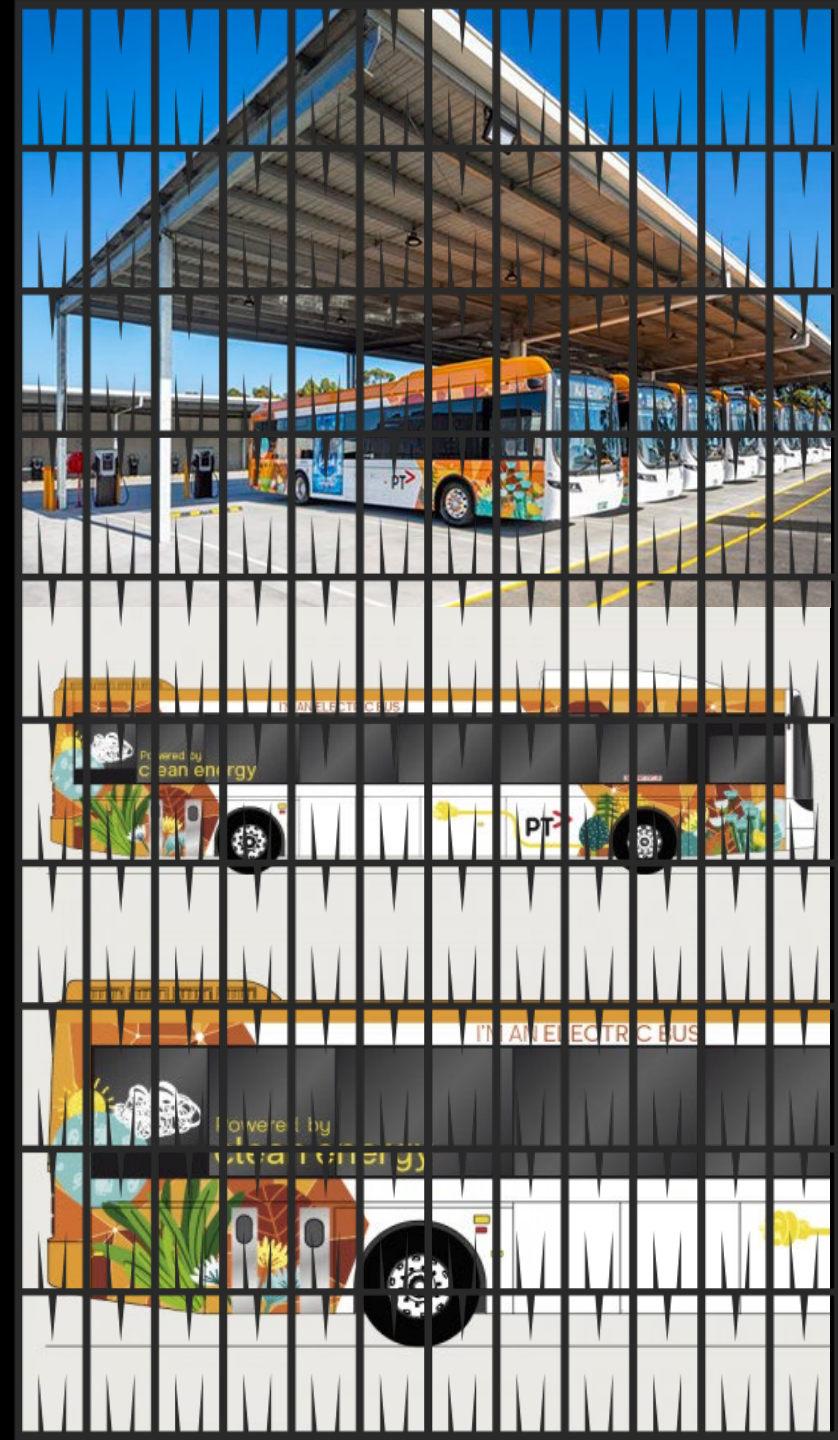


Transitioning to ZEB Summit Programme  
Eureka Rooms, Melbourne Conference and Exhibition Centre  
Saturday July 27th

# Opening Address – ZEB Transitions - an Independent View

Date: 27/7/2024 | Professor Graham Currie FTSE



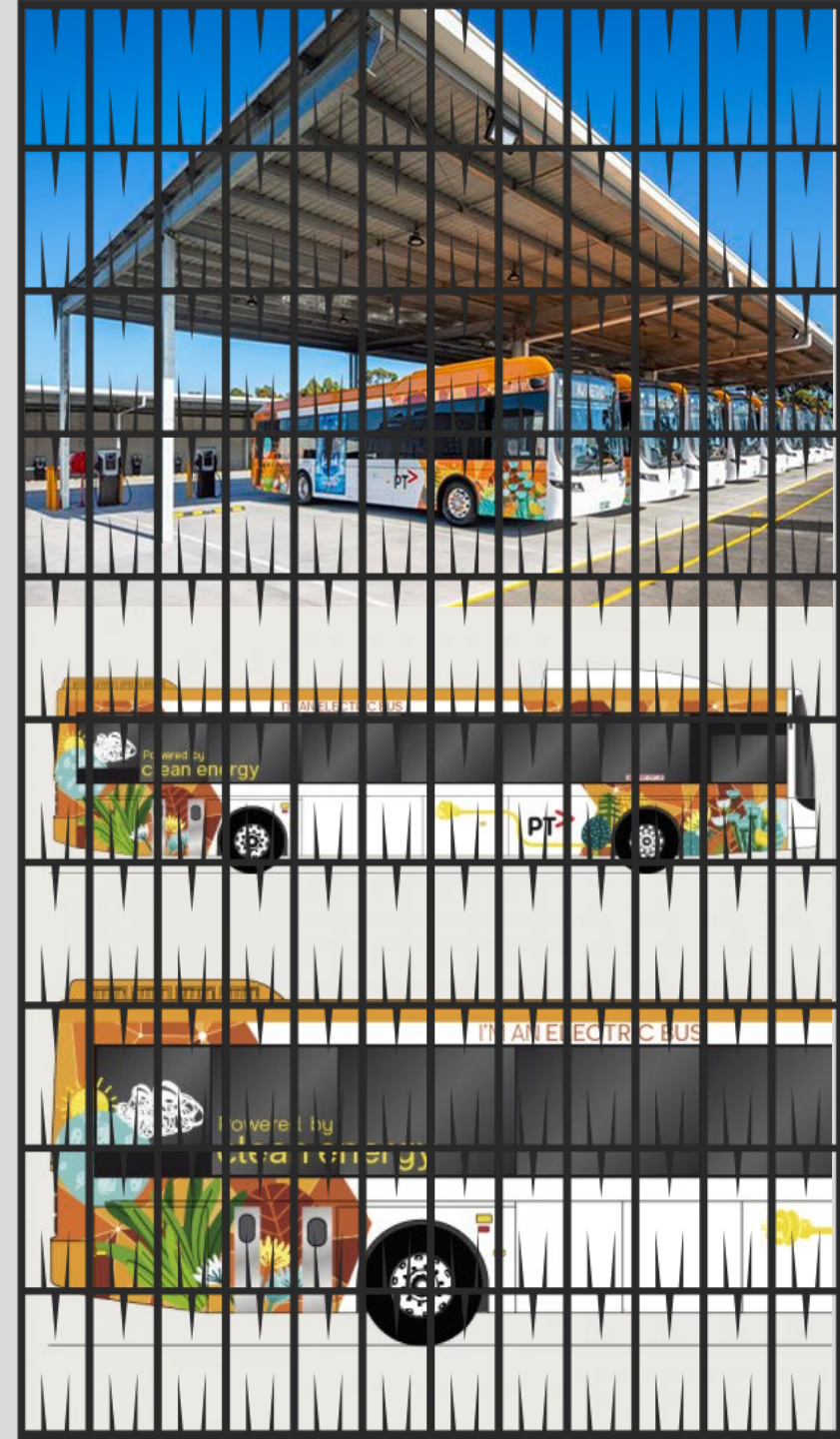
## Agenda

Introduction

Motivation

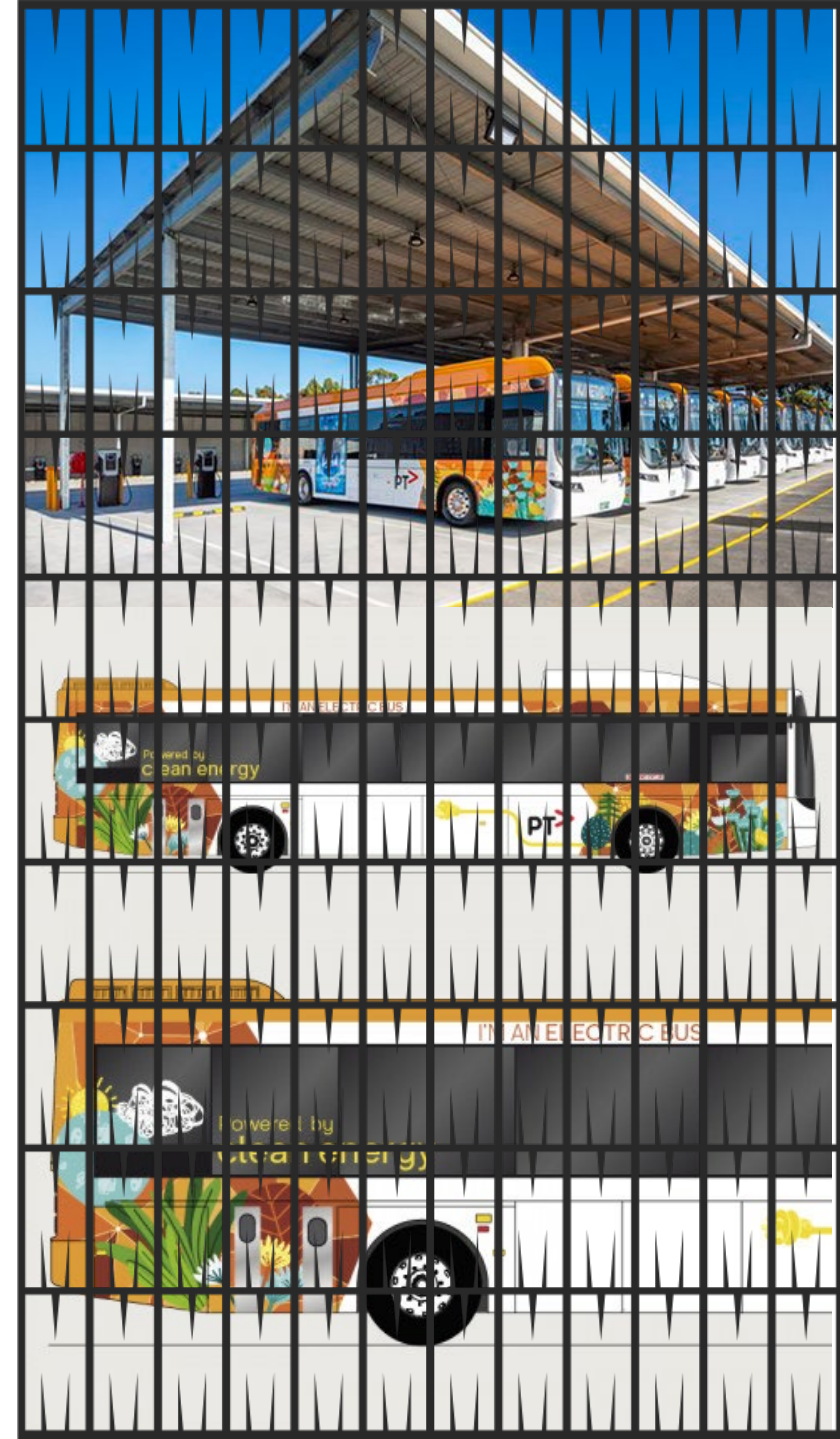
Context

Challenges

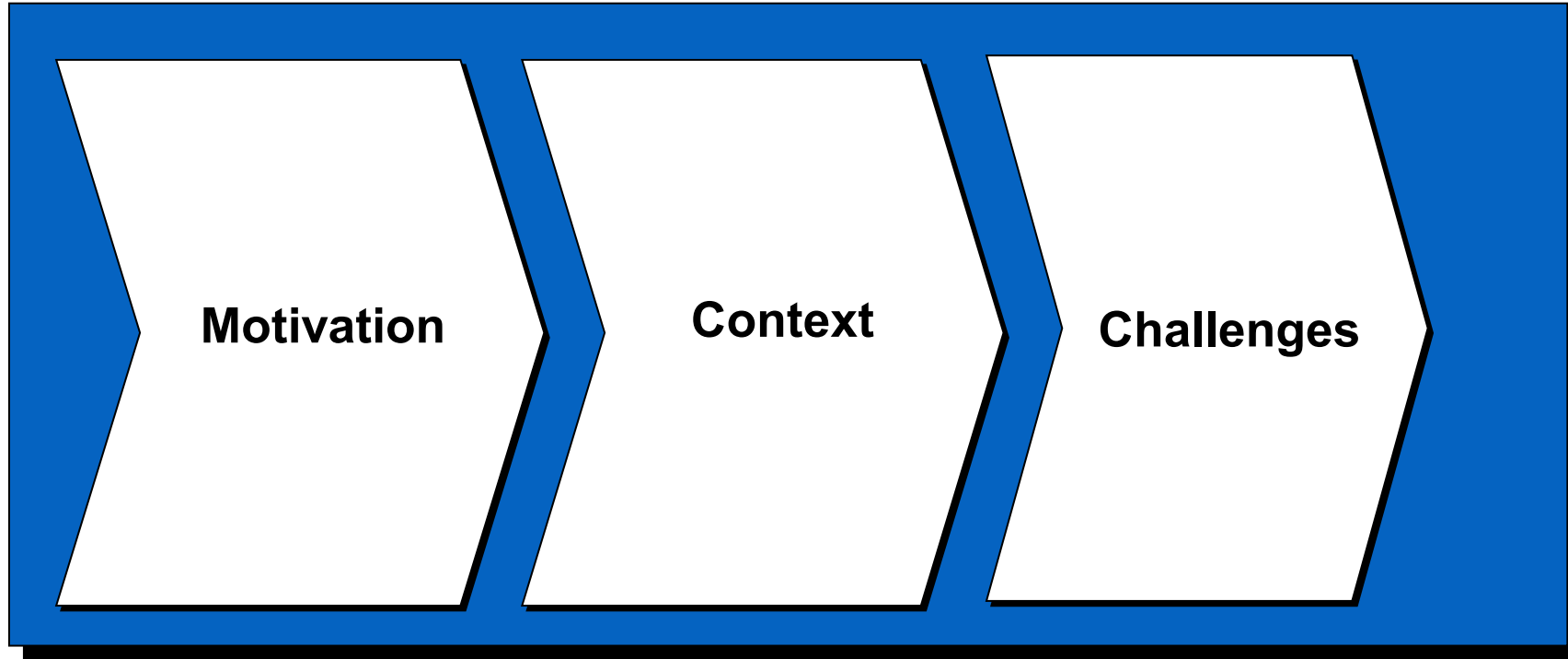


# This presentation explores Victorias ZEB transit its challenges and opportunities

- Key issues explored:
  - Motivation
  - Context
  - Challenges



It is structured as follows;



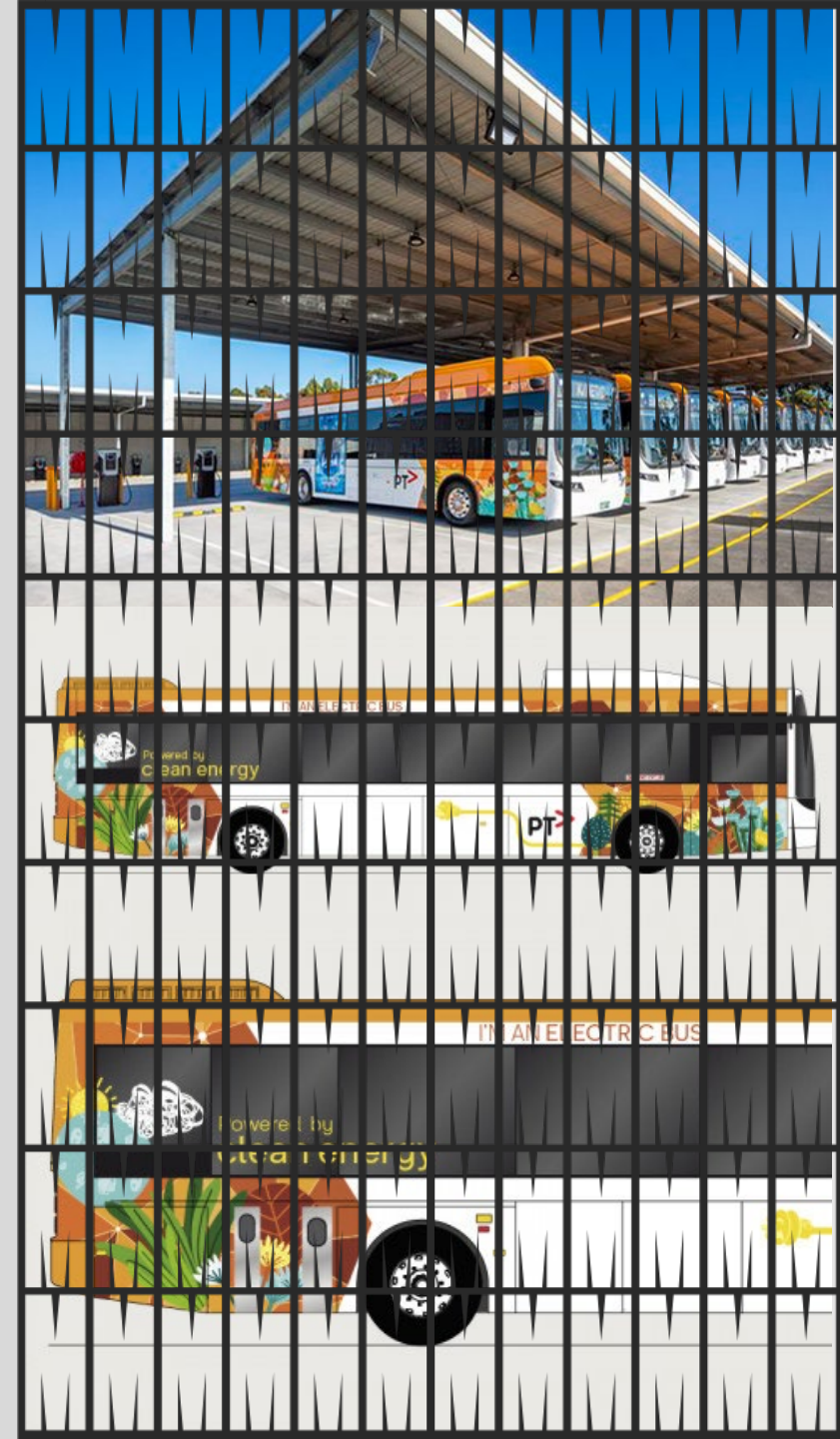
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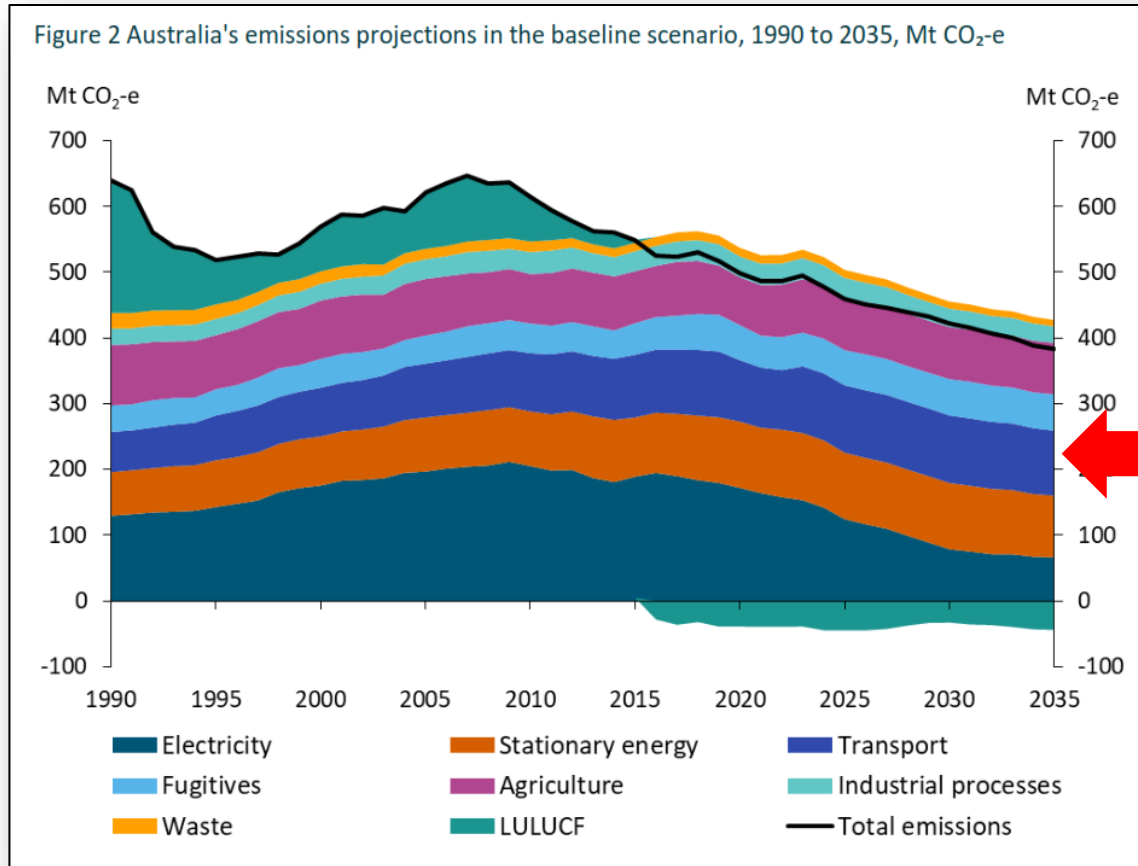
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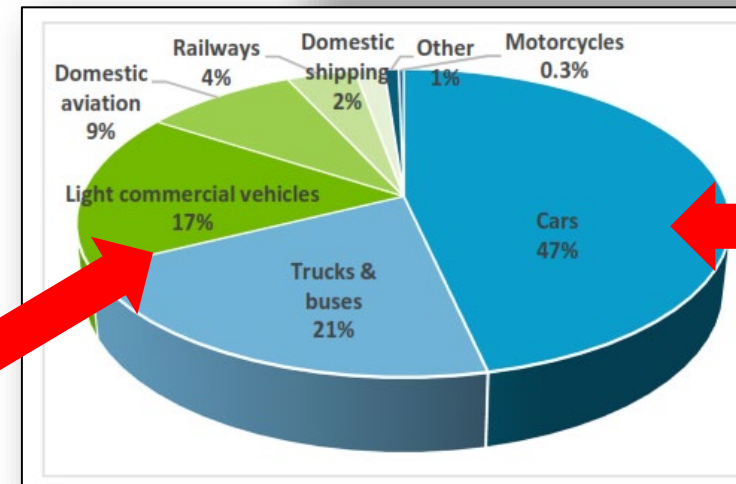
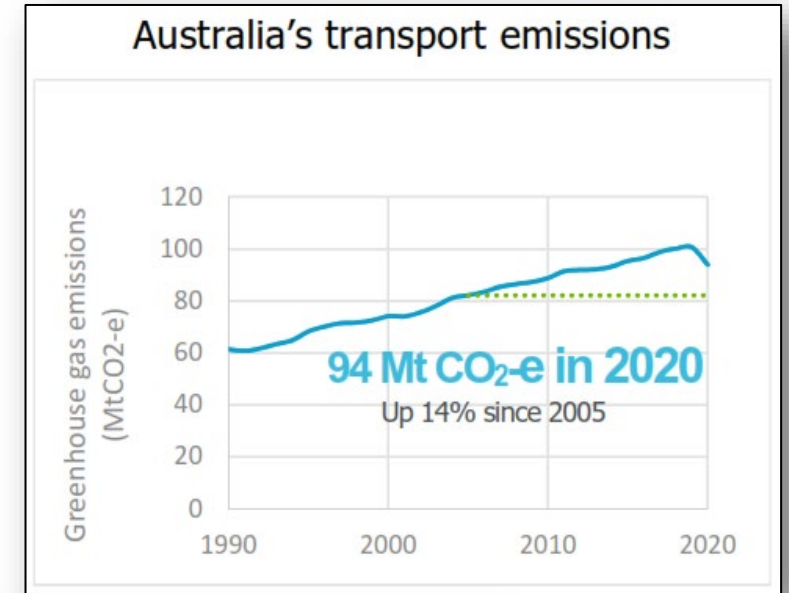
Challenges



# Transport - 3<sup>rd</sup> largest CO<sub>2</sub> emissions; grew 18% since 2005; by 2030 the 2<sup>nd</sup> largest emission area; the **HIGHEST** emission growth sector – private car/vans dominate but bus also important

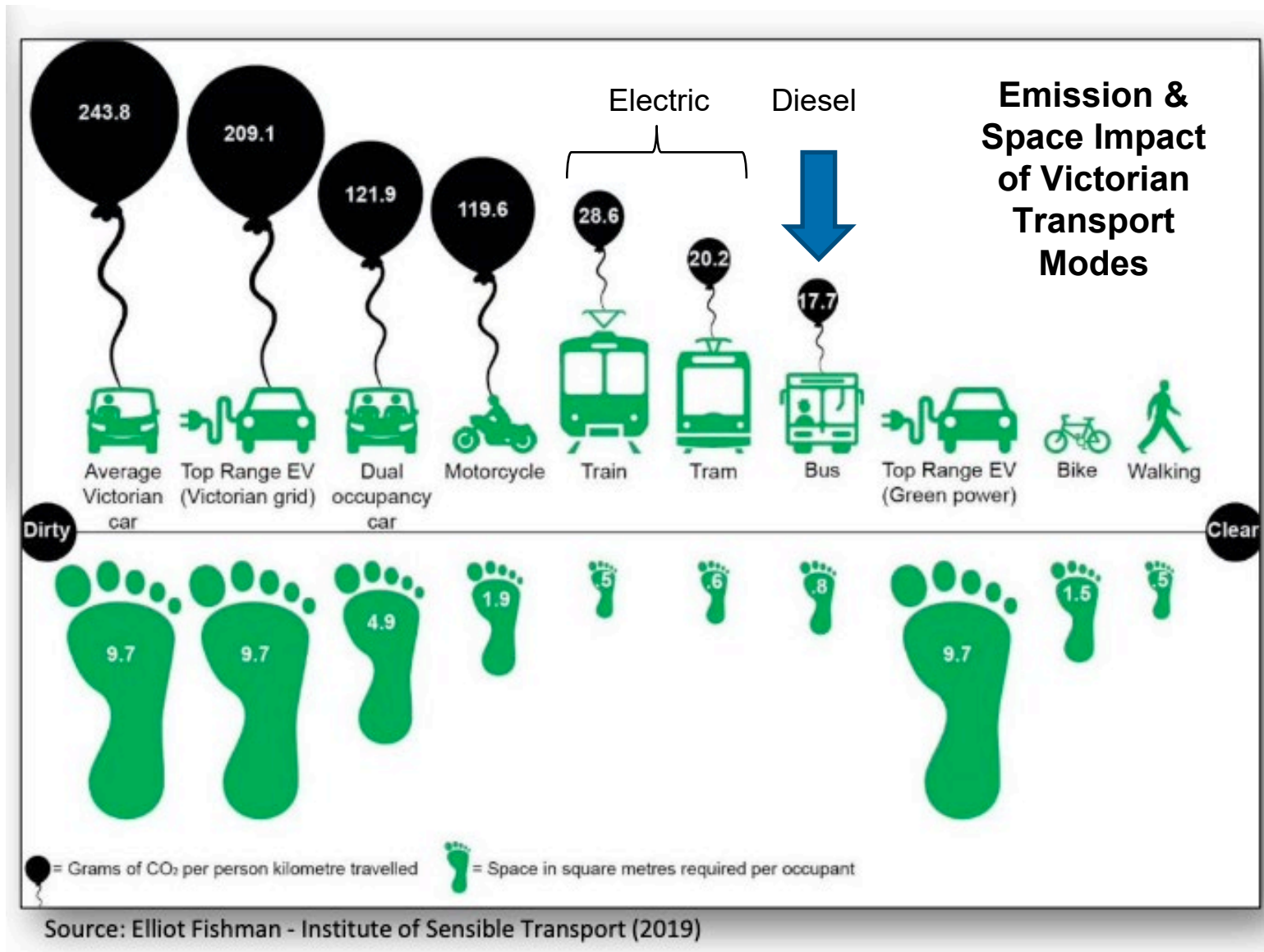


Source: Australia's emissions projections 2022 – Dept Climate Change, Energy the Environment and Water Dec 2022

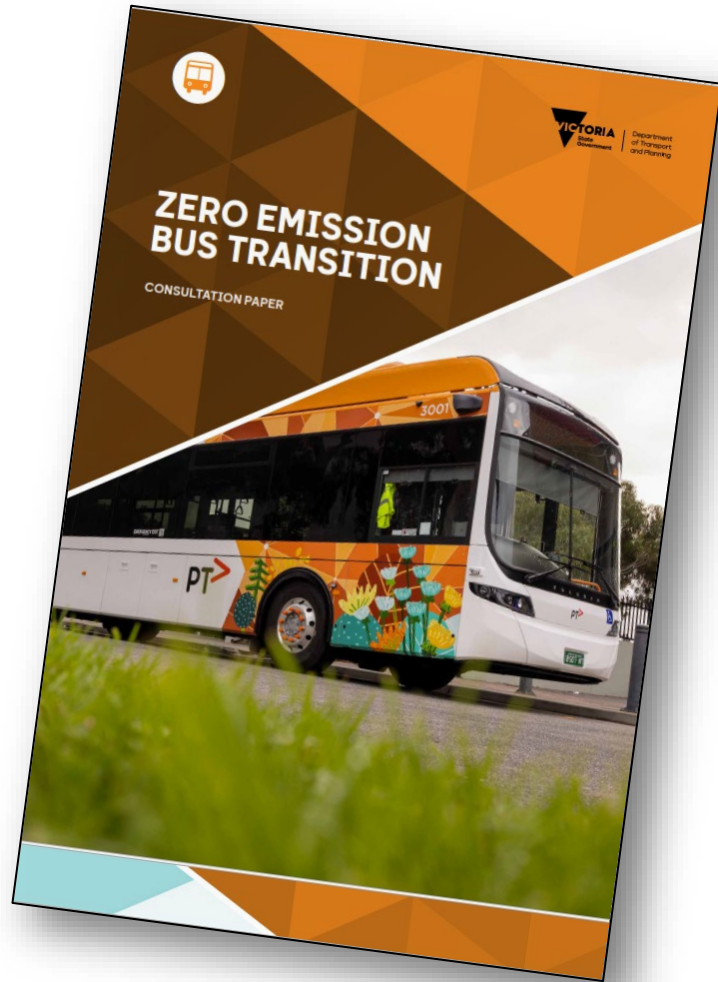


Source: Fact Sheet Transport 2021– Dept Climate Change, Energy the Environment and Water Dec 2022

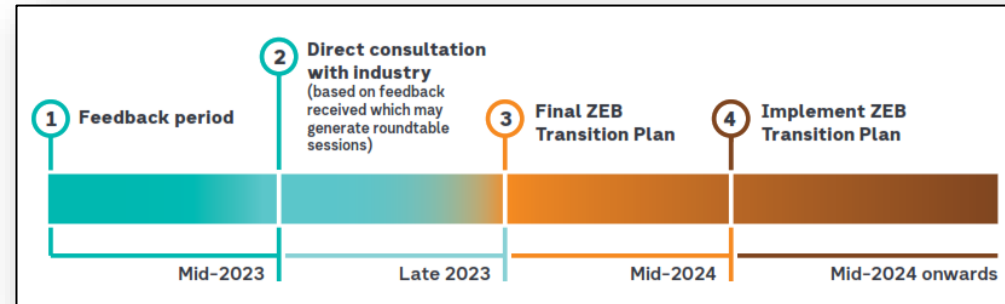
**Cars - most CO<sub>2</sub> & space inefficient pax modes – bike/walk are best for local travel, bus (diesel) for medium long distance – electric bus could be preferred medium distance mode**



A critical ZEB motivator for the bus industry is that it has **NO CHOICE** – the fleet transition is mandated by Government...

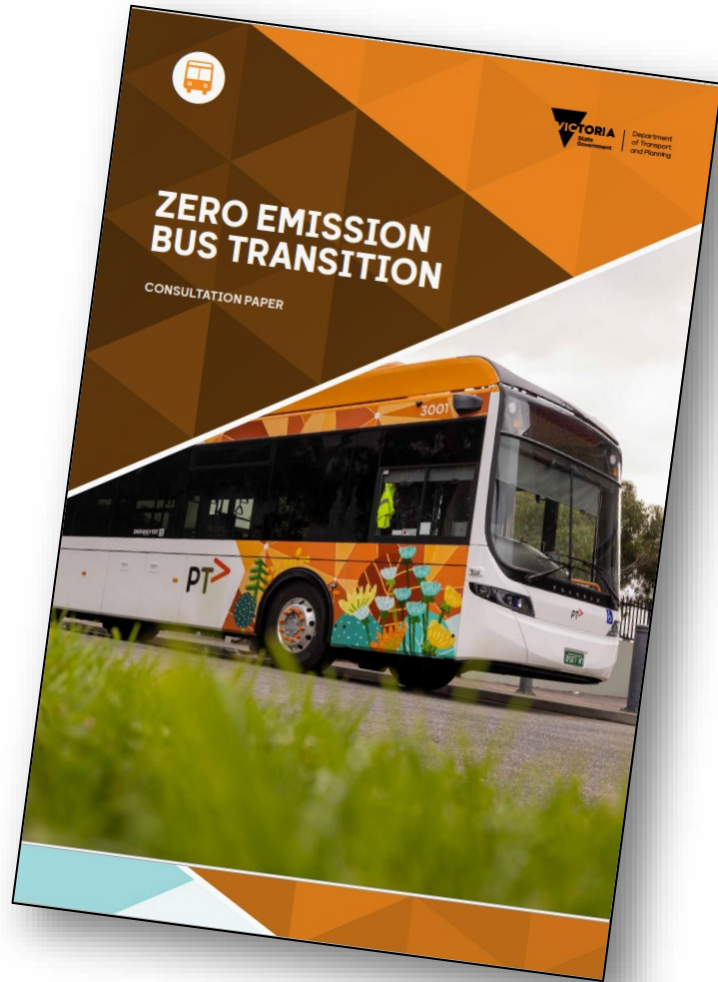


***“As part of Victoria’s Climate Change Strategy, the Victorian Government has pledged to take action to shift to zero emissions transport powered by clean energy. Under the proposed Victorian ZEB Transition Plan, all new buses purchased from 2025 will be Zero Emission Buses (ZEBs)”.***

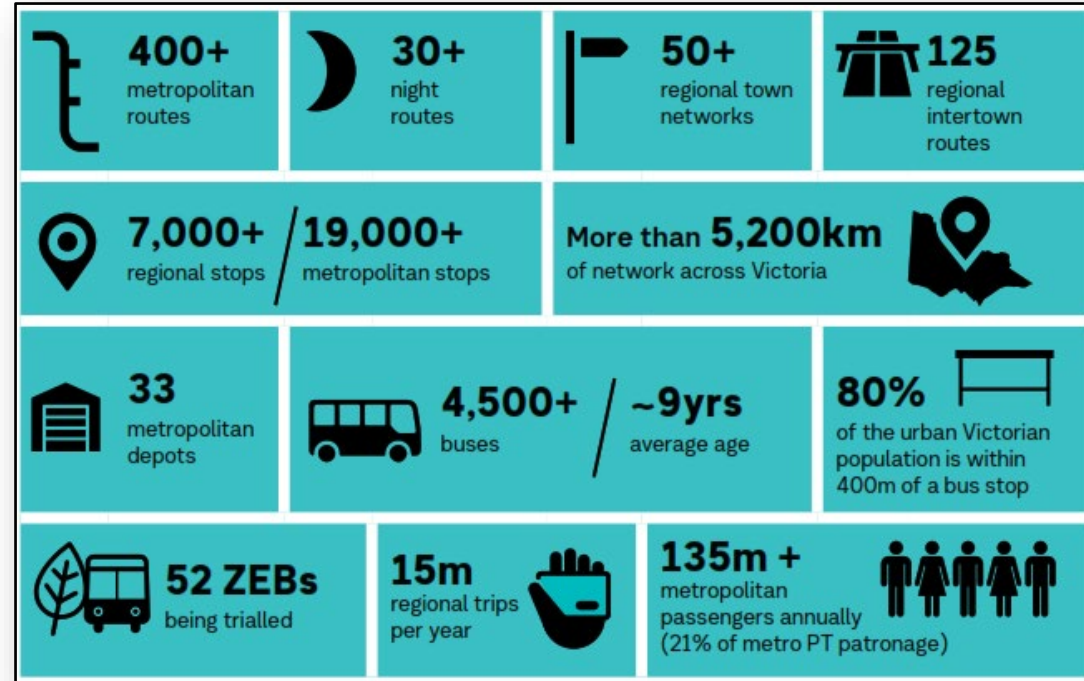




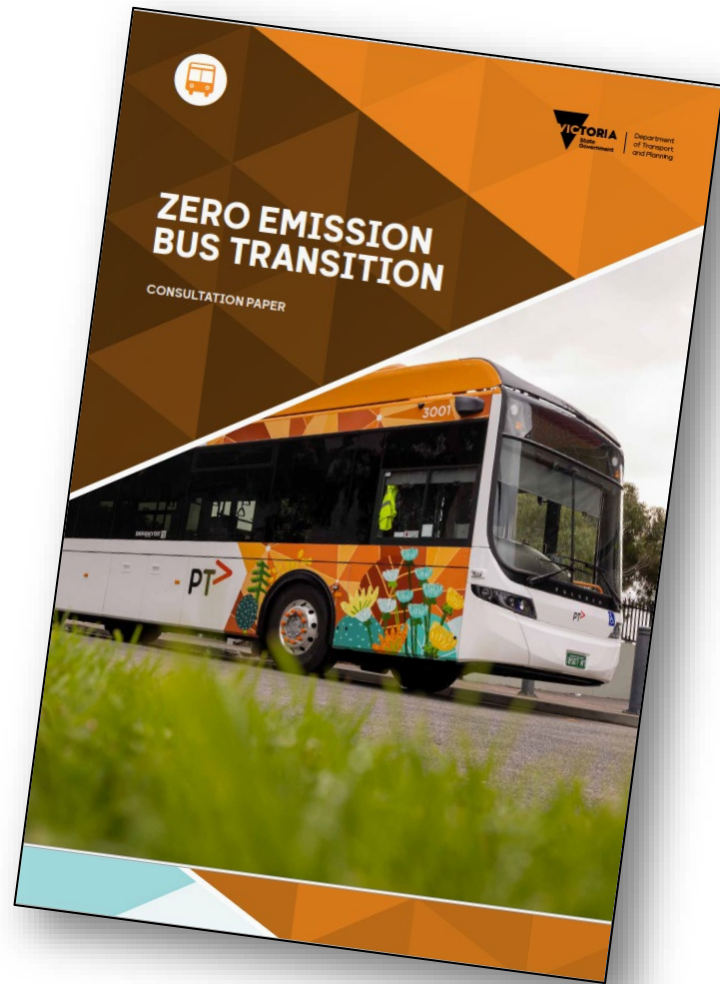
...impacting renewal of the all of the Victorian bus fleet; 4,500 buses. Current renewal is 4.4% p.a. or about 200 buses p.a. from 2025



### The Victorian Bus Industry



# A wider range of operating, cost and ridership benefits are also likely from a ZEB fleet transition



## ZEB Benefits

BENEFIT	DESCRIPTION
<b>Environmental benefits</b>	<ul style="list-style-type: none"> <li>– Contribute towards meeting the Victorian Government’s commitment to reaching a target of net zero greenhouse gas emissions by 2045</li> <li>– Zero tailpipe emissions from vehicles</li> <li>– Zero unintended oil leakages on roads and into stormwater</li> <li>– Improved greening of supply chains, including green energy supply sources</li> <li>– Every ZEB is able to eliminate 1,690 tons of CO2 over a 20-year lifespan, equivalent to taking over 100,000 cars off the road for Victoria’s 4,500 fleet</li> </ul>
<b>Improved health outcomes for local communities</b>	<ul style="list-style-type: none"> <li>– Improved air quality</li> <li>– Improved noise and environmental outcomes surrounding metropolitan depot sites and along bus routes, resulting in improved local liveability outcomes</li> <li>– Significant health and environmental benefits commensurate with the transition’s progression</li> </ul>
<b>Smoother and quieter ride for passengers</b>	<ul style="list-style-type: none"> <li>– Lower levels of noise and vibration experienced within the vehicle while in operation</li> <li>– Smoother ride due to improved vehicle ergonomics and electric propulsion technology</li> </ul>
<b>Job creation and industry development benefits</b>	<ul style="list-style-type: none"> <li>– Introduction of ZEBs and further development and scaling up of clean propulsion technologies is expected to drive market development and modernisation, leading to job creation and upskilling of existing workforces to support the economy of the future</li> <li>– Depot upgrades and construction will support Victoria’s construction industry and supply chains</li> </ul>
<b>Value for money benefits</b>	<ul style="list-style-type: none"> <li>– Potential for reduced operating and maintenance costs (noting higher upfront costs)</li> <li>– Scaling up ZEB deployment can spur investment and create jobs in existing and new industries, particularly in bus manufacturing and depot construction.</li> </ul>

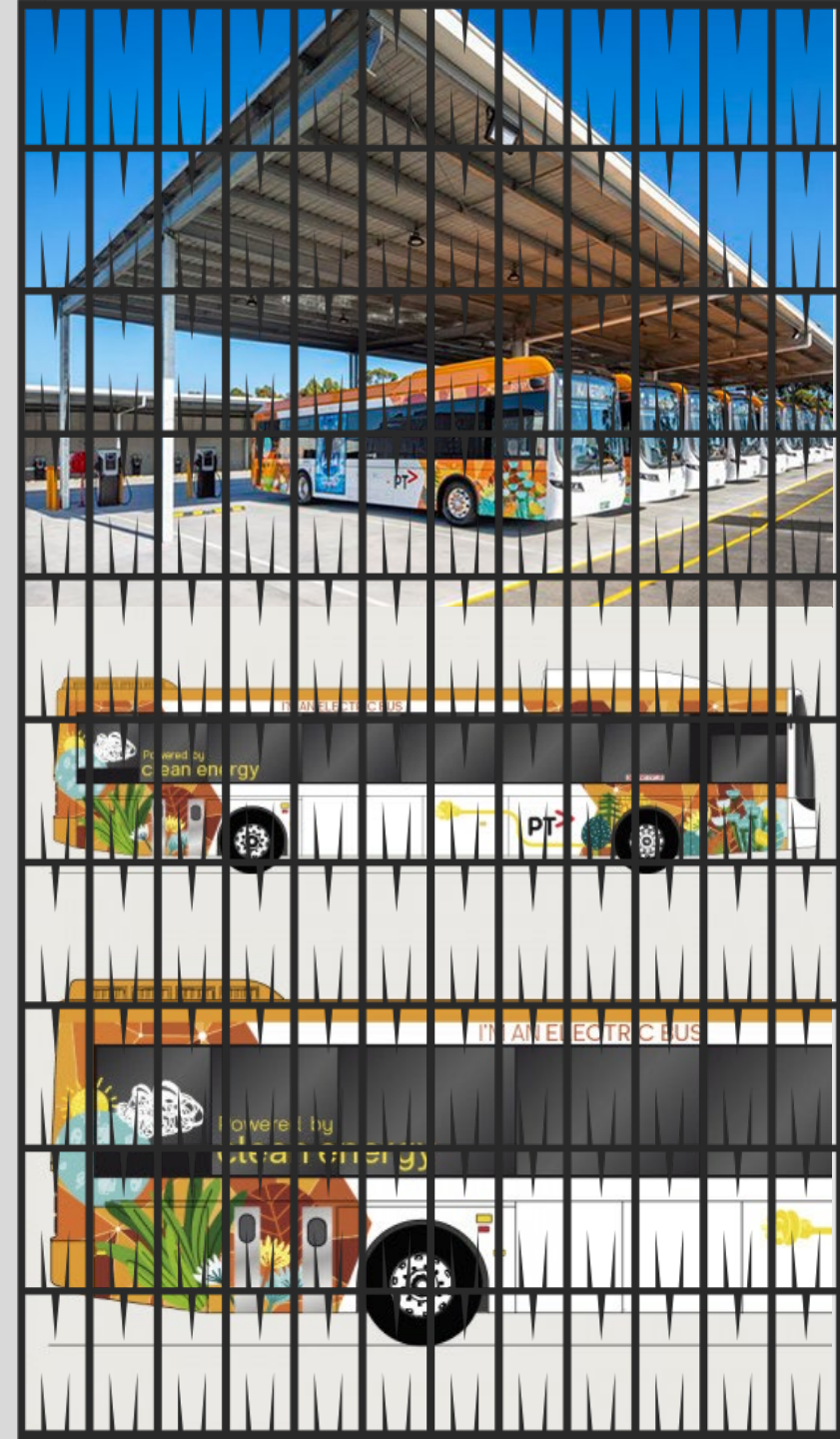
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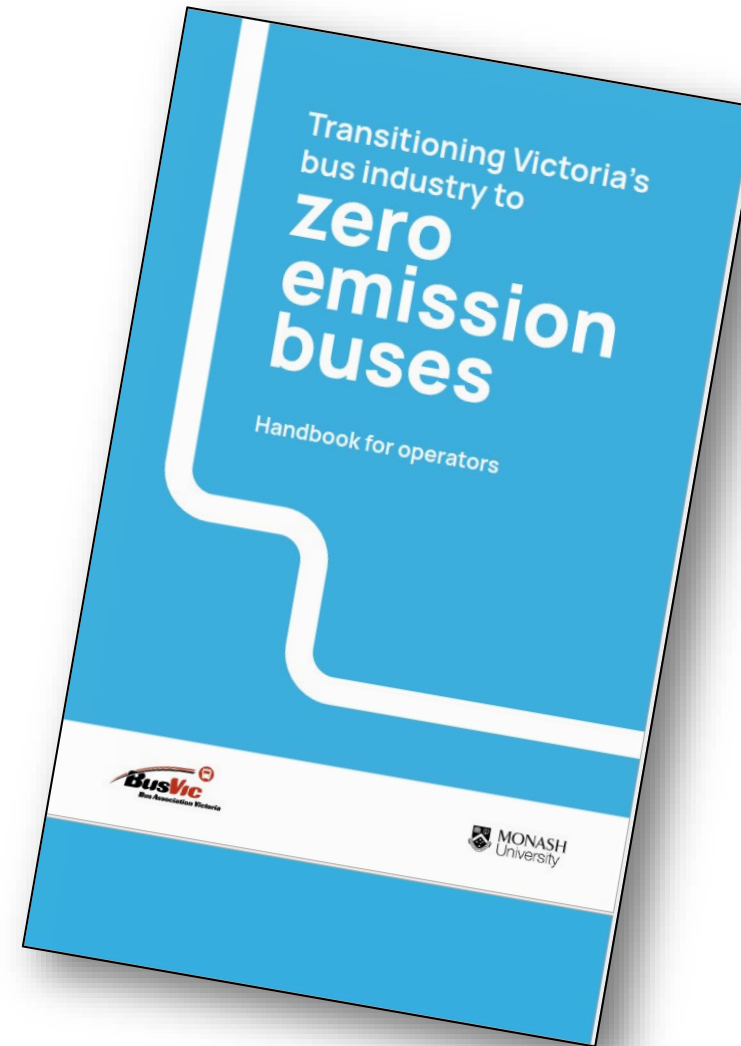
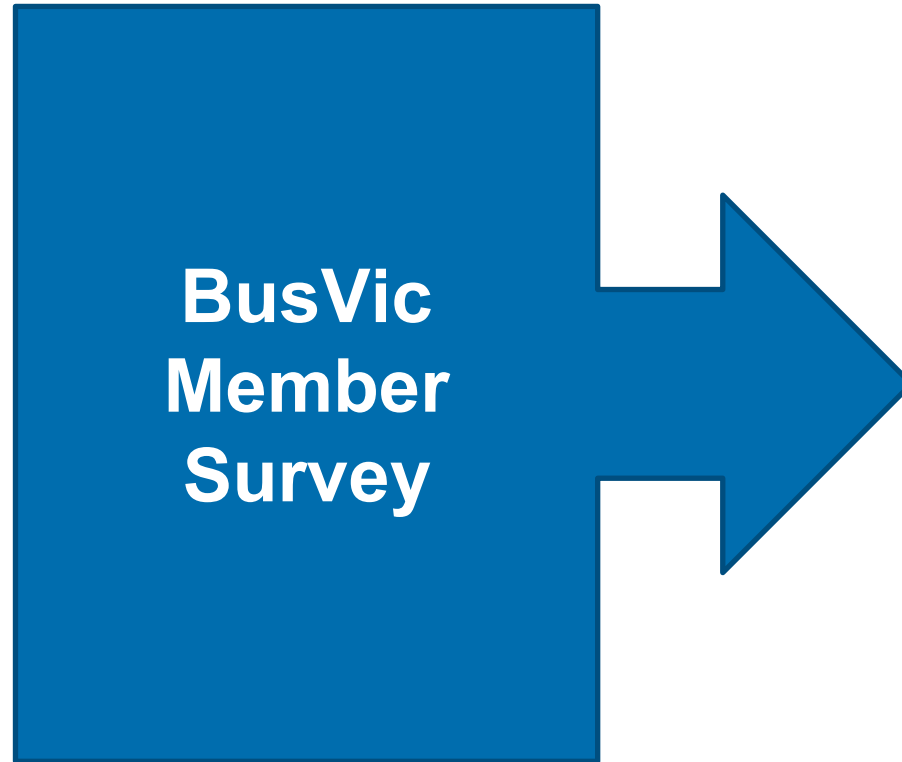
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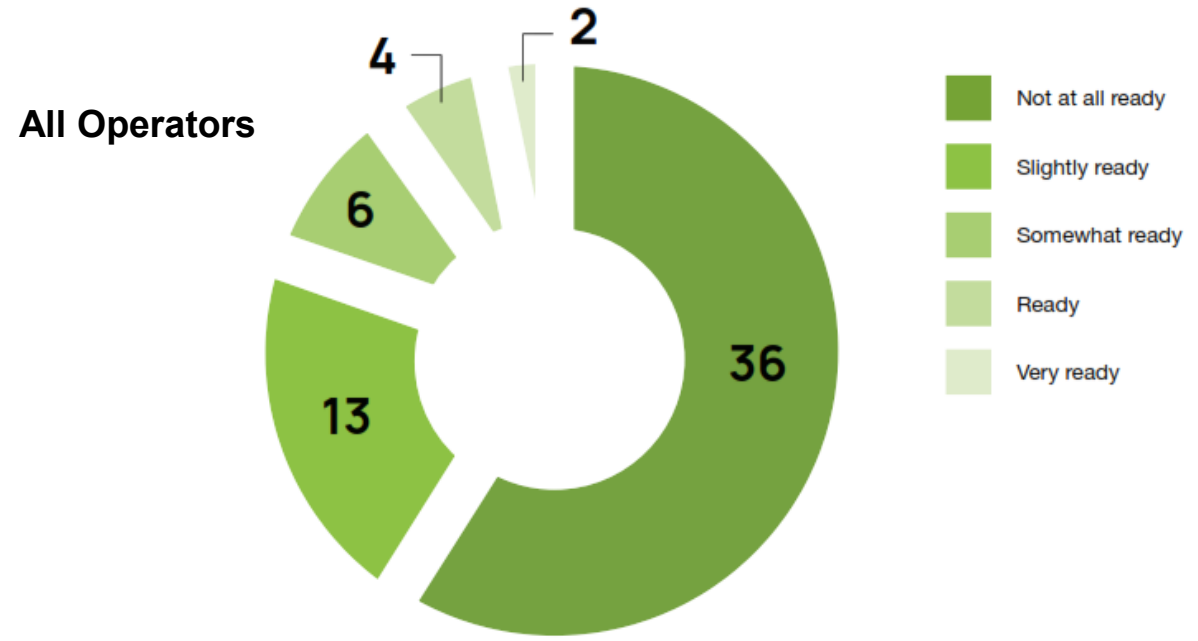
Challenges



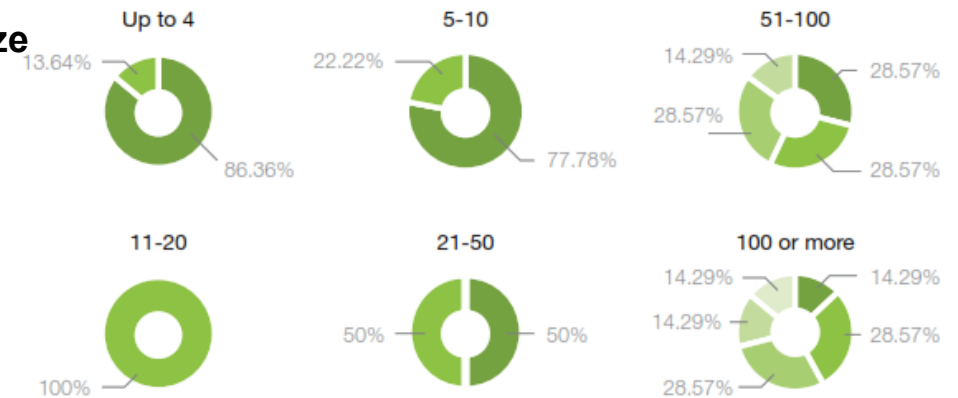
# BusVic members were surveyed to identify their views/readiness for the ZEB transition



**Most operators (61%) were not ready at all, 21% were slightly ready – smaller operators very unready; even 14% of the larger operators were not at all ready**



**Operators by Employee Size**



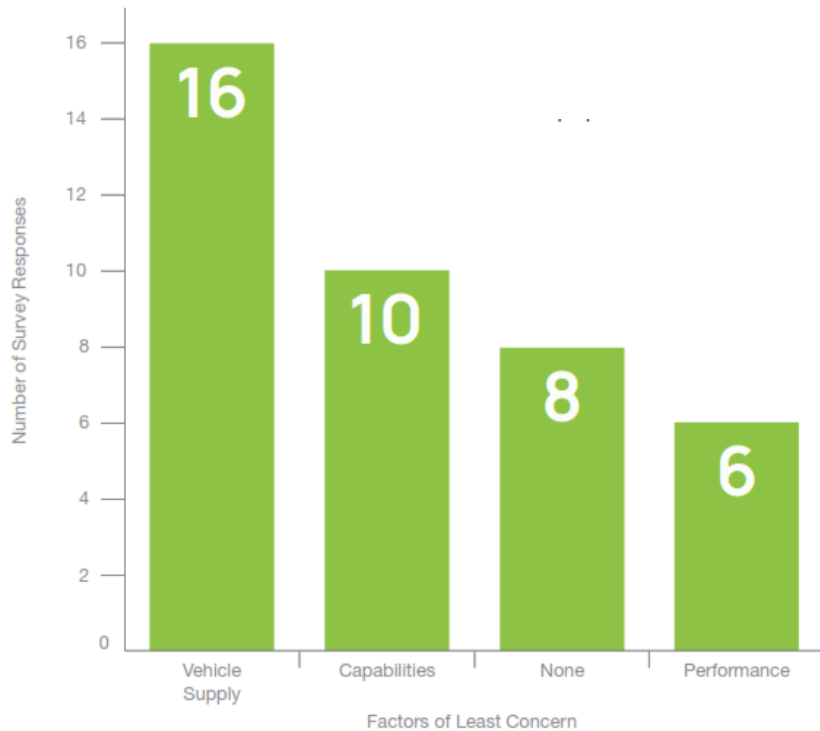
Source: Transitioning Victoria's bus industry to zero emission buses  
 Monash University Mobility Design Lab for Bus Association of Victoria Dec 2021



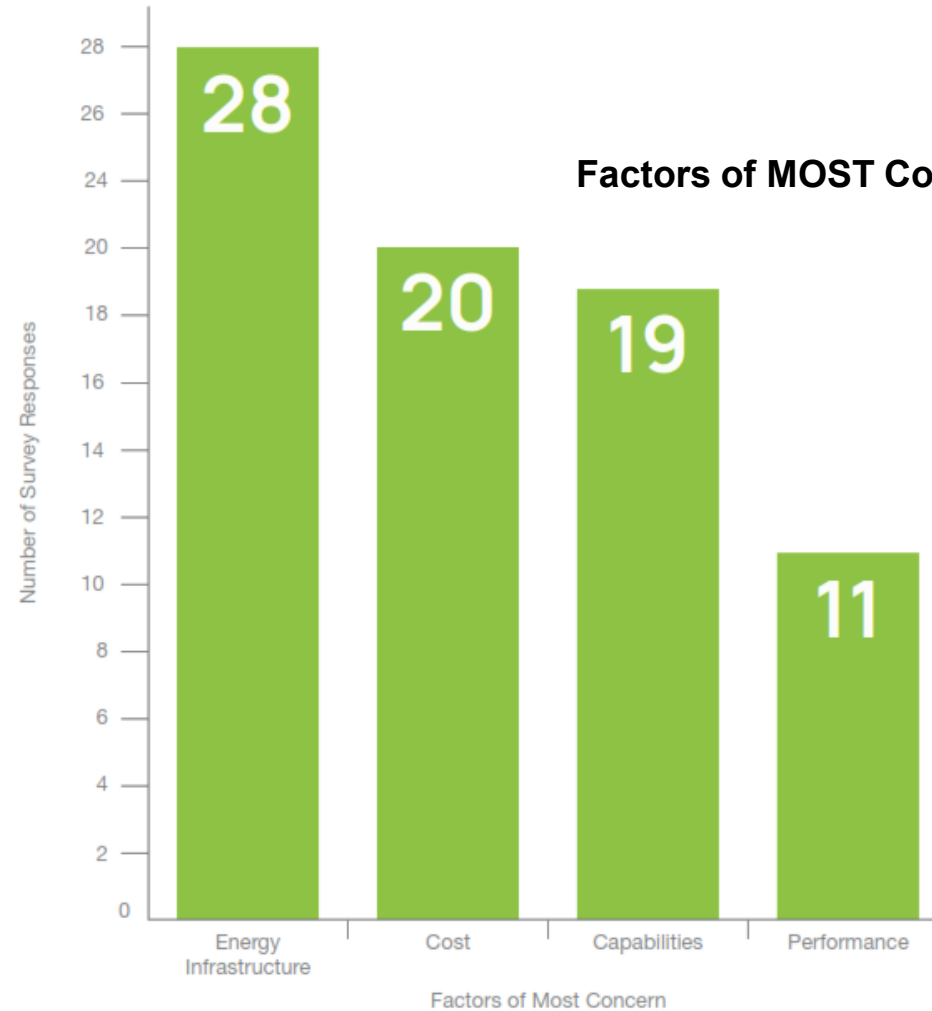
**Transition Readiness**

# Energy infrastructure, cost, capabilities and performance are the transition issues of greatest concern to the Victorian bus industry

### Factors of LEAST Concern



### Factors of MOST Concern

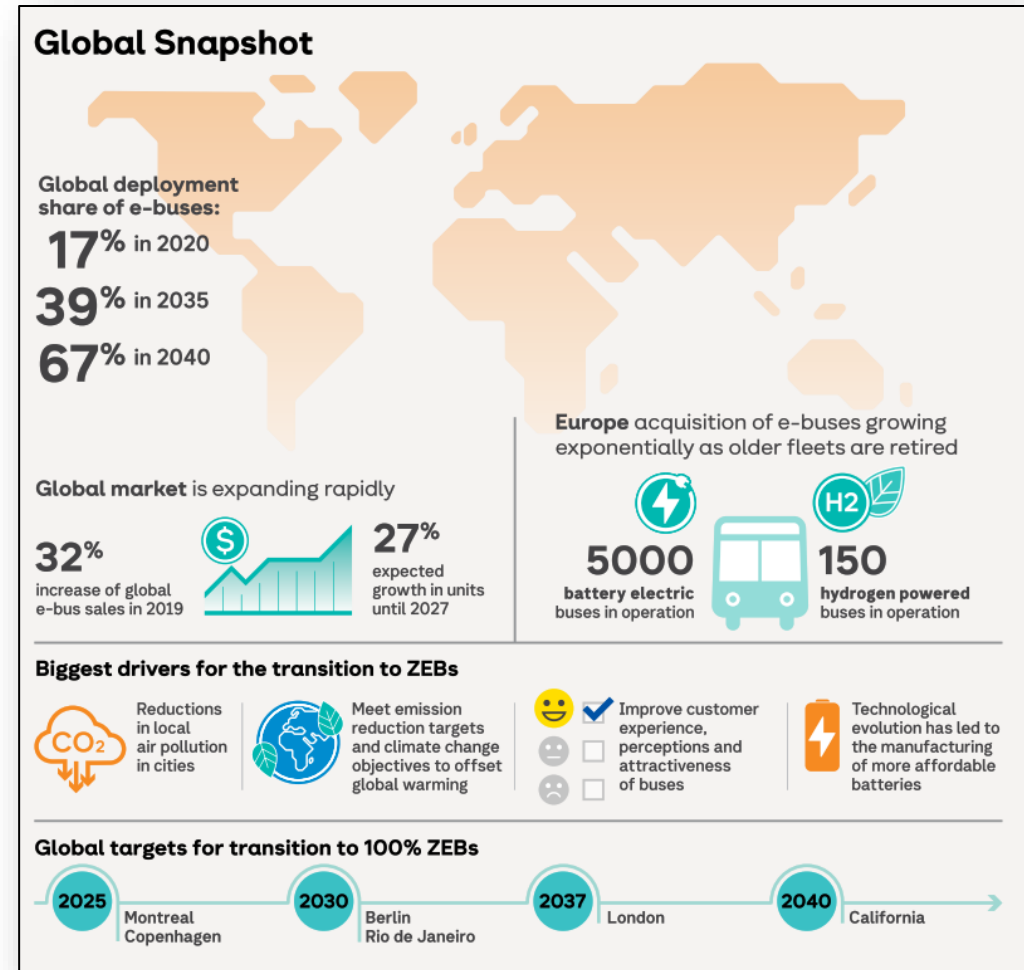
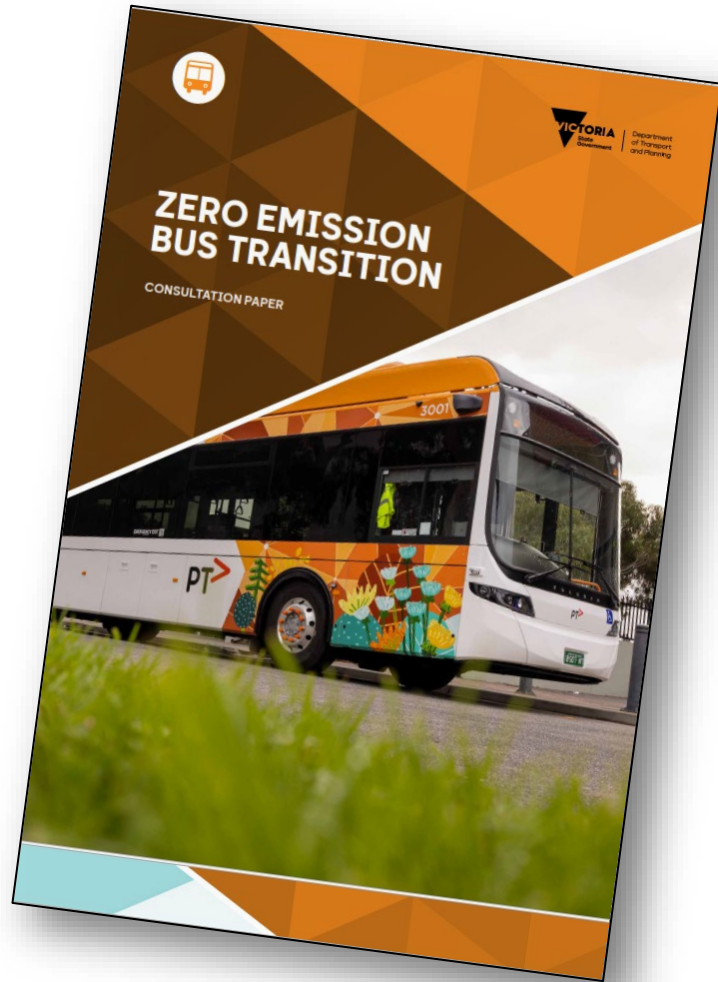


# The industry is watching/observing transition planning to learn best approaches to adopt

## Interview Outcomes

“Our overall strategy is to watch. It’s to observe the government contractors implementing this ahead of time and seeing what works and what doesn’t. And then seeing what the market offers up that will, or won’t fit our commercial business.”

# The global context is also a key motivator; all operations and vehicle manufacturing is transitioning to ZEB's





**Victoria (Australia) is a lagging agent in the ZEB transition; watching and learning from the leaders makes a lot of sense; Vic likely 100% ZEB outcome is @ 2050**



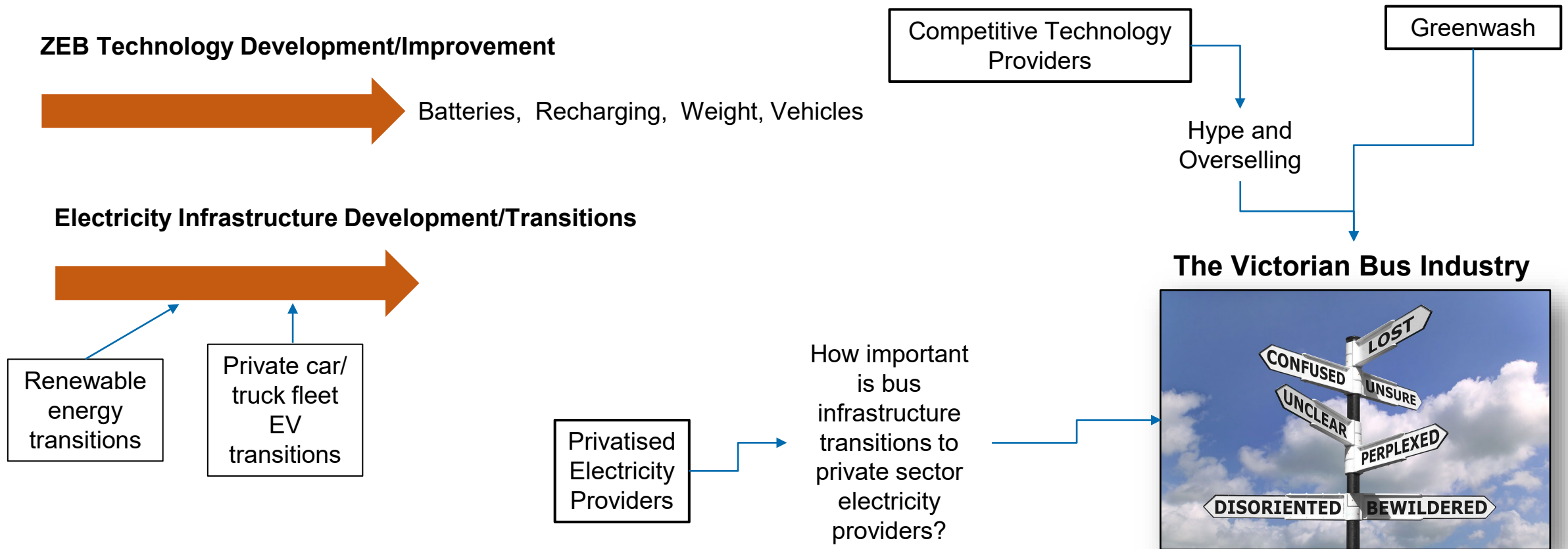
Source: Zero Emission Bus Transition – Consultation Paper.  
Department of Transport and Planning

### Assumptions

- ▶ 4.4% fleet renewal every year
- ▶ Implies 23 years for 100% renewal
- ▶ Start 2025 this will get to 100% in 2048

# The ZEB context is a 'wicked' problem – much change will influence energy technology & infrastructure affecting outcomes – risk/ uncertainty dominate the VIC ZEB transition

## The Changing Energy Technology and Infrastructure Context for Victorian ZEB Transition



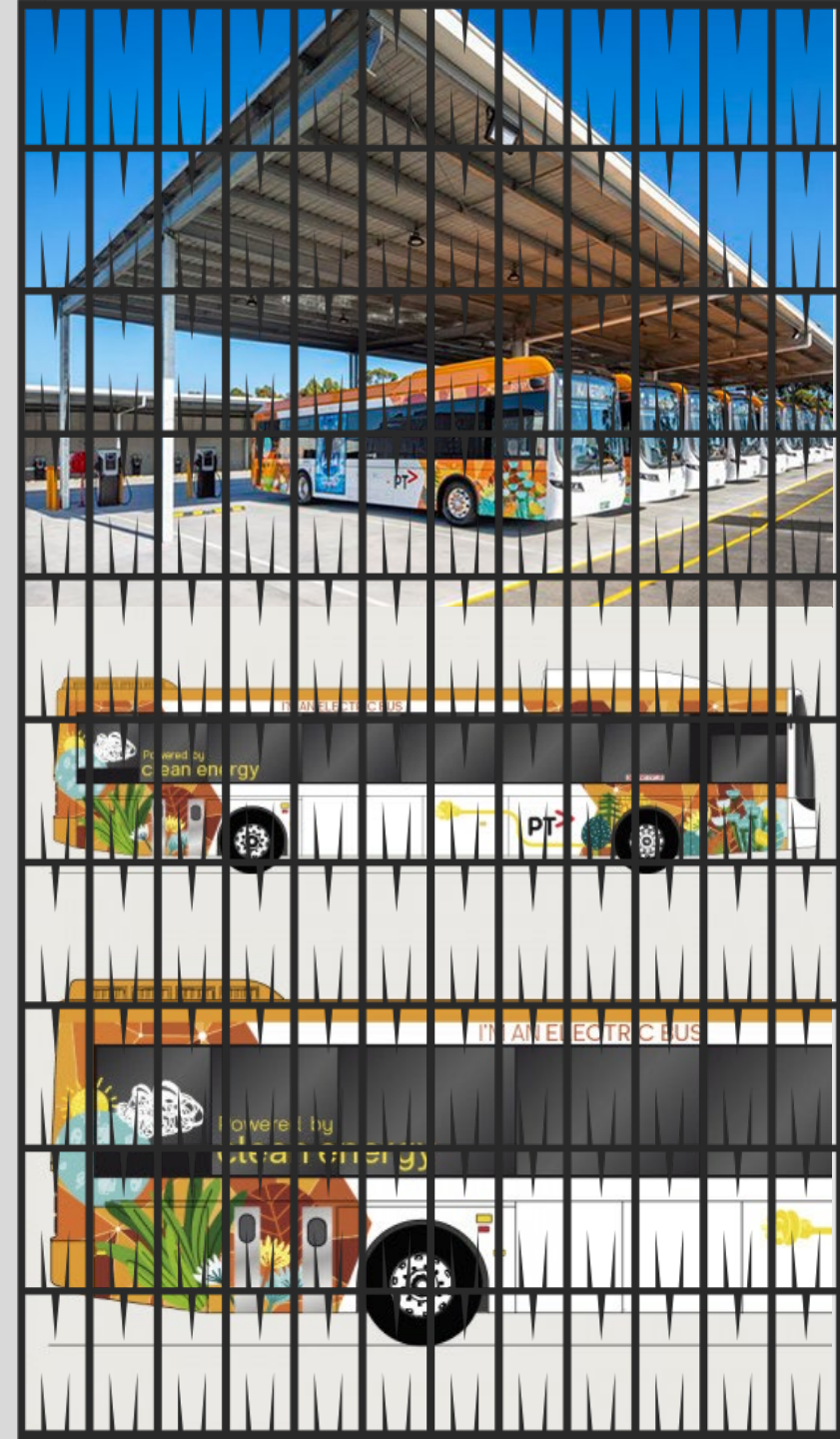
## Agenda

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# A range of significant challenges affect the Victorian ZEB transition

## ZEB Transition Challenges for Victoria

1. Upfront Costs

2. Charging Infrastructure

3. Range and Battery Technology

4. Charging Time

5. Operational Integration

6. Grid Capacity and Power Supply

7. Life Cycle Environmental Impact

8. Cold Weather Performance

9. Political and Stakeholder Buy-In

10. Standardization and Regulation

# ZEB vehicles are more expensive to purchase putting pressure on upfront investment budgets

## ZEB Transition Challenges for Victoria

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- ▶ Electric buses typically have higher upfront costs compared to traditional diesel or natural gas buses. This initial investment can be a barrier for many transit agencies, especially those with limited budgets

# Charging infrastructure is critical but expensive; who pays for this? It's a multi-agency issue.

## ZEB Transition Challenges for Victoria

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- ▶ Building and maintaining a robust charging infrastructure is crucial but expensive. Transit agencies need to install charging stations at depots and potentially along routes, which requires significant planning and investment.

# Range anxiety is real for longer distance routes; fleet size impacts are expensive realities impacting staffing; battery technology is in flux making these critical issues unclear

## ZEB Transition Challenges for Victoria

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▶ Electric buses need to have sufficient range to complete their routes without needing frequent recharging. Battery technology is improving, but achieving longer ranges while keeping costs reasonable remains a challenge.

**Charging technologies are also in flux; difficult choices between when and where are needed (onroute/ off route). This will vary by context; there is no 'one size fits all'**

**ZEB Transition Challenges for Victoria**

**1. Upfront Costs**

**2. Charging Infrastructure**

**3. Range and Battery Technology**

**4. Charging Time**

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**7. Life Cycle Environmental Impact**

**8. Cold Weather Performance**

**9. Political and Stakeholder Buy-In**

**10. Standardization and Regulation**

▶ Unlike refueling with diesel or natural gas, charging electric buses can take longer. Fast-charging technologies are being developed, but optimizing charging times without compromising battery life is essential.



# Integration of diesel & ZEB fleets implies a mix of operational deployment metrics – this mix will change over time implying a continuous juggling of route operations planning

## ZEB Transition Challenges for Victoria

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► Transitioning from diesel to electric buses requires changes in operations, maintenance procedures, and driver training. Transit agencies need to ensure that their staff is adequately trained and prepared for the switch.

# Bus operators are small pawns in the electricity supply infrastructure market; yet they are about to critically rely on how private power suppliers will cater for their needs

## ZEB Transition Challenges for Victoria

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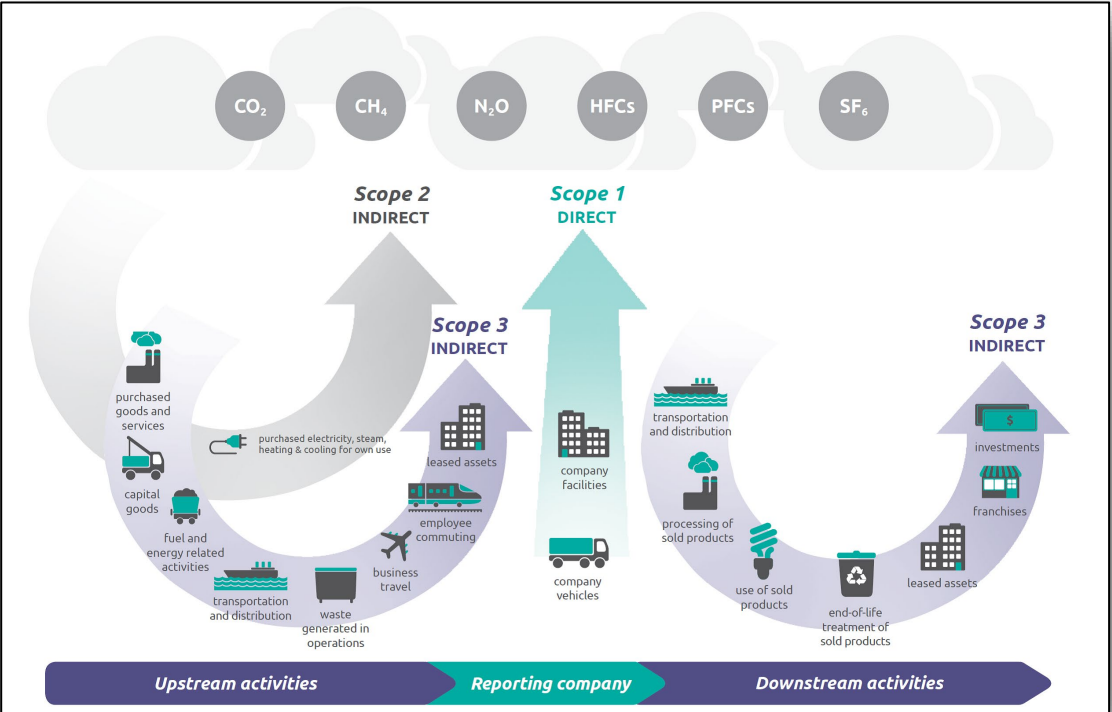
- ▶ Introducing a large number of electric buses can strain local electricity grids, especially during peak times. Coordinating with utilities to upgrade infrastructure and manage power demand is crucial.

# A strategic problem with energy emission planning is that its based on direct (scope 1) emissions; indirect emission estimates are immature but may be critical to climate change

## ZEB Transition Challenges for Victoria

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▶ While electric buses produce no tailpipe emissions, the environmental impact of manufacturing batteries and disposing of them at the end of their life cycle needs consideration.



# Cold weather performance of ZEB have been poor/unreliable in some European contexts. Vehicle air conditioning critically influences ZEB performance and needs careful planning

## ZEB Transition Challenges for Victoria

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▶ Electric buses can experience reduced range and performance in cold weather due to battery efficiency issues. Heating and air conditioning systems also draw power, further reducing range during winter/summer months.

# Many political and external stakeholders need to align to achieve an effective ZEB transition

## ZEB Transition Challenges for Victoria

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► Transitioning to electric buses often requires political will and support from various stakeholders. Convincing decision-makers and the public of the long-term benefits despite initial costs can be challenging.

# ZEB Standardization and effective regulation are needed to aid an easier ZEB transition

## ZEB Transition Challenges for Victoria

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▶ Developing standards for charging infrastructure, battery technology, and safety regulations for electric buses can vary regionally, complicating fleet management and procurement. Federal buy-in to smoothing standards/regulations will make the transition easier to manage

# In the context of these challenges; the BusVic 'Transitioning to ZEB Summit' seems an excellent step to better informing the bus industry on an effective ZEB transition

## ZEB Transition Challenges for Victoria

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TIME	SESSION
9.30AM - 10AM	Registration, arrival tea/coffee.
10AM	Welcome and Acknowledgement of Country.
10.10AM - 10.30AM	Opening - Gabrielle Williams, Minister for Public and Active Transport. (invited)
10.30AM - 11AM	Overview of the Victorian ZEB Trials. Andy Korr, Director, Commercial Planning, Dept Transport and Planning.
11AM - 11.30AM	Transitioning to fully electric bus depots: Zenobe's case study for the Ivanhoe Depot. Gareth Ridge, Zenobe.
11.30AM - 12.30PM	The role of hydrogen fuel cell buses in a zero emissions future. Geoff Drucker, Countrywide Hydrogen.
12.30PM - 1.15PM	ARCC hydrogen fuel cell bus performance review. James Mitchell and Kieran Bray, ARCC.
1.15PM - 1.45PM	Volgren/Wrightbus Hydrogen Fuel Cell Bus: features and capability. Yuri Tessari, Volgren.
1.45PM - 2.15PM	Networking lunch and tea/coffee.
2.15PM - 2.40PM	Fires on ZEBs: historical fires, causes, lessons learnt, best practice maintenance, best practice fleet systems. Rob Dunster, Kidde Technologies UK.
2.40PM - 2.55PM	Maintaining & inspecting ZEBs - Nick Curran, Volvo & Tim Gangel, RSI.
2.55PM - 3PM	Scheduling for ZEBs - Kathy Lazaras, Urban Transit Solutions.
	Right of Reply - John Pesutto MP, Leader of the Opposition.
	Close

# New in 2024

Questions? Contact : [alexa.delbosc@monash.edu](mailto:alexa.delbosc@monash.edu)

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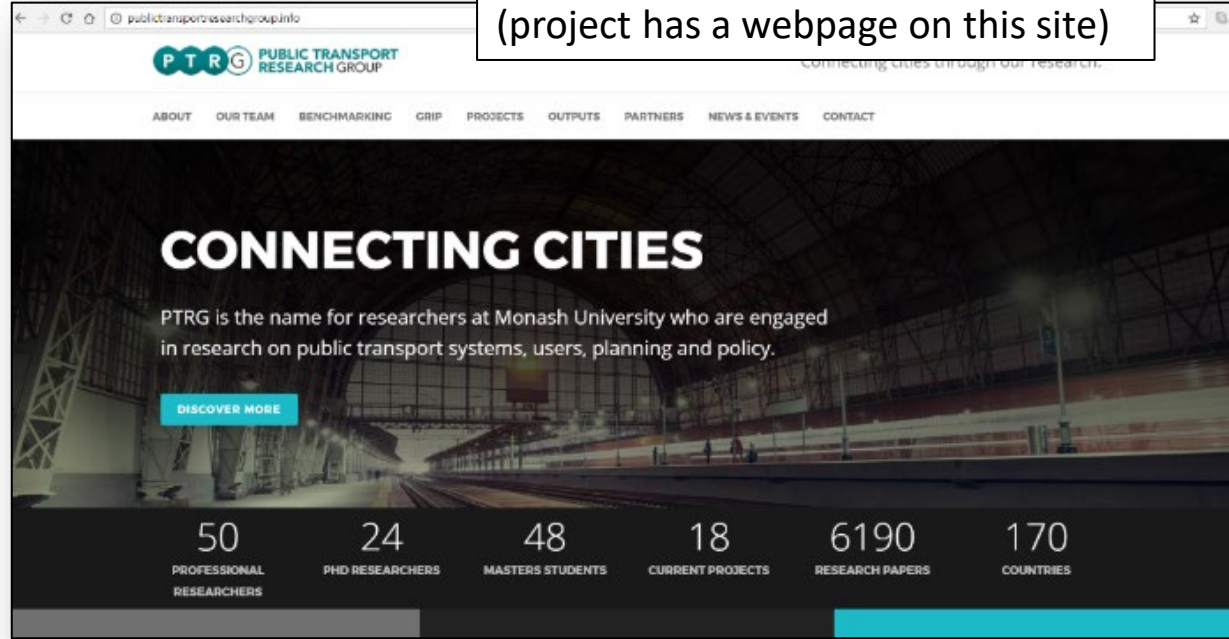


Please reach out for more information



graham.currie@monash.edu

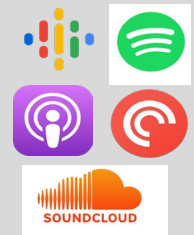
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(project has a webpage on this site)



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RT5 – Long term impact of COVID-19 on Travel Behaviour





**Monash College, 750 Collins St, Melbourne CBD**



Melbourne, Australia

**Tuesday 19<sup>th</sup> – Friday 22<sup>nd</sup> November 2024**



<https://ppts-course.org/>



**Graham Currie**

- ▶ Strategic perspectives and Public Transport Governance
- ▶ Transit Network (Route) Design In Practice
- ▶ Route Level Demand Forecasting



**Avi Ceder**

- ▶ Service Design: Frequency and Timetable Development
- ▶ Transit Network (Route) Design Planning
- ▶ Data-Based Policy Trends and Future Transport Mobility



**Niels van Oort**

- ▶ Towards high quality public transport: BRT and LRT challenges and opportunities
- ▶ Beyond Public Transport: Interaction and integration of transit with bicycles and micromobility
- ▶ Planning and operating reliable transit; dealing with unplanned disruptions



**Liton Kamruzzaman**

- ▶ Land use and transit network planning
- ▶ Transit-oriented development
- ▶ Transforming cities with transit, the City Center and public transport



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