Australian Government
Australian Renewable Energy Agency

ARENA

11 September 2023

Ben Carroll MP

Minister for Public Transport

Victorian Government

GPO Box 643
Canberra ACT 2601
Tel: +61 2 9243 7773
ABN: 35 931 927 899
www.arena.gov.au

ARENA submission on the Zero Emission Bus Transition Consultation paper

ARENA has supported a number of projects that have generated insights relevant to Victoria's *Zero Emission Bus Transition Consultation Paper.* This submission summarises insights from relevant projects and extends an offer to meet with Victorian government representatives to discuss them further.

In the public transport sector, ARENA has largely funded projects to accelerate the deployment of charging infrastructure. Recently, an ARENA-funded project demonstrated the effective integration of Zero Emissions Buses (ZEBs) into Australia's electricity system. To date, ARENA has committed more than $60 million towards projects that reduce transport emissions: addressing uptake, integration and innovation and continues to support the sector through the $130 million *Driving the Nation* funding round. This fund is currently accepting applications aligned with the program focus areas, including support to bus fleets transitioning to new technologies.

Key insights from the Next Generation Electric Bus Depot project

ARENA funded Zenobe's Next Generation Electric Bus Depot project, which provided the Australian public transport sector with a commercial and technical blueprint to solve some of the most critical issues facing large-scale bus fleet electrification, including impact on the grid and the management of the associated electrical infrastructure.

The project supported Transit Systems (bus operator) to decarbonise its fleet by deploying 40 electric buses at their Leichardt bus depot located in NSW. Now complete, this project demonstrated the viability of electric buses in Australia and delivered valuable lessons for the wider public transport sector. Some key lessons learned from the project are listed on the next page and covered in more detail in Zenobe's Final Report:

1. ***Modern batteries are large enough to meet any bus route requirements.***

   Leichardt's ZEBs have batteries that provide (on average) 345 km of driving range per charge, which is sufficient to meet the daily operational requirements of any bus route. The batteries are capable of fast charging, which allows them to **charge from 40% to 80% capacity in 1.5 hours** if only one bus is connected to the 120-kW dual DC charger. This has helped to minimise the time required to charge the electric buses and maximise their availability for service.

2. ***Average energy use varies with seasons, and peaks in summer.***

   The figure below shows energy consumption is higher than average during the hottest and coldest months of the year as additional energy is required to cool and heat buses in summer and winter. More cooling than heating is needed so the highest consumption occurs in summer.

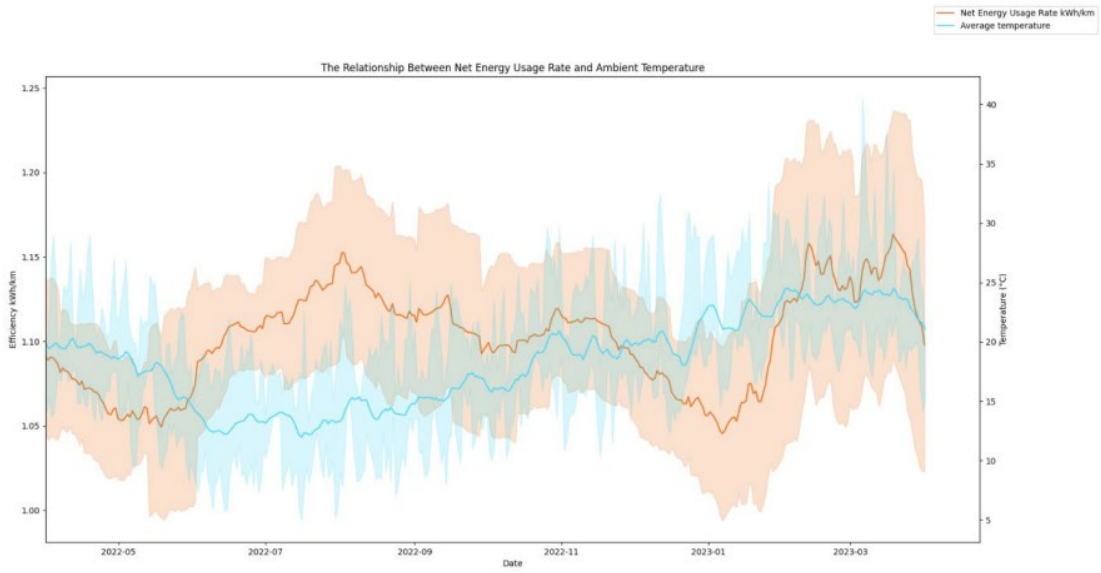

Figure 1 - Net Energy Usage against average temperature in Sydney.

3. ***Monitoring buses is key to determining future fleet needs.***

   Monitoring how energy consumption of ZEBs varies depending on factors such as: temperature, traffic, and passenger loading; builds the knowledge base on the operation of electric buses, and will enable accurate modelling of future electrification projects, meaning a cost-effective deployment of ZEB fleets.

4. ***The length of the daily routes impacts overall performance.***

   The trial found that vehicles that travel a short range in a day have a higher average energy usage than those which have travelled further. This is likely due to the energy consumed while idling. Longer routes mean less time is spent idling between services which allows for an overall lower average energy use.

Daily Distance Range (km)	Total Distance (km)	Avg Net Energy Usage (kWh/km)	Avg Regen Rate (kWh/km)	Avg SOC Usage (%)
0 – 50	43,983	1	0	6
50 - 100	263,809	1.17	-0.59	28.54
100 - 150	862,494	1.11	-0.61	37.61
150 - 200	679,837	1.07	-0.61	47.69
200 - 250	108,263	1.02	-0.62	57.27
250 - 300	4,090	1.00	-0.56	57.44
300 - 350	930	0.90	-0.67	63.67

Figure 2 - Analysis of Net Energy usage aggregated by distance travelled.

Other ARENA-funded hydrogen transport projects relevant to ZEBs

The heavy transport sector is recognised as an area where hydrogen could be considered as an alternative to existing transport fossil fuels. To date, ARENA has contributed $30 million to hydrogen transport projects, two of which are in Victoria:

- VIVA Energy's New Energies Service Station in Geelong is a hydrogen refuelling station to support the uptake of hydrogen fuel cell electric vehicles including buses and trucks. The station has received Development Approval and the project is expected to be operational in 2024.

- The Toyota Ecopark Hydrogen Demonstration transformed part of Toyota Australia's decommissioned car manufacturing plant in Altona into a renewable energy hub to produce renewable hydrogen for both stationary energy and transport energy uses.

ARENA has also funded hydrogen transport projects in other states:

- BOC's operational Renewable Hydrogen Production and Refuelling Project aims to demonstrate renewable hydrogen production at a commercially viable scale. The hydrogen refuelling station has officially opened to the public in Brisbane and ARENA could facilitate a site visit upon request. As part of the project, BOC also installed a 220-kW electrolyser and a 100-kW solar array at its Bulwer Island facility.

About ARENA

ARENA is the Australian Renewable Energy Agency. We were established by the Australian Government on 1 July 2012. We support the global transition to net zero emissions by accelerating the pace of pre-commercial innovation, to the benefit of Australian consumers, businesses and workers.

Our purpose is to support improvements in the competitiveness of renewable energy and enabling technologies, increase the supply of renewable energy in Australia, and to facilitate the achievement of Australia's greenhouse gas emissions targets by providing financial assistance and sharing knowledge to accelerate innovation that benefits all Australians.

Please contact Adrian Salinas, Knowledge Sharing Manager (adrian.salinas@arena.gov.au) if you would like to set up a meeting to discuss any aspect of ARENA's submission.

Yours sincerely

Alicia Barnes

General Manager - Project Delivery, ARENA