finance for EPCA trucks via an operating lease.

He has alliances with the owner of the Hazelmere workshop where he's building EVs, 16-year-old EMJC Earthmoving and Plant Hire, Australian Stock Exchange-listed mine dump-truck tray maker Austin Engineering, local battery energy storage company UON, and automation start-up Far Energy.

Franklin thinks battery technology from Ireland's Xerotech best suits his needs at this stage.

"For us collaboration is key," he says.

"Rather than us try and make a charger, build our own battery pack and start with a truck from square one, we've teamed up with UON ... and they are 100% behind us. Austin Engineering know more about trays than anyone else in the industry. Xerotech have got what I think is probably the best [battery formula] for offroad machines worldwide.

"Those partnerships have really helped us drive forward rapidly.

"We did build the truck quickly but we built it right as well and I am very happy with the design.

"If you look at what was [on display] at the Electric Mine conference, which is the worldwide conference to be at, there were six underground machines and we had the only surface mining equipment.

"We are a very small company that comes along and brings an electric truck to the Electric Mine conference and bigger players like Caterpillar bring diesel-electric trucks."

Part of a small team that designed and built the EPCA truck, engineer Nicolas Vidal said: "The thing that stood out to me the most at the Electric Mine show was that nearly everyone that came to talk to us was, like, this must have taken you two or three years.

"No, we were driving it seven months from the [design stage]."



Franklin says perhaps 30% of the estimated 5500 surface mine trucks in Australia are in the 90-140-tonne-payload bracket, and more smaller vehicles could replace bigger trucks in future with higher levels of autonomy and a greater focus on energy management and optimisation.

The proportion of smaller trucks in most offshore markets is even higher.

At events such as The Electric Mine, a common refrain from miners, contractors and original equipment manufacturers has been that retrofitting and/or replacing the world's diesel equipment fleet could take decades and that's with new suppliers supplementing incumbent sources. The biggest OEMs will prioritise ultra-class fleet renewal, which they are still at least two years away from starting.

"The reality is that we can't meet [mid-range diesel-emission reduction targets] without transitioning the entirety of our small fleet, which is 150t trucks or less, to at least a hybrid solution," Shane Clark, then energy transition group manager at the world's largest surface mining contractor, Thiess (now general manager corporate development at Capricorn Metals), said at The Electric Mine.

"We need our current diesel-electric fleet to all be converted to BEV by 2035 and we need a large portion of our excavator fleet to at least be hybrid.

"Most of the work has to be done by 2030.

"It becomes a very big problem as to how we transition,"

"The answer more and more is we just have to have options.

"We have to connect with early adopters to build out our capability to support that battery electric fleet of tomorrow.

"But more than anything, we just need to get started.

"If you're a contractor or a [miner] trying to pick one winner out of hundreds of possible solutions going forward, you are thinking about the problem the wrong way.

"The energy cost inside the mine gate is the real problem.

"How do we enable a step change there?"

Franklin says the superior efficiency and cost profile of BEVs is a major part of the answer. Solar power, with some different thinking, is another.

"My view has always been that this energy source should be solar," he says, "with [direct current, or DC] charging via a decentralised solar farm.

"By that I mean the truck should come to the farm and consume power directly at the source where it's generated. We don't want to transmit the power.

"The farm should be at the same bus voltage as the truck so you don't have to worry about inverters.

"We want to dump that charge directly into the truck and charge the batteries when the truck pulls up."

Franklin says a 100m-by-100m solar-panel area coupled with the UON battery storage (9MWhr) and 3.7MW charger is adequate for 10 or so 90-tonne battery trucks running 24/7.

"And if you think about it there's an energy source that's going to last for the next 25 years," he says.

"You're not moving diesel up and down from Kwinana [south of Perth].

"We ship in diesel from Singapore, put it in tanks, and then we move it up and down to the Pilbara from Kwinana because we don't have [a local] refinery anymore.

"The state has got a week's supply of diesel sitting in Kwinana.

"Why would you want to have that dependency?"

# EPCA to debut 100t electric mining truck

Engineering workshop EPCA is converting a 100t mining truck into a battery electric vehicle with the industry getting a glimpse of the zero-emissions Caterpillar 777D at an electric mining conference in Perth this year.

The truck will be able to run continuously for eight hours under full load and recharge in less than one hour. It will be unveiled at The Electric Mine 2024 conference on May 21.

EPCA will retrofit 44 mining trucks at its Hazlemere facility once the demonstration model is finished. The company is constructing a new workshop in Muchea which will triple production capacity to 80 trucks a year.

The company says fully electric haulage would benefit balance sheets as much as ESG credentials and claims one EV truck can save about \$745,000 in opex, maintenance and capex yearly.

EPCA evaluates haul fleet conversion projects on a case-by-case basis and carries out detailed performance testing using environmental and mining data.

“Before we even build the machine, we take our client’s environmental and mining data and run it through an extensive simulation we’ve developed in-house,” EPCA founder and owner Clayton Franklin said.

“That simulation shows us exactly how the battery electric truck performs in the mine environment. We can demonstrate to 90% accuracy how well our truck works in each mine.”

The relative mechanical simplicity of EVs reduces maintenance costs and Franklin said reduced operating costs also increased the potential of EV conversions to save money.

“It’s a bit like a Tesla, there are far fewer moving parts on a battery electric truck,” Franklin said. “You have a lot less mechanical wear and therefore the maintenance costs come down dramatically, we estimate a 28% reduction. There are no air filters, oil filters, coarse fuel filters, oil changes or oil sampling and therefore a massive reduction in minor and major maintenance activities.

“The operating cost for a 100t mining truck running on diesel is \$112/hour.

“If you compare that to the cost of power in the Pilbara, which is about \$22/hour, you get an 80% saving.

“Admittedly, there is an increase in capital of about 25% because you have

to install the batteries but if you look over 20 years and you consider the total cost of ownership, you’ll see a diesel truck is about \$25 million, whereas a battery-electric truck is about \$11 million, which includes replacement of the batteries every five and a half years.”

EPCA’s electric motors, power electronics and inverters have a 20-year life expectancy and Franklin said the ideal maximum age of a truck to be converted to a EV was between 20,000-40,000 operating hours.

The company also assists with building charging infrastructure which can be designed to use renewable power.

“The [charging] infrastructure consists of a DC charger which comes in the form of a 10-foot sea container,” Franklin said.

“For one of our 100t trucks, there would be about four of these sea containers.

“Our DC charger can be coupled to an AC network or DC network which allows the miner to plug into a DC solar farm.

“For 10n of our trucks running, you would need a 250m by 250m solar farm – about 8MW. You would also need a BES (bulk electric system) so that it can store energy past the irradiance periods.”

EPCA’s EV conversion process takes 12 months and involves disassembly of the truck’s existing diesel engine and running gear. The lead time on parts is six months and despite the company sourcing components from Europe and the US, Franklin pointed to a dearth of binding agreements with suppliers, allowing it to secure the highest quality products on the market.

“We source globally, our cooling circuit equipment comes from Germany, our batteries come from Europe and our motors are from America,” Franklin said. “We look for a proven track record [for our parts] as well as a high number of installations using those parts which are already in operation.

“All our products are commercially available, we’re not trying to build battery packs or do any R&D, our systems are well-tested and well-tried.”

Franklin has spent more than 25 years in the mining industry and started his career as an electrical project engineer at WMC’s Kwinana nickel refinery. He then worked on renewable energy systems for indigenous communities before spending time at BHP Ltd’s Jumblebar and South Flank projects as a safety engineer and



**EPCA founder Clayton Franklin inside the gutted 100t Caterpillar 777D the company plans to convert into a fully electric mining truck**

Chevron’s Barrow Island Gorgon LNG plant as an E&I engineer.

His first taste of electrical engineering came when growing up on a banana farm in Cloncurry, Queensland. Together with his father, a mechanical engineer, he converted a quad bike to electric power which still runs and charges on the farm’s photovoltaic system.

EPCA aims to export diesel-to-electric conversion kits for mining equipment globally and Franklin said the company planned to work on its project pipeline this year.

He cited conversations with mine operators in Australia, Africa and Canada about EV conversions, a sign the mining industry is serious about decarbonisation and said the sentiment towards building a net zero economy would only strengthen.

“Mining companies need to take responsibility for the environmental aspects of their operations,” Franklin said.

“I don’t think the technical challenges to reduce carbon emissions from mining would be particularly difficult to overcome. Each year the public sentiment to build a net zero economy is increasing and with this, there is a desire for mining companies to act.”

– Michael Cameron