

First Australian-built Battery Electric Locomotive (BEL) for the Australian freight industry.



Australia's largest rail freight company, Aurizon has committed to building **Australia's first freight locomotive powered by batteries**, with the goal of moving to future use of totally renewable energy sources for freight hauls.

The zero-emissions capable¹ prototype is a core initiative as Aurizon moves to decarbonise its business. Aurizon is investing in a range of initiatives to reduce carbon emissions across its national footprint, with the target of reaching net-zero operational emissions by 2050. This includes work to replace diesel locomotives with zero-emission capable² freight trains using batteries and hydrogen fuel cells; using renewable diesel in existing operations; and the ongoing introduction of new train technology to reduce fuel usage.

Battery Technology Solutions

Our retrofit BEL prototype (Fig. 2A and B), with Progress Rail, a Caterpillar company, is a measured step forward to introduce the new technology to our operations and customers while demonstrating a tangible transition pathway for a large portion of our fleet. It is the first freight locomotive assembled in Australia that will be powered by batteries, allowing the potential future use of totally renewable energy sources for freight hauls. It will also capture re-generative energy that is created when trains brake or travel downhill.

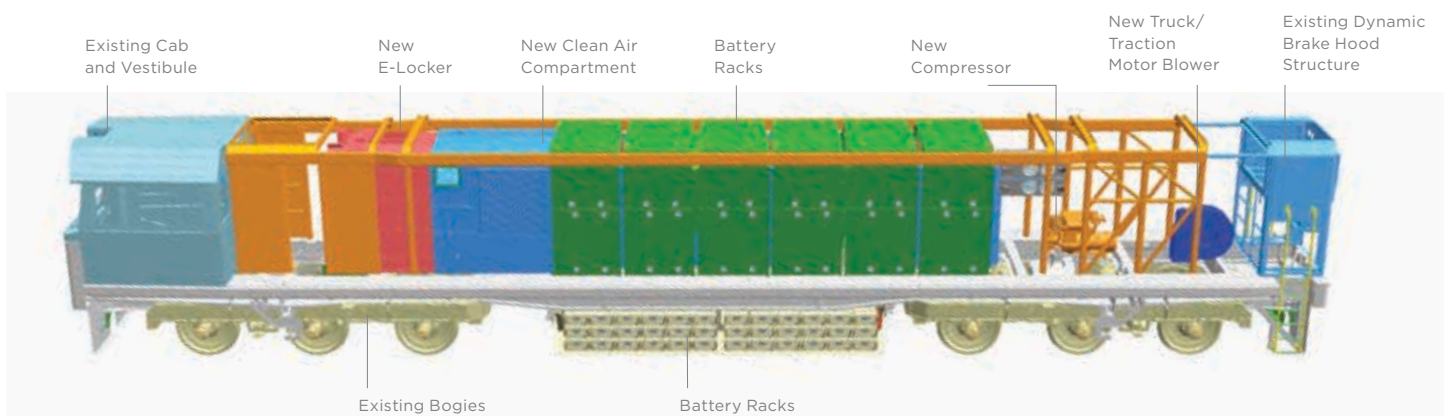
Figure 1 Aurizon Operations Map



Figure 2A Aurizon BEL



Figure 2B Retrofit Concept Design (Image courtesy of Progress Rail)



^{1,2} Zero-emissions rail haulage will be technically achievable when totally renewable energy sources (eg solar, wind) are available to charge the locomotive batteries. This does not include associated activities such as loading and unloading and other activities within the haulage supply chain.

How we will build the BEL prototype

Retrofit an existing locomotive, with the aim of recycling and re-using existing assets with stored carbon, and promoting a circular economy.

- Strip out the insides of an existing locomotive
- Remove the diesel engine, fuel tank, radiators, alternator, two traction inverters and many other components
- Overhaul and retain the drivers cab, the chassis, and bogies and traction motors
- Install the the new components:
 - Lithium-ion battery packs
 - Control system
 - Inverters for each axle
 - Air compressor

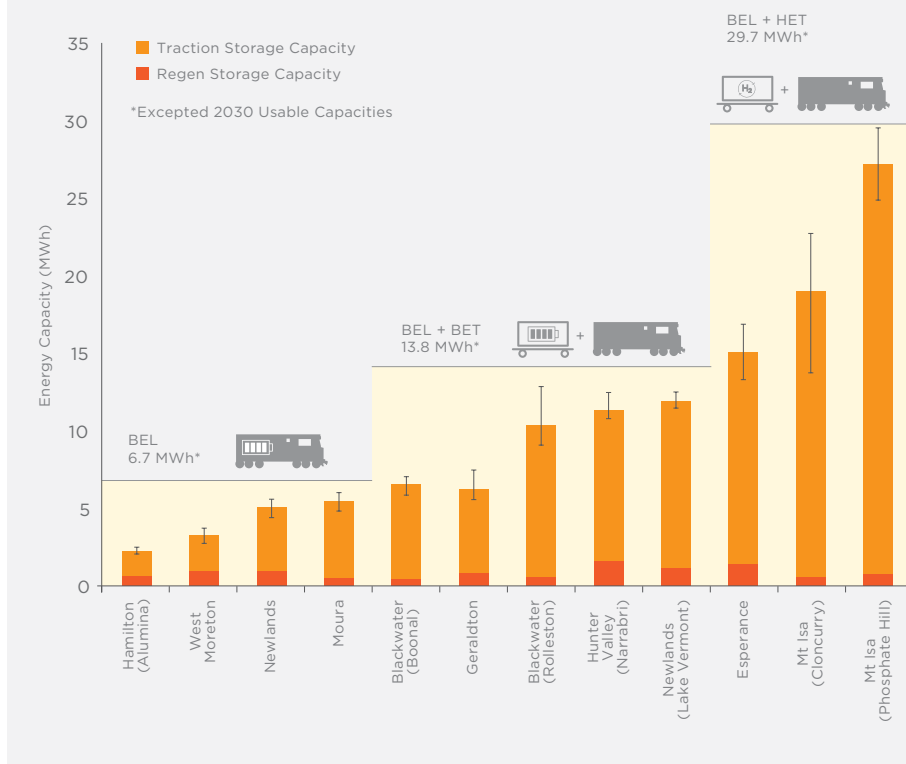
Key takeaways

- Aurizon is committed to building a more sustainable future and to further reduce its carbon footprint, as the company works towards net-zero operational emissions by 2050
- Highly efficient freight trains powered by renewable energy will be a key enabler in decarbonising Australian supply chains, delivering major safety, economic and environmental benefits for customers, the economy and the general community
- The aim is to deliver locomotives with equal or better power and performance as the current fleet but running on renewable, clean energy
- The prototype being developed by Aurizon is not only expected to deliver major fuel savings on its own, but it also aims to pave the way through rigorous trialling and testing, for a future fleet of renewable energy locomotives, built for Australian conditions.

While the BEL will be the platform for our renewable energy fleet, Aurizon recognises it will require different solutions for different hauls across our national footprint, to meet the needs of our customers:

- Battery-powered loco for hauls up to 400 km (BEL)
- Battery-powered loco plus extra battery wagon for up to 850 km (BEL + BET)
- Battery-powered loco plus extra hydrogen fuel cell on a wagon for hauls above 850 km (BEL + HET)

Figure 3 Energy storage requirements compared with platform capacities per round trip per locomotive



Fast facts

- The BEL will have 4.5MWh of battery capacity, the equivalent of 90 Tesla Model 3's
- The 4000-class locomotive that the BEL is based on burns 16 L/h in idle and up to 590 L/h at full throttle
- Freight Rail is up to 16 times more efficient than Road in litres/NTK* comparison³

About Aurizon

Aurizon is Australia's largest rail-based transport business. Each year, the Company transports about 250 million tonnes of Australian commodities, connecting miners, primary producers, and industry with international and domestic markets. Aurizon provides customers with integrated freight and logistics solutions across an extensive national rail and road network, traversing Australia.

³ Value of Rail 2020 Report, Deloitte Access Economics, November 2020.

* Net Tonne Kilometres

Contact us

Aurizon Corporate Affairs
media@aurizon.com.au

