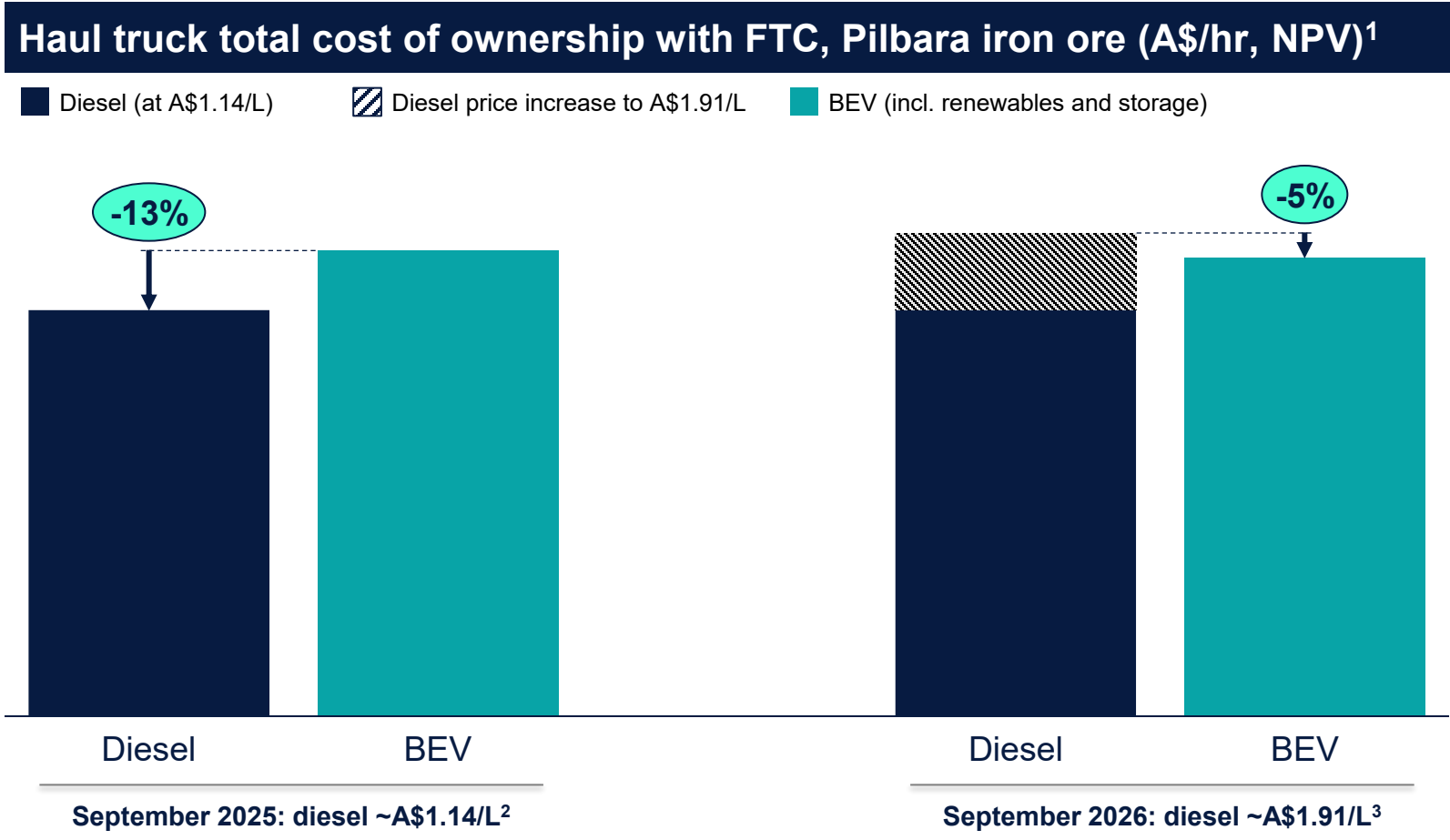


Economic Analysis on Large Haul Truck Tech – Pilbara Iron Ore

October 2026

At September 2026 diesel prices, BEV haul trucks are cheaper to operate than diesel, and within reach of cost parity under reasonable assumptions



Key Takeaways

- **Even prior to the Middle East conflict, the cost gap between the technologies (including FTCs) was within 15%.**
- **On our modelling, BEVs are cheaper than diesel haul trucks at current diesel prices.** Even if we adopt other reasonable industry assumptions, the technologies are within reach of cost parity.
- **Diesel price expectations may explain uneven uptake amongst firms.** Expectations of elevated diesel prices over the medium-term favour switching; firms that expect a return to subdued diesel prices until 2035/40 will delay switching.
- **Deployment will lag economics.** Upfront capital, procurement lead times, and need for preparatory infrastructure to be built push scaled uptake to 2029 at the earliest.

Every haul truck moved off diesel strengthens fuel security and competitiveness, and eases the path to budget repair

Fuel security	Competitiveness	Budget
0.7 to 1.1 ML p.a. of diesel displaced per truck, mostly imported 1.6-2.4 MtCO2e abated p.a. Indicative carbon abatement across industry, for a fleet of 850+ trucks¹ Each BEV reduces diesel demand and imports. Australia imports over 85% of its diesel; replacing diesel haulage with BEVs removes that fuel requirement for the life of the truck.	A\$0.5M to A\$0.8M added to a diesel truck's annualised fuel bill at today's prices, relative to Sep 2025² A\$460M to A\$690M p.a. Indicative additional cost borne by industry, for a fleet of 850+ trucks - Policy settings may lead industry to make decisions that have long-term costs. Elevated prices are costing industry hundreds of millions in 2026, while tech developments in BEVs may lock-in these higher costs longer-term. - BEV fleet costs are large, and weigh most heavily on mid-tier & junior miners, contractors. A switch removes exposure to the next oil shock, with even short periods of supply shocks putting these lower-margin businesses under financial pressure.	A\$0.4M to A\$0.6M of fuel tax credit claims removed per truck a year³ A\$320M to A\$480M p.a. Indicative savings for Federal Budget, if implemented across a fleet of 850+ trucks today Budget savings can support whole-of-economy fuel security support. Savings from iron ore haul trucks alone are material, and can underwrite meaningful support for low-margin trucking and farming businesses to adopt energy-secure tech.

Figures are indicative, based on Cyan Ventures proprietary modelling. Site-specific and industry-wide costs and savings will vary by fuel burn, operating hours & efficiency, fleet size and growth, supply availability.

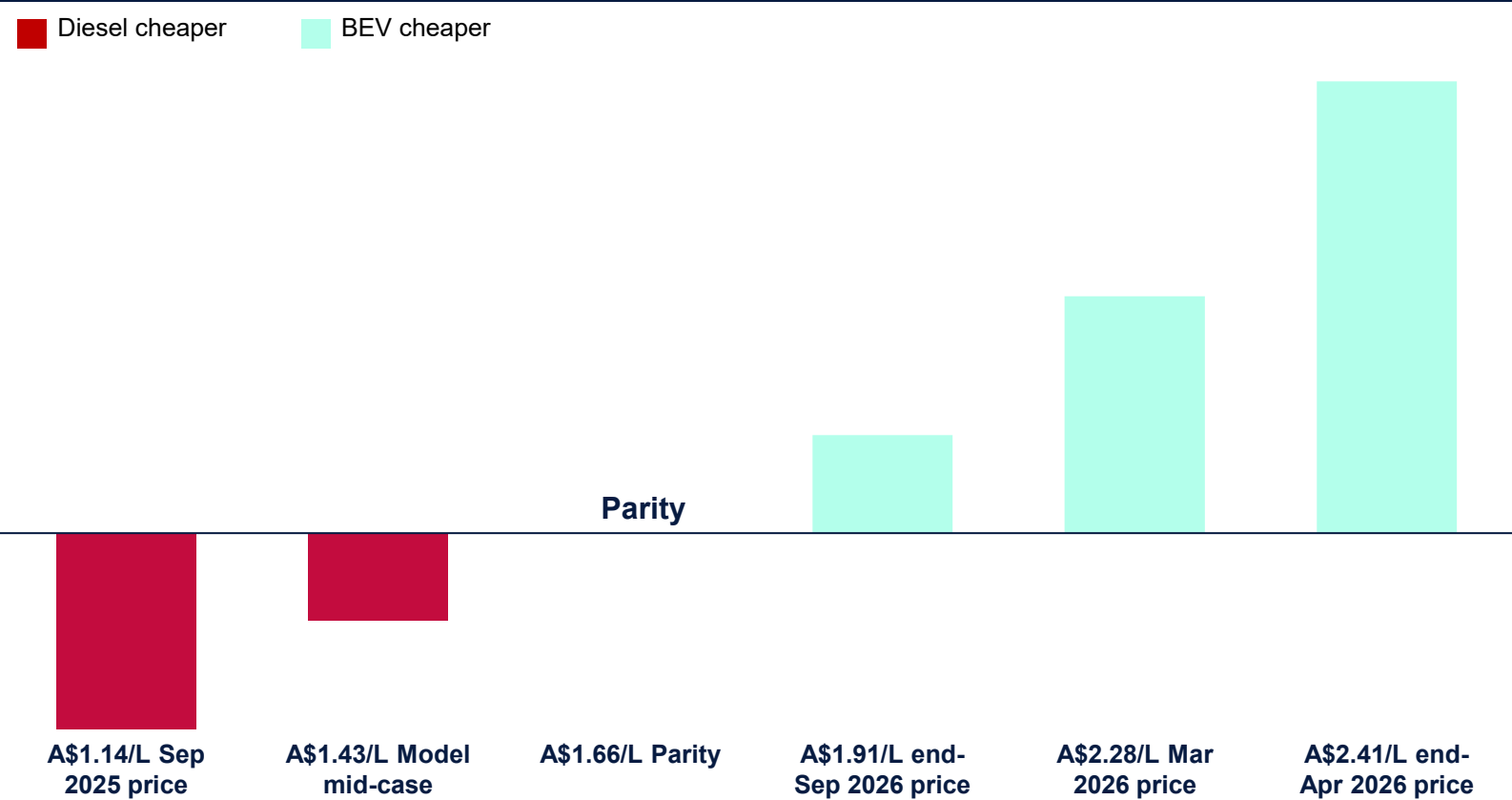


Sources and Notes: Indicative Cyan Ventures modelling, Pilbara iron ore cohort. Indicative per truck figures at ~140 L/hr (within industry range) and 5,000 to 7,500 operating hours a year. 1. Based on latest NGER emissions factors. 2. Net diesel A\$1.14/L (ACCC 2025) to A\$1.91/L (AIP 2026). 3. FTC rate A\$0.519/L (weighted average FY26), before the temporary excise cut, and and \$0.537 (current rate, Sep 2026).

BEVs hold the advantage above ~A\$1.66/L diesel, but fleet decisions in the next 2-4 years will lock-in costs as the parity price falls over time

Overall Finding BEVs offer savings at current diesel prices, but fleet purchases in 2026–29 will shape costs into the early 2040s. Measures to accelerate uptake warrant consideration now to secure fuel security, competitiveness and budget benefits before the replacement window (2-4 years) closes.

BEV cost advantage over diesel by net lifetime diesel price, 2026 (A\$/hr, NPV)¹



Key Takeaways

- **The advantage is price contingent.** Each A\$0.10/L moves the gap by ~A\$14/hr. Prices have swung by more than the margin of difference between diesel and BEV haulage (~13% if prices fall back to \$1.14/L).²
- **BEVs competitive over ~A\$1.66/L, on our indicative modelling.** Exact parity depends on specific assumptions but will be in range, tech advancements by 2035 will reduce parity point over time.
- **OPEX is the primary driver of lifetime costs, driven by fuel.** Diesel haulage CAPEX expected to be ~34% below BEV by 2035, albeit more expensive overall. Fleet decisions are effectively a bet on lifetime diesel prices.³
- **The window is short.** Decisions in the next 2 to 4 years set fleets to the early 2040s. Back at A\$1.14/L under current settings, breakeven slips to 2035.⁴



Sources and Notes: 1. Cyan Ventures modelling. Difference between 2026 diesel and BEV NPV-annuitised total cost of ownership (full enabling system basis, fuel tax credit retained), average Pilbara iron ore cohort. Positive values favour BEV. All prices net of GST and fuel tax credit: ACCC Australian Petroleum Market Report, September Quarter (2025); AIP terminal gate prices (2026); mid case is the model sensitivity. 2. ACCC (2025), AIP (2026). 3. Diesel versus BEV haulage capex in 2035, Cyan Ventures modelling. 4. Stakeholder consultations; breakeven range from Cyan Ventures sensitivity analysis, rebate retained.

Appendix

October 2026

Battery-electric haul fleets of 100+ trucks (90-150T) run commercially in China, but the 220T+ class used in the Pilbara is still in trial

Selected large battery-electric haul truck deployments and trials (status as at October 2026)				
Site (operator), location	Truck and payload	Stage	Scale and results	Operating circumstances
Xinjiang Zijin Zinc (Zijin), China	Mixed incl. Breton, LGMG and Zijin LK220E, 105-140 t	Fleet operation	290+ trucks carrying over 80% of mine haulage ¹	AI-enabled battery swaps in ~4 minutes, 180+ a day OR 23 minute charging ¹ ; operates from -40° C to 40° C ¹
Zhundong coal (CHN Energy), China	Tonly TLE138 wide-body, 90 t	Fleet operation	120 autonomous trucks, among the largest single-site battery fleets ²	28 charging points; charging scheduled by autonomous dispatch ²
Julong Copper (Zijin), China	Mixed incl. Zijin Longking LK220E, 150 t	Fleet operation	60 autonomous trucks with attendance above 90% ³	Elevation ~5,300 m; larger LK350E ordered on LK220E performance ³
Yimin coal (Huaneng), China	XCMG ZNK95 cabless, 90 t	Fleet operation	100 autonomous trucks since May 2025; ~47,800 battery swaps by November ⁴	Unmanned operation up to 22 hours a day; battery swapping plus plug-in charging ⁴
Fortescue iron ore hub, Australia	Liebherr T 264 and XCMG XDE260E, both 240 t	Pre-deployment	~360 trucks; first T 264 for operational deployment by end 2026, first XDE260E testing 2027, shipping 2028 ⁹	6 MW charger (~30 minutes); Green Grid of 1.2 GW solar, 600+ MW wind, 4-5 GWh storage ⁹
Kansanshi (First Quantum), Zambia	Hitachi EH4000AC-3 full battery, ~200-220 t (ultra-class)	Commissioned, FY27 deployment	Commissioned April 2026 after a 2024-25 trial moving 30,000+ t over 4,000+ km ⁶	Charges from existing trolley lines on a hydro grid; commercial sale from FY2027 ⁶
Oyu Tolgoi (Rio Tinto), Mongolia	Tonly battery-swappable trucks, 91 t	Trial	Eight trucks; trial in advanced stages after starting in October 2025 ⁵	With State Power Investment Corporation; swapping avoids charging downtime ⁵
Jimblebar (BHP, Rio Tinto), Australia	2 x Cat 793 XE Early Learner, ~220 t	Trial	100+ operating hours and 200+ laps in first three months ⁷	High-power static charging and in-motion Dynamic Energy Transfer due in FY27 ⁷
Longyan (Zijin Longking), China	Zijin Longking ZL230E, 230 t	Trial	Unveiled August 2026 as China's largest battery mining truck by tonnage ⁸ , likely to trial with Zijin	350 t gross weight and 125 m ³ heaped body; built for long hauls and heavy climbs ⁸



Sources and Notes: 1. International Mining (2026; 2026); The Driven (2026). 2. International Mining (2026); Global Mining Review (2026). 3. Global Mining Review (2026); Zijin Mining (2026; 2026). 4. International Mining (2025). 5. Rio Tinto H1 2026 results (2026); Mining Weekly (2025). 6. Mining Technology (2026; 2025); Plant and Equipment (2026); International Mining (2026); Mining for Zambia (2026). 7. Rio Tinto (2026); pv magazine (2026); International Mining (2026; 2026); Mining Technology (2026). 8. The Driven (2026). 9. Fortescue (2024; 2026); The Driven (2026); Australian Bulk Handling Review (2026); International Mining (2026; 2026). Selection is illustrative, not exhaustive.

Deployments show lower energy and maintenance costs; charging downtime is the main unresolved operational issue for ultra-class trucks

Benefits: lower energy and maintenance costs recur across deployments, including in harsh conditions

Energy cost is a fraction of diesel. At Huolinhe coal mine, Inner Mongolia, a converted battery truck used US\$263-298 of power a day against US\$1,480-1,970 of diesel.¹ Faster acceleration and loading may also increase productivity.¹⁰

Maintenance and idle costs fall. Simpler drivetrains, no exhaust after-treatment and no energy draw when stationary; SRK estimates ~US\$3 million saved per 150 t truck over ten years, after battery replacements;¹ Cyan Ventures confidential stakeholder consultations suggest over 25% reduction in maintenance hours.

Performance holds in harsh conditions. Julong runs 60 trucks at over 90% attendance at ~5,300 m; Xinjiang Zijin operates from -40° C to 40° C.^{2,3}

Ultra-class trucks have run in live mines. Kansanshi (Zambia) moved 30,000+ t over 4,000+ km with better acceleration and less noise than diesel, with 200-220T trucks that have been commissioned with commercial deployment targeted for FY27; Fortescue has trialled 240 t Liebherr T 264s, due to commercially run in the Pilbara by end 2026.^{4,6,8}

Pilbara electrification already works in other fleets. Fortescue runs 16 electric excavators, each saving about one million litres of diesel a year⁶, albeit with differences due to the nature of the equipment.

Issues: charging downtime, power supply and ultra-class maturity remain unresolved

Ultra-class trucks have not yet seen widespread deployment. Seven Cat 793 XE Early Learners are in testing worldwide and Hitachi's commissioned truck enters commercial sales from FY2027.^{4,5,6} This may change if Fortescue's planned Pilbara rollout goes ahead in 2026.

Static charging costs production time. BHP uses theoretical modelling to estimate ~1,000 lost hours p.a. per 220T truck⁷ (not based on its Caterpillar trial), Fortescue finds that this is 33-50% lower⁹. The optimal mitigation for ultra-class trucks is not clear: In-motion charging (BHP trial of Cat DET in FY27), trolley charging (Kansanshi), swapping (Xinjiang, Oyu Tolgoi) and autonomous charge scheduling (China).^{3,7}

Operational changes are necessary. Introducing BEVs requires fleet management and optimization strategies to be changed.¹⁰

Power supply must be built with the fleet. A 30 minute charge needs a charger of about 6 MW; Fortescue is building a Green Grid of 1.2 GW solar, 600+ MW wind and 4-5 GWh storage by 2028, and BHP plans to stage fleet, power and infrastructure together, site by site (these issues considered)^{6,7,8}

Fast charging can shorten battery life. The 1-3C charge rates needed for productivity accelerate degradation and may bring forward replacement¹



High-level global modelling assumptions

Item	Assumption Units	Notes
Exchange Rate AUD:USD	0.65 A\$/US\$	2025 exchange rate, used as standard in resources industry for financials in 2025. Aligned for consistency.
FTC Growth Rate	2.5 % p.a.	Midpoint of RBA Inflation Target band (2-3%), grown from ATO reported FTC rates e.g. (A\$0.519/L weighted average for FY26). Conservative assumption, near-term growth rate is higher due to higher inflation. No excise changes were assumed given the Federal Treasurer had indicated that excise halving was a short-term measure. ¹
Diesel Price (with rebate, Sep 2025)	1.14 A\$/L	ACCC September Quarter 2025 – Average retail price minus excise & GST. Conservative assumption, lower than current levels.
Diesel Price (with rebate, Sep 2026)	1.91 A\$/L	AIP 22 nd September 2026 price Perth – Average retail price minus excise & GST. Prices at peak of Middle Eastern conflict were higher, although fluctuations are expected.
Pilbara Premium for Renewables	~2 times	Pilbara premium derived from Rio's \$600M investment in 200MW solar + 200MWh BESS in Pilbara, implies double the cost of GenCost levels.



Note: 1. Sydney Morning Herald ([2026](#)), ABC ([2026](#)).

High-level haulage modelling assumptions (1/2)

Item	Assumption Units	Notes
Lifespan	100,000-150,000 hours	Cyan Internal Assumption, based on discussions with various stakeholders
Annual Operating Hours	5000-7500 hours	Cyan Internal Assumption, based on discussions with various stakeholders
Fleet Fuel Burn	120-200 L/hr	Cyan Internal Assumption, based on discussions with various stakeholders
Engine/Battery Replacement Cycle	25,000-30,000 hours	Discussions with stakeholders, data from SunHunk
Diesel Haulage Upfront Cost	5-8 US\$M	OEM list prices, IEEFA , SunHunk Heavy Industries
Diesel Engine Rebuild Cost	1-3 US\$M	SunHunk Heavy Industries
OPEX (ex fuel)	0.13 Fraction of CAPEX	Cummins



High-level haulage modelling assumptions (2/2)

Item	Assumption Units	Notes
BEVs powered by Renewables	- -	From Stakeholder discussions, we assume industry will power BEV Haulage and other BEV equipment with Renewable Energy. The cost comparison for BEV vs Diesel Haulage will include an amortised share of the required renewable build-out.
Efficiency of Diesel Engine	0.4 fraction	International Council on Clean Transport (2014), DPIRD NSW (2021)
Efficiency of Electric Engine	0.9 fraction	Range of estimates used e.g. DPIRD NSW (2021) uses 90%, Journal of Cleaner Production (2025) estimates 95+%.
Hourly Energy per truck	0.57-0.95 MWh/hr	Calculation from NGER Diesel Fuel:Energy ratios, and relevant engine efficiencies.
Implied RE Build-out nameplate capacity	2.0-3.5 MW	Implied nameplate capacity needed to support average power demand of one truck. Using ITK/David Leitch , we assume ~68% is solar with the remaining Wind and an appropriately sized BESS.
Renewable Energy (Pilbara) Levelised Costs	150-166 \$/MWh	Based on Cyan Ventures internal model based on analysis and stakeholder consultations, with costs trending lower over horizon to 2035.

