Technical visit to Transit Systems (Sydney)

Some observations about Zero Emission Buses (ZEBs)

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Background

- During the Thredbo 17 conference held in September 2022 in Sydney, a technical visit was arranged to Transit Systems in Sydney (part of the Australian Kelsian Group)
- Kelsian operates commuter buses in Sydney, Melbourne, Perth, London and Singapore (also school bus contracts)
- It currently has a combined fleet of about 3156 buses and 5588 staff
- It operates mainly diesel buses but also 60 electric buses and 10 hydrogen fuel cell buses on trial in London in partnership with TfL (2013-2020) (two to be introduced in Sydney)
- In Sydney, the electric buses are part of an Electric Bus Trial run by Transit Systems

Source: Technical visit and Transit System's website

Source: Transit Systems Website

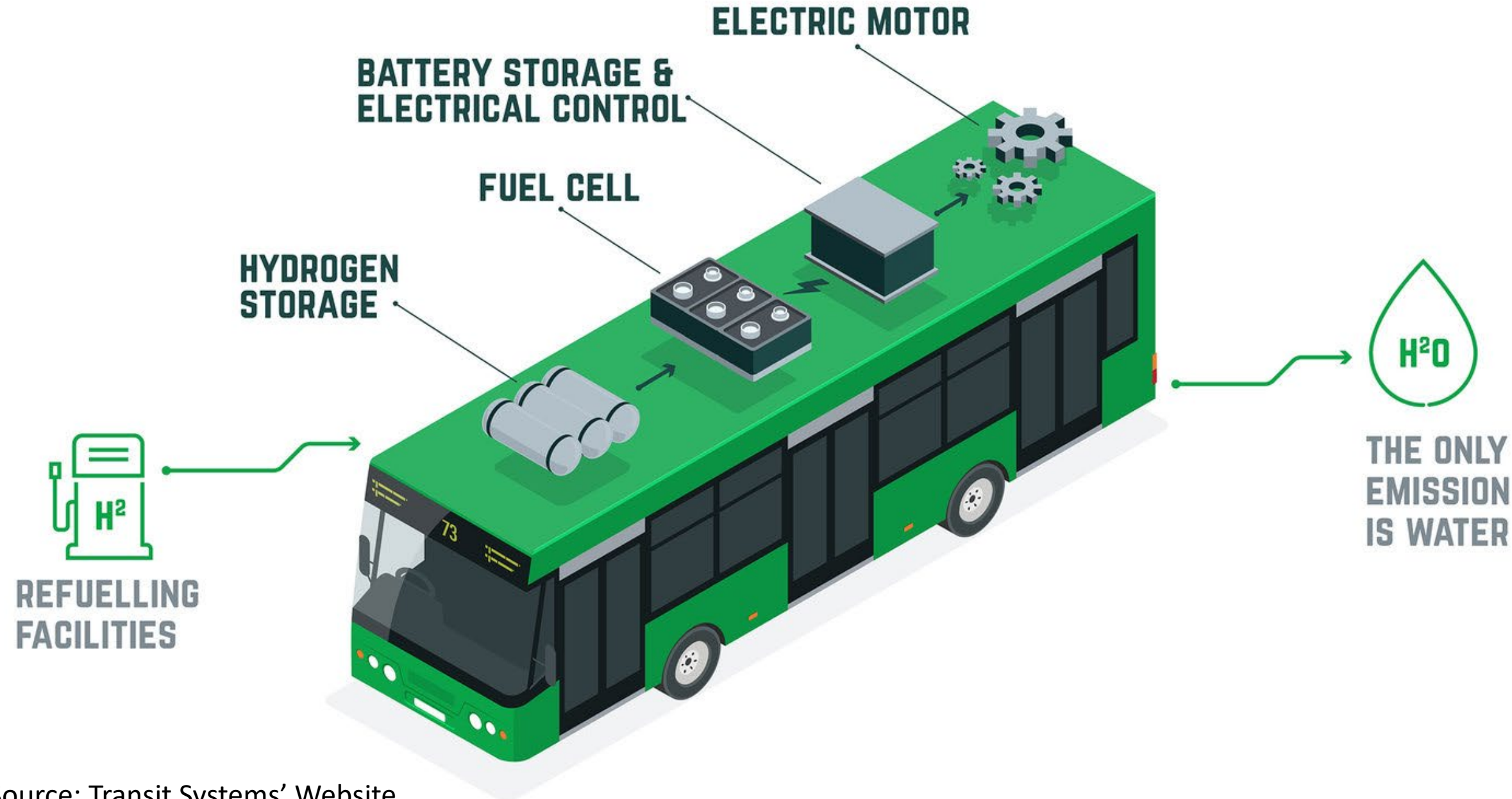
Hydrogen fuel cell buses

- Foton Mobility Australia is the supplier to Transit Systems in Sydney
- Foton has manufactured and delivered in excess of 1100 of these buses including 450 buses used at the Beijing Winter Olympics in 2022
- The company has 13 million km of operating data
- In London Transit Systems operated the buses 17 hours per day 7 days per week
- The fueling infrastructure was located at Tower Transit's Lea Interchange Depot who also maintained the buses
  - This included two full time hydrogen fuel cell technicians
  - Supporting technicians
  - Specialist training in the Ballard Fuel Cell, Luxfer Dynetek hydrogen system and hybrid/ high voltage systems
- Safety measures included hydrogen alarms, venting, power shutdowns and other alarm systems to detect gases

Source: Technical visit and Transit System's website

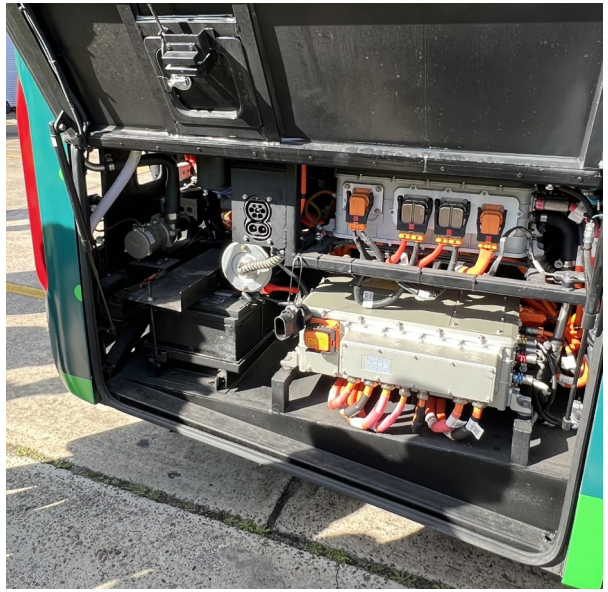

EMERGENCY EXIT
TRANSIT SYSTEMS
PART OF KELSIAN
HYDROGEN
THE FUTURE HAS ARRIVED
HELP DRIVE A GREENER FUTURE
JOINTRANSIT.COM.AU
HYDROGEN IS A KEY TECHNOLOGY IN THE FUTURE OF AUSTRALIAN PUBLIC TRANSPORT
TRANSITSYSTEMS.COM.AU


40
WHEN LIGHTS FLASH
TRANSIT SYSTEMS
PART OF KELSIAN
HYDROGEN
THE FUTURE HAS ARRIVED
A BREATH OF FRESH AIR
ZERO TAILPIPE EMISSIONS
DO NOT OVERTAKE TURNING VEHICLE



Source: Transit Systems' Website


亿华通
SinoHytec
WARNING




亿华通
SinoHytec
WARNING
DO NOT OVERTAKE
TURNING VEHICLE

Source: Technical visit and Transit System's website

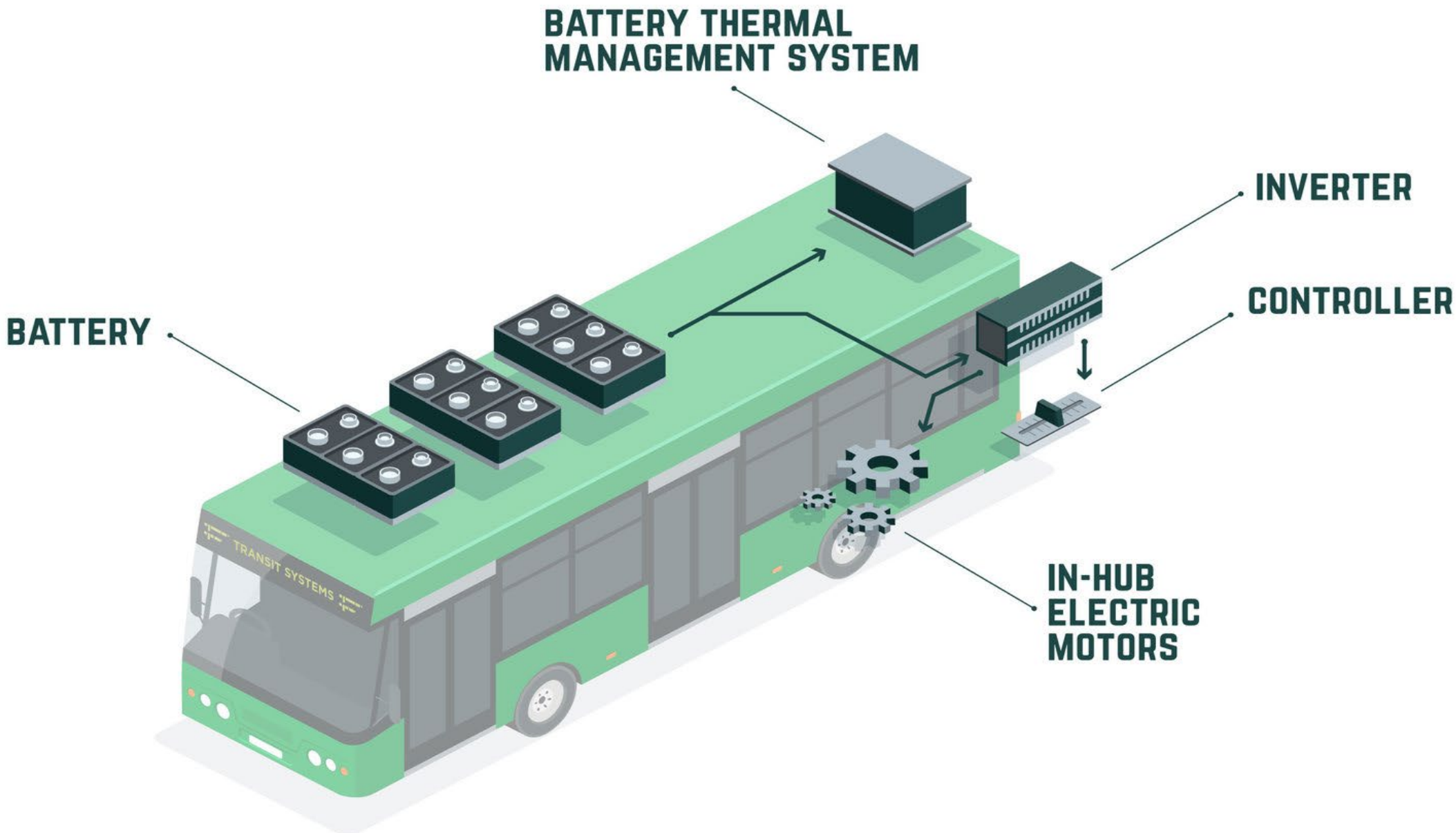
Battery Electric Buses (BEBs)

- The electric buses in Sydney are manufactured by BYD (chassis) and meet Australian design standards. Gemilang Australia is responsible for the bus bodies which it manufactures at its plant in Malasia (35 seated and 27 standees)
- All buses have fire suppression systems installed and fitted to the battery packs located on the roof and at the rear of the bus
- Total battery capacity is 328kW and uses about 80kW/hour.
- The bus generates about 30-40% of its battery capacity through braking, depending on traffic conditions
- Drivers need to be trained on how to operate the buses to make best use of the regeneration mode to increase range
- Transit Systems can see real time data on bus performance as well as the charging status of individual buses charging at the depot

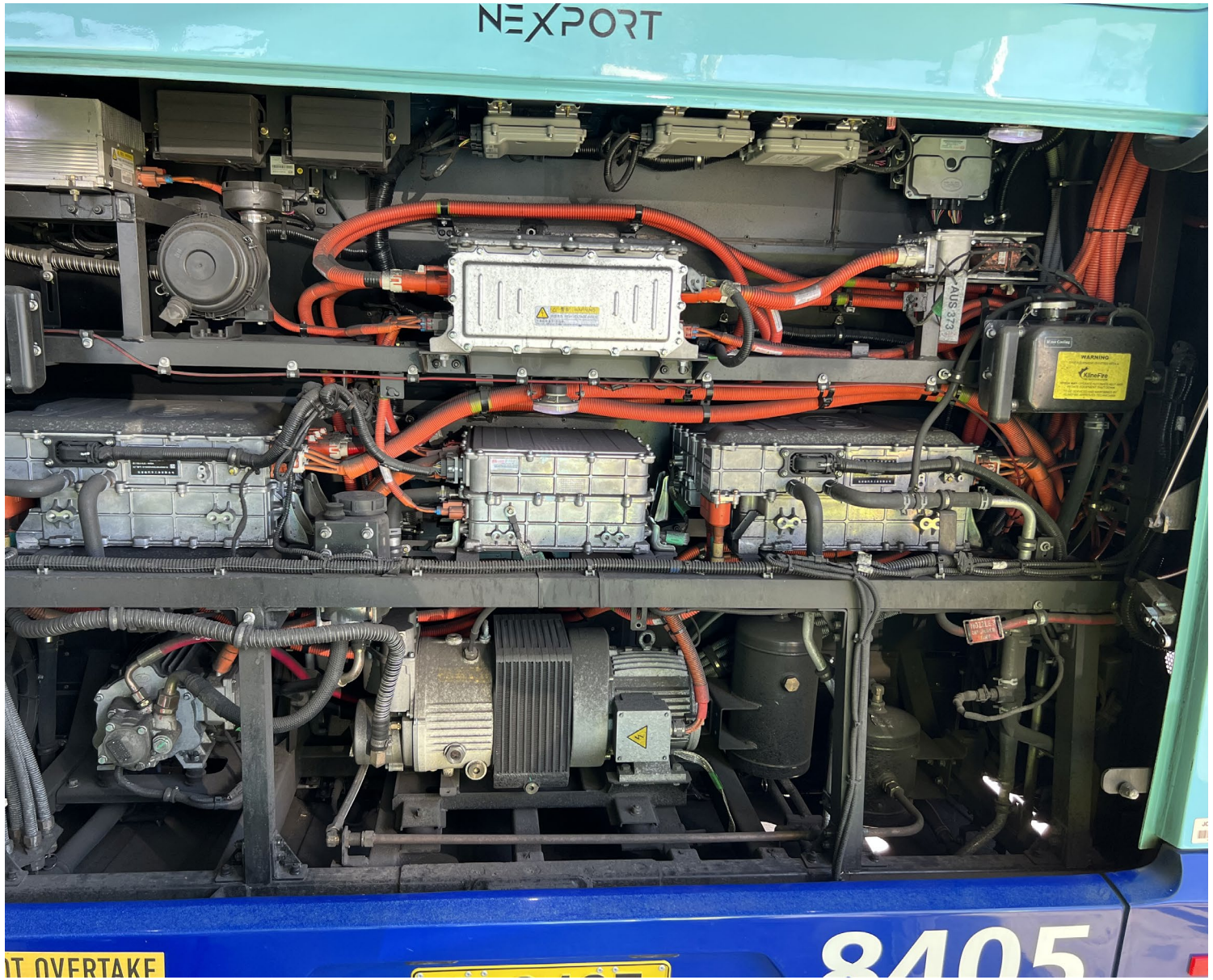
Source: Technical visit and Transit System's website


FOTON
PLEASE
SIGNAL DRIVER


TRANSIT SYSTEMS
8104
8105
8106



Source: Transit System's website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KlineFire
8405


WHEN LIGHTS
Transport Buses
8105


ZENOBE


急停
E-STOP


Powered by
ZENOBE

Observations about Battery Electric Vehicles

- Neil Smith MD of Transit Systems Australia – battery electric buses *"a no-brainer"*. Much cheaper to operate – energy wise and maintenance costs
- Expensive when compared to diesel buses and major upfront investments are needed (need for life cycle costing)
- Modular approach for funding? – buses 25 years and batteries 7 years
- Yuton; Futon (1 motor); BYD (2 motors) big players in Australia.
- Australian operators are concerned about becoming too dependent on China for the buses and technology – some operators are waiting for European manufacturers to also provide (competitive) solutions
- Charging infrastructure can take up as much as 25% of a depot area – scheduling the buses for charging important
- Debate about AC/DC charging of buses
- 15 year concessions needed if operator owns ZEBs and contracts need to be flexible for the introduction of ZEBs

Source: Technical visit and Transit System's website

Positives of BEBs

- Known technology
- Clean energy in support of the BEBs (COP 27) – currently 800 panels on the roof at Transit Systems' depot in Sydney (+/- 480kW) plus Tesla battery for power backup
- Charging system inclusive of charging facilities for buses outsourced over a 15 year concession to a third party
- Charging buses on-grid in the off-peak (after 20:00) (due to a peak electricity pricing regime in Sydney) with charging from the panels and Tesla battery off-grid during the day and evening
- Low maintenance and operating costs
- Avoids the major price fluctuations (and cost) of diesel as electricity pricing is more predictable and stable – simplifies contracting costing
- Scheduling bus charging between shifts no problem – buses can easily cover shifts between charges
- In Singapore air conditioning consumes between 22% and 29% of battery power – no problem to cover shifts (NOTE: relatively short travel distances compared to SA)

Source: Technical visit and Transit System's website

Source: Technical visit and Transit System's website

Uncertainties on BEBs

- When to invest due to rapidly changing technologies – batteries/charging infrastructure/increased efficiency improvements
- New diesel buses introduced today will last to 2040 – how to manage the transition to clean energy buses a big challenge (phase out regime needed with transport authority part of the solution)
- Need to align the perspectives of authorities and operators
- Capital cost risk apportionment between operators and authorities - buses and infrastructure, a necessity
- Management contracts for operations and ownership of buses and infrastructure with authorities in future?
- Risk of reliable power supply for the buses (SA) and monopoly power supplier impact on operations and costs

Source: Technical visit and Transit System's website

The role of China in BEBs?

- The global electric bus market is expected to be about US$ 45 billion in 2022 (1)
- As of 2019, 99% of all battery electric buses in the world have been deployed in **Mainland China**, with more than 421,000 buses on the road, which is 17% of China's total bus fleet. (2)
- The Future of EV Battery Manufacturing (3)

Rank	Country	2021 Li-ion manufacturing capacity (GWh)	% of World Total
#1	China	558	79.0%
#2	U.S.	44	6.2%
#3	Hungary	28	4.0%
#4	Poland	22	3.1%
#5	South Korea	18	2.5%

Source: (1) https://www.globenewswire.com/en/news-release/2022/08/24/2503669/28124/en/Global-Electric-Bus-Markets-Report-2022-Market-is-Expected-to-Grow-to-47-31-Billion-in-2026-at-a-CAGR-of-12-3-Long-term-Forecast-to-2031.html
(2) https://en.wikipedia.org/wiki/Electric_bus#:~:text=As%20of%202019%2C%2099%25%20of,300%2C%20and%20Europe%20had%202%2C250.
(3) S&P Global Market Intelligence

Conclusion

- South Africa needs to begin trials on electric buses due to our unique circumstances (route lengths, temperatures etc.) as the technology is rapidly advancing and clean energy objectives are encapsulated in international agreements
- GABS is the first known SA bus operator to explore BEBs at their own cost and must be applauded for this initiative. It also started its green revolution years ago with solar power alternatives
- Contract specifications ought to make provision for the transition from diesel buses to ZEBs over the span of the contract
- Current tenders/NCs in Gauteng do not make provision for ZEBs – this ought to change
- The industry stands ready to engage with the authorities on the introduction of ZEBs